## PETROLOGY AND GEOCHEMISTRY OF DONEGAL GRANITES IRELAND.

BY

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#### CHAPTER SIX

#### MODELLING OF THE DONEGAL GRANITES

#### 6.1 INTRODUCTION

The geochemistry of the Donegal granites (Chapter 5) shows that the granites consist of individual melts which later make up specific granitic plutons. In general, the variation in granitic rocks can be produced by one of several processes. These include fractional crystallisation, effect of a vapour phase, restite unmixing, magma mixing, crustal assimilation and thermo gravitational diffusion. In the Donegal granites crystal fractionation appears to be the dominant process that produced the variation of the rocks. The variation in the Thorr pluton is regarded as due to accretion from the margin of the pluton (Oglethorpe 1987). The variation of Barnesmore resulted from fractional crystallisation of a granodioritic magma (G1 type ; Dempsey 1987). In the Rosses pluton, the decrease of biotite from margin to the centre of the pluton suggests the effects of fractional crystallisation. However the exception is probably shown by the Ardara granite, where the three units (the outer, intermediate and inner units) are not related by simple fractionation. A process that may be important is the effect of vapour phase fractionation (Whalen 1983) in producing the muscovite granite in the Trawnagh Bay pluton.

This chapter attempts to model the geochemistry of the individual plutons of the Donegal granites as seen at the present erosion level. The modelling has been carried out in three stages. Firstly, the granites will be modelled using the large ion lithophile elements (LILE) Ba, Sr and Rb. These elements have been used to determine the crystallising proportions of biotite, plagioclase, alkali feldspar and hornblende. Secondly the major elements have been used to determine the crystallising proportion of the major phases such as plagioclase, alkali feldspar, hornblende and biotite and some of the accessory phases such as apatite, ore phases and sphene (Atherton et al. 1992). Thirdly, REEs have been used to evaluate the roles of the various accessory phases.

#### 6.2 INTRODUCTION TO MODELLING USED IN THIS CHAPTER.

#### 6.2.1 LILE Modelling

The LIL elements Ba, Sr and Rb are of considerable value in determining the type and amount of major phase fractionation in intermediate and acid rocks because :

(a) they are held predominantly in the major phases,

(b) Kd's for commonly occurring major phases are available,

(c) each element behaves somewhat differently ; thus Rb is taken up preferentially by biotite, Ba by biotite and alkali feldspar and Sr by plagioclase and alkali feldspar.

The arrow in the log Sr vs Ba, Ba vs Rb and Rb vs Sr diagrams indicates the net change in composition of the liquid for 20% Rayleigh fractionation of the named phase. This was calculated using (Rayleigh) fractional crystallisation :

 $C_l/C_o = F^{Da-1}$  where

 $C_0$  = concentration of element 'a' in the original melt

C<sub>l</sub> = concentration of element 'a' in residual melt

Da = bulk distribution coefficient for element a

F = weight fraction of melt remaining.

The ranges of Kds used are listed in Table 6.1.

#### 6.2.2 Major element modelling

The next step is to use a more sophisticated approach to model the effect of fractional crystallisation. For this purpose an arbitrary start and target using 8 major element oxides is used to model the precipitated phases. The calculation of the major element modelling is determined by the following simple mass balance equation (Sanderson and Atherton 1985).

melt o  $M_k = (M_k - S_k) / (1 - F)$ 

	Hb	Bi	Plag	K-felds
Ba	0.044	6.36	0.36	6.12
Sr	0.022	0.12	4.4	3.87
Rb .	0.014	3.26	0.048	0.34

Table 6.1 : Partition coefficients of Ba,Sr and Rb used in the LILE modelling. After Arth (1976). All values are for rhyolitic rocks.

		_K-felds_			Plagioclase		Bi	Qu	Hb	Ap	Zr	All	Mag	Sp
La	0.08	0.072	0.08	0.38	0.3	0.3	0.03	0.015	1	30	7	2594 -820	1.2	15
Ce	0.044	0.046	0.037	0.24	0.27	0.27	0.04	0.014	1.5	35	10	2278-635	1.6	25
Nd	0.025	0.038	0.035	0.17	0.21	0.21	0.04	0.016	4.3	57	5	1620 -463	2.3	78
Sm	0.018	0.025	0.025	0.13	0.13	0.013	0.05	0.014	7.8	63	11	866 - 205	2.8	107
Eu	1.13	2.6	4.45	2.1	5.42	2.15	0.015	0.06	5.1	30	20	111 - 81	1	94
Gd	0.011	0.01	0.01	0.9	0.125	0.097	0.08	0.015	10	56	29	250 - 130	3	113
Tb	0.025	0.033	0.025	0.02	0.033	0.033	0.09	0.017	12	53	38	273 - 71	3.3	112
Dy	0.006	0.052	0.055	0.086	0.112	0.064	0.1	0.014	13	51	108	136 - 45	2.6	111
Er	0.006	0.006	0.006	0.084	0.084	0.055	0.12	0.015	12	37	336	50 - 20	2	107
Yb	0.012	0.015	0.03	0.077	0.09	0.049	0.18	0.017	8.4	24	564	30 - 8.9	1.5	83
Lu	0.006	0.031	0.033	0.062	0.092	0.046	0.19	0.015	5.5	20	648	33 - 7.7	1.2	62
			1. B. A.	3.										

#### References :

K-Feldspar : Arth (1976), Nash and Crecraft (1985), Mahood & Hildreth (1983) Plagioclase : Arth (1976), Nash and Crecraft (1985), Mahood & Hildreth (1983) Biotite : Arth (1976) Hornblende : Arth (1976) Quartz : Nash and Crecraft (1985) Magnetite : Petford (1990) Zircon : Micheal (1983) Apatite : Petford (1990) Allanite : Mahood and Hildreth (1985), Brooks at al. (1981) Sphene : Hellman and Green (1979)

Arth (1976) : Rhyolites Nash and Crecraft (1985): Rhyolites Mahood and Hildreth (1983): High silica rhyolites Micheal (1983): High silica tuff/rhyolites Brooks et al. (1981): Obsidian Hellman and Green (1979): Hydrous mafic composition

### Table 6.2: Partition coefficients used in REE modelling.

where

melt
Mk = weight % of element oxide k in final melt after fractionation
o
Mk = weight % of element oxide k in the initial melt
F = fraction (0 - 1) of the melt crystallised

 $S_k$  = sum of k-th element oxide in the crystallised fraction.

#### 6.2.3 REE modelling.

The third stage is modelling using REEs. The influence of accessory minerals, notably apatite, zircon, sphene and allanite has been shown to be crucial in determining the REE pattern in silicic rocks (Gromet and Silver 1983 ; Atherton et al.1992). The mixture of minerals predicted from the major element modelling which includes apatite, sphene, magnetite, zircon and allanite was used to calculate the REE profiles of the evolved liquids. The partition coefficients for the major phases and the accessory minerals are given in Table 6.2.

#### 6.3 THORR PLUTON

Field and chemical evidence show that the Thorr pluton is normally but asymmetrically zoned ; the central part of the pluton consists of granite (*s.s.*) and grades outwards to granodiorite, then to diorite, mainly in the south and southwest (Map 2.5). No contacts have been found between these rocks (Pitcher and Berger 1972). Oglethorpe (1987) suggested that the accretion from the margin to the centre of the pluton is the important process in producing the observed chemical zonation of the Thorr pluton. Thus in this section, the Thorr granite will be modelled from the margin (hornblende bearing Normal facies) to the centre (hornblende free Normal facies) of the pluton.

#### 6.3.1 LILE modelling

Inter elements variation diagrams for the pairs Rb-Sr, Ba-Sr and Ba -Rb for both hornblende bearing and hornblende free normal facies are shown in **Fig 6.1**. In all three plots, the hornblende free granite has low Ba and Sr and high Rb compared to the hornblende bearing granite. On a Sr vs Ba plot (Fig 6.1a), the trend shown by the granite from both facies is consistent with the crystallisation of some combination of alkali feldspar, biotite and plagioclase. Thus the crystallisation options are plagioclase + alkali feldspar and plagioclase + alkali feldspar + biotite.

On a Ba vs Rb plot (Fig 6.1a), indicates that the plagioclase and hornblende are important in the early magmatic evolution of the rocks from the hornblende bearing facies. As the granite evolved to the hornblende free facies, alkali feldspar and biotite became more important.

On a Rb vs Sr plot (Fig 6.1c) calculated Rayleigh fractionation vectors for single mineral phases imply that the crystallisation of alkali feldspar + plagioclase + hornblende is responsible for evolving the liquid from hornblende-bearing to hornblende-free granites, with feldspars becoming more important at acid compositions.

The conclusions that can be drawn from LILE modelling of the Thorr pluton are : (1) Plagioclase, hornblende and minor biotite are important in the evolution of the hornblende bearing normal facies and (2) Plagioclase, alkali feldspar and perhaps biotite are important in the hornblende free normal facies.

#### 6.3.2 Major element modelling

In this section the normal facies will be modelled from the margin to the centre of the pluton in two stages ; (1) quartz diorite to granodiorite (hornblende bearing normal facies) and (2) granodiorite to granite (hornblende free normal facies). The results of both stages and the difference between the target composition and the target model are shown in **Tables 6.3 and 6.4** respectively. The mineral compositions used in this modelling are taken from the microprobe analyses of the starting sample (Oglethorpe 1987). The mineral mix in the first stage is plagioclase, alkali feldspar, biotite, hornblende, magnetite, apatite and sphene at 50% fractionation (**Table 6.3**).

The mineral mix of the second stage is plagioclase, alkali feldspar, biotite, hornblende, quartz, magnetite, apatite and sphene at 24% fractionation (**Table 6.4**). The results indicate that the plagioclase, alkali feldspar, biotite and hornblende

precipitation are important in the first stage whereas in the second stage alkali feldspar become more important and hornblende and plagioclase less so.

#### 6.3.3 REE modelling

As with the major elements, the REE modelling of the Thorr pluton has been done in the same two stages. The REE profiles of the observed start and target compositions used in the modelling, together with the calculated melt profile are shown the **Fig 6.2** and **Fig 6.3** respectively. The mineral mixtures of both stages are very similar to the major element modelling (**Table 6.5**).

#### 6.3.4 Discussion

Summary of the major and REE modelling is given in Table 6.5. The results show that in the first stage (hornblende bearing normal facies) plagioclase, biotite, alkali feldspar and hornblende are dominant while in the second stage plagioclase, alkali feldspar and biotite are dominant. Oglethorpe (1987) modelled the Thorr granite in five stages from the margin to the centre of the pluton. He showed that the biotite is important in the late stage of the hornblende bearing normal facies and that the proportion of hornblende decreases with fractionation.

Since all the Thorr granites have > 75% normative An+ Ab+ Or+ Qz, their bulk compositions can be represented reasonably accurately on a tetrahedral An-Ab-Or-Qz plot (Fig 6.4). Calculated normative composition of rocks from hornblende bearing and hornblende free normal facies were plotted on this diagram. It shows that the bulk of Thorr crystallised high in the plagioclase volume. Later crystallisation drove the liquid towards the plagioclase-alkali feldspar surface. At this stage alkali feldspar started to crystallised.



FIGURE 6.1 : Inter element variation diagrams for LIL elements Ba,Rb and Sr of the normal facies of Thorr pluton. Mineral vectors indicate the net change in composition of the initial liquid after 20% Rayleigh fractionation of the named phase.

	Start composition	Target composi (TC)	tion	Target model (TM)	Different (TM-TC)
Rock type	Quartz diorite	granodiorite			
SiO2	61.97	69.54		69.68	0.14
TiO2	0.76	0.46		0.21	-0.25
AI2O3	17.51	15.2	S	16.29	1.09
Fe(tot)	4.32	2.2		1.52	-0.68
MgO	2.76	1.06		2.09	1.03
CaO	4.17	2.1		2.8	0.7
Na2O	3.5	3.62		2.55	-1.07
K2O	3.8	4.31		3.28	-1.03
Total	98.79	98.49		98.42	
	PI: 48.7	Ap:1			
	Ksp:16	Sp: 1.5		ну. <sup>‡</sup>	
	Bi : 17.8	Mag: 1		e de la companya de l	1. j. 4.
	Hb: 14				

% precipitation: 50%

TABLE 6.3: Summary results obtained from the major element modelling from diorite to granodiorite (Hornblende bearing normal facies of the Thorr pluton. Whole rock and mineral composition are taken from Oglethorpe (1987).

S	Start composition	Target composition	Target model	Different (TM-TC)	
Rock type	granodiorite	granite	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
SiO2	70.64	74.05	73.99	-0.06	
TiO2	0.4	0.29	0.24	-0.05	
AI2O3	14.26	13.96	13.06	-0.9	
Fe(tot)	2.11	1.14	1.41	0.27	
MgO	0.93	0.46	0.6	0.14	
CaO	1.85	1.18	1.45	0.27	
Na2O	3.13	3.52	3.01	-0.51	
K2O	5.22	5.18	4.65	-0.53	
Total	98.54	99.78	98.41		

Mineral extract proportion

PI : 37 Ksp : 36.1 Bi : 16 % precipitation: 24% Hb : 1.5 Qu : 6.6 Mag : 1 Ap : 0.8 Sp : 1

TABLE 6.4: Summary results obtained from the major element modelling from granodiorite to granite (hornblende free normal facies) of the Thorr pluton. Whole rock and mineral composition are taken from Oglethorpe (1987).

	Start TH36I quartz diorite	Target TH9 Granodiorite	Target model	Bulk Kd	Min	Prop
La	28.4	17.47	16.26	4.4	PI	47.38
Ce	64.8	41.66	41.31	4.26	Kf	16.10
Nd	8.4	14	18.47	4.35	Bi	18 57
Sm	31.6	2.68	2.58	4.19	Hb	12
Eu	1.62	0.56	0.54	5.4	7r	0.22
Gd	4.3	2.05	2.05	3.75	All	0.03
Dy	3.51	1.48	1.55	4.24	Sn	2
Er	2.19	0.83	0.87	4.26	An	26
Yb	1.59	0.8	0.93	3 71	Man	1 1
Lu	0.25	0.1	0.14	3.07	Mag	

% precipitation : 21%



FIGURE 6.2 : Summary of the REE modelling of the quartz diorite to granodiorite of the Thorr pluton. At the top is the summary of start and target compositions, target model, amount of mineral precipitate (%) and bulk Kd of the REE used in the modelling . % precipitation is the percentage precipitated to move the start composition to the target model. Below is the graphical presentation of the modelling.

	Start TH9 granodiorite	Target TH1 granite	Target model	Bulk Kd	Min	Prop
La	17.47	11.67	11.93	3.99	PI	37
Ce	41.66	32.87	29.55	3.7	Kf	36.2
Nd	14	9.2	10.12	3.56	Bi	16.32
Sm	2.68	1.84	2.09	2.96	Hb	1.5
Eu	0.56	0.37	0.39	3.87	Zr	0.15
Gd	2.05	1.44	1.8	2.05	All	0.13
Dy	1.48	1.13	1.28	2.18	Sp	1
Er	0.83	0.8	0.77	2.22	Ap	0.8
Yb	0.8	0.75	0.69	2.16	Mg	0.9
Lu	0.1	0.11	0.09	1.98	J.	

% precipitation : 12%



FIGURE 6.3 : Summary of the REE modelling of the granodiorite to granite of the Thorr pluton. At the top is the summary of start and target compositions, target model, amount mineral precipitate (%) and bulk Kd of the REE used in the modelling . % precipitation is the percentage precipitated to move the start composition to the target model. Below is the graphical presentation of the modelling.

Major element modelling

	Pl	KF	Bi	Hbl	Qtz	Mag	Ар	Sp	% ppt		
Stage 1	48.7	16	17.8	14	0	1	. <b>1</b>	1.5	50%		
Stage 2	37	36.1	16	1.5	6.6	1	0.8	1	24%		
REE mod	lelling										
	PI	KF	Bi	НЫ	Qtz	Zr	Ali	Sp	Ар	Mag %	ppt
Stage 1	47.4	16.1	18.6	12	0	0.22	0.03	2	2.6	1.1 2	1%
Stage 2	37	36.2	16.3	1.5	6	0.15	0.13	. 1.	0.8	0.9 1;	2%

TABLE 6.5: Summary of (a) major elements and (b) REE modelling of the Thorr pluton. Stage 1 : hornblende bearing normal facies and stage 2 : hornblende free normal facies.





#### 6.4 ROSSES PLUTON

The geochemistry of the Rosses granites indicates that there is a distinct chemical break at the G2 - G3 contact. It also appears that G3 is more basic than G2 which does not support the idea of continuous evolution from G1 to G4. The Harker plots show that each of the units of the Rosses granite overlap in SiO<sub>2</sub> content. Rosses granites will be modelled in two parts (1) Intra units (each unit separately), (2) Inter units.

#### 6.4.1 Intra unit modelling

#### 6.4.1.1 LILE modelling

Inter element variation diagrams for the pairs Rb-Sr, Ba-Sr and Ba-Rb are shown in Fig 6.5. All the units show a similar trend on all plots. On a Sr vs Ba plot (Fig 6.5a) there is a good positive correlation. The sequence of decreasing Ba and Sr values is microgranite - porphyry dykes - G1- G3 - G2 and G4. Rayleigh fractionation vectors for single mineral phases imply that the crystallisation of alkali feldspar, plagioclase and biotite may have controlled the trends in all units. The same minerals may have controlled the trends shown on a Ba vs Rb (Fig 6.5b) plot.

On a Rb vs Sr (Fig 6.5c) plot, plagioclase and alkali feldspar are important in controlling the trends in all units.

#### 6.4.1.2 Major element modelling

The results of major element modelling are shown in **Tables 6.6 to 6.11**. Each unit has been modelled from its most basic to most felsic rock. The mineral compositions used are from the microprobe analyses (Appendix 4). The results are :

(1) The microgranite sheet has been modelled from 69.92% to 75.4% SiO<sub>2</sub>. The model target composition can be achieved at 72% fractionation and the mineral mix is plagioclase, biotite, alkali feldspar and magnetite (**Table 6.6**).

(2) G1 has been modelled from 70.2 % to 74.3% SiO<sub>2</sub>. The model target composition can be achieved at 27% fractionation and the mineral extract is plagioclase, alkali feldspar, biotite. quartz and magnetite (Table 6.7).

(3) G2 has been modelled from 71.4% to 76.5% SiO<sub>2</sub>. The model target composition can be achieved at 36% fractionation and the mineral extract is plagioclase, alkali feldspar, biotite, quartz, and magnetite (Table 6.8).

(4) The porphyries have been modelled from 70.1% to 72.82% SiO<sub>2</sub> The model target composition can be achieved at 15% fractionation and the mineral extract is plagioclase, alkali feldspar, biotite and magnetite (Table 6.9).

(5) G3 has been modelled from 72.8 % to 75.6 % SiO<sub>2</sub>. The model target composition can be achieved at 16% fractionation and the mineral extract is plagioclase, alkali feldspar, biotite, quartz and magnetite (Table 6.10).

(6) G4 has been modelled from 73.7 % to 76.6 % SiO<sub>2</sub>. The model target composition can be achieved at 21% fractionation and the mineral extract is plagioclase, alkali feldspar, biotite and quartz (Table 6.11).

#### 6.4.1.3 REE modelling

The REE in the Rosses pluton have been modelled in three stages, from the basic to the most felsic rocks of G1, G2 and G3. The REE profiles of the start and target compositions used in the modelling, together with the calculated melt profile are shown graphically in Fig 6.6, Fig 6.7, Fig 6.8 and are summarised in Table 6.12a.

G1 has been modelled from ROS11 (SiO<sub>2</sub>= 70.05%) to ROS12 (SiO<sub>2</sub> = 71.66%). The mineral mix plagioclase, alkali feldspar, biotite, quartz and magnetite, allanite, apatite and zircon at 23% fractionation is required to produce the calculated REE profile (Fig 6.6).

G2 has been modelled from ROS5 (SiO<sub>2</sub> = 72.29%) to ROS15 (SiO<sub>2</sub> = 75.26%). The mineral mix plagioclase, alkali feldspar, biotite, quartz, magnetite, allanite, apatite and zircon at 45 % fractionation is required to produce the calculated REE profiles (Fig 6.7).

G3 has been modelled from ROS18 (72.83%) to ROS20 (73.34%). The mineral mix of the REE modelling of the G3 namely plagioclase, alkali feldspar, biotite, quartz, magnetite, allanite, apatite, and zircon at 16% fractionation is required to produce the

calculated REE profile (Fig 6.8).

#### 6.4.2 Inter units modelling

Inter unit modelling of the Rosses granite are divided into two paths, (1) Microgranite to G1 to G2 and (2) Porphyry dyke to G3 to G4. The samples for both paths were selected using the Ba vs Sr plot (see Fig 5.11) and are shown in Figure 6.9. The location of the samples is shown in a small map in Fig 6.9. Note that in the first path (microgranite to G1 to G2), sample ROS7 is not in line with other samples. However, it was included in the modelling because it has the highest Ba and Sr contents compared to other G2 samples. Each path was modelled using the major elements and the results are:

The first path is modelled in three stages :

Stage 1 has been modelled from 69.9% (microgranite sheet) to 72.6% SiO<sub>2</sub> (G1). The model target composition can be achieved at 22% fractionation and the mineral mix is plagioclase (50%), alkali feldspar (30.4%), biotite (17%), quartz (2%) and magnetite (0.6%).

<u>Stage 2</u> has been modelled from 72.6% (G1) to 73.3%(G2) SiO<sub>2</sub>. The model target composition can be achieved at 7% fractionation and the mineral mix is plagioclase (47%), alkali feldspar (33.2%), biotite (15%), quartz (4%) and magnetite (0.8%).

Stage 3 has been modelled from 73.3%(G2) to 74.02% (G2) SiO<sub>2</sub>. The model target composition can be achieved at 6% fractionation and the mineral mix is plagioclase (45.9%), alkali feldspar (35.7%), biotite (13%), quartz (5%) and magnetite (0.4%).

The second path is modelled in four stages :

Stage 1 has been modelled from 71.6% (porphyry dyke) to 72.8% (G3) SiO<sub>2</sub>. The model target composition can be achieved at 9% fractionation and the mineral mix is plagioclase (44.5%), alkali feldspar (36.7%), biotite (18%) and magnetite (0.4%).

<u>Stage 2</u> has been modelled from 72.8% (G3) to 73.3% (G3) SiO<sub>2</sub>. The model target composition can be achieved at 5% fractionation and the mineral mix is plagioclase (46%), alkali feldspar (35.7%), biotite (15%), quartz (3%) and magnetite (0.3%).

<u>Stage 3</u> has been modelled from 73.3% (G3) to 73.4% (G3) SiO<sub>2</sub>. The model target composition can be achieved at 1% fractionation and the mineral mix is plagioclase (46.3%), alkali feldspar (35.4%), biotite (15%), quartz (3.8%) and magnetite (0.3%).

Stage 4 has been modelled from 73.4% (G3) to 74.9% (G4) SiO<sub>2</sub>. The model target composition can be achieved at 9% fractionation and the mineral mix is plagioclase (41%), alkali feldspar (41.1%), biotite (11%), quartz (6%) and magnetite (0.9%).

#### 6.4.3 Discussion

Major, LILE and REE modelling of the Rosses granites indicate that the evolution of each unit is controlled by the same minerals viz plagioclase, alkali feldspar and biotite but in different proportions. A summary of the major element modelling is given in **Table 6.12a**. In general, it shows no systematic decrease or increase the role of a given mineral through the whole sequence microgranite - G1 -G2 - porphyry - G3 and G4. However, biotite and quartz proportions show two separates but similar trends. Thus the role of biotite decreases in importance through the sequence microgranite (19%) to G1 (18%) to G2 (14%). It then becomes more important in the porphyry dykes (19%) but again less so in G3 (15.5%) and in G4 (12%). On the other hand, the role of quartz is important in controlling the rock composition through the sequence of microgranite (0%) to G1 (2%) to G2 (6%). It then becomes unimportant in the porphyry (0%) but increases in importance in G3 (2%) and finally in G4 (5%).

A summary of the inter unit modelling is shown in **Table 6.12b**. Two paths have been modelled namely (1) microgranite to G1 to G2 and (2) porphyry to G3 to G4. The modelling is divided into two paths because 'G2' cannot fractionate to 'G3' type magmas as the latter is more basic (see section 5.2.2.1 and 5.2.2.2). In the first path plagioclase and biotite decrease whereas alkali feldspar and quartz increase from stage 1 to 2 to 3. In the second stage plagioclase and alkali feldspar do not show any trend whereas quartz increases and biotite decreases from stage 1 to 2 to 3 to 4.

The results seem to support Mercy's suggestion (1960b) that the evolution of the Rosses pluton involved two cycles i.e. microgranite to G1 to G2 and porphyry/G3 to G4.



FIGURE 6.5: Inter element variation diagrams for LIL elements Ba, Rb and Sr of the Rosses pluton. Mineral vectors indicate the net change in composition of the initial liquid after 20% Rayleigh fractionation of the named phase.

	Start	composition	Target composition (TC)	Target model (TM)	Different (TM-TC)
Rock type		Granite	Granite		
SiO2		69.92	75.4	75.39	-0.01
TiO2		0.27	0.08	0.14	0.06
AI2O3		15.36	13.24	12.97	-0.27
Fe(tot)		2.02	0.64	1.19	0.55
MgO		1.38	0.16	1.09	0.93
CaO		1.88	0.56	1.17	0.61
Na2O		4.56	4.4	4.78	0.38
K2O		4.23	5.1	3.49	-1.61
Total		99.62	99.58	100.22	

Mineral extract proportion

Bi : 19 % precipitation: 72% PI : 50.9 Ksp : 30 Qu : 0 Mag : 0.1

TABLE 6.6 : Summary results obtained from the major element modelling of the microgranite sheets of Rosses pluton. Mineral data from G1 rock (Appendix 4).

	Start composition	Target composition (TC)	Target model (TM)	Different (TM-TC)
Rock type	Granite	Granite		
SiO2	70.2	74.3	74.4	0.1
TiO2	0.3	0.14	0.17	0.03
AI2O3	15	13	13.36	0.36
Fe(tot)	2.2	1.2	0.93	-0.27
MgO	0.71	0.39	0.43	0.04
CaO	1.1	0.89	0.81	-0.08
Na2O	4	4	4.18	0.18
K20	5.1	4.6	4.07	-0.53
Total	98.61	98.52	98.35	

Mineral extract proportion

Bi:18	•	% precipitation: 27%
PI: 39		
Ksp : 39		
Qu: 2		
Mag : 2	anton an la statu Antonia	

TABLE 6.7 : Summary results obtained from the major element modelling of G1 of the Rosses pluton. Mineral data from G1 rock (Appendix 4).

	Start composition	Target composition (TC)	Target model (TM)	Different (TM-TC)
Rock type	Granite	Granite		
SiO2	71.4	76.5	76.43	-0.07
TiO2	0.25	0.17	0.15	-0.02
AI2O3	14.6	12.3	12.3	0
Fe(tot)	1.8	1.1	0.87	-0.23
MgO	0.76	0.35	0.57	0.22
CaO	1.4	1.1	1.32	0.22
Na2O	4.2	4.2	4.13	-0.07
K2O	4.3	4.6	3.45	-1.15
Total	98.71	100.32	99.22	

Mineral extract proportion

Bi : 14 Pl : 44.6 % precipitation: 36% Ksp : 35 Qu : 6 Mag : 0.4

TABLE 6.8: Summary results obtained from the major element modelling of G2 of the Rosses pluton. Mineral data from G2 of the Rosses granite (Appendix 4).

	Start	composit	ion	Target composition (TC)	n Target model (TM)	Different (TM-TC)
Rock type	s dia P	Granite		Granite		
SiO2		70.10		72.82	72.61	-0.21
TiO2		0.35		0.16	0.29	0.13
AI2O3		15.00		13.50	13.98	0.48
Fe(tot)		2.50		1.90	1.89	-0.01
MgO		1.00		0.75	0.82	0.07
CaO		1.70		2.00	1.52	-0.48
Na2O		4.20		4.40	4.28	-0.12
K20		4.50		4.00	3.90	-0.1
Total		99.35		99.53	99.29	

Mineral extract proportion

BI : 19	
PI:39	% precipitation: 15%
Ksp : 38	
Mag:2	

TABLE 6.9 : Summary results obtained from the major element modelling of the porphyry dykes of the Rosses pluton. Mineral data from the porphyry of the Rosses granite (Appendix 4).

	Start composition	Target composition (TC)	Target model (TM)	Different (TM-TC)
Rosk type	granite	granite		
SiO2	72.82	75.6	75.52	-0.08
TiO2	0.17	0.05	0.1	0.05
AI2O3	14.21	14.1	13.09	-1.01
Fe(tot)	1.32	0.54	0.65	0.11
MgO	· 1	0.1	0.94	0.84
CaO	0.97	0.4	0.68	0.28
Na2O	3.98	4.1	4.45	0.35
K2O	4.55	4.4	4.09	-0.31
Total	99.02	99.29	99.52	

Mineral extract proportion

Bi: 15.5 % precipitation : 16% PI:45 Ksp: 32 Qu: 2 Mag: 0.5

TABLE 6.10 : Summary results obtained from the major element modelling of G3 of the Rosses pluton. Mineral data from G3 rock (Appendix 4).

	Start composition	Target composition (TC)	Target model (TM)	Different (TM-TC)
Rosk type	granite	granite		
SiO2	73.7	76.6	76.58	-0.02
TiO2	0.11	0.1	0.04	-0.06
A12O3	14.6	13.7	13.41	-0.29
Fe(tot)	0.97	0.39	0.57	0.18
MgO	0.26	0.3	0.07	-0.23
CaO	0.51	0.46	0.14	-0.32
Na2O	3.9	3.4	3.88	0.48
K2O	4.6	4.6	3.76	-0.84
Total	98.65	99.55	98.45	

Mineral extract proportion

Bi: 12 PI:40 Ksp: 43 Qu: 5

% precipitation : 21%

TABLE 6.11: Summary results obtained from the major element modelling of G4 of the Rosses pluton. Mineral data from G4 rock (Appendix 4).

	Start ROS11 granite	Target ROS12 granite	Target model	Bulk Kd	Min	orop
La	30.18	23.58	18.99	2.77	PI	38.03
Се	60.52	44.69	40.79	2 51	Kf	30.03
Nd	23.09	16.7	17.58	2.04	Ri	10
Sm	3.81	3.04	3.49	1 22		1 76
Eu	0.72	0.55	0.53	2 23	All .	
Gd	2.55	2.3	2 78	0.68	An .	0.05
Dy	1.68	1.66	1.80	0.00	7r	0.7
Er	0.73	0.78	0.77	0.74		1.2
Yb	0.72	0.7	0.77	1 01	мад	1.3
Lu	0.1	0.09	0.10	1.05		

% precipitation : 23%



FIGURE 6.6 : Summary of the REE modelling of G1 from Rosses pluton. At the top is the summary of start and target compositions, target model, amount of mineral precipitate (%) and bulk Kd of the REE used in the modelling. % precipitation is the percentage precipitated to move the start composition to the target model. Below is the graphical presentation of the modelling.

	Start ROS5 Granite	Target ROS15 Granite	Target model	Bulk Kd	Min Prop
					and the second second
La	16.17	7.12	6.55	2.51	Pl 44.03
Ce	32.27	17.1	15.9	2.18	Kf 33.2
Nd	14.45	6.1	7.13	2.18	Bi 14
Sm	3.61	1.99	2.08	1.92	Qu 5.8
Eu	0.46	0.28	0.25	2.01	All 0.05
Gd	3.3	2.08	2.4	1.53	Ap 2.4
Dy	2.91	2.45	2.34	1.37	Zr 0.08
Er	1.62	1.49	1.43	1.22	Mag 0.44
Yb	1.45	1.6	1.39	1.07	
Lu	0.2	0.2	0.2	1.04	

% precipitation: 45%



FIGURE 6.7 : Summary of the REE modelling of G2 from Rosses pluton. At the top is the summary of start and target compositions, target model, amount of mineral precipitate (%) and bulk Kd of the REE used in the modelling. % precipitation is the percentage precipitated to move the start composition to the target model. Below is the graphical presentation of the modelling.

	Start ROS18	Target ROS20	Target model	Bulk Kd	Min Prop	
	granite	granite			and a start of the second s Second second	
La	25.16	17.8	19.32	2.51	Pi 44.47	
Се	45.1	39.1	36.69	2.18	Kf 31	
Nd	17.3	14.97	14.07	2.18	Bi 14.5	
Sm	3.04	2.8	2.58	1.93	Ou 7	
Eu	0.6	0.51	0.5	2.01	All 0.05	
Gđ	2.1	2	1.91	1.53	Ap 1.4	
Dy	1.66	1.62	1.56	1.37	Zr 0.08	
Er	0.87	0.92	0.84	1.22	Mag 0.5	
Yb	0.85	0.92	0.84	1.07		
Lu	0.07	0.13	0.07	1.05		

% precipitation : 16%



FIGURE 6.8 : Summary of the REE modelling of G3 from Rosses pluton. At the top is the summary of start and target compositions, target model, amount of mineral precipitate (%) and bulk Kd of the REE used in the modelling. % precipitation is the percentage precipitated to move the start composition to the target model. Below is the graphical presentation of the modelling.



Ba



FIGURE 6.9 : Samples used in the inter units modelling of the Rosses granite. The modelling is divided into two paths i.e. (1) microgranite to G1 to G3 and (2) porphyry dyke to G3 to G4. Location of the samples shown in the small map. Result of the modelling is shown in Table 6.12b.



FIGURE 6.10a: Normative Ab-Or-An-Qz tetrahedral diagram for the Rosses granite (Microgranite - G1 - G2). Phase boundaries from Presnall and Bateman (1973).



FIGURE 6.10b: Normative Ab-Or-An-Qz tetrahedral diagram for the Rosses granite (porphyry - G3 - G4). Phase boundaries from Presnall and Bateman (1973).

### Major elements modelling

Units	PI	Ksp	Bi	Qu	Mag	%ppt	
Microgranite	50.9	30	19	0	0.1	72%	
G1	39	39	18	2	2	27%	
G2	44.6	35	14	6	0.4	36%	
Porphyry	39	38	19	0	2	15%	
G3	45	32	15.5	2	0.5	16%	
G4	40	43	12	5	0	21%	
			<i>.</i>			1.	
REE modell	ing a						
Linite		Ken	Ri	Ou	Maa	Au	An

orind	••	, top			mag	2.00	r p	<b>4</b> 1	whhr
G1	38.3	39	19	1.76	1.3	0.09	0.7	0.12	23%
G2	44.03	33.2	14	5.8	0.55	0.05	2.4	0.08	45%
G3	44.47	31	14.5	7	0.5	0.05	1.4	0.08	16%
						and the second			

TABLE 6.12a: Summary results of major and RE element modelling of the Rosses pluton. Note that in the major element modelling, biotite and quartz show decreasing and increasing trend respectively from microgranite to G1 to G3 and from porphyry to G3 to G4 (arrows).

STEPS	Plag	K-Felds	Quartz	Biotite	Magnetite	% ppt
PATH 1						
Maranite (ROS31) to G1(ROS4)	50	30.4	2	17	0.6	22%
G1 (ROS4) to G2 (ROS7)	47	33.2	4	15	0.8	7%
G2(ROS7) to G2 (ROS6)	45.9	35.7	5	13	0.4	6%
<ul> <li>A set of grant set of the set o</li></ul>			na butur Alta bar			
PATH 2						
Porphyry (ROS3) to G3(ROS18)	44.9	36.7	0	18	0.4	9%
G3(ROS18) to G3 (ROS20)	46	35.7	3	15	0.3	5%
G3(ROS20) to G3 (ROS8)	46.3	35.4	3.8	14.5	0.3	1%
G3(ROS8) to G4 (ROS10B)	41	41.1	6	11	0.9	9%

Table 6.12b : Summary results of the inter unit . modelling of the Rosses granite.

Mercy (1960b) suggested two cycles of differentiation at depth from magmas with compositions of the average microgranite and porphyry. The first cycle involved the differentiation of a biotite microgranite to form G1 and then G2 .The second cycle of differentiation involved the porphyries to G3 and G4. This radically different to Hall's model (1966c) in which he suggested that the changes in composition required to produce the Rosses G1 to G4 series resulted from *continuous assimilation* of the Thorr granodiorite at a depth of 30 km unlikely.

On a tetrahedral An-Ab-Or-Qz plot of the Rosses granites, two paths can be distinguished i.e. (i) microgranite-G1 and G2 (Fig 6.10a) and (ii) G3-porphyry-G4 (Fig 6.10b). The microgranite of (i) started precipitation in the plagioclase volume, but quickly included alkali feldspar as the plagioclase-alkali feldspar surface was reached. The porphyry dykes of the second path plot higher in the plagioclase volume compared to those of the first path. The crystallisation started at the plagioclase-quartz surface and at this time both plagioclase, minor quartz and alkali feldspar crystallised as phenocrysts. Further crystallisation would have moved the liquid away from the plagioclase-quartz surface towards the plagioclase-alkali feldspar surface. At this stage plagioclase precipitated along with alkali feldspar and final crystallisation involved quartz.

#### 6.5 ARDARA PLUTON

The geochemistry of the Ardara pluton (see section 5.2.3) indicates that the outer, intermediate and inner units are not related by simple crystal fractionation. Thus, each unit of the Ardara granite will be modelled separately.

#### 6.5.1 LILE modelling

Inter element variation diagrams for the pairs Rb-Sr, Ba-Sr and Ba-Rb are shown in Fig 6.11. The Sr vs Ba (Fig 6.11a) diagram shows that all units in Ardara pluton have restricted Sr and Ba contents compared to the other Donegal granites. The general trend shown by the Ardara rocks in this plot is consistent with minor fractionation of

hornblende and biotite. On a Ba vs Rb plot (Fig 6.11b), the outer unit has higher Rb value than the intermediate and inner units. This is odd considering that the outer unit of the Ardara pluton is the most basic of the Ardara rocks. On a Rb vs Sr plot (Fig 6.11c), the general trend of the Ardara granites is consistent with fractionation of alkali feldspar and biotite.

#### 6.5.2 Major element modelling

The Outer, intermediate and inner units have been modelled separately. The results are shown in **Tables 6.13 to 6.15**. Each unit has been modelled from its most basic to most felsic rock. The results are :

(1) <u>Outer unit</u>. This stage has been modelled from 60.6% to 63.2 % SiO<sub>2</sub>. The target composition can be achieved by 22% fractionation and the mineral mix is plagioclase, biotite, hornblende, alkali feldspar, apatite, magnetite and sphene (Table 6.13).

(2) <u>Intermediate unit</u>. This stage has been modelled from 62.6 % to 68.6 % SiO<sub>2</sub>. The target composition can be achieved by 36% fractionation and the mineral mix is plagioclase, biotite, alkali feldspar, hornblende, magnetite, apatite and sphene (**Table 6.14**).

(3) <u>Inner unit</u>. This stage has been modelled from 68.6 % to 72.18 % SiO<sub>2</sub>. The target composition can be achieved by 24% fractionation and the mineral mix is plagioclase, biotite, alkali feldspar, hornblende, magnetite, apatite and sphene (Table 6.15).

#### 6.5.3 REE modelling

As in major elements modelling, the REEs have been modelled in the outer, intermediate and inner units.

In the outer unit, the start sample (ARD1F) is taken from the outer margin and the target sample (ARD 1E) is from the inner margin. The mineral mixes from major element modelling plus 0.14% allanite and 0.19% zircon at 16% fractionation are required to produce the calculated REE profiles shown in **Fig 6.12**.

In the intermediate unit, the start sample is ARD2 (69.18 % SiO2) and the target

sample is ARD4 (69.47 % SiO<sub>2</sub>). The mineral mixes from major element modelling plus 0.14% allanite and 0.19% zircon at 3% fractionation are required to produce the calculated REE profiles shown in **Fig 6.13**. The amount of magnetite is less in the REE modelling compared to the major element modelling.

In the inner unit, the start sample is ARD13 (69.3 SiO<sub>2</sub>) and the target sample is ARD 11 (72.18 SiO<sub>2</sub>). The mineral mixes from major elements modelling plus 0.05% allanite and 0.24% zircon at 22% fractionation are required to produce the calculated REE profiles shown in **Fig 6.14** 

To further investigate the relationship between each unit, the differentiation index (Fig 6.15) and Rb/Sr (Fig 6.16) values of the traverse samples of each unit were plotted against the distance from the margin to the centre of the pluton (see Fig 5.21). The mineral proportion and remaining liquid proportion (F) results obtained from the REE modelling (see Fig 6.12, 6.13 and 6.14) were used to model Rb/Sr value of the target sample. These were compared to the actual values in Fig 6.16. The results are summarised below.

#### <u>Outer unit</u>

The changes observed from the outer margin (contact with the country rocks) to the inner margin (contact with the intermediate unit) of the outer unit are :

(1)  $SiO_2$  and DI decrease from the outer margin to the inner margin; 61.85% to 61.68% and 70.6 to 67.1 respectively. Thus the outer unit of Ardara granite is finely reversely zoned.

(2) Rb/Sr ratio decreases from the outer margin to the inner margin ; 0.39 to 0.17.

(3) Modelled Rb/Sr value is 0.17.

#### Intermediate unit

The changes observed from the outer margin (contact with the outer unit) to the inner margin (contact with the inner unit) of the intermediate unit are :

(1) Rb/Sr decreases and SiO<sub>2</sub> and DI increase from the outer to inner margin. Thus in terms of SiO<sub>2</sub> and DI, the intermediate unit of the Ardara granite is normally zoned.

(2) The gap observed in the intermediate unit is marked by the sudden increase of DI

and SiO<sub>2</sub> (see also Fig 5.21; section 5.2.3.3.).

(3) Modelled Rb/Sr values are 0.08 (before the gap) and 0.04 (after the gap). Inner unit.

The change observed from the outer margin (contact with the intermediate unit) to the centre of the inner unit are :

(1) SiO<sub>2</sub>, DI and Rb/Sr increase to the centre of the unit. Thus the inner unit is normally zoned which is in contrast to the outer unit.

(2) Modelled Rb/Sr value is 0.04.

#### 6.5.4 Discussion

The summary of the major and REE modelling within the units is given in **Table 6.16.** Although all the units show a similar trend in the LILE plots, the mineral precipitates from the major element modelling are significantly different in the three units. The difference is obvious when comparing the inner unit to both the outer and intermediate units. Thus the amount of plagioclase (62%) precipitated in the inner unit is higher compared to both outer and intermediate units (53 and 50% respectively). The amount of hornblende precipitated is high in the outer and low in the intermediate to inner units. The amount of alkali feldspar precipitated in the inner unit (14.5%) is lower than that in the intermediate unit (15.5%). These results are opposite to what would be expected in a simple closed evolving granite system.

By using mass balance Yarr (1991), showed that the outer and intermediate units are closely related and that it is possible to generate an intermediate composition from an outer unit type parent magma. Yarr's results give an average of 65% plagioclase precipitated in order to move the liquid from the composition of the outer unit magma to that of the intermediate unit type magma. However, tests of Yarr's model using an average Sr for the outer unit of 513 ppm and KdSr Plag = 4.4 (Arth 1976), if 65% plagioclase was precipitated by fractional crystallisation, the average of Sr in the intermediate unit would be 156 ppm. It is 591 ppm. Furthermore the Rb/Sr ratio for the outer unit is higher than the intermediate unit, the opposite of what would be expected if



FIGURE 6.11: Inter element variation diagrams for LIL elements Ba, Rb and Sr of the Ardara granite. Mineral vectors indicate the net change in composition of the initial liquid after 20% Rayleigh fractionation of the named phase.

	Start composition	n Target composition (TC)	Target model (TM)	Different (TM-TC)
Rock type	QMZD	QMZD		
SiO2	60.57	63.22	63.23	0.01
TiO2	0.91	0.84	0.77	-0.07
AI2O3	17.82	16.65	17.44	0.79
Fe(tot)	4.84	4.35	3.87	-0.48
MaO	3.28	2.76	3.19	0.43
CaO	4.06	2.97	3.51	0.54
Na2O	4.52	4.1	4.53	0.43
к20	3.47	4.15	3.48	0.67
Total	99.47	99.04	100.02	
	Mineral extract p	roportion	and a start of the second s Second second	

PI : 52.5	Ap : 0.5	% precipitation : 22%
Bi : 20.5	Mag : 1.5	• • • • • • • • • • • • • • • • • • • •
Hbl :14	Sph : 2	
Ken 10		

TABLE 6.13 : Summary results obtained from the major element modelling of the outer unit of Ardara pluton. Mineral data from the outer unit rock (Appendix 4).

	Start composition	Target composition	Target model	Different
Rock type	QMZD	(TC) Granodiorite	(TM)	(TM-TC)
SiO2	62.6	68.55	68.52	-0.03
TiO2	0.7	0.38	0.33	-0.05
AI2O3	16.8	15.58	15.34	-0.24
Fe(tot)	4.2	2.62	2.33	-0.29
MgO	2.6	1.85	2.27	0.42
CaO	3.6	2.09	2.54	0.45
Na2O	4.3	4.51	4.29	-0.22
K2O	3.4	3.75	2.92	-0.83
Total	98.2	99.33	98.54	

Mineral extract proportion

PI: 50	Hb:11
Bi : 19.5	Ap : 0.5
Ksp: 15.5	Sp:2
Mag : 1.5	

% precipitation : 36%

TABLE 6.14 : Summary results obtained from the major element modelling of intermediate unit of the Ardara pluton. Mineral data from the intermediate unit rock (Appendix 4).
	Start composition	Target composition (TC)	Target model (TM)	Different (TM-TC)	
Rock type	Granodiorite	Granodiorite			
SiO2	68.6	72.18	72.26	0.08	
TiO2	0.3	0.13	0.15	0.02	
AI2O3	16.2	14.79	14.93	0.14	
Fe(tot)	2	0.9	. 1.1	0.2	
MaO	1	0.86	0.69	-0.17	
CaO	2.5	1.2	1.92	0.72	
Na2O	5.5	5.61	5.6	-0.01	
K20	2.9	3.45	2.62	-0.83	
Total	99	99.12	99.27		

Mineral extract proportion

PI: 62.4 Bi: 19.5 % precipitation : 24 % Ksp : 14.5 Mag : 1.5 Hb : 1 Ap : 0.4 Sp : 1

TABLE 6.15 : Summary results obtained from the major element modelling of the inner unit of the Ardara pluton. Mineral data from the inner unit rock (Appendix 4).

	Start ARD1F QMZD	Target ARD1E QMZD	Target model	Bulk Kd	Min Prop
La	67.58	38.28	37.43	4.39	PI 52.75
Ce	156	71.9	86.97	4.35	Kf 9.22
Nd	59.5	28.8	29.53	5.02	Bi 20.5
Sm	9.66	5.16	4.74	5.08	Hbl 13
Eu	1.69	1.21	0.94	4.35	Mag 1.5
Gd	6.28	3.75	3.1	5.05	All 0.14
Dy	4.65	2.56	2.35	4.93	Sp 2.2
Er	2.53	1.14	1.27	4.95	Ap 0.5
Yb	2.19	1.23	1.23	4.31	Zr 0.19
Lu	0.26	0.15	0.17	3.57	

% precipitation : 16%



FIGURE 6.12 : Summary of the REE modelling of the Outer unit, of the Ardara pluton. At the top is the summary of start and target compositions, target model amount of mineral precipitate (%) and bulk Kd of the REE used in the modelling. % precipitation is the percentage precipitated to move the start composition to the target model. Below is the graphical presentation of the modelling.

	Start ARD2 granodiorite	Target ARD4 granodiorite	Target model	Bulk Kd	Min F	rop
La	15.37	15.17	13.89	4.33	Pl	49.68
Се	34.8	32.3	31.55	4.22	Kf	18
Nd	15	15.66	13.42	4.65	Bi	18.09
Sm	3.36	3.17	3.02	4.52	Hbl	10
Eu	0.69	0.75	0.63	3.95	Mag	0.5
Gd	2.05	2.38	1.85	4.38	All	0.14
Dy	1.69	1.53	1.53	4.19	Sp	1.9
Er	1.14	0.8	1.03	4.26	Ap	0.5
Yb	0.72	0.72	0.66	3.76	Zr	0.19
Lu	0.1	0.1	0.09	3.21		

% precipitation : 3%



FIGURE 6.13 : Summary of the REE modelling of the intermediate unit, of the Ardara pluton. At the top is the summary of start and target compositions, target model, amount of mineral precipitate (%) and bulk Kd of the REE used in the modelling . % precipitation is the percentage precipitated to move the start composition to the target model.Below is the graphical presentation of the modelling.

	Start ARD13 granodiorite	Target ARD11 granite	Target model	Bulk Kd	Min Prop
La	15.36	14.98	12.52	1.82	Pl 62.51
Се	33.2	28.1	27.7	1.73	Kf 14.5
Nd	14.6	10.8	11.88	1.83	Bi 19.5
Sm	2.48	1.78	2.08	1.7	Hbl 1
Eu	0.66	0.51	0.46	2.5	Mag 1.1
Gd	1.8	1.48	1.42	1.96	All 0.05
Dy	1.47	0.65	1.27	1.58	Sp 0.7
Er	0.89	0.13	0.69	1.99	Ap 0.4
Yb	0.61	0.4	0.44	2.28	Zr 0.24
Lu	0.06	0.04	0.04	2.56	

% precipitation : 22%



FIGURE 6.14 : Summary of the REE modelling of the inner unit of the Ardara pluton. At the top is the summary of start and target compositions, target model, amount of mineral precipitate (%) and bulk Kd of the REE used in the modelling % precipitation is the percentage precipitated to move the start composition to the target model. Below is the graphical presentation of the modelling.



FIGURE 6.15: Differentiation index (DI) accross the Ardara traverse (see Fig 5.21).



modelled results by using mineral prop. and
 F from REE modelling.

FIGURE 6.16: Rb/Sr ratios vs the relative distance from the margin to the centre of the Ardara pluton. Dotted line in the intermediate unit indicate the general trend of Rb/Sr ratio across the unit.

# Major elements modelling

	P	Ksp	Bi	Hbl	Ар	Mag	Sph	% ppt
Outer	52.5	9	20.5	14	0.5	1.5	2	22%
Intermediate	50	15.5	19.5	11	0.5	1.5	2	36%
Inner	62.4	14.5	19.5	1	0.4	1.5	<b>1</b>	24%

# REE modelling

	PI	Ksp	Bi	Hbl	Ap	Mag	Sph	All	Zr	% ppt
				N. 2010 - 120						
Outer	52.75	9.22	20.5	13	0.5	1.5	2.2	0.14	0.19	16%
Intermediate	49.68	18	18.09	5 11	0.5	0.5	1.9	0.14	0.19	3%
Inner	62.51	14.5	19.5	- <b>1</b> - 1	0.4	1.1	0.7	0.05	0.24	22%

Table 6.16: Summary results of major and RE element modelling of the Ardara pluton.





both units are related by a simple fractionation involving plagioclase.

On a Rb/Sr vs SiO<sub>2</sub> plot (see Fig 5.19a; section 5.2.3.2), Rb/Sr ratios generally decrease from the outer to intermediate and inner units i.e it does not show the systematic increase that would be expected in a normally zoned pluton where zoning is related to a in situ fractional crystallisation inwards from the walls (e.g. Tindle and Pearce 1981; Tindle 1982). Thus modelling and Rb/Sr data indicate that the units of Ardara granite are not related by a simple fractional crystallisation. This is supported by Harker trace element plots, where most of the data is scattered and does not show any trend, between units (see Fig 5.18). The style of zoning within the three units is also different, thus the outer unit is reversely zoned and the inner and intermediate units are normally zoned. Such difference in zoning style would have not occurred if each unit was related by simple in situ fractional crystallisation.

The traverse profiles (Fig 5.21, 6.15 and 6.16) indicate that a gap occurs in the intermediate unit. The gap is also obvious in the Harker major and trace element plots (see Fig 5.16 and 5.18) and occurs at SiO<sub>2</sub> rocks between 65 % to 67%. It may be a true gap and not related to undersampling as Hall (1966d) analyses also indicate a similar gap.

On a tetrahedral An-Ab-Or-Qz plot (Fig 6.17) the outer and intermediate unit magmas started to crystallise in the plagioclase volume whereas the inner unit magma crystallised lower, nearer to the alkali feldspar-plagioclase surface. This reflects the higher An of plagioclase in the outer and intermediate units but the plots do not indicate a single coherent liquid lineage.

### 6.6 FANAD PLUTON

Major and trace elements geochemistry indicates that the Fanad pluton consists of three separate units or facies namely Rosguill quartz monzodiorite to granodiorite, Melmore quartz monzodiorite and Fanad peninsula quartz monzodiorite. The latter can be divided according to the Ba content into low Ba Fanad peninsula and high Ba Fanad peninsula (Map 5.1). Thus the Fanad granites will be modelled separately viz. (1) Rosguill, (b) Melmore, (c) Low Ba Fanad peninsula and (d) high Ba Fanad peninsula.

# 6.6.1 LILE modelling

Inter elements variation diagrams for the pairs Rb-Sr, Ba-Sr and Ba-Rb are shown in Fig 6.18. On a Sr vs Ba plot (Fig 6.18a) the Melmore, low Ba Fanad Peninsula and Rosguill rocks have a similar trend. The fractionation vectors indicate that the trend is strongly controlled by hornblende and plagioclase. A different trend is shown by the rocks from the high Ba Fanad peninsula and this trend is strongly controlled by plagioclase. On a Ba vs Rb plot (Fig 6.18b), rocks from the high and low Ba Fanad Peninsula have a similar trend which is strongly controlled by plagioclase. The trend from the Rosguill rocks is controlled by hornblende and plagioclase. On a Rb vs Sr plot (Fig 6.18c), a similar trend is shown by the rocks from Melmore, high and low Ba Fanad Peninsula which appear to be controlled by the crystallisation of the plagioclase and minor hornblende. On the other hand the minor trend of the Rosguill rocks is controlled by hornblende and minor biotite. In conclusion, the LILE modelling shows that the evolution of the Fanad granite is strongly controlled by hornblende and plagioclase.

### 6.6.2 Major element modelling

The results of major element modelling are shown in **Tables 6.17 to 6.20**. They are . (1) <u>High Ba Fanad peninsula</u>. This unit has been modelled from a sample with 58.4% SiO<sub>2</sub> to one with 61.93 % SiO<sub>2</sub>. The target can be achieved by 34% fractionation and a mineral mix of plagioclase, biotite, alkali feldspar, hornblende, magnetite and sphene (Table 6.17).

(2) Low Ba Fanad peninsula This unit has been modelled from a sample with 57.3 % SiO<sub>2</sub> to one with 64.37 % SiO<sub>2</sub>. The target can be achieved by 24 % fractionation and a mineral mix of plagioclase, biotite, alkali feldspar, hornblende, magnetite and sphene (Table 6.18).

(3) <u>Rosguill quartz monzodiorite-granodiorite</u>. This unit has been modelled from a sample with 58.6 % SiO<sub>2</sub> to one with 62.04 % SiO<sub>2</sub>. The target can be achieved by 29% fractionation and a mineral mix of plagioclase, biotite, alkali feldspar, hornblende,

apatite and sphene (Table 6.19).

(4) <u>Melmore quartz monzodiorite</u>. This unit has been modelled from a sample with 55.44 % SiO<sub>2</sub> to one with 56.85 % SiO<sub>2</sub>. The target can be achieved by 11% fractionation and a mineral mix of plagioclase, biotite, alkali feldspar, hornblende, apatite and magnetite **Table 6.20**.

### 6.6.3 REE modelling

The REE modelling of the Fanad granite is restricted to two units, namely low Ba Fanad peninsula and Rosguill.

Low Ba Fanad peninsula. The Low Ba Fanad peninsula rocks have been modelled from a sample with 57.3% SiO<sub>2</sub> to one with 64.86% SiO<sub>2</sub>, cf major element modelling. The mineral mixes from the major element modelling plus 0.16 % allanite, 0.18% apatite and 0.16% zircon at 11 % fractionation are required to produce the calculated REE profiles shown in Fig 6.19.

<u>Rosguill</u>. The Rosguill rocks have been modelled from a sample with 60.42% SiO<sub>2</sub> to one with 64.86% SiO<sub>2</sub>. The mineral mixes from major element modelling plus 0.09% allanite and 0.4% zircon at 27% fractionation are required to produce the calculated REE profiles shown in Fig 6.20.

### 6.6.4 Discussion

The summary of the major and REE element modelling of the Fanad pluton is given in Table 6.21. Major, LIL and RE elements modelling shows the importance of precipitation of plagioclase and hornblende in each unit of the Fanad granite. The high Ba Fanad peninsula requires the highest amount of plagioclase and hornblende precipitation compared to the other units. The low Ba Fanad peninsula modelling indicates low plagioclase and high alkali feldspar precipitation. The modelling results of the high and low Ba Fanad peninsula suggest that the former may represent a cumulate; this is supported by high positive Eu anomalies shown by the rocks from this unit (see section 5.3.4.3). The modelling results of the Fanad granite suggest that the



FIGURE 6.18: Inter element variation diagrams for LIL elements Ba, Rb and Sr of the Fanad granite. Mineral vectors indicate the net change in composition of the initial liquid after 20% Rayleigh fractionation of the named phase.

	Start composition	Target composition (TC)	Target model (TM)	Different (TM-TC)
Rock type	QMZD	QMZD		
SiO2	58.4	61.93	61.96	0.12
TIO2	0.8	0.64	0.74	-0.17
A12O3	19.01	17.78	18.86	0.11
Fe(tot)	5.55	4.23	4.32	0.7
MgO	3.33	2.72	2.88	0.73
CaO	4.22	2.58	2.89	0.7
Na2O	4.55	4.25	4.65	-0.3
K20	3.05	4.27	3.26	-1.28
Total	98.91	98.4	99.56	
v.	Mineral extract prop	ortion		
<b></b>	Bi : 15	Hbl : 25	% precipitation:	34%
	PI: 52.8	Mag : 0.1		
	Ksp : 7	Sph : 0.1		

TABLE 6.17 : Summary results obtained from the major element modelling of the rocks from high Ba Fanad peninsula, Fanad pluton. Mineral data from the Fanad peninsula rock (Appendix 4). QMZD : quartz monzodiorite, GDR : Granodiorite.

•	Start	compositio	n Ta	rget composition (TC)	n Tar	get model (TM)	Different (TM - TC)
Rock type		QMZD		QMZD	n an		
SiO2		57.3		64.37		64.31	-0.06
TiO2		0.98		0.57		0.45	-0.12
AI2O3		17.49		15.23		16.71	1.48
Fe(tot)		6.29		3.92		3.36	-0.56
MgO		3.38		3.49		2.68	-0.81
CaO	1	4.47		3.74		3.02	-0.72
Na2O		3.95		4.09		3.87	-0.22
K20		3		3.37		1.87	-1.5
Total		96.86		98.78	1.4.5	96.27	

Mineral extract proportion

Bi : 14.3 % precipitation : 45% PI : 43.5 Ksp : 17 Qu : 0.1 Mag : 3 Hbl : 21.1 Sph : 1

TABLE 6.18 : Summary results obtained from the major element modelling of the rocks from low Ba Fanad peninsula, Fanad pluton. Mineral data from the Fanad peninsula rock (Appendix 4). QMZD Quartz monzodiorite.

	Start composition	Target composition (TC)	Target model (TM)	Different (TM-TC)
Rock type	QMZD	granodiorite		
SiO2	58,61	62.04	62.16	0.03
TiO2	0.91	0.67	0.6	0.1
A12O3	18.2	18.11	18	1.08
Fe(tot)	5.63	4.24	4.94	0.09
MgO	3.34	2.26	2.99	0.16
CaO	4.75	3.21	3.91	0.31
Na2O	4.37	4.67	4.37	0.4
K20	2.83	3.83	2.55	-1.01
Total	98.64	99.03	99.52	

Mineral extract proportion

1. A. M.		
Bi: 18	Hbi : 19	ŧ.
PI:49	Ap:1	
Ksp:9	Sph : 1	

% precipitation: 29%

TABLE 6.19: Summary results obtained from the major element modelling of the quartz monzodiorite (QMZD) to granodiorite of Rosguill, Fanad pluton.Mineral data from the Rosguill rock (Appendix 4).

	Start composition	Target composition (TC)	Target model (TM)	Different TM -TC
Rock type	QMZD	QMZD		
SiO2	55.44	56.85	56.77	-0.06
TiO2	0.87	0.88	0.81	-0.12
AI2O3	20.09	19.17	20.48	1.48
Fe(tot)	6.09	5.6	5.38	-0.56
MgO	3.23	3.04	2.9	-0.81
CaO	5.02	3.87	4.66	-0.72
Na2O	4.82	4.45	4.99	-0.22
K20	2.8	3.52	2.79	-1.5
Total	98.36	97.38	98.78	

Mineral extract proportion

PI: 51 Bi: 16 Hbl:23 Ksp: 9.5 Ap: 0.5 Mag:0.8

% precipitation : 11%

TABLE 6.20: Summary results obtained from the major element modelling of the rocks from Melmore, Fanad pluton. QMZD : Quartz monzodiorite. Mineral data from the Melmore rock (Appendix 4).

	Start FAN13 QMZD	Target FAN10 QMZD	Target model	Bulk kd	Min P	rop
La	41.68	26.56	31.6	4.87	PI	43.18
Ce	89.8	58.9	68.31	4.62	Kf	16.92
Nd	41	25.91	26.7	4.94	Bi	14.9
Sm	6.36	4.05	4.06	4.88	Hb	20
Eu	1.79	1.07	1.19	5.42	Mag	3
Gd	4.35	2.98	2.68	4.24	All	0.16
Dy	2.79	1.77	1.69	4.93	Sp	1.5
Er	1.06	0.68	0.66	4.84	Ap	0.18
Yb	1.07	0.75	0.75	4.07	Zr	0.16
Lu	0.11	0.08	0.08	3.29		

% precipitation : 11%



FIGURE 6.19 : Summary of the REE modelling of the low Ba Fanad peninsula, Fanad pluton. At the top is the summary of start and target compositions, target model, amount of mineral precipitate (%) and bulk Kd of the REE used in the modelling . % precipitation is the percentage precipitated to move the start composition to the target model.Below is the graphical presentation of the modelling.

	Start FAN 23 QMZD	Target FAN 29 Granodiorite	Target model	Bulk kd	Min P	rop
La	76.07	50.6	49.96	4.87	Pl	48.01
Ce	137	97.5	88.07	4.52	Kf	10.79
Nd	49.1	29.9	29.38	4.94	Bi	18.1
Sm	6.65	3.43	3.72	4.00	Hb	20
Eu	2.1	1.21	1.34	5.42	Mag	0.5
Gd	3.64	1.95	2.01	4.32	All	0.09
Dy	2.38	0.95	1.02	4.93	Sp	0.6
Er	1.83	0.52	0.59	4.71	Ap	0.8
Yb	0.96	0.29	0.24	4.07	Zr	0.4
Lu	0.13	0.05	0.04	3.6		

% precipitation : 27%



FIGURE 6.20 : Summary of the REE modelling of the rocks from the Rosguill of the Fanad pluton. At the top is the summary of start and target compositions, target model, amount of mineral precipitate (%) and bulk Kd of the REE used in the modelling . % precipitation is the percentage precipitated to move the start composition to the target model. Below is the graphical presentation of the modelling.

# Major element modelling

	P	Bi	Ksp	НЫ	Mag	Ар	Sp	% ppt
High BaFanad	52.8	15	7	25	0.1	0	0.1	34%
Low Ba Fanad	43.5	14.3	17	21.1	3	0	1	45%
Rosguill	49	18	9	19	0	1	1	29%
Melmore	51	16	9.5	23	0.8	0.5	0	11%

# REE modelling

	Pi -	Bi	Ksp	НЫ	Mag	Ар	Sp	All	Zr	% ppt
Low Ba Fanad	43.14	14.9	16.92	20	3	0.18	1.5	0.16	0.16	11%
Rosguill	48.01	21	10.79	17	0.5	0.8	0.6	0.09	0.4	27%

TABLE 6.21 : Summary of major element and REE modelling of the Fanad pluton.

• Rosguill

- + Fanad peninsula
- × Melmore





different units of this granite (Melmore, Fanad peninsula and Rosguill) represent separate magma batches.

Plots of samples representative of Rosguill, Melmore and Fanad peninsula on a tetrahedral An-Ab-Or-Qz plot are shown in Fig 6.21. All three units overlap. Precipitation starts in the high plagioclase volume and it would appear that extensive plagioclase crystallisation occurred. Hornblende and magnetite also crystallised at this stage. Further crystallisation moved the liquid towards the quartz liquid surface.

### 6.7 MAIN DONEGAL PLUTON.

The Main Donegal granite consists of two main lithologies namely dark bands (trondhjemite) and light bands (granodiorite-granite), which may have a different origin (chapter 5). The latter probably represent a continental trondhjemite that has tholeiitic to calc alkali affinities while the light bands magma which are similar to the other Donegal granite magmas (high-K calc alkali). Thus in this section, trondhjemite (dark bands) and granodiorite - granite (light bands) will be modelled separately.

## 6.7.1 LIL modelling

Inter elements variation diagrams for the pairs Rb-Sr, Ba-Sr and Ba-Rb are shown in Fig 6.22. On a Sr vs Ba plot (Fig 6.22a), the trondhjemite has lower Ba than the granodiorite-granite. Both trondhjemite and granodiorite-granite evolved on a different path in this diagram and the fractionation vector indicates that trondhjemite evolution is strongly controlled by the plagioclase whereas the evolution of granodiorite to granite is controlled by some combination of alkali feldspar, plagioclase and biotite. On a Ba vs Rb plot (Fig 6.22b), both trondhjemite and granodiorite-granite show a similar trend. Both trends are controlled by plagioclase with hornblende. On a Rb vs Sr plot (Fig 6.22c), both trondhjemite and granodiorite-granite show a similar trend controlled by plagioclase and hornblende.

In conclusion the LILE modelling shows that the plagioclase (+ hornblende) are the most important phases in the evolution of the trondhjemite whereas plagioclase,

biotite and perhaps alkali feldspar contolled the trend shown by the granodiorite - granite.

## 6.7.2 Major element modelling

The results of major element modelling are shown in **Table 6.22** and **6.23** respectively. The mineral mix of the major element modelling of the dark bands is plagioclase, alkali feldspar, biotite and quartz and the light bands is plagioclase, alkali feldspar, biotite, magnetite and quartz. The model target of the dark band can be achieved by 20% fractionation whereas the light band requires 47% fractionation.

#### 6.8.3 REE modelling

The REE modelling of the Main Donegal granite has been modelled from the granodiorite to the granite of the light bands. The REE profiles of the observed start and target compositions used in the modelling, together with the calculated melt profile are shown in **Fig 6.23**. The mineral mix is the same as in the major element modelling plus 0.75% apatite, 0.12 allanite and 0.2% zircon and 47% precipitation is required to produce the calculated REE profiles.

### 6.8.4 Discussion

The results of the major and REE modelling of the Main Donegal granite are given in **Table 6.24**. The results of major elements modelling show that the amount of plagioclase (56%) is relatively low in the light band model compared to the dark band (77%). On the other hand the amount of alkali feldspar precipitation in the dark band model is low compared to the light band granodiorite-granite (1 to 24.9%). This is consistent with the modal composition of the dark band trondhjemite which has <1% alkali feldspar. Modal biotite and quartz are higher in the dark band trondhjemite. The major elements modelling supports the LILE modelling which shows that the plagioclase is the most important phase in the evolution of the dark band trondhjemite whereas plagioclase and alkali feldspar are important in controlling the evolution of the light



FIGURE 6.22: Inter element variation diagrams for LIL elements Ba, Rb and Sr of the Main Donegal granite. Mineral vectors indicate the net change in composition of the initial liquid after 20% Rayleigh fractionation of the named phase.

	Start composition	Target composition (TC)	Target model (TM)	TM-TC	
Rock type	granodiorite	granite			
SiO2	67.76	74.65	74.23	-0.42	
TiO2	0.27	0.12	0.01	-0.11	
AI2O3	15.83	12.94	12.03	-0.91	
Fe(tot)	2.24	0.88	0.84	-0.04	
MgO	0.76	0.72	0.33	-0.39	
CaO	1.74	0.96	1.05	0.09	
Na2O	4.5	3.43	3.89	0.46	
K2O	4.05	5.12	2.72	2.4	
Total	97.15	98.82	95.1		

Mineral extract proportion

PI: 56 Kf: 24.9 % precipitation : 47% Bi: 16 Qu: 3 Mag: 0.1

Table 6.22: Summary results obtained from the major element modelling of the light band of the Main Donegal granite. Mineral data from the granodiorite of the light band (Appendix 4).

	Start composition DON25	Target composition (TC)	Target model (TM)	(TM - TC)
Rock type	trondhjemite	trondhjemite		2
SiO2	68.99	71.24	71.19	-0.05
TiO2	0.32	0.25	0.26	0.01
AI2O3	15.83	14.93	14.58	-0.35
Fe(tot)	2.8	2.02	2.47	0.45
MgO	1.32	1.19	1.29	0.1
CaO	2.62	2.85	2.48	-0.37
Na2O	5.64	5.58	5.33	-0.25
K20	2.4	1.17	2.48	1.31
Total	99.92	99.23	100.08	

Mineral extract proportion

PI: 77			
Bi: 20	1990 - 1999 1990 - 1999	% precipitation	: 20%
Qu: 5			
Ksp: 1			

Table 6.23: Summary results obtained from the major element modelling of the dark band of the Main Donegal granite. Mineral data from the trondhjemite rock of the Main Donegal (Appendix 4).

	Start DON1 granodiorite	Target DON5 granite	Target model	Bulk Kd	Min Prop
La	49.07	14.27	11.45	3.43	PI 55
Ce	93.4	28.2	26.73	3.09	Kf 24.6
Nd	28.2	10.3	11.84	2.45	Bi 16.21
Sm	4.66	2.28	3.26	1.59	Zr 0.2
Eu	0.78	0.34	0.37	2.24	All 0.12
Gd	2.58	1.52	2.01	0.69	Qu 3
Dy	1.84	1.5	2.04	0.83	Ap 0.75
Er	1.46	1.07	1.395	1.08	Mag 0.12
Yb	0.84	0.69	0.65	1.43	
Lu	0.11	0.09	0.08	1.55	

% precipitation : 45%



FIGURE 6.23 : Summary of the REE modelling of the light band of the Main Donegal pluton. At the top is the summary of start and target compositions, target model, amount of mineral precipitate (%) and bulk Kd of the REE used in the modelling. % precipitation is the percentage precipitated to move the start composition to the target model.Below is the graphical presentation of the modelling.

# Major elements modelling

	Pl	Ksp	Bi	Qu	Mag	% ppt
	5.0		10	<u> </u>		470/
Light band	56	24.9	01	3	0.1	41%
Dark band	77	1	20	5	0	20%

# REE modelling

	PI	Ksp	Bi and Qu	Ap	Mag	All Zr	% ppt
Light band	55	24.6	16.21 3	0.75	0.12	0.12 0.2	45%
			· · · · · · · · · · · · · · · · · · ·				

TABLE 6.24: Summary results of major and RE element modelling of the Main Donegal granite.



FIGURE 6.24: Normative Ab-Or-An-Qz tetrahedral diagram for the Main Donegal granite. Phase boundaries from Presnall and Bateman (1973).

# band rocks.

On a tetrahedral An-Ab-Or-Qz plot (Fig 6.24) the dark band trondhjemite and the light band granodiorite-granite plot in different fields. The trondhjemite plots in the plagioclase volume nearer to the Ab apex and extends towards the plagioclase-quartz surface. The granodiorite-granite lies in the lower plagioclase volume, and presumably crystallised to eventually reach the plagioclase-alkali feldspar surface. Quartz is also involved in the final crystallisation.

The results of the modelling of the Main Donegal granites confirm the difference between the light and the dark bands which likely originated from a different sources from that of the light band.

# 6.8 TRAWENAGH BAY PLUTON.

The major and trace element geochemistry suggests that the biotite granite from the Trawenagh Bay and granodiorite and granite from Main Donegal plutons have a common origin, supporting Pitcher and Read's (1959) suggestion that the Trawenagh Bay biotite granite represents a magma displaced from Main Donegal (granodiorite and granite or light band) and which was intruded in the final stage of the emplacement of the Main Donegal granite. The Trawenagh Bay pluton consists of two main types of granite i.e. biotite granite and muscovite granite. The latter is more felsic and has crystallised as the final magmatic stage of the parental biotite granite magma.

In this section the Trawenagh Bay granite will be modelled in two stages (1) the most basic rock from the light bands of the Main Donegal granite to the biotite granite of the Trawenagh Bay (to confirm or reject the Pitcher and Read model) and (2) the biotite granite to the muscovite granite.

# 6.8.1 LILE Modelling

Inter element variation diagrams for the pairs Rb-Sr, Ba-Sr and Ba-Rb for the Trawenagh Bay granite and the granodiorite-granite (light bands) of the Main Donegal granite are shown in **Fig 6.25**. The muscovite granite of the Trawenagh Bay has very low

Ba (below detection limit), thus no Ba data points for the granite are shown (Fig 6.25a &

b).

In general, in all three plots (Fig 6.23) both biotite granite and the rocks from the light bands plot in the same field which suggests that they have common a origin. On a Rb vs Sr plot (Fig 6.25c), the muscovite granite has lower Sr but slightly higher Rb compared to the biotite granite. On a Sr vs Ba plot (Fig 6.25a), the trend shown by the biotite granite and the rocks from the light bands of the Main Donegal granites is consistent with the removal of biotite and alkali feldspar with perhaps minor plagioclase whereas on a Ba vs Rb plot (Fig 6.25b), the trend can be produced by the removal of alkali feldspar and plagioclase.

On a Rb vs Sr plot (Fig 6.25c) plot, The evolution of biotite granite to muscovite granite is strongly controlled by fractionation of plagioclase and alkali feldspar. This is supported by the major and REE modelling. The limited trend of the biotite granite and the rocks from the light bands of the Main Donegal granites is consistent with the removal of plagioclase.

In conclusion, the LILE modelling of the Trawenagh Bay granite shows that the plagioclase, alkali feldspar and biotite are important phases in the evolution of the granite.

# 6.8.2 Major element modelling

In the first stage for modelling the granodiorite of the Main Donegal granite to the biotite granite of Trawenagh Bay, granodiorite (DON1) with  $SiO_2 = 67.76\%$ , was selected from the light bands of the Main Donegal granite as a start composition for the modelling. This is the most basic rock of the light band and is more likely to represent the source composition. The target is the biotite granite sample (TRA 5) with  $SiO_2 = 71.87\%$ . The results are shown in Table 6.25. The target composition can be achieved by 25% fractionation and the mineral mix is plagioclase, alkali feldspar, biotite and magnetite.

The second stage involves modelling from the evolution of the Trawenagh Bay

biotite granite to muscovite granite. The results are shown in **Table 6.26**. The target composition can be achieved by 23% fractionation with a mineral mix of plagioclase, alkali feldspar, biotite, quartz and magnetite.

## 6.8.3 REE modelling

The same start and the target samples used in the major element modelling were also used in the REE modelling. The results for the modelling of granodiorite of the Main Donegal granite to the biotite granite of the Trawenagh Bay are shown in **Fig 6.26**. The mineral mix is plagioclase, alkali feldspar, biotite, zircon, allanite, apatite and magnetite.

Results of the modelling of the biotite granite to the muscovite granite of the Trawenagh Bay are shown in the Fig 6.27. The mineral mixes are similar to the major element modelling plus 0.35% allanite, and 0.4% apatite with 48% fractionation.

#### 6.8.4 Discussion

On all three LILE plots, the biotite granite of the Trawenagh Bay and the light band rocks from the Main Donegal granite plot in the same field and with the trend which is controlled by the same mineral proportions of plagioclase, alkali feldspar and biotite. This may suggest that the granites are co-genetic. This is supported by the fact that both granites plot in the same field in all major and trace element Harker diagrams (see section 5.2.6). A summary of the major and REE modelling of the Trawenagh Bay pluton and the light band of the Main Donegal granite are shown in **Table 6.27**. The results are consistent with the LILE modelling where plagioclase, alkali feldspar and biotite are mportant.

The chemical data (section 5.2.6) indicates that the muscovite granite is highly evolved granite. Modelling indicates that the crystallisation of plagioclase and alkali feldspar (Fig 6.25c) plus apatite, allanite and zircon for the fractionation of the muscovite granite magma from the biotite granite.

On a tetrahedral An-Ab-Or-Qz plot (Fig 6.28), biotite granite magma



FIGURE 6.25 : Inter element variation diagram for LIL elements Ba, Rb and Sr of the biotite and muscovite granites of the Trawenagh Bay pluton and the granodiorite-granite (light bands) of the Main Donegal granite. Mineral vector indicates the net chance in composition of the initial liquid after 20% Rayleigh fractionation of the named phase.

	Start composition	Target composition (TC)	Target model (TM)	Different (TM-TC)
Rock type	Granodiorite	granite		
SiO2	67.76	71.87	71.75	-0.12
TiO2	0.27	0.18	0.16	-0.02
AI2O3	15.83	14.37	13.9	-0.47
Fe(tot)	2.24	1.48	1.6	0.12
MaO	0.76	0.76	0.3	-0.46
CaO	1.74	1.32	1.03	-0.29
Na2O	4.5	4.4	4.63	0.23
K20	4.05	4.5	3.45	-1.05
Total	97.15	98.88	96.82	

Mineral extract proportion

PI: 52.9 Bi: 19 Ksp : 28

% precipitation : 25%

Mag: 0.1

TABLE 6.25: Summary results obtained from the major element modelling of the granodiorite (light band) of the Main Donegal granite to the biotite granite of the Trawenagh Bay granite. Mineral data from the granodiorite of the Main Donegal granite. (Appendix 4).

	Start composition	Target composition	Target model	Different
Rock type	granite	granite	(114)	(1)/-10)
SiO2	71.78	75.46	75.42	-0.04
TiO2	0.18	0.04	0.12	0.08
A12O3	14.37	13.35	12.23	-1.12
Fe(tot)	1.48	0.29	0.9	0.61
MgO	0.76	0.26	0.74	0.48
CaO	1.32	0.39	0.98	0.59
Na2O	4.4	5.44	4.11	-1.33
K2O	4.5	3.87	3.66	-0.12
Total	98.79	99.1	98.16	

Mineral extract proportion

PI:51 Bi: 10 % precipitation : 23% Ksp: 37.4 Qu: 0.8 Mag: 0.8

TABLE 6.26: Summary result obtained from the major element modelling of the biotite granite to muscovite granite of the Trawenagh Bay pluton. Mineral data from the biotite granite Appendix 4)

	Start DON1 granodiorite	Target TRA5 Bi granite	Target model	Bulk Kd	Min F	Prop
La	49.07	22	20.19	4.98	PI	51.79
Ce	93.4	47.86	43.29	4.45	Kf	28
Nd	28.2	16.39	16.56	3.39	Bi	19
Sm	4.66	2.78	3.67	2.08	Zr	0.3
Eu	0.78	0.59	0.58	2.32	All	0.18
Gd	2.58	1.78	2.72	0.78	Ар	0.66
Dy	1.84	1.58	1.85	0.98	Mag	0.07
Er	1.46	0.78	1.33	1.42		
Yb	0.84	0.64	0.67	1.99		
Lu	0.11	0.09	0.08	2.21		

% precipitation : 20%



FIGURE 6.26: Summary of the REE modelling of the granodiorite (DON1) from the Main Donegal granite to the biotite granite (TRA 5) of the Trawenagh Bay granite. At the top is the summary of start and target compositions, target model, amount of mineral precipitate (%) and bulk Kd of the REE used in the modelling. % precipitation is the percentage precipitated to move the start composition to the target model. Below is the graphical presentation of the modelling.

	Start TRA6 granite	Target TRA3 granite	Target model	Bulk Kd	Min P	rop
La	20.76	6.97	3.97	3.25	PI	51.6
Ce	39.76	11.6	12.65	2.56	Kf	37.5
Nd	14.79	5.48	6.92	20.4	Bi	10.00
Sm	2.56	2.86	2.3	1.15	All	0.35
Eu	0.55	0.03	0.031	4.9	Ap	0.40
Gd	1.99	2.74	2.7	0.82	Mag	0.50
Dy	1.48	3.25	2.11	0.52	0	
Er	0.89	1.3	1.47	0.32		
Yb	0.87	2.14	1.53	0.23		
Lu	0.12	0.24	0.21	0.21		

% precipitation : 48%



FIGURE 6.27 : Summary of the REE modelling of biotite granite to muscovite granite of the Trawenagh Bay pluton. At the top is the summary of start and target compositions, target model, amount mineral precipitate (%) and bulk Kd of the REE used in the modelling . % precipitation is the percentage precipitated to move the start composition to the target model. Below is the graphical presentation of the modelling.

# Major elements modelling

Units	Pl	Ksp	Bi	Qu	Mag	% ppt
Granodiorite to Bi granite	52.9	28	19	0	0.1	25%
Bi granite to Mu granite	51	37.4	10	0.8		23%

# REE modelling

Units	ана <b>Р</b> 111 Селотор <b>Р</b> 111	Ksp	Bi	Qu	Ар	Mag	All	r % ppt
Granodiorite to Bi grar	nite 51.79	28	19	0	0.66	0.07	0.18 0	.3 20%
Bi granite to Mu granit	te 51.6	37.5	10	0	0.4	0.5	0.35	48%

TABLE 6.27: Summary results of major and RE element modelling of the Trawenagh Bay granite.Granodiorite samples are from the light band of the Main Donegal granite.



FIGURE 6.28: Normative Ab-Or-An-Qz tetrahedral diagram for the Trawenagh Bay granite. Phase boundaries from Presnall and Bateman (1973). precipitation started in the lower plagioclase volume, and later reached the plagioclase-alkali feldspar surface. Final crystallisation also involved quartz. Precipitation of muscovite granite took place near/at the cotectic where plagioclase, quartz and alkali feldspar crystallised simultaneously.

### 6.9 BARNESMORE PLUTON

The Barnesmore granites generally define a single linear trend on a bivariate plot (major and trace elements ; see section 5.2.7) supporting the suggestion that the Barnesmore granites are comagmatic and that the magmas have undergone fractionation. Dempsey (1987) suggested that fractional crystallisation of a granodioritic magma (G1 type) was the dominant process in the production of the geochemical variation in the Barnesmore complex. In this section the units of the Barnesmore granite will be modelled separately.

### 6.9.1 LILE modelling

Inter elements variation diagrams for the pairs Rb-Sr, Ba-Sr and Ba-Rb are shown in Fig 6.29. All three plots of Barnesmore granite show a clear evolution trend from G1 to G2 to G3. On a Sr vs Ba plot (Fig 6.29a), the Barnesmore rocks show a good trend of decreasing Ba and Sr which is strongly controlled by alkali feldspar, perhaps with minor biotite and plagioclase. On a Ba vs Rb plot (Fig 6.29b), Ba decreases from 763 ppm in G1 to 6 ppm in G3 over Rb range of 159 to 416 ppm. The trend for all units is controlled by fractionation of biotite and alkali feldspar. On a Rb vs Sr plot (Fig 6.29c), Rb slightly increases and Sr decreases from G1 to G3. The trends for all units are compatible with liquid evolution by extraction of plagioclase and alkali feldspar. In conclusion, the LILE modelling shows that plagioclase, alkali feldspar and biotite are important in determining the overall trend of the units of the Barnesmore granite.

### 6.9.2 Major element modelling

The three main units of the pluton have been modelled separately namely : (1)

G1, (2) G2 and (3) G3. The results are shown in **Tables 6.28 to 6.30**. All analyses for the modelling (whole rock and mineral compositions) are taken from Dempsey (1987). The results are :

(1) G1 has been modelled from a sample containing 71.79 SiO<sub>2</sub> to one with 75.79 % SiO<sub>2</sub>. The target composition can be achieved by 20 % fractionation with a mineral mix of plagioclase, alkali feldspar, biotite, quartz, and magnetite (Table 6.28).

(2) G2 has been modelled from G2 basic facies (72.23 % SiO<sub>2</sub>) to G2 porphyritic facies
(76.49 % SiO<sub>2</sub>). The target composition can be achieved by 23 % fractionation with a mineral mix of plagioclase, alkali feldspar, biotite, quartz, and magnetite (Table 6.29).
(3) G3 has been modelled from the most basic (75 % SiO<sub>2</sub>) to the most felsic (76.8 % SiO<sub>2</sub>) sample in the unit. The target composition can be achieved by 9 % fractionation with a mineral mix of plagioclase, alkali feldspar, biotite, quartz, and magnetite (Table 6.30).

### 6.9.3 REE modelling

The REE of the Barnesmore granite has been modelled for two units i.e (1) G2 and (2) G3. All REE analyses are taken from Dempsey (1987). For the evolution of G2 the mineral mixes are similar to the major element modelling plus 1.23% apatite, 0.14% allanite and 0.13% zircon and 36% fractionation is required to produce the calculated REE profiles shown in Fig 6.30. For the evolution of G3, mineral mixes are similar to the major element modelling plus 0.2% apatite, 0.12 allanite and 0.13% zircon and 24% fractionation is required to produce the calculated REE profiles as shown in Fig 6.31.

### 6.9.4 Discussion.

A summary of the major and REE modelling is given in **Table 6.31**. In the major element modelling, a clear decrease in biotite and increases in alkali feldspar and quartz precipitated from G1 to G2 to G3 suggest that they are comagmatic and have undergone fractionation. The good correlation and sequential variation in the LILE plots supports the fact that the Barnesmore rocks are comagmatic.
On a tetrahedral An-Ab-Or-Qz plot (Fig 6.32), precipitation of the Barnesmore magma started in the lower plagioclase volume, and later reached the plagioclasealkali feldspar surface. Final crystallisation also involved quartz, probably on the cotectic.



FIGURE 6.29: Inter element variation diagrams for LIL elements Ba, Rb and Sr of the Barnesmore granite. Mineral vectors indicates the net change in composition of the initial liquid after 20% Rayleigh fractionation of the named phase.

Start composition	Target composition (TC)	Target model (TM)	Different (TM-TC)	
Granite	Granite			
71.79	75.79	75.25	-0.54	
0.28	0.16	0.16	0	
14.59	13.44	13.59	0.15	
1.8	0.88	1.05	0.17	
0.83	0.5	0.56	0.06	
1.27	0.33	1.06	0.73	
4.05	4.4	4.36	-0.04	
4.52	4.05	3.92	-0.13	
99.13	99.55	99.95	관계 : 1199 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299 - 1299	
	Start composition Granite 71.79 0.28 14.59 1.8 0.83 1.27 4.05 4.52 99.13	Start composition         Target composition (TC)           Granite         Granite           71.79         75.79           0.28         0.16           14.59         13.44           1.8         0.88           0.83         0.5           1.27         0.33           4.05         4.4           4.52         4.05           99.13         99.55	Start composition (TC)Target composition (TC)Target model (TM)GraniteGranite71.7975.7975.280.160.280.1614.5913.4413.591.80.880.50.561.270.334.054.44.524.0599.1399.55	

Mineral extract proportion

PI: 40	
Bi : 20	% precipitation : 20 %
Qu: 10	
Mag:1	
Ksp: 29	

TABLE 6.28 : Summary results obtained from the major element modelling of the G1, Barnesmore pluton. Whole rock and mineral data are taken from Dempsey (1987).

Start composition		Target composition (TC)	Target model (TM)	Different (TM-TC)	
Rock type	Granite	Granite			
SiO2	72.23	76.49	76.35	-0.14	
TiO2	0.27	0.12	0.18	0.06	
AI2O3	14.75	13.13	13.25	0.12	
Fe(tot)	1.85	0.87	1.25	0.38	
MgO	0.59	0.2	0.34	0.14	
CaO	1.08	0.52	0.57	0.05	
Na2O	4.16	4.06	4.32	0.26	
K2O	4.45	4.83	4.17	-0.66	
Total	99.38	100.22	100.43		

Mineral extract proportion

PI: 53.1 Bi: 15 Qu: 10 Mag: 0.9 Ksp: 21

% precipitation : 23 %

TABLE 6.29 : Summary results obtained from the major element modelling of the G2, Barnesmore pluton. Whole rock and mineral analyses are taken from Dempsey (1987).

	Start composition	Target composition (TC)	Target model (TM)	Different (TM-TC)
Rock type	granite	granite		
SiO2	75	76.78	76.74	-0.04
TiO2	0.07	0.04	0.04	0
AI2O3	14.17	13.38	13.5	0.12
Fe(tot)	0.57	0.59	0.37	-0.22
MgO	0.11	0.13	0.04	0.09
CaO	0.56	0.37	0.34	-0.03
Na2O	4.42	4.48	4.49	0.01
K2O	4.98	4.51	4.82	0.31
Total	99.88	100.28	100.34	

Mineral extract proportion

PI : 53.1 Bi : 9 % precipitation : 9% Qu : 7 Mag : 0.7 Ksp : 32.2

TABLE 6.30 : Summary results obtained from the major element modelling of the G3, Barnesmore pluton. Whole rock and mineral are taken from Dempsey (1987).

	Start G2/52 granite	Target G2/90 granite	Target model	Bulk Kd	Min Prop
La	15.4	11.48	13.15	2.37	PI 42
Ce	26	21.43	24.13	2.2	Ksp 30.1
Nd	10.7	5.53	6.13	2.64	Bi 17
Sm	2	1.03	1.11	2.46	Qu 10
Eu	0.36	0.21	0.21	2.83	Mag 1.5
Gd	1.7	0.9	0.86	2.58	Ap 1.23
Dy	1.43	0.86	0.95	1.96	All 0.14
Er	0.92	0.56	0.67	1.75	Zr 0.13
Yb	1.32	0.99	1.04	1.61	
Lu	0.22	0.19	0.2	1.58	

% precipitation : 36%



FIGURE 6.30 : Summary of the REE modelling of G2 of the Barnesmore pluton. At the top is the summary of start and target compositions, target model, amount of mineral precipitate (%) and bulk Kd of the REE used in the modelling. % precipitation is the percentage precipitated to move the start composition to the target model.Below is the graphical presentation of the modelling.

	Start G3/215 granite	Target G3/186 granite	Target model	Bulk Kd	Min F	Prop
La	7.50	6.57	8.66	1.65	PI	45
Ce	11.53	11.76	10.39	1.43	Ksp	32
Nd	3.50	3.08	3.4	1.49	Bi	11.23
Sm	0.68	0.59	0.64	1.25	Qu	12
Eu	0.07	0.06	0.072	2.53	Mag	0.2
Gd	0.55	0.53	0.56	1.49	Ap	1.03
Dy	0.69	0.57	0.62	1.004	All	0.12
Er	0.41	0.47	0.404	1.05	Zr	0.13
Yb	0.90	1.24	0.85	1.156		
Lu	0.20	0.26	0.161	1.21		
Yb Lu	0.90 0.20	1.24 0.26	0.85 0.161	1.156 1.21	21	0.15

% precipitation : 24%



FIGURE 6.31 : Summary of the REE modelling of G3 of the Barnesmore pluton At the top is the summary of start and target compositions, target model, amount of mineral precipitate (%) and bulk Kd of the REE used in the modelling. % precipitation is the percentage precipitated to move the start composition to the target model. Below is the graphical presentation of the modelling.

# Major element modelling

	Pi	Ksp	Bi	Qu	Mag	% ppt
G1	43	29	20	7	1	20%
G2	42	30	15	12	0.9	23%
G3	45.1	32.2	9	13	0.7	9%

# REE modelling

	P	Ksp	Bi	Qu	Mag	Ар	All	Zr	% ppt
				لا الاستخدام ال	a an an	e to second	et solar estato	a da ser sakara	len et geweld
G2	42	30.1	17	10	1.5	1.23	0.14	0.13	36%
G3	45	32	11.23	12	0.2	1.03	0.12	0.13	24%
G2 G3	42 45	30.1 32	17 11.23	10 12	1.5 0.2	1.23 1.03	0.14 0.12	0.13 0.13	36% 24%

TABLE 6.31: Summary results of major and RE element modelling of the Barnesmore pluton.



FIGURE 6.32: Normative Ab-Or-An-Qz tetrahedral diagram for the Barnesmore granite. Phase boundaries from Presnall and Bateman (1973).

# CHAPTER SEVEN

# AGE AND TECTONIC SETTING OF THE DONEGAL GRANITES.

## 7.1 INTRODUCTION.

During the Caledonian orogeny, the British Isles was intruded by abundant granitic bodies. These are known as Caledonian granites and include those studied here. Several models have been suggested to explain the tectonic setting of the Caledonian granites, these include subduction (Thirwall 1981), post-collision uplift (Pitcher 1983) and strike slip faulting (Leake 1990). The main aim of this chapter is to discuss the tectonic setting of the Donegal granites. However because the Donegal granites are part of the Caledonian granites, any suggestion on the tectonic setting of the latter must be taken into account when studying the Donegal granites. This chapter will also discuss the isotopic age of the Donegal granites.

# 7.2 AN OUTLINE OF CALEDONIAN OROGENY

Major Paleozoic orogenies are recorded along both coasts of the North Atlantic. Among them, the Caledonian orogeny (Upper Silurian to Lower Devonian) is widespread in the British Isles, Scandinavia and eastern Greenland.

During the Early Ordovician, a major early Paleozoic ocean, Iapetus was bordered by the Baltica and Laurentia continents (Map 7.1). During this time, the British Isles was divided into two parts. The southern part together with the adjacent part of continental Europe formed the eastern Avalonia microcontinent whereas the northern part was associated with the Laurentia craton (Map 7.1). The Iapetus ocean eventually closed in Ordovician and early Silurian times and the position of the Iapetus suture can be traced along the Solway line (Map 7.2). Collision occurred between two continental masses, Laurentia and Baltica on one hand and a microcontinent, Avalonia on the other hand (Map 7.1). By considering the published data from Britain, Greenland, Scandinavia and Newfoundland, Soper et al.(1992) showed that western and eastern Avalonia and Baltica docked sinistrally against Laurentia in Silurian times.

The evidence of the closure of Iapetus ocean is given by McKerrow and Soper (1989),

viz :

(1) The presence of distinct Ordovician faunas on either side of the orogen.

(2) The occurrence of early Paleozoic ophiolitic rocks at Ballantrae, southwest Scotland (Stone 1984) and Tyrone, Ireland (Hutton et al. 1985).

A chart summarizing the chronology of Late Caledonian events including the formation of the Iapetus suture in the British Isles is shown in Figure 7.1 (after Watson 1984).

## 7.3 AGE OF THE DONEGAL GRANITES

The work on the geochronology of the Donegal granites began when Brown (1968) reported K-Ar mineral ages for mica and hornblende separates from Thorr, Ardara, Rosses and Main Donegal granites in the range  $365 \pm 8$  Myr to  $412 \pm 8$  Myr. These dates indicate that the granites belong to the 'Younger' granites of Read (1961). Leggo et al.(1969) published the first whole rock Rb-Sr isochron on rocks from Thorr, Main Donegal, Trawenagh Bay and Rosses plutons. A single isochron was drawn through the granite data set which defined an age of 470  $\pm 1$  Myr, suggesting that Donegal granites are intermediate between the 'Older' and 'Younger' granites of Read (1961).

In contrast to Leggo et al. (1969), Long (1978) reported a reconnaissance Rb-Sr date on the Donegal batholith of  $405 \pm 7$  Myr. This result was supported by the work of Fitch and Miller (1980) who published an 40Ar - 39Ar muscovite age from the Main Donegal granite of  $400 \pm 2$  Myr. Subsequently Halliday et al. (1980) presented individual Rb-Sr isochrons for Ardara, Rosses, Trawenagh Bay and Main Donegal granites ( $405 \pm 5$ ,  $404 \pm 3$ ,  $405 \pm 3$  and  $388 \pm 3$  respectively). The later works of Long (1978), Fitch and Miller (1980), Halliday et al. (1980) showed that the Donegal granites are related to the 'Younger' granites of Read (1961), and that the previous date determined by Leggo et al. (1969) was in error.

The work of O'Connor et al.(1982) using the Rb-Sr method suggested that the Thorr granite was emplaced around  $418 \pm 26$  Myr and the Main Donegal granite has an emplacement age of  $407 \pm 23$  Myr. More recent work by O'Connor et al. (1987) suggests that



MAP 7.1 : Geotectonic model for the early devonian, after collision between Baltica and Laurentia with Cadomian terranes (after Soper and Hutton 1984 ; Soper 1987).



MAP 7.2 : Outcrops of Lower Paleozoic volcanic and related rocks in the British Isles and some of the major lineaments. Note the location of the Iapetus suture (Solway line) (after Moseley 1982).



FIGURE 7.1 : Chart summarizing the chronology of the late Caledonian events (after Watson 1984).

the Barnesmore granite was emplaced around  $397 \pm 7$  Myr and Fanad around  $402 \pm 10$  Myr. Dempsey (1987) gives slightly an older age for Barnesmore (417 ± 6 Myr) compared to that of O'Connor et al. (1987). The various isotopic ages from the Donegal granites are summarised in Table 7.1.

The isotopic ages from the Donegal granites indicate that they are part of the Caledonian granites, emplaced in a relatively short time span between 392 to 418 Ma and can be classified as 'Newer' granites according to Read's classification. Moreover, the results do not show a real difference in intrusion age as shown by the field relations of the granites (see Chapter 2). Pankhurst and Sutherland (1982) suggested that long cooling, reheating and contamination processes are factors which may have complicated the radiometric dating of the Donegal granites. However, Oglethorpe (1987) has shown that factors such as contamination did not play an important role in granite petrogenesis in Donegal. On the other hand, Atherton and Boyle (1994) concluded the tight age grouping with no real difference in age was probably because the granites were formed at more or less at the same depth and there was no time for differential uplift.

### 7.4 OCCURRENCE OF THE CALEDONIAN GRANITES

The distribution of the Caledonian granites in the British Isles is shown in Map 7.3. In Ireland, the Caledonian granites occur north and south of the Iapetus suture. Pankhurst and Sutherland (1982) have divided the granites into 2 groups according to whether they occur in the metamorphic or non-metamorphic belt (Map 7.4). The first group occurs in the Dalradian metamorphic belt. These are comparable to those in the Scottish Highlands and include Donegal, Mayo and Galway granites. The second group occurs in the non-metamorphic belt and includes the Newry, Tyrone and Leinster granites.

In Scotland, the Caledonian granites occur widely in the Grampian Highlands, north of the Highland Boundary Fault (Map 7.5). Here, the granites can be divided into three groups.

(1) The granites from the NE Highlands: These include Cairngorm, Monadliath, Ben Rinnes, Peterhead and Ardclach plutons. They are mainly peraluminous, dominated by a



MAP 7.3 : Distributions of Newer granites in the British Isles. INSET : Rb/Sr and U-Pb ages of Newer granite from north and south of the Highland Border Fault Zone (HBFZ) (after Soper 1987).



MAP 7.4 : Granitic intrusions in Ireland (after Pankhurst and Sutherland 1982)

INTRUSIONS	LOCATION	METHOD	AGE		SOURCE
Donegal Complex	Thorr, Main Granite,	Rb-Sr (WR	) 487 ±	5	3
Donegal Complex	Trawenagh Bay & Rosses	Rb-Sr (WR	.) 405 ±	7	4
Thorr	650 yds E of Gweebarra	K-Ar (Mu)	391 ±	8	1
Thorr	Owenator river , near	K-Ar (Bi)	390 ±	7	2
Thorr	Lough Agher Tonalite,aplite,granite	R-Ar (HDI Rb-Sr (WR	$392 \pm 2$ $418 \pm 2$	8	2 7
Ardara	Ardara-Clooney road (Hornfels at contact)	K-Ar (Bi)	414 ±	8	1
Ardara	Outer monzodiorite,	K-Ar (Bi) K-Ar (Hbl	394 ±	8	2
Ardara	crooney	Rb-Sr (WR	$405 \pm 100$	5	5
Rosses	Greisen, Sheskinarone	K-Ar (Mu)	404 ±	8	1
Rosses Rosses	Greisen,Lough Nabrack Garnetiferous MG,	K-Ar (Mu) K-Ar (Mu)	384 ± 382 ±	8	2
Rosses	south of Dungloe G3,G4 & aplite	Rb-Sr (WR	2) 404 ±	3	5
Main Donegal	Pelitic raft Barnesher	K-Ar (Bi)	357 +	8	1
Main Donegal	gap.	K-Ar (Mu)	382 ±	8	1
Main Donegal	Losset.	K-Ar (Mu)	384 ±	7	1
Main Donegal	New Bridge	K-Ar (Mu)	378 ±		2
Main Donegal	of Sand Lough	K-Ar (Mu)	372 ±	6	2
Main Donegal	of Sand Lough	Ar-SAr (Mu	$1) 400 \pm 2$		6
Main Donegal		Rb-Sr(WR, B Mu, Ksp, Plg Apa)	31, 388 ± 1,	3	5
Main Donegal	Light main granite, dark main granite & aplite.	Rb-Sr (WR)	407 ±	23	7
Trawenagh Bay	Aplite phase	Rb-Sr (WR)	405 ±	3	5
Fanad Fanad		Rb-Sr (WR) Rb-Sr (WR)	403 ± 402 ±	10 10	8 9
Barnesmore	G1 G2 G3 f aplite	Rb-Sr (WR)	394 ±	8	8
Barnesmore	G1,G2,G2 porphyritic & G3	Rb-Sr (WR)	397 ± 412 ±	6	9 10
List of Source :					
<ol> <li>R.S.J.Lambert</li> <li>Brown et al.(1</li> <li>Leggo et al.(1</li> <li>Long (1978)</li> <li>Halliday et al</li> <li>Fitch and Mill</li> <li>O'Connor et al</li> <li>O'Connor et al</li> <li>O'Connor et al</li> <li>O'Connor et al</li> </ol>	(in Pitcher and Berger 1 968) 969) (1980) er (1980) (1982) (1985) (1987)	1972 , p91)			
WR - Whole Roc Mu - Muscovite Bi - Biotite Ksp - K-Feldspa Plg - Plagiocla Apa - Apatite MG - Microgram	k se se				

TABLE 7.1 : Table showing the geochronological work that has been done on the Donegal granites.

pink biotite granite facies' rarely associated with appinitic bodies and have tendency to 'A' type characteristics (Harrison and Hutchison 1987; Stephen and Halliday 1984).

(2) The granites from SW Highlands region consist of Etive, Strath Ossian, Ballachulish, Glen Coe, Ben Nevis, Rannoch Moor and Kilmelford. These are mainly made up of granodioritic to dioritic rocks.

(3) The granites from S Highlands and the Midland Valley : these include the plutons of Garabal Hill, Arrochar and Distinkhorn.

Caledonian granites of Scotland also occur in the Lower Paleozoic rocks of the Southern Uplands. They include Loch Doon, Mull of Galloway, Cairnsmore of Fleet and Criffell plutons. Most of the plutons here tend to be concentrically zoned from diorite at the margin to granite at the centre.

## 7.4.1 Division of the Caledonian granites

Several authors have attempted to subdivide the Caledonian granites (Stephens and Haliday 1984 ; Brown et al. 1981). Stephens and Halliday (1984) divided the late Caledonian granites of Scotland into 3 suites, each of which has distinctive chemical characteristics. They are the Cairngorm, Argyll and south of Scotland suites. The essential characteristics of these suites are given in Table 7.2.

(1) The Cairngorm suite lies in the eastern Grampian region and has been divided by Harrison and Hutchison (1987) into an early group which includes the Monadliath, Lochnagar, Hill of Fare and Kincardine plutons. This group is often associated with relatively abundant diorites. A slightly later group not associated with diorites includes Ben Rinnes, Moy, Cairngorm and Bennachie. This suite is characterised by highly silicic metaluminous compositions and has high Nb, Rb, Th and low Ba and Sr contents.

(2) The Argyll suite is typically represented by granodiorite and diorite. An appinite suite is well developed in this region (SW Highlands), principally occurring as small satellite pipes (Wright and Bowes 1979). The granitic plutons in this suite include Etive, Ballachulish, Garabal Hill, Ben Nevis and Glen Coe. This suite is calc alkalic

	Cairngorm suite	Argyll suite	S of Scotland suite
Rock types	Mainly red biotite granites; intermediate types rare; few appinites	Common grandiorites and diorites; appinites abun- dant; hornblende charac- teristic of diorites	Commonly diorites and granodiorites; pyroxene typical of diorites; appinites in the N only.
Major oxides	Highly silicic metaluminous compositions	Calc-alkalic high Na <sub>2</sub> O com- positions	Calc-alkalic
Trace-elements	High Nb, Rb and Th; low Ba, Sr	Very high Sr and Ba; low Nb, Th, Rb	Low La. Ce, Ba, Sr
Age (Ma)	408-415	410-415	390-408
<i>ɛ</i> Sr	+24-+33	-7-+58	+1-+54
εNd	-81	-10 - +3	-4-+1
δ <sup>18</sup> O	8.2-11.1	7.2-10.7	7.9-10.4

TABLE 7.2 : Characteristics of late granitic suites of Scotland (after Stephens and Halliday 1984)

with high Na<sub>2</sub>O and very high Sr, Ba and low Nb,Th and Rb contents.

(3) The south of Scotland suite consists of several plutons ranging from diorite to granite in composition, usually zoned in a concentric manner. The main plutons of this suite are Loch Doon, Criffell and Mull of Galloway. This suite is characterised by calc alkalic affinity and low La,Ce,Ba and Sr contents.

Brown et al.(1981) divided the Caledonian granites of the British Isles into three groups based on the ages of the granites and their tectonic setting.

1. A pre-tectonic group mainly dioritic plutons with associated migmatites and with isotopic ages exceeding 460Ma.

2. A post-tectonic , mainly forcefully emplaced group of zoned granodiorites with ages ranging from 410 to 460 Ma (pre-mid Silurian).

3. A post-tectonic , mainly discordant groups of granites and granodiorites with ages ranging from 390 to 410 Ma.

They also showed that the first two groups have many features in common. These include lack of prominent gravity anomalies, probably indicating small volumes of magma; generally low LIL trace elements abundances which are reminiscent of average crustals rocks in the region and variable isotopic characteristics which nevertheless, generally include some evidence of a partly crustal derivation.

In terms of rock type and major and trace elements, the Donegal granites are comparable to the Argyll suite of Stephens and Halliday (1984). Thus

(1) The most common rock type in Donegal is granodiorite with diorite and granite occurring in lesser amount. Appinite is mainly associated with Ardara pluton and hornblende is characteristic of the dioritic rocks.

(2) Major oxides show that the Donegal granites are calc-alkali with high Na<sub>2</sub>O (3.9 -6.2%). The Argyll suite is also characterised by being calc alkalic with high Na<sub>2</sub>O.

(3) The Donegal granites have high Sr and very high Ba (up to 4500 ppm). Fig 7.2(a) shows that the Donegal granites have the widest range of Ba content, greater than the





MAP 7.5 : Location map showing the granitic plutons in the Scotland (after Stephens and Halliday 1984)



MAP 7.6 : Two plate model for the generation of the Scottish Old Red Sandstone volcanics by subduction of Iapetus lithosphere (Thirwall 1981). This model account for Newer Granite magmatism northwest of the Highland Border but not in the south. three late granites suites of Scotland. The highest Ba is from Fanad pluton which is higher than Argyll suite rocks. Fig 7.2(b) shows that the Sr content of the Donegal granites is comparable to Argyll suite whereas Cairngorm and South of Scotland suites have much lower Sr contents. Fig 7.2(c) shows that the Donegal granites have higher Rb compared to the Argyll and S of Scotland suite. The concentration of Rb in Donegal granites is very similar to that in the Cairngorm suite.

(4) Epsilon Nd of Donegal granites ranges from -8.3 to -1.2 Although the range is similar to the Cairngorm suite (-8 to -1) it still lies within the range of the Argyll suite (-10 to +3).

In terms of the Brown et al. (1981) classification of Caledonian granites, the Donegal granites fall into group three i.e. post tectonic with ages ranging from 390 -410Ma.

#### 7.5 TECTONIC SETTING

In this section the three models describing the tectonic setting of the Caledonian granites will be summarised and a tentative alternative model will be provided. The three models are (a) subduction related (Thirlwall 1981) (b) adiabatic decompression during rapid post orogenic uplift (Pitcher 1983,1993) (c) strike slip faulting accompanied by uplift (Leake 1990). In addition to these models, a mantle plume model has been proposed by Hill et al. (1990).

## 7.5.1 Caledonian granites and subduction related models

The Iapetus ocean was believed to have closed by the subduction of ocean crust (e.g Phillips et al.1976) during the Caledonian Orogeny. Several models have been proposed to explain the occurrence of the Caledonian granites of the British Isles in relation to Iapetus subduction. One is a two plate model (e.g.Phillips et al.1976 ; Thirlwall 1981) and the other a three plate model (Soper 1986).

The two plate model assumes the convergence of two continental plates i.e. Eastern Avalonia (which later formed southern Britain and the eastern part of Europe)



FIGURE 7.2: Plots of (a) Sr vs Ba and (b) Sr vs SiO2 for the Cairngorm, Argyll, South of Scotland suites and the Donegal granites. Data for the Cairngorm, Argyll and South of Scotland suites are from Stephen and Halliday (1984).



FIGURE 7.2: Continued, (c) plot of Rb vs SiO2 for the Cairngorm, Argyll, South of Scotland suites and the Donegal granites.

and Laurentia plate (e.g.Thirlwall 1981) (Map 7.6) in Ordovician or mid-Silurian times (Watson 1984). The Caledonian granites and associated volcanic rocks are thought to be related to this subduction. Thirlwall (1983) showed that the volcanism in the Scottish Highlands and Midland Valley occurred close to 410 Ma. The recognition of tholeiitic, calc alkaline and alkaline volcanics together with ophiolitic rocks near Girvan and along the Highland Border is interpreted as evidence for the existence of a volcanic arc related to the subducted margin.

The alternative three plate model (Soper and Hutton 1984 ; Soper 1986) involves Laurentia, Baltica and Armorica plates (Map 7.1). According to this model, Laurentia and Baltica converged during Ordovician time so by late Silurian time, Laurentia and Baltica were sutured together to form part of the Laurentian supercontinent. This part later formed the northern part of the British Isles. Subsequently the Eastern Avalonia which formed southern Britain, was accreted on to the southern margin of Laurasia in the Devonian. This model involves three late Caledonian magmatic arcs.

(1) Laurentia - Baltica convergence with westward subduction beneath the Scottish sector of the Laurentian margin in the Ordovician and Early Silurian, which generated the early members of the late Caledonian granite suite in the Highlands.

(2) Northward Silurian to Early Devonian subduction at the Solway line which produced the younger late Caledonian granites and volcanic rocks north of the Highland Border.
(3) Northward accretion of the Armorica terrane in the Early Devonian which produced intrusive and extrusive magmatism in southern Ireland and the English Midlands.

However the two models above raise some interpretative problems when compared to the other known subduction related granites batholiths e.g. Peninsular Range (Silver and Chappell 1988). Among the problems are :

(1) The distance between the trench and arc in modern examples is normally greater than 90 km and is often 150 km or more. The approximate distance of the Scottish Highland granite plutons from the Iapetus suture is about 150 to 200 km whereas the granite plutons from Southern Uplands are less than 50 km. Thus the two plate model may explain the occurrence of the granites in the Scottish Highland but not those in the

Southern Uplands. The same difficulty is seen in Ireland where the distance of the Galway and Newry plutons is less than 50 km from the Iapetus suture.

(2) Brown (1991) has pointed out that the plutons also fail to show the progressive space-time changes in chemistry which are characteristic of magmatism at a plate margin. Marked isotopic, age and trace elements vriations within the subduction related granite batholiths, e.g. Peninsular Ranges batholith (Gromet and Silver 1987) are not found in the Caledonian granites.

(3) Another characteristic of Caledonian granites which is different from the subduction related batholiths such as the Peninsular Ranges batholith, is the presence within the latter of continuous magmatism over a period of at least 45 Ma (85 Ma if the extension of the magmatic arc across the Gulf of California is considered). This is in contrast with the magmatic history of the Caledonian plutonism which is characterised by short periods of intense activity separated by periods of relative quiescence.

(4) The peninsular Ranges batholith that developed in a subduction environment is elongated over a distance of more than 1000 km and is parallel to subducting oceanic crust. Such batholiths in this environment usually comprise hundreds of cross cutting plutons variable in diameter from 1 to 50 km. whereas the Caledonian granites usually occur as separate small plutons, which are not elongated.

(5) The rock types present in the Caledonian batholith vary from quartz monzodiorite to granite (s.s) and do not form a gabbro-granite continuum, typical of the subduction environment.

# 7.5.2 Adiabatic decompression during post orogenic uplift model.

In this model, the late Caledonian granitic complexes (440 to 390 Ma) have been regarded as post-collision and magma genesis was suggested to be induced by adiabatic decompression during rapid post orogenic uplift (e.g.Pitcher 1983). However, the problem with this model is that the Highland metamorphic terrain was already deeply eroded before the emplacement of Newer granites and the crust was never sufficiently thickened enough to induce the rapid uplift and decompression required to produce widespread

#### 7.5.3 Srike slip faulting

The main period of intrusion of Late Caledonian granites (440 to 390 Ma) coincided with major strike-slip faulting (e.g. Soper and Hutton 1984) during the closing of the Iapetus ocean. Such long continued strike-slip faulting is invariably accompanied by uplift, depression and rotation of blocks (Nur and Boccaletti 1989 in Leake 1990), compression (Soper et al.1987), extension (Pankhurst and Sutherland 1982) at different locations and times during this episode.

Leake (1990) postulated that the result of compression would be to depress and uplift crustal blocks. Those pushed down into the mantle would provoke partial melting of the lower crust while those uplifted would initiate isothermal melting of the mantle and lower crust (Leake 1990)(Fig 7.3). Thus both mantle and crustally derived magmas would be produced. The existence of active fractures cutting right through the crust would serve to channel the intrusive and extrusive magmas up through the crust to active sites of extension where granite batholiths would fill the opening spaces (Leake 1990) (Fig. 7.3).

The strong correlation between Caledonian granites and strike slip faulting is shown by many of the granites. In Ireland, the Leinster batholith was emplaced along a sinistral shear zone (Copper and Bruck 1983) .The Galway granite also occurs along the Skird Rock fault, a splay extension of the Southern Uplands fault (Leake 1963). In Scotland, Watson (1984) has correlated many of the Caledonian granites (e.g. Helmsdale granites) with the Great Glen fault. The emplacement of the Cairngorm granite has been suggested to reflect a tensional block fault system conjugate to the Great Glen fault set (Watson 1984). Potts et al (1995), showed that the Sound of Iona fault is one of many late Caledonian faults and postdates the Ross of Mull granite which strongly suggests the possibility of the granite being intruded through the fault (Potts , pers. comm). Leake (1990) concluded that the faulting and the crustal movements are not coincidently temporally related to the Caledonian granites but they are genetically related .



FIGURE 7.3 : Postulates of the influence of faulting on granite formation and emplacement (after Leake 1990). (A) Initial pre-fracture state. (B) Faulting with depression of a crustals block and some uplift. (C) Crustal melting due to depression into the mantle and isothermal melting due to uplift. Granite magma concentrates along fractures and begin to move upwards. (D) Deep fracturing of the crust and mantle . (E) Basic magma aggregates along the faults and intrudes the crust causing partial melting ; some basic magma injects as dykes. (F) Granite produced by partial melting moves sideways and upwards into the fractured zone; volcanic rocks are largely mantle derived but with some crustal contamination. (G) Differential uplift brings hot mantle blocks against the lower crust by upward and sideways motion thus provoking isothermal and other melting. (H) Granite magma gathers at fractures. (I) Granite plutons form and move upward, leaving restite.



MAP 7.7 : The Donegal granites and other Devonian acid intrusions after restoration of the Leannan fault system. Note that the alignment of Thorr,Rosses,Trawenagh Bay, Ardara and Barnesmore approximately along the direction of N12°E (Hutton and Alsop 1996)

Recently Hutton and Alsop (1996) showed that the Caledonian strike swing and related lineaments, including faults (Fig 7.3) controlled the sedimentation, deformation and igneous intrusion pattern in Donegal. They also showed that after restoration of the 34 km sinistral displacement on the Leannan fault system five out of the eight Donegal granites would align remarkably along a direction approximately N12<sup>o</sup>E (Map 7.7). The five plutons are Thorr, Rosses, Ardara, Trawenagh Bay and Barnesmore. They suggested that the lineament (N12<sup>o</sup>E) may represent a deep fault, reaching down into the granite source regions and which preferentially allowed magmas to be channelled up to the level of emplacement.

#### 7.5.4. The mantle plume model

A mantle plume model appears to explain successfully a wide range of observations relating to both ocean island and flood basalt provinces (e.g. Griffiths and Campbell 1990). A plume ascending from the core-mantle boundary consists of a large volume head followed by a narrow and possibly long lived conduit. The conduits keep supplying mantle material to the ascending head. Upon reaching the upper crust, the head will spread and give rise to a disc of hot material predicted to be 1500 to 2500 km across and 100 to 200 km thick (Griffiths and Campbell 1990).

The volume of basaltic material in the plume head (probable temperature of 1300°C to 1550°C) may initiate partial melting of overlying continental crust (Hill et al.1992a). Conductive heat transfer into overlying mantle and crust may play an important role in the development of continental crust. The relationship between mantle plumes and continental tectonics has been reviewed by Hill et al. (1992a). They suggested that probable candidates for a plume head province include Late Caledonian granites terrains of Scotland and southeastern Australia.

Hill et al. (1992a) reviewed the magmatic history of two inferred plume head provinces ; Karoo and Yilgarn provinces. They showed that both areas have a rather similar magmatic history which is summarised below.

1.

Partial melting of the bulk of a rising and spreading mantle plume head resulted

in an early period of basaltic volcanism and melting of much hotter material that ascended in the axial conduit and produced komatiites. Conduction of heat upwards after a delay time of 25 Ma - resulted in the production of crustally derived melts. Heat transport by conduction will usually involve a time gap (of a few Ma to several tens of Ma) between mafic and felsic magmatism, as heat is conducted from the hot mantle source into the overlying crust (Hill et al.1992b). Thus the time gap between the start of mantle derived mafic magmatism (gabbroic rocks) and crustally derived felsic magmatism can be explained as being the time taken to conduct sufficient heat from plume head into the crust in order to initiate melting (Hill et al.1992b).

2. The first anatectic episode in the plume related area produced the early granites and volcanic rocks which were voluminous but of brief duration (several million years) as a consequence of conduction of heat into the crust.

3. Continued conduction of heat into the crust resulted in the production of second set of anatectic melts having high SiO<sub>2</sub>, K<sub>2</sub>O and Na<sub>2</sub>O contents and low mafic mineral abundances. This second anatectic melts have been interpreted (Hill et al. 1992a) as indicating derivation from originally structurally higher material that underwent partial melting at lower temperature and pressures than during the first melting episode.

4. The youngest granites of the plume related area (High T-felsic magmatism) are alkali rich, water poor and may contain fluoride and alkali pyroxene.

Hill et al.(1992a) constructed the stratigraphies of the inferred plume related areas (Yilgarn and Karoo province), magmatic arcs (Sierra Nevada batholith) and igneous rocks from Lachlan fold belt (Fig 7.4). In the present study, I have constructed the stratigraphy of the igneous rocks from the Caledonian orogeny in the British Isles for comparison (Fig 7.4). The 'stratigraphy' of the Caledonian granites is more similar to a plume related area rather than subduction related area e.g. Sierra Nevada batholiths. This suggests that the Caledonian granites may not be related to subduction rather to some form of plume magmatism.



FIGURE 7.4 : Stratigraphic columns summarizing the magmatic history of, the Yilgarn and Karoo province, two inferred plume head provinces, a continental magmatics arc, e.g. Sierra Nevada batholith of western North America and the Lachlan fold belt of the southeastern Australia (after Hill 1992). The Caledonian granite (Ireland and Scotland) complexes are in many respects similar to Karoo and Eastern Yilgarn.

#### 7.5.4.1 Problems with the plume model

Although the plume model seems to explain the occurrence of the Caledonian granites much better than the subduction model, it also has some problems .

1. There are no picrites and komatiites in the British Isles : No such rocks were found in the British Isles at the beginning of the Caledonian orogeny which can be related to plume activity.

2. Magmatic provinces associated with mantle plumes are predicted to be equant and have a diameter of 2000 km whereas the Caledonian granites province of the British Isles mainly consists of separate plutons and rarely formed a big batholith.

#### 7.5.5 Discussion

In this chapter I have reviewed the occurrence and the tectonic setting of the Caledonian granites. I also reviewed the isotopic ages of the Donegal granites which showed them to belong to the late Caledonian granites (440 - 390 Ma) which are post plate closure and are usually associated with fault or fault uplift according to Pitcher (1993,p 280).

Stephens and Halliday (1984) have divided the late Caledonian granites of Scotland into three suites namely Argyll, Cairngorm and South of Scotland suites (Table 7.2). The Donegal granites have characteristics similar to the Argyll suite. These features include : predominantly granodiorite and diorite rocks with abundant associated appinitic bodies ; they are calc alkali with high Na<sub>2</sub>O, Sr and Ba contents.

The association of the Caledonian granites with strike slip faulting or crustal movements is confined only to the late Caledonian plutons (less than 450Ma). Watson (1984) showed that crustal movement during this time coincided with the post collisional regime of strike-slip motion after Iapetus closed. Thus the crustal movement discussed in section 7.5.3 was clearly the crucial factor in the onset of the magmatism during the late Caledonian orogeny. In Donegal, intrusions of the granites coincided with major strike slip movements (Hutton 1982 ; Hutton and Alsop 1996). Hutton and Alsop (1996) also showed that these movements and associated lineaments controlled the

Dalradian stratigraphy and sedimentation pattern in the Donegal area.

The relation between mantle plume and uplift (e.g Griffiths and Campbell 1990; Nadin et al.1995) and extension (Houseman and England 1986; Hill 1991) of the crustal lithosphere has long been recognised. Surface uplift due to the positive buoyancy of the hot plume material has been quantified at as much as ~ 1000 m (Hill et al.1992a). The amount of uplift can lead to extension of the overlying crust (Houseman and England 1986). Thus, if one accepts the importance of the plume model in the Caledonian orogeny, the crustal movements during this time probably related to the early stage rising of the plume head.

## 7.6 Summary

(1) Donegal granites are part of the late Caledonian granites and have similar characteristics to the Argyll suite of mainland Scotland.

(2) Faulting and the crustal movements are important factors in the emplacement of the late Caledonian granites.

(3) Conductive heat transfer by mantle plume into overlying mantle and crust may have been an important heat source in the formation of Caledonian granites.

# CHAPTER EIGHT

# CLASSIFICATION OF THE DONEGAL GRANITES

## 8.1 INTRODUCTION

At least 20 schemes of granite classification have been proposed. Among the criteria that have been used in classifying rocks of granitic composition are petrography (e.g. Orsini 1976; Tischendorf and Palchen 1985), mineralogy (e.g. Lameyre and Bowden 1982), peraluminosity (Shand 1943), zircon morphology (Pupin 1980), major elements chemistry (e.g Chappell and White 1974; Debon and Lefort, 1983) and tectonic environment (e.g.Pitcher 1983, 1987).

This chapter is divided into two main parts. The first part is a brief review of the main schemes of granite classification, the second part is the application of some of these classifications to the Donegal granites.

### 8.2 CLASSIFICATION OF GRANITIC ROCKS.

## 8.2.1 Classification based on mineralogy

The main minerals of granitic rocks are quartz, plagioclase, alkali feldspar and mafics (mainly biotite & hornblende). Pitcher (1987) noted that the mineralogy and mode are important in the classification of the granitic rocks. One of the most widely used mineralogical classifications in igneous rocks is the quartz - alkali feldspar - plagioclase diagram (QAP) (Streckeisen 1967,1976). In this diagram, granitic rocks show considerable variation in the relative proportion of alkali feldspar (albite, orthoclase and microcline) and plagioclase (An>5) and contain between 20 - 60% quartz (Fig 8.1). In this diagram, granitic rocks are subdivided into alkali feldspar granite, syenogranite, monzogranite, granodiorite and tonalite. It not only classifies rocks of granitic type but also more basic rocks such as diorite, monzonite, syenite and gabbro. Thus, the QAP classification is valuable in classifying the rocks of granitic series and their related intermediate and basic counterparts (Lameyre & Bowden 1982).

The QAP diagram discriminates three characteristic series among the large variety of granitic rocks associated in intrusions. The series are (Fig 8.2) (1) Calc-



FIGURE 8.1 : Modal classification of granitic rocks (Streckeisen 1973).



FIGURE 8.2: Main trends of some plutonic type series (modal composition). 1. tholeiitic series COLEMAN and PETERMAN (1975) ; WAGER and BROWN (1967) , 2 . Calc alkaline-trondhjemite series ARTH et al. (1978) , 3. Calc alkaline-granodiorite series ORSINI (1976) 4. ISHIHARA and ULRIKSEN (1980) , 5. ATHERTON et al.(1979) , 6. BATEMAN et al. (1963) , 7 . Monzonitic series ORSINI (1976) and PAGEL (1980) , 8,9,10,11. Alkaline series STRECKEISEN (1967),BOWDEN and TURNER (1974), BONIN (1980), GIRET and LAMEYRE (1980) , GIRET (1979)
alkaline series and its variants (2) Tholeiitic series (3) Alkaline series. The calc alkaline series can be further divided into calc- alkaline trondhjemite (Arth et al. 1978), calc-alkaline granodiorite (Atherton et al.1979 ; Bateman et al. 1963) and calc-alkaline monzonite (Orsini 1976 ; Pagel and Leterrier 1980). Bowden et al.(1984) showed that each of the series has its own chemical characteristics and some are different in source material.

# 8.2.2 Classification based on the peraluminosity

This classification was introduced by Shand (1943) and is based on the molar proportion of Al<sub>2</sub>O<sub>3</sub> to CaO, Na<sub>2</sub>O and K<sub>2</sub>O (e.g mol Al<sub>2</sub>O<sub>3</sub>/CaO + Na<sub>2</sub>O + K<sub>2</sub>O (ACNK)). Thus granitic rocks have been divided into three groups, namely peraluminous granites : A > CNK, metaluminous granites : CNK > A > NK and peralkaline granites : A < NK (Clarke 1981).

Each of the subdivisions above can be recognised by the minerals present in the rock. Peraluminous granite is characterised by muscovite, garnet, cordierite and alumino-silicate and biotite (high ACNK<sub>biotite</sub>) as well as normative corundum. Metaluminous granite can be recognised by the presence of hornblende, diopside and sphene and peralkaline granite by minerals such as riebickite, fluorite and acmite.

Peraluminosity in granitic rocks can be achieved through a number of diverse mechanisms: (1) melting of diopside normative basaltic and andesitic compositions to leave amphibole as a significant component in residues has been found by Heltz (1976) to produce corundum normative peraluminous melt, (2) crustal anatexis of peraluminous material such as pelite can also generate the peraluminous 'S' type granitic magmas (Chappell and White 1974), (3) fractional crystallisation of amphibole with appropriate Fe/Mg ratios (Cawthorn and O'Hara 1976) and (4) assimilation either by material or fluid contamination of metaluminous magmas by aluminous sediments during ascent and emplacement or post emplacement hydrothermal interactions between granitic rock and country rock (Atherton and Sanderson 1987).

## 8.2.3 Classification using opaque minerals.

This classification was suggested by Ishihara (1977) and is based on the occurrence of opaque oxides in granitic rocks. The opaque minerals used in this classification are ilmenite and magnetite. In this classification, magnetite and ilmenite series rocks can be distinguished by their different magnetic susceptibilities ; rocks of the magnetite series showing high values (more than  $100 \times 10 \text{ emu/g}$ ) while those of the ilmenite series have lower than 100 X 10 emu/g. Ishihara (1977) emphasized the role of crustal carbon in the generation of the ilmenite - series magmas while deep seated carbon free material and a tensional tectonic setting favoured the generation of magnetite series magmas. He suggested that oxygen fugacity was the most important variable controlling the formation of magnetite and ilmenite series. This suggests that the ilmenite series was generated in the middle to lower continental crust where pelitic rocks containing carbonaceous material may occur and that the magnetite series originated at greater depth i.e. upper mantle or lower crust. Although there were attempts to correlate this classification with the I/S type classification (Chappell and White 1974), the two classifications are not exactly equivalent (Takahashi et al. 1980). Comparison between the characteristic features of the two types of classification is given by Beckinsale (1979) and is shown in Table 8.1.

#### 8.2.4. Classification using normative mineralogy

O'Connor (1965) introduced a normative An-Ab-Or classification of granitic rock which was modified by Barker (1979) (Fig 8.3). In this diagram granitic rocks were divided into 5 main fields i.e. tonalite, granodiorite, quartz monzonite, trondhjemite and granite (s.s). The disadvantage of this diagram is probably the lack of the fields for more basic rocks such as monzodiorite, monzonite and diorite, often associated with granites.

Streckeisen and Le Maitre (1979) proposed a classification based on the normative minerals which is intended to mirror the Streckeisen QAP classification (Streckeisen 1967,1975). This rectangular diagram has two axes which reflect the silica saturation (y-axis , QU) and changing feldspar composition (x-axis , ANOR) (Fig 8.4).



FIGURE **8.3** : The classification of 'granitic' rock according to their normative An-Ab-Or composition (Barker 1979)- heavy lines. The original fields of O'Connor (1965) are shown in faint lines.



FIGURE 8.4 : The Q'-ANOR (normative) classification of plutonic rocks (Streckeisen and LeMaitre 1979). The small diagram is Q'-ANOR plot of rocks from various tectonic environment (Bowden et al.1984).

Open diamond : Plagiogranites from Cyprus and Oman

Closed circle : Cordilleran granitic rocks.

Closed square : Caledonian granitic, post orogenic rocks. Closed diamond: 2-mica cordierite granites, Strathbogie, Australia. Closed triangle : 'A' type granite - anorogenic rocks, Nigeria. Open inverted triangle : 'A' type granite from Lachlan fold Belt.

I-type or magnetite-series granites	S-type or ilmenite-series granites			
Tend to be the acid end of a broad compositional spectrum from basic to acid	Tend to occur in restricted ranges of only acidic compositions			
Relatively high sodium contents	Relatively low sodium contents (< $3.2\%$ Na <sub>2</sub> O in rocks with ~ $5\%$ K <sub>2</sub> O)			
Low initial <sup>87</sup> Sr/ <sup>86</sup> Sr ratios (<0.708)	High initial ${}^{87}$ Sr/ ${}^{86}$ Sr ratios (> 0.708)			
Normal range of $\delta^{18}$ O values (approx. 6–10 ‰, SMOW)	Enriched in <sup>18</sup> O (δ <sup>18</sup> O values ≥ about 10%, SMOW)			
Magmas with relatively high oxygen fugacity; relatively high ferric/ferrous ratios; characterized by magnetite	Magmas with relatively low oxygen fugacity; relatively low ferric/ferrous ratios; characterized by ilmenite			
Hornblende and sphene commonly present	Muscovite, monazite, cordierite and garnet commonly present			

TABLE 8.1 : Characteristic features of 'I' type /magnetite series and 'S' type / Ilmenite series (after Beckinsale 1979).

I-type	\$	S-types
(i)	Metaluminous mineralogy; horn- blende common and more abundant than biotite in mafic samples: acces- sory sphene common	Peraluminous mineralogy: biotite and mus- covite predominate; no hornblende; some cordierite and/or aluminosilicates; monazite may be accessory
(ii)	Hornblende-rich igneous-appearing xenoliths	Pelitic or quartzose metasedimentary xeno- liths
(iii)	Relatively high Na <sub>2</sub> O	Relatively low Na <sub>2</sub> O
(iv)	Molecular $Al_2O_3/(Na_2O + K_2O + CaO) < 1.1$	Molecular $Al_2O_3/(Na_2O + K_2O + CaO)$ >1.1
(v)	Normative diopside or small amounts of normative corundum	Normative corundum >1%
(vi)	Broad spectrum of compositions from mafic to felsic	Narrow range of more felsic rocks
(vii)	Regular inter-element variations within plutons; linear or near linear variation diagrams	More irregular variation diagrams
(viii)	Mafic hornblende-bearing enclaves	Metasedimentary enclaves
(ix)	Initial <sup>87</sup> Sr/ <sup>86</sup> Sr 0.704-0.706	Initial <sup>87</sup> Sr/ <sup>86</sup> Sr >0.708
(x)	Usually unfoliated; contacts strongly discordant well developed contact aureoles	Often foliated; sometimes surrounded by high grade metamorphic rocks

TABLE 8.2 : Summary of distinctive features of the 'S' and 'I' type granites of Lachlan Fold Belt as originally proposed by Chappell and White (1974).

Bowden et al. (1984) plotted granites from different environments on this diagram (oceanic plagiogranite, Cordilleran granite, Caledonian granite, Australia 'S' type granite and Nigerian anorogenic granite , **Fig 8.4**) and recommended that the diagram should be used more widely in future studies as all of the series can be separated.

## 8.2.5 Classification based on zircon morphology

The idea of using zircon in the characterisation of granitic rocks was developed by Poldervart (1950,1956). Later, Pupin (1980) divided granitic rocks into three main groups based on the morphology of zircon populations found in rocks. They are:

(a) crustal origin (autochthonous and aluminous granites),

- (b) mantle origin (alkaline and tholeiite granites),
- (c) mixed origin (calc alkaline and sub-alkaline granites).

Varva (1994) studied the internal morphology of zircon crystals from different types of granites. He observed that the morphological evolution of zircon varies systematically between the different granitic types. He concluded that important factors controlling the zircon morphology in the different types of granitic rocks are high cooling rates, magma mixing, enrichment of H<sub>2</sub>O and trace elements in residual liquids and the major element chemistry of the magma (Na and K to Al).

### 8.2.6 Alphabet classification

The concept of alphabet classification (adopted from Clarke 1992) in granitic rocks was introduced by Chappell and White (1974). This classification was developed by these authors in a series of papers on the Lachlan Fold Belt, Australia (e.g. Chappell and White 1984, 1991 ; White and Chappell, 1983, 1988).

The first subdivision of this classification was between those granites derived from a sedimentary or igneous source rock. The distinction between 'I' and 'S' type granitic rocks is largely genetic. 'I' type granites are considered to have been generated from igneous source materials and 'S' types granite from a sedimentary source (White and Chappell 1974). Relative to 'I' type granites, 'S' type granites are low in Na, Ca and Sr,

three elements which are lost during conversion of feldspar to clay minerals by weathering of sedimentary rock and are higher in Pb, Cr and Ni. As a result 'S' type granite is always corundum normative or peraluminous and becomes more strongly so as the rocks become more mafic (Chappell 1984). Felsic 'I' types are mildly peraluminous and overlap 'S' types, but more mafic 'I' types are metaluminous .

'I' and 'S' type rocks also show different characteristic minerals; 'S' types contain Al-rich minerals such as muscovite, and alusite, cordierite or sillimanite etc. and 'I' type rocks are characteristically hornblende bearing with accessory sphene. <sup>87</sup>Sr/<sup>86</sup>Sr ratios for 'S' type granite is more than 0.707 whereas for 'I' type it is less than 0.705. The summary of distinctive features of both types as originally proposed by Chappell and White (1974) are given in Table 8.2. Table 8.3 a and b show the specific geochemical characteristics of 'I' and 'S' types granites (White and Chappell 1983)

'A'-type granite was introduced by Loiselle and Wones (1979) for granites found in anorogenic areas. The letter 'A' also indicates the alkaline and anhydrous nature of 'A'-type granite. Collins et al. (1982) found that the chemical characteristics of 'A'-type granites from Lachlan Fold Belt, Australia include low MgO and CaO and high Na<sub>2</sub>O+  $K_2O$  (Table 8.5). They can be peraluminous and metaluminous. The geochemical characteristics of 'A' type granitic rocks are shown in Table 8.3 c.

'M'-type granite (White,1979; Pitcher 1983) was introduced for granite that originates in the mantle. This type of granite is usually associated with ophiolite. Among the characteristics of the 'M'-type granite are A/CNK < 1, strontium ratio < 0.705 and  $\partial^{18}$ O < 9‰, implying a mantle source (Clarke 1992). The origin of these granites can either be indirectly through partial melting of subducted oceanic crust or directly by extended fractional crystallisation of basalt.

Castro et al. (1991) introduced a new alphabet classification of granitic rocks. They reviewed the 'I'/'S' classification of Chappell and White (1974) and introduced hybridization as a new element in the granite typology particularly in orogenic environments. A new term - hybrid ('H' type) has been suggested to replace the 'I' type

PARAMETER	CHARACTERISTIC	EXPLANATIONS		
SiO2	Wide range (53 - 76 %)	Relatively mafic source rocks		
K2O/Na2O	Low	Na has not been removed by weathering.		
K2O/SiO2	Variable	Derived from source rocks of moderate and variable content		
Ca	High in mafic rocks	High Ca in source ; not removed by weathering.		
A/CNK	Normally low	Only minimum tempreture melts or fractionated I type may be peraluminous		
Fe3+/Fe2+	Moderate			
Cr and Ni	Low	Source rocks relatively low in Cr and Ni , indicating prior fractionation		
∂18O	Low	Primary igneous source rocks		
87Sr/86Sr	Generally Low	Mantle derived igneous source rocks.Some high value for granitoids derived from old source with high Rb/Sr		

а

CHARACTERISTIC VALUE	EXPLANATIONS
Within range 65 - 74%	Derived from SiO2 rich source
High	K adsorbed by clays on weathering, whereas Na is removed
Low	Removed in weathering cycle
High (> 1.05) and increase as the rocks becomes more mafic.	Weathering increase Al relative to Na + K + Ca
Low	Carbon common in sedimentary source rocks
High relative to I types	Cr and Ni incorporated into clays during weathering
High	Oxygen isotopes fractionates during production of clays during low temp.weathering
High (normally > 0.708)	Rb concentrated relative to Sr during weathering and sedimentation
	CHARACTERISTIC VALUE Within range 65 - 74% High Low High (> 1.05) and increase as the rocks becomes more mafic. Low High relative to I types High High (normally > 0.708)

PARAMETER	CHARACTERISTIC VALUE	EXPLANATIONS		
SiO2	Usually high , often near 77%	Small degree of partial melting		
Na2O	High	Small degree of partial melting		
CaO Lew		Small degree of partial melting,Ca not compatible with melt structure.		
Ga/Al	High	Ca complexed in melt , plagioclase in residue.		
Y and REE	high except Eu	Complexed in melt, with much Eu remaining in anorthite		
Nb and Sn	High	Complexed in melt		
Zr	Normally high , particularly in more mafic varieties	Complexed in melt		
F and Cl	High	Source rock is a residue from an earlier melt and rich in F and Cl.		

TABLE 8.3 : Characteristic of (a) I type (b) S type (c) A type granite. (After White and Chappell 1983)

Granitoid types					
S-type	H <sub>5</sub> -type	H <sub>ss</sub> -type	H <sub>m</sub> -type	M-type	
Leucogranites (2 mica) sienogranites to monzo- granites	monzogranites to granodiorites	granodiorites and tonalites	tonalites (fine grained mostly)	quartzdiorites and tonalites	
Metamorphic restites (biot., sill., cord., etc.)	metamprohic restites, mafic enclaves scarce	mafic enclaves predominate	poor in enclaves scarce or no restites	only cumulate-like enclaves	
Residual phases from the melting reaction (K-feld, cord, sill, etc.) biotsill, clots	K-felds. megacrysts and cord. from the melting reaction, biotite clots	crysts K-felds. megacrysts hb clots characteristics m the resorbed. reaction from $px \rightarrow hb$ reaction ion. $cord \rightarrow bi$ frequent, $bi. \rightarrow hb$ reaction hb-bi clots		stable ferromagne- sian phases, only peritectic reactions	
Simple zonir.3 in plag., no resorbtion zones No xenocrysts	complexely zoned plagioclases with conspicuous resorbtion zones scarce or no xenocrysts hornblende clots plag., K-felds, and q.			oscillatory, simple zoning in plag. no xenocrysts	
Major association with regional, high-grade metamorphism	with generally associated with M-type and S-type granitoids in large batho- liths with transitional contacts; at epizonal levels, each type can appear in isolated, single plutons				
Crustal isotopic ratios $\delta^{18} O \ge 10\%$ Sr initial ratio $> 0.708$ $\epsilon_{3.4} \ll 0$	tal isotopic ratios isotopic ratios very variable; isotopic ratios are generally intermediate between mantelic and crustal ratios; mixing lines are characteristic itial ratio > $0.708 = 0$				
$K_{2}O/Na_{2}O > 1$		<1			
Saturation alumina inde	ex(SAI) > 1	SAI close to 1	SAl < 1	tholeiitic affinities	
Partial melting of metasedimentary rocks compositional varia- tions explained by restite unmixing	developed by magma m derived mafic magmas (S-type) magmas	ixing (hybridization) bet (M-type) and supracrusta	ween mantle- al anatectic	fractionation of mantle-derived, basaltic magmas	

TABLE 8.4 : Alphabet classification by using hybridation as a new element (After Castro et al.1991)



TABLE 8.5 : Granite classification according to their tectonic occurrence (after Pitcher 1993).

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FIGURE 8.5 : The classification of plutonic rock using parameter R1 and R2 (after de la Roche et al.1980). R1= 4Si - 11(Na+K) - 2(Fe+Ti) ; R2=6Ca + 2Mg + Al.



FIGURE 8.6 : Summary diagram of the major granitic association, base on Pitcher (1979,1983) and Harris et al. (1983) (after Batchelor and Bowden 1985).



FIGURE 8.7 : Various granitic rocks plotted in the An-Ab-Or-Qz tetrahedron (a) Santa Rosa-major super unit from the Coastal Batholith Peru (Atherton 1984) ; (b) Lachlan'S' types granites (Chappell 1984) , and Thai granites (Ishihara et al. 1980) and Dartmoor (Watson et al.1984) ; (c) Plagiogranite and trondhjemites (Malpas 1979) ; (d) `A' type granites (Collins et al. 1982). (after Atherton 1988)

granite. They suggested that in orogenic environments, 'H'-type granite may be developed from the mixing of mantle derived magmas ('M'-type) and anatectic, supracrustal melts (S-type). The 'M' and 'S' types magmas were regarded as the end members of the 'H' type. By mixing these two end members, they suggested that three 'H' types magmas can be produced. These are  $H_s$  ('S'-type predominates), 'H<sub>m</sub>' ('M' type predominates) and  $H_{ss}$  ('S' and 'M' equal). The distinctive features of these types are given in **Table 8.4**.

#### 8.2.7 Classification based on the major element cation proportions.

De La Roche et al.(1980) proposed a classification scheme for volcanic and plutonic rocks based upon their cationic proportions of major elements, expressed as millications. The diagram is a X - Y bivariate graph using the plotting parameters R1 and R2 where :

R1 = 4Si - 11(Na + K) - 2(Fe + Ti)

$$R2 = Al + 2Mg + 6Ca)$$

The diagram is important in classifying granitic and associated rocks (Fig 8.5). Among the advantages of using this diagram are (1) the entire major element chemistry of the rock is used in the classification, (2) the scheme is sufficiently general to apply to all types of igneous rock and (3) the degree of silica saturation and changing feldspar compositions can be shown. Batchelor and Bowden (1985) showed that the diagram can discriminate five granitic groups related to the tectonomagmatic divisions proposed by Pitcher (1979,1983, Fig 8.6).

## 8.2.8 Lineages and granitic series.

Atherton (1988) suggested that granitic rocks should be considered in terms of the lineage which produced the major variation at the exposed level. A large number of parameters have to be considered to complete the definition of the lineage among which are ascent modification and fractionation, mixing, final crystallisation and tectonic regime (Atherton 1990).

The lineage character of a granitic series can be expressed using the QAP modal diagram (Streikeisen 1967) and the system An-Ab-Or-Qz-H<sub>2</sub>O. The importance of the latter lies in the fact that most granitic batholith rocks contain more than 80% normative An-Ab-Or-Qz, so their evolution can be readily shown in the granite system. Different lineages and mineral paragenesis can be plotted in the An-Ab-Or-Qz diagram (Atherton 1988,1989) (Fig 8.7).

## 8.2.9 Tectonic classification of granitic rocks.

This classification has been proposed by Pitcher (1983,1987,1993). He suggested a five fold classification of the granites depending on their tectonic setting (**Table 8.5**). According to Pitcher (1983) "the close relationship between granite type and geological context is because granite in the widest sense, arises at the end stage of several generative processes involving different source rocks, each process and source being appropriate to a particular environment". The survey is mainly based on granites of Phanerozoic age (Pitcher 1983). Granitic rocks were first divided into two main types, Orogenic and Anorogenic. The Orogenic granites have been further subdivided into four types according to their tectonic setting namely oceanic island arc, continental margin arc, post closure uplift and continental collision (**Table 8.5**).

## 8.2.10 Synthetic classification

Barbarin (1990) summarised many of the previous granitic classifications, then offered yet another classification. He compared some twenty previous granite classifications (**Table 8.6**). In almost all classifications, alkaline and peralkaline granites are separated from calc-alkaline, peraluminous and metaluminous granites. Most of the classifications distinguished three groups of granites corresponding to their sources i.e. crustal, mantle-derived or mixed.

Barbarin (1990) noted that the majority of orogenic granites originate at the crust-mantle interface and involve crust and mantle components. He later suggested that granites can be broadly divided into three main petrogenetic groups (1) almost

Classification	Authors	Origin									
Basis		Crustal			Mixed			Mantle			
First chemical Nomenclatures	Shand (1943)	PERALUMINOUS		rocks	METALUMINOUS pecks rock			ks		PERA	LKALINE rocks
	Lacroix (1933)	Roches Ca HYPERALU	ileo-ALC. MINEUSES		Ro	Roches CALCO-ALCALINES					s ALCALINES
Petrography	Capdevila and Floor (1970) Capdevila <i>et al.</i> (1973)	Granites MESO	CRUSTAUX	Granites MI	XTES	Granites BASICRUSTAUX					
	Orsini (1976 and 1979)			A.M. SUE Alumin	B-ALC. Neux	A.M. SUB-ALC. A.M. Hypoalum. Calco-Alc					
	Yang Chaoqun (1982)		MM-TYPE	CR-TY	PE	MS-TYPE				м	D-TYPE
	Tischendorf and Palchen (1985)	S,	Ss	S,		I <sub>KK</sub>	Iок	I,	п		Ima
Enclaves	Didlier and Lameyre (1969) Didier <i>et al.</i> (1982)	C-1 ("1	YPE (Crustal) .eucogranites")			M-TYPE (N ("Monzogranite	tixed or mantle s & Granodiori	) tes")			
Mineralogy (QAP system)	Lameyre (1980) Lameyre and Bowden (1982)	"LEUCOGRANITES" CAL (Crustal fusion) (High K			CAL (High K	C-ALKALINE Seri Medium K or Lo	THOLEITIC Series		(PER) ALKALINE Series		
Matic Minerals	Rossi and Chevremont (1987)	A.M. ALUMINOPOTASSIQUE (s.s. ou composites)				A.M. A.M. CAL- MONZONITIQUE COALCALINE		A.M. THO- LEITIQUE		A.M. (PER) ALCALINE	
Biotite Composition	Nachit et al. (1985)	Lignées ALUMINO-POTASSIQUES			Lignées CALCO et SUBALC			Lignées et HYPI	ALCALINES		
Zircon Morpology	Pupin (1980 and 1985)	TYPE 1 TYPE 2 TYPE 3 TYPE 4 & 5		& 5	TYPE 7		TYPE 6				
Opaque Oxides	Ishihara (1977) Czamanske <i>et al.</i> (1981)	ILMENITE Series				ITE Ser	ies				
Geochemistry (Major Elements)	Chappell and White (1974 and 1983) Collins <i>et al.</i> (1982). Whalen <i>et al.</i> (1987)		S-TYPE			(I-TYPE)*		м-түре		(Л-ТҮРЕ)*	
	La Roche (1986) La Roche <i>et al.</i> (1980)	AK-L M	Α.	ак-с ма	i.	SA M.A.	СА М.А.	тн м.а.		А-РА М.А.	
	Debon and Lefort (1983 and 1988)	ALU	MINOUS M.	Ν.		ALUMINOCAFEMIC and C/ (Subalkaline, cale-alkaline, tholeiitic,		and CA oleiitic.	CAFEMIC M.A. itic, and (per)alkaline)		
	Maniar and Piccoli (1989)	CCG			POG		CAG	IAG	OP	RRG	CEUG
Geochemistry (Trace Elements)	Tauson and Kozlov (1973)	PLUMASITIC ULTRA-MM PALI LEUCOGR GRANITES (Nor			INGENIC GRANITES rmal and Subalkalines)		PLA GRAN	CIO- NITES	LEUC	GPAITIC OGRANITES	
	Pearce ct al. (1984)	C O L G - Collision Granites (Syntectonic) (Post-tec			nites VAG st-tectonic) Volcanic Arc (		Granites	ORG	Within	WPG Plate Granites	
Associated Mineralizations	Xu Keqin <i>et al.</i> (1982)	TRANSFORMATION TYPE (Continental crust)			SYNTEXIS TYPE (Transitional crust)		MANTLE-DERIVED TYPE		ED TYPE		
Tectonic Environment	Pitcher (1983 and 1987)	HERCYNOTYPE CALI		CALEDONIAN TYPE AND		ANDINOTYPE	E W.PACIFIC TYPE		NIGERIA TYPE		
	Suggested classification	C <sub>st</sub>	Ссл	C	3	H <sub>LO</sub>	Нса	· 7	Г		A

TABLE 8.6 : Comparison of the main petrogenetic classification of granitic rocks (after Barbarin 1990)

			(BARBARIN, 19	90)
- ORIGIN -	- GRANITOID TYPES -	- TECTONIC SETT	'ING -	
	Intrusive Two-mica Leucogranites	CST	COLUSION	
CRUSTAL ORIGIN	Peraluminous Autochtonous Granitoids	CCA	OR	ORO
PERALUMINOUS ROCKS	Peraluminous Intrusive Granitoids C <sub>C1</sub>		POST-COLLISION	ogenic grani
MIXED ORIGIN (Crust + Mantie)	Potassic Calc-Alkaline granitoids (High K - Low Ca)		ZONES	
METALUMINOUS OR CALC-ALKALINE ROCKS	Calc-Alkaline Granitoids (Low K - High Ca)	HCA	SUBDUCTION	TOIDS
MANTLE ORIGIN	Island Arc Tholeiitic Granitoids Midocean Ridge Tholeiitic Granitoids	T <sub>IA</sub> T <sub>OR</sub>	ZONES	R≹
THOLEIITIC, ALKALINE OR PERALKALINE ROCKS	Alkaline and Peralkaline Granitoids	A	RIFTING OR DOMING ZONES	WITCHOS

TABLE 8.7: Proposed classification obtained from the comparison of the main petrogenetic classification of the granitic rocks and the relationships to the origin of the magmas and tectonic settings (After Barbarin 1990)

exclusively crustal orogenic group (C-group) (2) hybrid orogenic granites with mixed origin, both crustal and mantle derived (H-group) and (3) mantle derived anorogenic granites (T-or A-group).

In this synthetic classification, eight types of granitic rocks fit into the three main categories of rocks of crustal, mantle and hybrid (crust + mantle) origin (**Table 8.7**). This classification underlines the close relationship between the origin of granitic rocks and their tectonic setting.

# 8.3 CLASSIFICATION OF THE DONEGAL GRANITES

In this part the Donegal granites will be classified using some of the classifications that have been surveyed in the first part of this chapter. Pitcher (1983) has classified the granites together with other Caledonian granites of the British Isles as Caledonian  $\mathbf{\hat{I}}$  type that occur in a post closure uplift tectonic regime. Dempsey (1987) studied the geochemical aspects of Barnesmore pluton and said that the pluton is subalkaline and generally peraluminous. Barbarin (1990) has grouped the granites as calc-alkaline type with high-K and low-Ca.

# 8.3.1 Classification by mineralogy

Modes of the quartz, alkali feldspar and plagioclase of the 120 samples from the Donegal granites are given in Appendix 2. They were plotted on a QAP diagram (Streckeisen 1967; Fig 8.8, Fig 8.9). In terms of the granite series (Lameyre and Bowden 1982 ; Bowden et al. 1984), the Donegal granites fall in the calc-alkaline granodioritic series, similar to the subduction related granitic rocks from Cordilleran granites (Bateman 1963). However, the geological evidence (see chapter 7 for discussion) does not support this conclusion. In general the Rosses, Trawenagh Bay, Ardara, Thorr, Fanad and Barnesmore plutons belong to the calc-alkaline granodioritic series. The Main Donegal granite however show a trend similar to the calc-alkaline trondhjemite series (Arth et al.1978 and Fig 8.9).

The granitic rocks from Rosses, Barnesmore, Trawenagh Bay and some of the rocks



FIGURE 8.8 : Modal Q-A-P plot for the Donegal granites. The field of 'S'-type and 'I'-type granitic rocks from Lachlan fold belt, Australia (Bowden et al. 1984) is also shown. It shows that the general trend is similar to calc alkaline granodiorite series (Atherton et al. 1979 ; Bateman et al. 1963).



FIGURE 8.9 : Lineages of individual plutons of the Donegal granites plotted in the Q-A-P diagram (Streckeisen 1967).

from the Main Donegal granite (granite-granodiorite) occupy a central area of the diagram (Fig 8.8). Granites plotting in this area have been regarded as crustal melts (Bowden et al.1984) and this suggests the importance of crustal material in the source rocks of those plutons. Furthermore many of the rocks from Rosses and Barnesmore plutons plot in the 'S'-type field of Lachlan fold Belt (Bowden et al. 1984) (Fig 8.8).

## 8.3.2 Classification based on the peraluminosity

A plot of aluminium saturation index (ACNK) versus SiO<sub>2</sub> for the Donegal granites is shown in Fig 8.10. In general the ACNK value for the Donegal granites range from metaluminous to peraluminous. Quartz monzodiorite from the Fanad pluton has the lowest ACNK value (0.8) and the highest ACNK values are from 'contact' facies rocks of Thorr pluton (1.32). The range of ACNK for individual plutons are given in Table 8.8.

The plots of ACNK versus SiO<sub>2</sub> for the individual plutons are shown in Fig 8.11. The ACNK value for the Ardara and Rosses plutons increases and the Main Donegal and Barnesmore decreases with SiO<sub>2</sub>. There are no clear trends for the Thorr, Fanad and Trawenagh Bay plutons.

(1) <u>Trawenagh Bay</u> : all Trawenagh Bay rocks plot in the 'I' type field (Chappell and White 1974) with the majority of the rocks being slightly peraluminous.

(2) <u>Main Donegal</u> : the samples from the Main Donegal granite plot in both metaluminous to peraluminous fields with considerable grouping of data points near the line of ACNK = 1. All samples plot in the 'I' type field.

(3) <u>Ardara</u> : The majority of the samples from the outer unit plot in the 'I' type field and are metaluminous. The samples from the inner unit show a wider range of ACNK from metaluminous to peraluminous, only 2 samples from this unit fall in the 'S' type field. These samples were collected from the inner unit of the Ardara pluton.

(4) <u>Fanad</u>: The samples are mainly metaluminous with some slightly peraluminous.All samples from Fanad plot in the I type field

(5) <u>Rosses</u> : Samples from Rosses show consistent variation of increasing ACNK (metaluminous to peraluminous) from porphyry dykes to G4. The majority of the samples

Pluton	Range ACNK
Trawenagh Bay	0.85 to 1.09 (1.01)
Main Donegal granite	0.95 to 1.14 (1.01)
Fanad	0.86 to 1.09 (0.94)
Ardara Outer Unit	0.86 to 1.03 (.94)
Ardara Inner Unit	0.92 to 1.12 (1.02)
Rosses G1	0.95 to 1.12 (1.03)
Rosses G2	0.89 to 1.12 (1.04)
Rosses G3	0.94 to 1.16 (1.03)
Rosses G4	0.99 to 1.2 (1.08)
Thorr normal facies	0.92 to 1.07 (1.0)
Thorr contact facies	1.03 to 1.32 (1.13)
Barnesmore G1	1.01 to 1.12
Barnesmore G2	1.02 to 1.11
Barnesmore G2pf	1.01 to 1.05
Barnesmore G3	0.95 to 1.04

TABLE 8.8 : Range of ACNK values of different plutons of the Donegal granites.



FIGURE 8.10 : Al<sub>2</sub>O<sub>3</sub>/CaO+Na<sub>2</sub>O+K<sub>2</sub>O vs SiO<sub>2</sub> diagram for Donegal granites. Line at ACNK=1 divided between peraluminous and metaluminous (Shand 1927) and line at ACNK=1.1 divided between I type and S type granite (Chappell and White 1974)



FIGURE 8.11 : ACNK vs SiO<sub>2</sub> for individual plutons of the Donegal granites. Line ACNK=1 divides peraluminous and metaluminous field and line ACNK = 1.1 divides the 'I' and 'S' type granite (Chappell and White 1974).

plot in the 'I' type field. Three samples from G4 and one each from G1 and G2 plotted in the 'S' type field.

(6) <u>Thorr</u>: In Thorr, the samples from the contact facies plot in the 'S' type field and all are peraluminous. Hornblende free, hornblende bearing and transitional facies rocks are metaluminous to slightly peraluminous and plot mainly in the 'I' type field

(7) <u>Barnesmore</u>: In contrast to the Rosses, the Barnesmore samples show slight decrease of ACNK with increasing SiO<sub>2</sub> from G1 to G3. The majority of the samples are peraluminous and plot in the 'I' type field.

The diagrams (Fig 8.11) show that most of the Donegal granites (except the contact facies from Thorr and the G4 of the Rosses plutons) are 'I' type and are metaluminous to slightly peraluminous. Both G4 from Rosses and contact facies rocks from Thorr gained peraluminosity by high level interaction with fluid and pelites respectively.

## 8.3.3 Normative classification.

The normative data for rocks of the Donegal granites were plotted on an An-Ab-Or triangular diagram (Barker (1979), Fig 8.12). All Rosses samples plot in the granite(s.s) field. This is similar to the Rosses rocks in a Q-A-P diagram and in the major element plots (de La Roche 1980 ; Batchelor and Bowden 1985). 20% of the rocks of the Main Donegal granite plot in the trondhjemite field and grade into the granite field. Fanad rocks plot mainly in the granodiorite and tonalite fields. Thorr rocks plot in the granodiorite to the granite field.

The other normative plot, the Q' vs ANOR (Streckeisen and Le Maitre 1979) is shown in Fig 8.13. The rocks trend from granite to monzogranite to granodiorite to tonalite. This general trend follows the Caledonian post orogenic trend of Bowden (1984). All Rosses, Trawenagh Bay and Barnesmore samples plot in the granite and monzogranite fields whereas Ardara, Main Donegal, Fanad and Thorr samples grade from granodiorite to tonalite.



D= Trondhjemite

E= Granite

FIGURE 8.12 : Classification of the Donegal granites by using normative anorthite, albite and orthoclase (after Barker, 1979)



FIGURE 8.13 : Q'-ANOR plot for the Donegal granites. The main trend of the plot follows the Caledonian post orogenic trend of Bowden et al. (1984)

## 8.3.4 Alphabet classification

On a plot of Na<sub>2</sub>O vs K<sub>2</sub>O (Fig 8.14), 99% of the samples of Donegal granites plot in the 'I' type field of White & Chappell (1983); only two rock samples fall into the 'S' type field. They are from the 'contact' facies of the Thorr pluton.

Comparison of the Donegal granites with the original 'I'/'S' type classification (Chappell and White 1974) is shown in **Table 8.9.** In terms of their mineralogy, the Donegal granites show both metaluminous and peraluminous characteristics. Metaluminous mineralogy is evident in the basic plutons such as Fanad, Ardara and Thorr which contain hornblende and accessory sphene. The more felsic plutons such as Rosses, Trawenagh Bay, Main Donegal and Barnesmore show peraluminous mineralogy including muscovite and garnet. They do not contain hornblende. The Donegal granites also have a wide range of SiO<sub>2</sub> between 52% to 77%. This is comparable to the SiO<sub>2</sub> range of the original 'I' type (White and Chappell 1983) between 53% to 76% **(Table 8.3a)**.

## 8.3.5 Major element classification.

Major element data from Donegal granites have been plotted in R1-R2 diagram of De La Roche et al.(1980) (Fig 8.15). This diagram shows that, in terms of rock types the Donegal granites range from monzodiorite to tonalite to granodiorite to monzogranite and syenogranite (cf. Fig 8.5). Fig 8.15 also shows the tectonic setting of the granites. The general trend of the Donegal granites coincides with the trends defined by the post collision uplift and late orogenic granitic trends.

## 8.3.6 Tectonic classification

It has been shown (section 8.3.5) that the Donegal granites are 'I' type according to the Chappell and White (1974) classification. Pitcher (1983) has divided the 'I' type granites into two types according to their tectonic environment i.e.'I' (Cordilleran) and 'I' (Caledonian) type granite. Comparison of the characteristics of these two types to the Donegal granites (Table 8.10) shows that the Donegal granites have both 'I'type (Caledonian) and 'I' type (Cordelleran) characteristics.



FIGURE 8.14: Plot of Na2O vs K2O for the Donegal granites. The 'I' and 'S' type field is after Chappell and White (1983). (n = 705)

## 'I' Type

Metaluminous mineralogy, hornblende and accessory sphene common. hornblende exceed biotite in mafic samples

Hornblende rich igneous appearing xenoliths

Relatively high Na2O

ACNK < 1.1 , normative diopside or small amount of normative corundum

Broad spectrum of composition mafic to felsic

Regular interelement variations within plutons;linear or near linear variation diagrams

Initial 87Sr/86Sr - 0.704 - 0.706

Initial 87Sr/86Sr >0.708.

# 'S' Type

Peraluminous mineralogy : no hornblende, biotite and muscovite predominate, with cordierite, aluminosilicate, monazite and garnet.

Pelitic or quartzose metasedimentary xenoliths

Relatively low Na2O

ACNK > 1.1 and normative corundum > 1%

Narrow range of more felsic rocks

More irregular variation diagrams

#### **Donegal** granites

Metaluminous and peraluminous mineralogy present. Hornblende and sphene occur in more basic plutons (Fanad,Thorr and Ardara). Muscovite, garnet occur in more felsic pluton (Rosses, Trawenagh Bay, Main Donegal and Barnesmore

Both igneous and sedimentary xenoliths to rafts size occur (Thorr, Fanad, Main Donegal and Ardara)

Relatively high Na<sub>2</sub>O

ACNK: 0.86 to 1.32

Generally broad range of composition from mafic (diorite,quartz monzodiorite) to granodiorite and trondhjemite to felsic composition (granite (s.s.))

Regular inter-element variation within plutons.

Initial 87Sr/86Sr - < 0.707

TABLE 8.9 : Comparison of 'I'/'S' types (Chappell and White 1974) with the Donegal granites.



- □ Fanad
- Ardara
- Main Donegal & Trawenagh Bay
- △ Thorr
- ♥ Rosses

R1 = 4 Si - 11(Na+K) - 2 (Fe + Ti)R2 = 6Ca + 2 Mg + Al

FIGURE 8.15 : R1-R2 diagram (De La Roche et al. 1980) and major tectonic association (Pitcher 1979,1983) of the Donegal granites.

#### **T TYPE CORDILLERAN**

Tonalite dominant but broad compositional spectrum

Hornblende, biotite, magnetite and sphene

K-feldspar interstitial and xenomorphic

Dioritic xenoliths ; may represent restitic material

ACNK - 1.1

87Sr/86Sr < 0.706

Great multiple, linear batholiths with arrays of composite cauldrons

Associated with great volumes andesites and dacite

## T TYPE CALEDONIAN

Granodiorite-granite contrasted association with minor bodies of hornblende diorite & gabbro

Biotite predominated, ilmenites and magnetite

K-feldspar interstitial and invasive

Mixed xenolith populations

#### ACNK-1

87Sr/86Sr > 0.705 < 0.709

Dispersed, isolated complexes of multiple plutons and sheets

Sometimes associated basaltandesites lave plateaux

## DONEGAL GRANITE COMPLEX

Quartz monzodiorite-granite association with minor appinite bodies

Biotite predominate(Brown > green > reddish), hornblende magnetite, sphene

K-feldspar interstitial and invasive

Mixed xenoliths populations

ACNK 0.7 - 1.32

87Sr/86Sr 0.705 - 0.707

Isolated batholith with distinct plutons, multiple & sheets

Lacking of voluminous volcanic equivalent

TABLE 8.10 : Comparison of the Donegal granites to the 'I' type Caledonian and 'I' type Cordilleran. Both I type classifications after Pitcher (1983).

# 8.3.7 Summary

The Donegal granites are metaluminous to slightly peraluminous (ACNK : 0.86 - 1.2) and generally belong to the calc-alkaline granodiorite series. The granites are 'I' type according to the Chappell and White (1974) classification except the contact facies of the Thorr and the G4 of the Rosses plutons which show apparent 'S' type characteristics. In terms of tectonic classification the Donegal granite is 'I' (Caledonian) type which is late orogenic granite. A summary of the classification of the Donegal granites is shown in **Table 8.11**.

## **CLASSIFICATION**

## DONEGAL GRANITE

#### REFRENCES

1) Q-A-P Rock type

Trend

2) ACNK

4) Normative An-Ab-Or

5) R1-R2 classification Trend Tectonic

6) I/S Classification

7)Tectonic Classification

Quartz monzodiorite to granodiorite to granite with minor trondhjemite. Calc -alkaline granodiorite

Metaluminous to peraluminous

Tonalite to granodiorite to granite with minor trondhjemite

Subalkaline (similar to Ploumanac'h granite) Post collision uplift to late orogenic.

'I'type to felsic'I'type. S type only occurs in contact facies of Thorr and the G4 of Rosses

The Donegal granites show both characteristics of I type Caledonian and Cordilleran •

Streckeisen (1967)

Atherton et al.(1979) Bateman et al.(1963)

Shand (1943)

Baker (1979)

De La Roche (1980) Bowden & Batchelor(1985)

Chappell & White (1974)

Pitcher (1983)

TABLE 8.11 : Summary of classification of the Donegal granites.

# CHAPTER NINE

# **CONCLUSIONS AND FUTURE WORK**

## 9.1 Introduction

This study has been concerned with the petrological, mineralogical and geochemistry of the Donegal granites. The Donegal granites are located in the north west of Ireland, in County Donegal (Map 2.1). They are part of the Caledonian granites of the British Isles and cover an area of approximately 1150 km<sup>2</sup>. They are intruded into Late Precambrian to Cambrian Dalradian metasediments ranging from pelites, quartzites to marls. The granites plutons are : Thorr, Rosses, Ardara, Fanad, Barnesmore, Main Donegal and Trawenagh Bay plutons (Map 2.2)

In the terminology of Peacock (1931) the Donegal granites have a calc-alkali chemistry. This is supported by the AFM plot which also shows that the granites follow the calc alkaline trend. More specifically the granites show that they belong to the high-K calc alkaline series of Peccerillo and Taylor (1976; Na<sub>2</sub>O + K<sub>2</sub>O ranges from 5.9 to 9.8%). The rocks are metaluminous to slightly peraluminous (ACNK : 0.8 - 1.15). Higher ACNK values are shown by the rocks from the contact facies of the Thorr pluton and the G4 from the Rosses granite.

The granites are generally 'I' type according to Chappell and White (1977) classification. Specifically the Donegal granites can be classified as 'I' type Caledonian. An apparently 'S' type characteristic granite is from the contact facies' of the Thorr granite where the granitic magma interacts with the pelitic rafts or xenoliths. This 'S' type rocks however do not suggest the sedimentary origin of the contact facies magma, but it is the result of interaction between the Thorr magma with the pelitic rafts or xenoliths. It represent a modified 'I' type.

The essential mineralogy of the Donegal granites are plagioclase, alkali feldspar, quartz and biotite. Hornblende is only present in the mafic plutons (Ardara, Thorr, Fanad and Toories). Muscovite occurs as a secondary mineral in the felsic plutons (Rosses, Barnesmore, Main Donegal and Trawenagh Bay) and in the contact facies rock of the Thorr granites. According to the Quartz - Alkali feldspar - Plagioclase classification

(Streckeisen 1967) the rock types of the Donegal granites grade from diorite to quartz monzodiorite to tonalite to granodiorite to granite (Thorr), granite (Rosses and Trawenagh Bay), granodiorite to granite (Barnesmore), trondhjemite to granodiorite to granite (Main Donegal), quartz monzodiorite to granodiorite (Fanad and Ardara). Mineralogical (Q-A-P) lineages show that the rocks belong to the calc alkaline granodiorite series similar to those formed near a plate edge (Bateman et al. 1963, Atherton et al. 1979). The accessory minerals of the Donegal granites are apatite, sphene, zircon, allanite, magnetite, garnet, ilmenite, pyrite and epidote. Magnetite is the main opaque phase (up to 2 % in the mafic Fanad and Thorr rocks). This suggests that the Donegal granites belong to the magnetite series (Ishihara 1977) which is comparable with the 'T' type classification of the Donegal granites (e.g. Beckinsale 1979).

Correlation with the Caledonian granites of the British Isles gives the following conclusions:

(1) The Donegal and late Caledonian granites are calc alkali.

(2) The Donegal granites show characteristics similar to the late Argyll suite granites of the Mainland Scotland. They are high-K calc alkali, and have high Ba and Sr contents.

## 9.2 Subdivision of the Donegal granites.

Based on the petrology and geochemistry the Donegal granites were divided into three groups

(1) The most felsic group - Rosses and Barnesmore plutons.

(2) The felsic group - Main Donegal granite and Trawenagh Bay plutons.

(3) The mafic group - Ardara, Thorr and Fanad plutons.

# 9.2.1 The most felsic group.

This group consists of the Barnesmore and Rosses plutons. The mineralogy of this group is alkali feldspar, plagioclase, biotite, quartz, magnetite, sphene, allanite, zircon and garnet. This group has high SiO<sub>2</sub> contents (70 - 79%), Rb, Th (Barnesmore only) and

Rb/Sr ; and has low Ba, Sr, Zr, Sr/Y and total REE.

## 9.2.2 The <u>felsic</u> group.

This group consists of the Trawenagh Bay and Main Donegal granites. It is characterised by intermediate to high  $SiO_2$  (65 - 75%) and Rb (Trawenagh Bay); intermediate Sr/Y; and low Sr, V, Ba and Rb/Sr. The mineralogy of this group is similar to the most felsic group.

## 9.2.3 The mafic group

This group consists of the Ardara, Thorr and Fanad granites and is characterised by a wide range of SiO<sub>2</sub> contents (52 - 72%) with the majority of the rocks between 52 - 65 % SiO<sub>2</sub>. Rocks of this group contain hornblende (up to 15%) and the modal amount of the accessory minerals such as allanite, apatite, sphene and magnetite are higher than those from the two previous groups. This group has high Ba (Fanad and Thorr), Ce, Sr, V, Zn, Zr, Sr/Y, and total REE ; intermediate to low Rb (Fanad and Thorr) ; and low Co, Rb/Zr, Rb/Ba and Rb/Sr compared to the other groups. It is interesting to note that among these three mafic plutons, Ardara shows a slight difference in geochemical characteristics. Compared to the Fanad and Thorr plutons, the Ardara pluton has :

(1) low Ba and Sr - the Ba content is similar to the felsic and the most felsic groups,

(2) high Rb especially in the rocks from the outer and intermediate units,

(3) high Th and Pb.

### 9.3 Individual plutons

## 9.3.1 Thorr pluton

(1) The Thorr pluton is normally but asymmetrically zoned and varies from quartz diorite (~55% SiO2) to true granite (75 % SiO2).

(2) The pluton can be divided into the hornblende-bearing normal facies and the hornblende-free normal facies. The latter facies, also known as the Gola facies (Whitten 1966), occurs in the NW of the pluton. This facies grades continously into a more basic one (granodiorite to diorite) towards the south and south-east viz hornblende-bearing normal facies. The rocks of the hornblende-bearing normal facies adjacent for to the pelitic xenoliths/rafts in the south and south-east change gradationally into the transitional facies and then to a contact facies (10 m wide).

Apart from the Bloody Foreland rocks the modal properties and the whole rock major and trace elements chemistry vary continuously from margin to core and there are no major internal contacts.

(3) In the normal facies the mineral phases present are alkali feldspar, plagioclase, quartz, biotite, hornblende, sphene, apatite, allanite, epidote, zircon, magnetite, pyrite and ilmenite. The dominant minerals in the contact facies are plagioclase, microcline, quartz, biotite, muscovite, apatite, zircon and rutile.

(4) The Thorr granite has the widest range of SiO<sub>2</sub> (from 56.75 to 75.19%) of all the Donegal granites. It also has the widest range of most of the major and trace elements and is exceptionally high in P<sub>2</sub>O<sub>5</sub>; high in Zr, Zn, Sr, V and has low Rb/Sr, Rb/Ba, Rb/Zr and Ni.

(5) The marginal accretion models of Oglethorpe (1987) may explain the compositional variation of the Thorr granite. Combined major and trace element modelling indicates that the compositional variation in the Thorr granites was produced by plagioclase, hornblende and biotite fractionation and alkali feldspar and quartz fractionation may have been important in the end-stage melt (= hornblende free facies)

# 9.3.2 Rosses pluton

(1) The pluton forms a ring complex which was intruded into the older Thorr pluton. The main body of the granite consists of 4 units, G1 to G4 and is generally medium to coarse grained biotite to muscovite granite. There is a peripheral group of arcuate, steeply inclined microgranite sheets and a north-south trending porphyry dyke swarm which intruded G1 and G2.

(2) The main rock type of the Rosses complex is granite (s.s.) consisting of plagioclase, microcline microperthite, quartz, biotite, apatite, magnetite, allanite,

zircon and hematite, sphene (secondary) epidote (secondary).

(3) The rocks have SiO<sub>2</sub> contents ranging from 69 to 77 %, low Ba, Ce, La, Nd, Sc, Sr, Th, V, Zr, Sr/Ba and Sr/Y and high Rb (G2 and G4), Ni, Co (G4 and G2), Rb/Sr, Rb/Ba, Y/Zr (G2 and G4) and Rb/Zr. ACNK increases with SiO<sub>2</sub>.

(4) A distinct chemical break occurs within the pluton at the G2 - G3 contact where G3 is more basic than G2. This indicates that the continuous evolution of the Rosses granites from G1 to G2 to G3 to G4 at the present level is unlikely. The primitive nature of G3 may be explained by the influx of basic magma into a magma chamber at depth after the emplacement of the G2.

(5) Combined major, LILE and REE element modelling indicates that the compositional variation in the pluton at the present level involved the precipitation of plagioclase, biotite and alkali feldspar. The variation of the Rosses granites can be explained by 2 cycles of magma evolution namely (1) microgranite to G1 to G2 and (2) porphyry/G3 to G4. The porphyry dykes may represent a basic quench of the G3 magma.

#### 9.3.3 Ardara pluton

(1) The Ardara pluton is normally zoned and consists of three units, an outer, intermediate and inner unit.

(2) The essential minerals of the rocks from this pluton are plagioclase, alkali feldspar, hornblende, biotite and quartz. The accessory minerals in decreasing abundance are epidote, sphene, apatite, magnetite, hemo-ilmenite and pyrite.

(3) The Ardara granitic rocks have SiO<sub>2</sub> contents ranging from 59.1 to 72 %. The rocks have high V, Th, Pb, Ce and low Co, Ba, Y/Zr, Rb/Zr, Rb/Sr, Rb/Ba compared to the other Donegal granites.

(4) The modelling showed that the units of the Ardara granite are not related by a simple in situ fractionation from the wall inwards. Each unit may represent three magmas, each has is fractionated separately (cf Yarr 1991).
#### 9.3.4 Fanad pluton

(1) The Fanad granite is located in the most northerly part of Donegal and consists of three separate units namely Rosguill, Melmore and Fanad peninsula. Using the geochemical data, the Fanad peninsula rocks are subdivided into 2 sub-units namely high Ba Fanad peninsula, low Ba Fanad peninsula.

(2) The dominant minerals in decreasing abundance are plagioclase, biotite, alkali feldspar, quartz, hornblende, sphene, magnetite, apatite, allanite and zircon, pyrite and ilmenite.

(3) The rocks are characterised by low SiO<sub>2</sub> contents ranging from 52 to 64% i.e it is the most basic of the Donegal granites and has high Ba, Nd, Sr, Sc, V, Zn, Zn, Zr, Sr/Y, total REE and low Co, Pb, Rb, Th, Y, Rb/Zr, Rb/Ba, Rb/Sr.

(4) Combined major, LILE and REE element modelling indicates that the compositional variation in the pluton is due mainly to the fractionation of hornblende and plagioclase. The geochemical evidence indicates that the separate units of the Fanad granites are not related at the present exposure level and may represent separate magma batches from different sources.

#### 9.3.5 Main Donegal pluton

(1) The Main Donegal granite is the largest intrusion of the Donegal granites. It is characterised by a broad, sheeted contact zone and internally by lithological banding of light (graniodiorite-granite) and dark (trondhjemite) bands.

(2) The dominant minerals in the light bands (in decreasing abundance) are plagioclase, alkali feldspar, biotite, quartz, sphene, magnetite, apatite, allanite, zircon, epidote, pyrite, hematite, ilmeno-hematite, chalcopyrite and geothite. The dark bands also have a similar mineral assemblages but with very low modal alkali feldspar and very high modal plagioclase.

(3) The dark bands have SiO<sub>2</sub> contents ranging from 66.2 to 71.2 % whereas the light bands range from 67.8 to 74.7%. The trondhjemite can be distinguished from the granodiorite-granite as it has lower K<sub>2</sub>O, Rb, Ba, Sr/Rb and and higher Na<sub>2</sub>O, Nb and

Rb/Ba values.

(3) The geochemical data suggests that the dark band trondhjemite from the Main Donegal granite is different to the granodiorite-granite and likely to have a different origin from other Donegal granite magmas.

9.3.6 Trawenagh Bay pluton

(1) The Trawenagh Bay granite is located at south-west end of the Main Donegal granite. No contacts have been observed between the two plutons.

(2) 90 % of the Trawenagh Bay pluton is made up of homogeneous, equigranular, medium to coarse grained biotite granite with diffuse areas of finer grain size in the centre and south of the pluton. The remaining 10 % is garnetiferous muscovite granite occurring as scattered patches at the centre and margins of the pluton. The contact between the two granites is gradational, the normal biotite granite grades into marginal muscovite granite by the disappeareance of biotite accompanied by the incoming first of muscovite and then of garnet.

(2) The biotite granite consists of alkali feldspar, plagioclase, quartz, biotite, muscovite, epidote, apatite, magnetite and allanite, whereas the muscovite granite consists of plagioclase, alkali feldspar, quartz, muscovite and accessory garnet.

(3) The muscovite granite of the Trawenagh Bay pluton is among the most evolved granites of Donegal (73.6 - 75.6% SiO<sub>2</sub>). It has low concentrations of TiO<sub>2</sub>, FeO, MgO, CaO, P<sub>2</sub>O<sub>5</sub>, Ba, Ce, La, Nd, Pb, Sr, V, Zn, Zr and Sr/Y and high Nb, Y/Zr, Rb/Zr and Sr/Ba compared to the other Donegal granites. The biotite granite has SiO<sub>2</sub> contents ranging from 69.9 to 73.28%. The rocks have high Ni and low Pb, Th, Zr, Ce, Ba, Rb/Ba, Rb/Zr, Rb/Sr compared to the other Donegal granites.

(4) Geochemical data show that the biotite granite of the Trawenagh Bay pluton is similar to the light band granodiorite - granite from the Main Donegal granite. This suggests that both granites may be cogenetic (cf. Pitcher and Berger 1972). The presence of pegmatite pods and aplites in the muscovite granite provides strong evidence for the presence and exsolution of a vapour phase from the Trawenagh Bay magma, probably at

the final stages of solidification.

#### 9.3.7 Barnesmore pluton

(1) The Barnesmore pluton consists of several distinct granite members, three of which were sufficiently separated in time of intrusion to be demarcated by sharp contacts. The G2 granite comprises three facies namely the main G2, G2 porphyritic facies and G2 basic facies and the main G2 is the most abundant component of the pluton.

(2) The rocks are made up of plagioclase, K-feldspar, quartz, muscovite, biotite, sphene, apatite, allanite, zircon, magnetite and ilmenite.

(3) The Barnesmore granite is the most felsic of the Donegal plutons with SiO<sub>2</sub> values ranging from 71.9 to 79.1%. It has low Ba, Sr, Zn, Zr, Sr/Ba, Sr/Y, Zr/Rb, total REE and high Nb, Pb, Rb, Th, Rb/Sr, Rb/Zr, Y/Zr and Rb/Ba

(4) Modelling indicates that fractional crystallisation of a granodioritic magma (G1 type) was the dominant process in the production of the geochemical variation in the Barnesmore complex.

#### 9.4 Tectonism and heat source.

Although previous chemical studies have credibly interpreted some of the British Isles Caledonian granitic and volcanic rocks as part of a continental margin magmatic arc generated by subduction of Iapetus oceanic lithosphere, problems of distribution and timing arise when attempts are made to relate the magmatic activity as a whole to the subduction model. The problems of the subduction model for the Caledonian granites are as follow :

(1) The distance between the trench and arc in subduction examples is normally greater than 90 km and is often 150 km or more. The approximate distance of the Scottish Highland granite plutons from the Iapetus is about 150 to 200 km whereas the granite plutons from Southern Uplands are less than 50 km

(2) The Caledonian granitic plutons fail to show the progressive space-time changes in chemistry which are characteristic of magmatism at a plate margin.

(3) The presence of a continuous magmatism over a period of at least 45 Ma in a subduction related batholiths. This is in contrast with the magmatic history of the Caledonian plutonism which is characterised by short periods of intense activity separated by periods of relative quiescence.

(4) The rock types present in the Caledonian batholith vary from quartz monzodiorite to granite (s.s) and do not form a gabbro-granite continuum, typical of subduction environment.

(5) Batholiths that developed in a subduction environment are elongated over a distance of more than 1000 km and parallel to the trench. Such batholiths in this environment usually comprise hundreds of plutons of variable diameter, from 1 to 50 km, whereas the Caledonian granites usually occur as separate small plutons, which are not elongated .

The mantle plume model (Hill et al. 1992) has been suggested as an alternative to the subduction models. This model is preferred here since :

(1) There is similarity in the 'stratigraphy' of the Caledonian magmatism in Donegal compared to that in a mantle plume area such as Karoo province.

(2) The occurrence of high Ba granitic rocks in the Fanad pluton and the plutons of the Argyll suite and associated appinites can best be explained by melting in response to a deep heat supply and underplated mafic magmas (Stephens and Halliday 1984 ; Yarr 1991 ; Tarney and Jones 1994).

The basic magma formed in the plume can provide heat into the crust resulting in the production of the anatectic melts which gave rise to the Caledonian granites.

#### 9.5 Future work.

(1) A detailed study of geochemistry and mineralogy of the individual plutons with more carefull, controlled sampling using a greater number of samples has to be done in order to understand more fully the petrochemistry of each of the plutons. Individual study is recomended for the Rosses, Fanad, Ardara, Trawenagh Bay and Main Donegal

plutons because the other two plutons (Thorr and Barnesmore) already have a substantial amount of chemical data and the modelling is good.

(2) Detailed study of radiogenic isotope especially Sr, Nd, Sm and Pb should be undertaken to determine the source region and other processes such as mixing and high level interaction.

(3) The various types of enclaves that occur in the Donegal granites (Pitcher and Berger 1972) should be studied in more detail because they may provide information (Barbarin and Didier 1991) on the mode of emplacement, the origin of the granitic magma and the dynamics of magma chambers including magma interaction.

# APPENDIX 1 ANALYTICAL METHODS.

#### A. MODAL ANALYSIS.

Modes were determined for medium and coarse grained rocks by point counting (Appendix 2). The data were collected using a Swift Model E point counter fitted with an automated stage. Samples were either normal thin sections (area of rock approximately 30 by 40 mm) or polished thin section that had been prepared for microprobe analyses. Usually the total counts were between 1500 - 2000 on each specimen in such way that the whole surface of the thin section was covered.

Minerals counted were alkali feldspar, plagioclase, quartz, biotite, hornblende, muscovite, sphene, allanite, zircon, epidote, Fe-Ti oxide and apatite. Where 'tr' (trace) appears in the table it implies that the mineral was observed , but not point counted.

#### **B. SAMPLE PREPARATION.**

Wherever possible, 2 kg samples of the freshest available material were collected; however, certain samples such as some of the aplites and dykes were considerably smaller. The samples were firstly trimmed in order to remove any altered/wethered material. Some of the removed sawn slabs were used for photograph. The clean and freshest samples were split into 1 cm cubes using a hydraulic jaw-splitter and an automatic jaw-crusher, washed to remove dust, and dried ( at room temperature ) overnight.

The chips were then reduced to powder by grinding in a "Tema" laboratory disc mill using a tungsten-carbide barrel. W, Co and Ta are known contaminants that could be introduced at this stage. Milling time was 30 seconds (150 micron) and another 15 seconds to reduce the size to 53 microns. The sample powder was not sieved as it is believed that this procedure introduces unnecessary inhomogeneity into the sample. The samples powder was then shaken and dried at 110 C for 12 hours.

### C. WHOLE ROCK MAJOR AND TRACE ELEMENTS ANALYSIS.

#### X-Ray Fluorescence Analysis

Glass fusion disc were used in the analysis of major elements. Each disc was prepared by using a mixture of approximately 0.62 g (weighed to 4 decimal places) of 153 microns of rock powder with 3.3 g of lithium borate flux in a ratio of 5.4321 : 1, flux : rock, at  $1000^{\circ}$ C and casting the melt onto 4 cm diameter aluminium platterns. The resultant glass disc was then mounted on a backing disc for analysis. Powder pellets used in trace elements analysis , were prepared by mixing 7 g of 53 microns powder with 12 to 15 drops moviol binder solution (4 g Moviol + 10ml ethanol + 50 ml distilled water) . The resultant mixture was pressed into a 4 cm disc under 5 tons pressure and left dried before analysis.

Major oxide elements (SiO<sub>2</sub>, TiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub> (expressed as Fetot in data tables), MgO, MnO, CaO, Na<sub>2</sub>O, K<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>) and trace elements (Ba, Ce, La, Cr, Nd, Nb, Ni, Pb, Rb, Sc, Sr, Th, V, Y, Zn and Zr) were analysed by X-Ray fluorescence at the Department of Earth Sciences, University of Liverpool; analyses are presented in Appendix 5. The equipment used was Siemens sequential X-Ray spectrometer. The major oxides were determined using Cr primary beam radiation generated at 50 kV and 40mA and trace elements using W beam radiation generated at 45kV and 60mA. Accuracy in major element analysis was checked by routine analysis of the USGS standard G2. Major element precision is given in Table 1.c.1. Trace elements precision and detection limit values is given in Table 1.c.2.

#### Ferrous and Ferric iron analyses.

Ferrous iron was determined by wet chemical analysis. This involved attacking ~0.5 g of rock powder with a mixture of HF and H<sub>2</sub>SO<sub>4</sub> and titrating with potassium dichromate solution using a sodium diphenylamine sulphonate indicator. The titration was undertaken in the presence of boric acid to complex flouride, and phosphoric acid to suppress ferric iron. The Fe<sub>2</sub>O<sub>3</sub> concentration in the rock sample was calculated from the XRF total iron value and the wet chemical FeO analysis using the following relationship : Fe<sub>2</sub>O<sub>3</sub> = Fe(XRF) - 1.111 FeO (wet).

#### D. WHOLE ROCK REE ANALYSIS.

The REE concentration was determined by using Inductive Couple Plasma (ICP) in the Department of Earth Sciences, Liverpool University.

#### Sample preparation.

1 g of powdered rock is weighted accurately into a Pt crucible and 3 g lithium metaborate added. The mixture was heated at 1000°C for about 1 hour. The metaborate disc (sample + lithium metaborate) was dissolved in complexing solution (10g oxalic acid + 50 ml conc. HCl + 5 ml H<sub>2</sub>O<sub>2</sub> + deionised water to 1 litre). The fusion solution was loaded into the chromatographic glass column (2 g resin loaded onto the column). The resin was then washed with 50 ml 1 N HCl to discard of the major elements. At this stage, the REEs are held quantitatively on the resin (together with Ba,Sr,Zr and Hf). The REEs were stripped off the resin by using 7.5N HCl and boiled down using conc. HNO3. Prior to ICP analyses the dry precipitated sample was dissollved in 10 ml 10% HNO3.

#### D. MINERAL CHEMISTRY ANALYSIS.

#### Electron probe microanalysis (EPMA) Energy Dispersive system (EDS).

Analysis of plagioclase, hornblende and biotite were carried out at the Department of Earth Sciences, University of Manchester on a modified Cambridge Instruments Geoscan EPMA equiped with a Link analytical 8.60 EDS and ZAF 4 software. All samples used were highly polished thin sections coated with a 20 nm carbon film.

The operating conditions were: 15kV Electron beam accelerating voltage, 75 X-Ray take-off angle, 3nA specimen current on Cobalt metal with a count time of 40 liveseconds, 2.5 KCPS output count rate from cobalt metal with 18% detection system dead time. The nominal beam width was 1 micron.

Element	x	sigma <sub>n-1</sub>	с%
SiO <sub>2</sub>	72.60	0.24	0.33
TiO <sub>2</sub>	0.30	0.0041	1.36
A1203	14.27	0.094	0.66
Fe2 03	1.76	0.015	0.86
MnO	0.16	0.0040	2.46
MgO	1.46	0.046	3.15
CaO	1.86	0.0063	0.34
Na2 O	5.81	0.101	1.74
K20	4.10	0.011	0.27
P205	0.08	0.012	15.1

Table 1.c.1: XRF major element precision.

Element	Detection limit	Precission c%
Ba	41	0.0436
Ce	21	0.0045
La se se se se se se se se	10 a. a. a. a. a. a.	0.073
Nd	6 · · · · · · · · · · · · · · · · · · ·	0.0372
NI	5	0.01617
Pb	7	0.1132
Rb	5	0.1005
Sc	3	0.0583
Sr and a second second	3	0.1233
Th	8	0.0685
V	4	0.01227
Y	4 - 1 <b>4</b> - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	0.0083
Zn	5	0.0907
Zr	3	0.0192

Table 1.c.2: Trace elements precision and detection limit of the trace element analysis.

# **APPENDIX 2**

# MODAL DATA

2.1 Thorr pluton.

### 2.2 Rosses pluton.

Sampel 1 to 32 from the Geology Department, University of Liverpool.

### 2.3 Ardara pluton .

Sample AR1 to AR8 (inner unit) from the Geology Department, University of Liverpool.

2.4 Fanad pluton.

2.5 Main Donegal pluton .

2.6 Trawenagh Bay pluton.

#### Notes.

All modes determined by the author unless otherwise stated (Source).

## THORR PLUTON.

Sample No. Unit Source	686 Hbl-bear	42671 Hbl-bear	42677 Hbl-bear	590 Hbl-bear	42681 Hbl-bear	43937 Hbl-bear	43908 Hbl-bear	43944 Hbl-bear	42660 Hbl-bear	42709 Contact	42701 Contact	43896 Contact
Plagioclase	56.7	41.1	39.3	45.4	44.6	43.4	28.2	34.6	32.7	54.4	39.2	42.7
Quartz	18	18.3	17.5	14.2	14	23.4	26.6	23.7	16.7	18.7	25	37.5
K-feldspar	4.8	23	tr	21.5	24.1	17.5	23.9	20.8	32.7	2.5	16.6	19.7
Biotite	16.5	12.1	9.3	12.9	13.6	12.8	20.4	15.3	12.3	17.9	15.6	12.1
Hornblende	2.2	4.1	1.7	2.8	1.8	0.9	tr	2.9	2.4	0	0	0
Apatite	0.1	0.2	0.1	0.4	0.1	0.1	0.3	0.4	0.2	0.4	0	0
Sphene	1.4	0.6	1.2	1.2	0.4	0.3	tr	0.8	0.8	0.1	0	0
Epidote	0.1	0.2	0.5	0.5	1	0.3	0.2	0.2	1.7	0	0	0
Opaque	tr	1	1	0.4	0.3	0.7	tr	0.3	tr	0	0.5	0.1
Allanite.	0.1	0.1	tr	0.2	tr	tr	tr	tr	tr	0	0	0
Zircon	tr	0.1	tr	tr	tr	tr	tr	0.2	tr	0	0.1	0
Muscovite	0	0	0	0	0	0	0	0	0	5.8	2.7	2.3
Sample No.	TH6	31/4	33	35A	35B	36	37	38	39A	39B	40	42
Unit	Contact	Contact	Contact	Trans	Contact	Hbl-bear	Contact	Hbl-bear	Hbl-bear	Hbl-bear	Hbl-bear	Contact
Source	Oglethorpe	Oalethorpe	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe
	- <u>3</u>	- 3	- 3	- 3	- 3	- <b>J ,</b> -	- <b>3</b>	- <u>3</u>	- <u>3</u>	- 3	- <u>3</u>	- 3
Plagioclase	51.5	47.9	54.2	54	59.1	50.4	58.3	51	57.2	60.8	49.4	52.3
K-feldspar	6.6	19.5	1.9	5.7	1	11.1	2.5	9.3	10.8	1.3	14.9	12.6
Quartz	9.2	8.1	23.9	21.9	18.8	15.4	16.9	15.6	10.4	13.4	12.3	19.3
Biotite	24.9	17.2	16.6	16.7	20.4	16.3	21.2	20.1	14.8	16.9	20.3	14
Hornblende	0	0	0	0	0	4.4	0	2.6	4.3	4.6	1.5	0
Muscovite	6.1	5.6	2.9	0.3	0.3	0	0.2	0	0	0.1	0	1.2
Sphene	0	0	0	0.2	0	1.6	0	0.8	1.6	1.5	0.8	0
Epidote	0	0	0	0.2	0	0.1	0	0.4	0.7	1.1	0.2	0
Apatite	1.5	1.2	0.4	0.1	0.2	0.3	0.6	0.2	0.1	0.2	0.5	0.3
Opaque	0	0.4	0	0.8	0	0.4	0.2	0	0.1	0	0	0.3
Zircon	0.2	0.1	0.1	0.1	0.2	0	0.1	0	0	0.1	0.1	0
Tourmaline	0	0	0	0	0	0	0	0	0	0	0	0
Consta No	10	50.4	5.0	5.2	E 4	5.0	252	0.0	0.4.0	100		
Sample No.	48	Ocatest	Contact	Ubl boor	Ubl boor	Tropo	Contact	98	240	198	45	47
Source	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe	Oglethorpe
Plagioclase	47.5	48.7	49.9	46.6	50.1	53.2	38.8	47.4	43.3	43.9	46.1	54
K-feldspar	18.3	18.7	12.5	21.9	15	10.7	10.1	29.3	36.7	21.1	21.7	15.5
Quartz	19.4	7.3	14.5	15.7	18	17.3	37.6	6.1	1.8	20	15.7	13.3
Biotite	11.7	21.5	19.8	11	12.2	17	12.5	14.3	0.3	7.5	14.6	12.5
Hornblende	1.4	0	0	1.7	2.1	0	0	0.3	16.2	6.7	0.4	2
Muscovite	0	2.8	2.8	0	0.1	0.5	0.4	0	0	0	0	0
Sphene	0.7	0	0	0.9	0.9	0.3	0	0.3	0.9	0.1	0.5	1.4
Epidote	0.7	0	0	0.9	1.3	0.8	0	1.8	0.1	0.1	0.4	0.8
Apatite	0.2	0.9	0.5	0.7	0	0.1	0.5	0.2	0.6	0.4	0.3	0.3
Opaque	0.1	0.1	0	0.5	0.3	0.1	0.1	0.3	0	0.2	0.3	0.2
Zircon	0	0	0	0	0	0	0	0	0.1	0	0	0
Tourmaline	0	0	0	0.1	0	0	0	0	0	0	0	0

## ROSSES PLUTON

Sample No. Unit Source	1 G1	2 G1	3 G1	4 G1	5 G1	6 G1	7 G1	8 G1	9 G1	ROS11 G1	ROS12 G1	ROS4 G1
Plagioclase Quartz K-feldspar Biotite Muscovite Apatite Epidote Opaque	34 43.1 21.1 3.4 0.3 tr 0.1 tr	29.2 29.4 37.2 2.2 1.4 tr 0.3 0.1	33 34.7 28.1 2.9 0.4 tr 0.4 tr	33.3 34.3 26.7 3.8 1.3 tr 0.1 tr	32.5 34.1 29.2 3.2 0.6 tr 0.1 tr	31.5 30.8 34.7 2.3 0.3 tr 0.2 tr	28.3 28.9 39.5 2.6 0.2 tr 0.2 tr	29.4 39.3 27.4 3.2 0.4 tr tr tr	30.2 35.5 28.2 4.2 0.9 tr 0.4 0.1	31.2 34 36 3.2 0.6 tr tr tr	33.2 35.2 36.5 2 0.1 tr tr tr	33.5 29.5 32.5 3 0.6 tr tr tr
Sample No. Unit Source	10 G2	1 1 G2	12 G2	1 3 G2	14 G2	15 G2	16 G2	17 G2	18 G2	19 G2	20 G2	ROS6 G2
Plagioclase Quartz K-feldspar Biotite Muscovite Apatite Epidote Opaque	30.1 45.1 21.9 2.3 0.3 0 tr tr	28.7 40.1 21.5 8.5 0.6 tr 0 0.2	27.3 40.3 29.8 2.2 0.1 0 0 tr	34.9 33.1 29.3 2 0.2 0 0 0 0.1	37.7 31.3 27.5 2.9 tr 0 0.1 tr	30.8 37.7 28.2 2.9 tr tr tr 0.1	43 27.2 23.9 4.5 0.9 tr tr tr	31.9 36.7 26.2 4.4 0.5 tr tr tr tr	37.1 29.6 27.1 4 1 0.1 0.1 0.1	36 32.8 24.6 4.2 1.5 tr tr tr tr	34 28.8 32.4 3.6 0.5 tr 0.3 0.1	32.4 34.3 27.8 3.4 1.3 tr tr 0.5
Sample No. Unit Source	21 G3	22 G3	23 G3	24 G3	25 G3	26 G3	27 G3	28 G3	29 G3	3 0 G3	3 1 G3	3 2 G3
Plagioclase Quartz K-feldspar Biotite Muscovite Apatite Epidote Opaque	24.3 42.7 29.1 2.7 0.5 tr 0.5 tr	27.03 39.4 27.9 3.1 1.8 tr 0.1 tr	44.7 28.7 20.7 4.5 1 tr tr tr	32.1 41.8 21.1 3.7 0.4 tr 0.6 tr	32.8 30.2 32.7 2.5 1 tr 0.4 tr	29.1 41.1 25.2 3.5 0.4 tr tr tr	32.4 40.7 23 3 0.7 tr tr tr	31.9 35.7 28.7 2.5 0.6 tr 0.3 tr	42.8 32.1 21.1 3.4 0.2 tr 0.1 tr	32.5 37.7 25.5 3.1 0.6 tr 0.3 tr	34 36.5 24.1 3.8 1 tr 0.2 tr	37.7 34.7 22.6 3.4 1 tr 0.3 tr

Sample No.	ROS10A	ROS10B	ROS10C
Unit	G4	G4	G4
Source			
Plagioclase	29.44	30.1	29.3
Quartz	39.6	40.2	42
K-feldspar	24.3	25.2	21
Biotite	tr	0.4	2
Muscovite	6.3	5	5
Apatite	tr	tr	tr
Sphene	tr	0	tr
Epidote	tr	0	tr

## ARDARA PLUTON

Sample No. Unit Source	224 Outer Akaad	249 Outer Akaad	250 Outer Akaad	251 Outer Akaad	254 Outer Akaad	256 Outer Akaad	261 Outer Akaad	302 Outer Akaad	AR1 Outer	AR2 Outer	AR3 Outer	AR4 Outer
Plagioclase	53.8	44.6	49.7	54.1	39.3	40.2	41.2	45	45.70	43.30	49.20	43.60
Quartz	11.6	14.4	11.7	10.2	14.9	18.3	13.1	14.7	14.20	20.10	14.10	16.00
K-feldspar	16	25.8	22.4	15.5	25.7	24.1	21.6	20	19.00	18.70	14.10	16.20
Biotite	16.6	11.8	10.2	13.7	15.7	14.5	17.4	11.5	11.60	9.10	13.20	13.50
Hornblende	0.4	1.1	3.4	2.9	1.7	1.4	3.4	6.3	6.00	6.70	6.10	7.40
Apatite	0.4	0.4	0.4	0.3	0.7	tr	1	0.6	tr	tr	0.40	0.30
Sphene	0.6	0.6	1.2	0.8	0.8	1	1.3	1.3	0.30	0.30	0.20	0.50
Epidote	0.6	1.1	0.8	2.3	1.2	0.4	1	0.6	2.20	0.80	1.70	1.10
Opaque	tr	0.1	tr	0.1	tr	tr	tr	tr	tr	0.10	0.30	0.70

Sample No.	AR5	AR6	AR7	AR8
Unit	Outer	Outer	Outer	Outer
Source				
Plagioclase	44.10	43.40	45.50	47.50
Quartz	17.80	18.00	15.60	19.90
K-feldspar	14.90	18.80	19.80	15.20
Biotite	14.50	11.20	11.10	12.00
Hornblende	5.60	6.60	5.30	3.70
Apatite	0.30	0.10	0.10	tr
Sphene	0.50	0.20	0.30	tr
Epidote	1.10	0.60	1.40	0.60
Opaque	0.50	0.20	0.30	0.30

Sample No. Unit Source	196 Intmdte Akaad	209 Intmdte Akaad	213 Intmdte Akaad	22 Intmdte Akaad	222 Intmdte Akaad	224 Intmdte Akaad	233 Intmdte Akaad	281 Intmdte Akaad	ARD4 Intmdte	ARD2 Intmdte		
Plagioclase	46.8	48.1	46.4	44.6	46.9	46.5	55.6	47.5	51.4	49.7		
Quartz	12.5	15	14.3	16.4	12.3	16.9	14.7	14.1	30.2	25.5		
K-feldspar	15.7	15	15.5	18.8	14.8	16	11.1	12.5	10.6	14.8		
Biotite	14.7	12.4	13.7	10.4	11.3	14	11.2	15.4	6.5	7.1		
Hornblende	3.3	6	6.8	6.3	11.2	5	5.4	5.6	0.7	1		
Apatite	0.1	tr	tr	tr	tr	tr	tr	tr	0.4	0.3		
Sphene	1	1	1.2	0.7	1.4	tr	tr	tr	0.4	0.2		
Epidote	4.8	2.5	2.1	2.7	1.9	1.6	1.9	4.9	0.3	1		
Opaque	1	tr	tr	tr	tr	tr	tr	tr	0.5	tr		
Sample No.	544	552	558	561	565	603	605	608	609	ARD11	ARD10	ARD13
Source	Akaad	Akaad	Akaad	Akaad	Akaad	Akaad	Akaad	Akaad	Akaad	Inner	inner	Inner
Plagioclase	45.3	50	56	53	42.2	56.7	47.8	49.2	47.6	43.2	40	42
Quartz	26.6	27.5	21.6	20.2	23.1	17.6	33.6	20.9	23.1	22.3	25.7	23.1
K-feldspar	22.7	14.8	13.6	14.6	27.4	16	12.6	16.6	13	28.3	25.6	21
Biotite	4.7	7.5	8	8.8	7	9	4	10.7	9.5	9	9	8.5
Hornblende	0	0	0.1	0	0	0	0	0	0	0	0	0
Apatite	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr	tr
Sphene	tr	0.2	tr	0.1	0.1	tr	tr	0.5	0.1	0.2	tr	0.1
Epidote	0.7	tr	0.8	3.4	0.2	0.7	tr	2.1	1.7	0.6	0.7	0.2
Opaque	tr	tr	tr	tr	0.1	tr	tr	tr	tr	tr	tr	0.1

## FANAD PLUTON

Sample No. Unit Source	FAN 18 Fan Pen	FAN2 Fan Pen	FAN23 Rosguill	FAN43 Melmore	FAN41 Fan Pen	FAN29 Rosguill	FAN46 Rosguill
Plagioclase	57.9	50	50.6	70	56	45.4	53
K-feldspar	11.9	15.7	14.3	2	10	16.6	15.1
Quartz	6	15	17.2	5	11	24.5	13.3
Biotite	18.1	13.7	15.8	14	12	11.1	12.1
Hornblende	4.9	1.4	0.6	7	10	0	4
Muscovite	0	0	0	0	0	0	0
Sphene	0.1	1	0.3	0.6	0.4	0.3	0.8
Epidote	0	0	0	0	0	0	0
Apatite	0.4	0.5	0.2	0.4	0.1	0.7	0.4
Opaque	0.1	1.2	0.9	0.6	0.5	0.6	1
Zircon	0.1	tr	0.2	tr	tr	0	tr
Allanite	0.1	tr	0	tr	0	0.7	0.2

### **APPENDIX 2.5**

## MAIN DONEGAL PLUTON

Sample No. Unit Source	1 a Dark Berger	1 b Dark Berger	2a Dark Berger	2 b Dark Berger	3a Dark Berger	3b Light Berger	3c Light Berger	4a Light Berger	4b Light Berger	4c Light Berger
Plagioclase	64.4	60.2	55.3	51.4	58.9	36	38.6	28.3	56.8	25.9
K-feldspar	2.8	0	0	5.7	0	28.2	26.8	35.3	10.5	21.8
Quartz	18	27.1	31.7	28.2	26.5	30.9	28.5	27.9	24.1	45.1
Biotite	13	11.6	10.5	12	13	4.8	3.8	4.2	6.2	4.1
Muscovite	1.9	1	2.2	2.5	1.3	0.6	2.1	3.7	2.4	2.9
Apatite	0.1	0.1	0.2	0.2	0.1	0.2	0.1	tr	0.1	0.1
Opaque	0.1	0.1	0.2	0.3	tr	0.3	0.2	0.1	tr	tr
Epidote	tr	tr	0.2	0.1	tr	0.1	tr	tr	0.1	0.1
Epidote	tr	tr	0.2	0.1	tr	0.1	tr	tr	0.1	0.1

### APPENDIX 2.6

## TRAWENAGH BAY PLUTON.

Sample No.	TRA4	TRA7	TRA3	TRA2	TRA1	TRA5	TRA6
Unit	Mu gra	Mu gra	Mu gra	Bi gra	Bi gra	Bi gra	Bi gra
Source				-			
Plagioclase	25.5	23	27.6	39.9	25.5	36.9	36.5
K-feldspar	34	38.4	38.4	22.9	34	31.9	32.5
Quartz	36.5	30.6	27.7	31.2	36.5	26.6	24.6
Biotite	0	0	0	4.8	3.9	5.1	4.7
Muscovite	3.9	7.8	4.6	0.4	0.6	0.4	0.6
Apatite	0	0	tr	0.3	0.1	0.1	tr
Opaque	0	0	0	tr	tr	tr	tr
Garnet	tr	tr	0.9	0	0	0	0
Epidote	0	0	0	0.5	0.2	0.3	tr
Allanite	0	0	0	tr	tr	tr	tr

# **APPENDIX 3**

## PREVIOUS WHOLE ROCK MAJOR AND TRACE ELEMENT ANALYSES

3.1 <u>Thorr pluton (Oglethorpe 1987).</u>

Hb bear : Hornblende bearing normal facies.

Hb free : Hornblende free normal facies.

Contact : Contact facies.

Trans : Transitional facies.

3.2 Rosses pluton (Mercy 1957)

Porp : Porphyry dykes.

Mg : Microgranite.

- 3.3 Ardara pluton (Yarr 1991).
- 3.4 Appinitic rocks associated with Ardara granite (Yarr 1991).
- 3.5 Barnesmore pluton (Dempsey 1987).

G2BF : G2 basic facies.

G2PF : G2 porphyritic facies.

3.6 Main Donegal pluton (Curtis, in Atkin 1977).

Light : Light band.

Dark : Dark band.

# APPENDIX 3.1 : THORR (OGLETHORPE 1987)

Sample Unit	T5H Hb-free	T7H Hb-free	T9H Hb-free	T10H Hb-free	T10BH Hb-free	T11H Hb-free	T21H Hb-free	T75H Hb-free	T78H Hb-free	T82H Hb-free		
SiO2 TiO2	74.05	72.00	70.68 0.37	72.01 0.30	72.27 0.30	72.15 0.30	68.68 0.49	75.19 0.15	71.57	70.64 0.39		
A1203	13.96	15.03	15.25	14.76	14.70	15.24	15.43	12.44	13.77	14.26		
FeO	0.60	0.79	0.83	0.08	0.01	0.72	1.10	0.65	0.78	1 21		
MaQ	0.46	0.94	0.95	0.85	0.89	0.96	1.14	0.20	0.76	0.93		
CaO	1.18	1.82	2.06	1.86	1.87	1.79	2.30	0.49	1.51	1.85		1000
Na2O	3.52	4.00	3.86	3.96	3.88	4.08	3.39	3.28	3.49	3.13		. <u>.</u> .
K2O	5.18	4.17	3.87	3.83	3.81	3.89	4.72	5.46	5.30	5.22		
P2O5	0.05	0.11	0.11	0.09	0.21	0.09	0.11	0.04	0.11	0.13		
MnO	0.04	0.05	0.05	0.05	0.05	0.05	0.01	0.05	0.04	0.05		
Ва	1212	766	740	753	703	816	1091	244	964	1646		
Ce	64	29	57	36	30	30	76	47	88	86	1	
Cr	15	18	22	18	16	17	16	20	30	28		· · · ·
La	41	14	26	12	16	16	49	29	56	63		
Nd	24	12	23	14	14	14	30	n.d	n.d	n.d		
NI Dh	- 10	10	9	8	8	- 8 - 37	0	- 12 nd	19	22		
70 85	22	137	30	28	132	124	21	140	0.0	0.0		an shi shi a
Sc	90 4	3	. 2	137	2	1	23	2	A	3		an Artic
Sr	494	366	392	377	369	400	440	. 97	349	544	a stat	1.1
Th	7	10	13	10	11	8	9	n.d	n.d	n.d		
v	45	28	30	27	26	26	40	10	27	33		$(x,y) \in \mathcal{A}_{\mathcal{A}}$
Y	12	10	13	7	5	6	14	11	41	11		2.1.1
Zn	60	38	44	38	38	39	41	21	41	39		
Zr	213	100	117	101	98	102	211	58	46	50		
Cu	n.d	n.đ	n.d	n.d	n.d	n.d	n.d	106	79	316		
	n.a	n.a	n.a	n.a	n.a	n.a	n.a	18	34	22		1
	i. Teoreta											
Sample Unit	T31S Contact	T31S Contact	T42S Contact	T50AS Contact	T52S Contact	T65S Contact	T69S Contact	T72S Contact	T73S Contact	T85S Contact	T91S Contact	T96S Contact
Sample Unit	T31S Contact	T31S Contact	T42S Contact	T50AS Contact	T52S Contact	T65S Contact	T69S Contact	T72S Contact	T73S Contact	T85S Contact	T91S Contact	T96S Contact
Sample Unit SiO2 TiO2	T31S Contact 56.89 0.86	T31S Contact 57.37 0.79	T42S Contact 67.57 0.57	T50AS Contact 63.94 0.65	T52S Contact 61.71 0.69	T65S Contact 70.06 0.39	T69S Contact 60.07 0.77	T72S Contact 69.26 0.49	T73S Contact 67.51 0.59	T85S Contact 67.24 0.57	T91S Contact 66.16 0.55	T96S Contact 70.37 0.48
Sample Unit SiO2 TiO2 A12O3	T31S Contact 56.89 0.86 20.10	T31S Contact 57.37 0.79 19.39	T42S Contact 67.57 0.57 16.60	T50AS Contact 63.94 0.65 17.76	T52S Contact 61.71 0.69 18.08	T65S Contact 70.06 0.39 15.81	T69S Contact 60.07 0.77 18.20	T72S Contact 69.26 0.49 15.95	T73S Contact 67.51 0.59 16.75	T85S Contact 67.24 0.57 16.38	T91S Contact 66.16 0.55 16.31	T96S Contact 70.37 0.48 14.55
Sample Unit SiO2 TiO2 A12O3 Fe2O3	T31S Contact 56.89 0.86 20.10 0.62	T31S Contact 57.37 0.79 19.39 0.84	T42S Contact 67.57 0.57 16.60 0.44	T50AS Contact 63.94 0.65 17.76 0.28	T52S Contact 61.71 0.69 18.08 0.76	T65S Contact 70.06 0.39 15.81 0.19	T69S Contact 60.07 0.77 18.20 1.04	T72S Contact 69.26 0.49 15.95 0.50	T73S Contact 67.51 0.59 16.75 0.20	T85S Contact 67.24 0.57 16.38 0.90	T91S Contact 66.16 0.55 16.31 0.81	T96S Contact 70.37 0.48 14.55 0.79
Sample Unit SiO2 TiO2 A12O3 Fe2O3 FeO	T31S Contact 56.89 0.86 20.10 0.62 4.10	T31S Contact 57.37 0.79 19.39 0.84 3.49	T42S Contact 67.57 0.57 16.60 0.44 2.68	T50AS Contact 63.94 0.65 17.76 0.28 3.76	T52S Contact 61.71 0.69 18.08 0.76 3.67	T65S Contact 70.06 0.39 15.81 0.19 1.22	T69S Contact 60.07 0.77 18.20 1.04 3.55	T72S Contact 69.26 0.49 15.95 0.50 2.57	T73S Contact 67.51 0.59 16.75 0.20 2.37	T85S Contact 67.24 0.57 16.38 0.90 2.69	T91S Contact 66.16 0.55 16.31 0.81 3.03	T96S Contact 70.37 0.48 14.55 0.79 2.41
Sample Unit SiO2 TiO2 A12O3 FeO MgO	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72	T50AS Contact 63.94 0.65 17.76 0.28 3.76 2.19	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.25	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.78	T73S Contact 67.51 0.59 16.75 0.20 2.37 1.15	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91	T91S Contact 66.16 0.55 16.31 0.81 3.03 1.61	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40
Sample Unit SiO2 TiO2 A12O3 FeO MgO CaO	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88	T50AS Contact 63.94 0.65 17.76 0.28 3.76 2.19 3.43	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.25 3.35	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31	T73S Contact 67.51 0.59 16.75 0.20 2.37 1.15 2.83	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91 3.37	T91S Contact 66.16 0.55 16.31 0.81 3.03 1.61 2.84	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40 2.45
Sample Unit SiO2 TiO2 A12O3 FeO MgO CaO Na2O	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12 2.97	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.49	T50AS Contact 63.94 0.65 17.76 0.28 3.76 2.19 3.43 3.29	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 3.10	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.25 3.35 2.85 2.85	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.43	T73S Contact 67.51 0.59 16.75 0.20 2.37 1.15 2.83 3.19	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91 3.37 3.77	T91S Contact 66.16 0.55 16.31 0.81 3.03 1.61 2.84 3.78	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40 2.45 3.45
Sample Unit SiO2 TiO2 A12O3 FeO MgO CaO Na2O K2O E2O5	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12 2.97 4.11 0.81	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79	T42S Contact 67.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.43	T50AS Contact 63.94 0.65 17.76 0.28 3.76 2.19 3.43 3.29 3.71 0.45	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.58	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 3.10 5.15 0.05	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.43 3.46 0.32	T73S Contact 67.51 0.59 16.75 0.20 2.37 1.15 2.83 3.19 4.02 0.38	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91 3.37 3.77 2.66 0.21	T91S Contact 66.16 0.55 16.31 0.81 3.03 1.61 2.84 3.78 3.76 0.97	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40 2.45 3.45 2.31 0.05
Sample Unit SiO2 TiO2 A12O3 FeO MgO CaO Na2O K2O P2O5 MnO	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12 2.97 4.11 0.81	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04	T42S Contact 67.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.43 0.07	T50AS Contact 63.94 0.65 17.76 0.28 3.76 2.19 3.43 3.29 3.71 0.45 0.05	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.56 0.06	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 3.10 5.15 0.03	T69S Contact 0.77 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94 0.08	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.43 3.43 3.43 0.62	T73S Contact 67.51 0.59 16.75 0.20 2.37 1.15 2.83 3.19 4.02 0.36 0.04	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91 3.37 3.77 2.66 0.21 0.07	T91S Contact 66.16 0.55 16.31 0.81 3.03 1.61 2.84 3.78 3.78 3.78 0.27 0.05	T96S Contact 70.37 0.48 14.65 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04
Sample Unit SiO2 TiO2 A12O3 FeO3 FeO MgO CaO Na2O K2O P2O5 MnO	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12 2.97 4.11 0.81 0.05	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.36 2.69 5.45 0.79 0.04	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.43 0.07	T50AS Contact 63.94 0.65 17.76 0.28 3.76 2.19 3.43 3.29 3.71 0.45 0.05	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.56 0.06	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 3.10 5.15 0.05 0.03	T69S Contact 0.77 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94 0.08	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.46 0.32 0.06	T73S Contact 0.59 16.75 0.20 2.37 1.15 2.83 3.19 4.02 0.36 0.04	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91 3.37 3.77 2.66 0.21 0.07	T91S Contact 66.16 0.55 16.31 0.81 3.03 1.61 2.84 3.78 0.27 0.05	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04
Sample Unit SiO2 TiO2 A12O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12 2.97 4.11 0.81 0.05	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.43 0.07	T50AS Contact 63.94 0.65 17.76 0.28 3.76 2.19 3.43 3.29 3.71 0.45 0.05	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.58 0.06	T65S Contact 70.06 0.39 15.61 0.19 1.22 0.83 1.40 3.10 5.15 0.05 0.03	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94 0.08	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.43 3.46 0.32 0.06	T73S Contact 67.51 0.59 16.75 0.20 2.37 1.15 2.83 3.19 4.02 0.36 0.04	T85S Contact 0.57 16.38 0.90 2.69 1.91 3.37 3.77 2.66 0.21 0.07	T91S Contact 0.65 16.31 0.81 3.03 1.61 2.84 3.78 3.76 0.27 0.05	T96S Contact 70.37 0.48 14.65 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04
Sample Unit SiO2 TiO2 A12O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12 2.97 4.11 0.81 0.05	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04 2051	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.43 0.07	T50AS Contact 63.94 0.65 17.76 0.28 3.76 2.19 3.43 3.29 3.71 0.45 0.05	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.58 0.06	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 3.10 5.15 0.05 0.03	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94 0.08	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.43 3.46 0.32 0.06	T73S Contact 67.51 0.59 16.75 0.20 2.37 1.15 2.83 3.19 4.02 0.36 0.04	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91 3.37 3.77 2.66 0.21 0.07	T91S Contact 66.16 0.55 16.31 0.81 3.03 1.61 2.84 3.78 3.76 0.27 0.05	T96S Contact 70.37 0.48 14.65 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04
Sample Unit SiO2 TiO2 A 12O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12 2.97 4.11 0.81 0.05	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04 2051 17 47	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.43 0.07	T50AS Contact 0.65 17.76 0.28 3.76 2.19 3.43 3.29 3.71 0.45 0.05	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.56 0.06	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 3.10 5.15 0.05 0.03	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94 0.08	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.43 3.46 0.32 0.06 1195 16 23	T73S Contact 67.51 0.59 16.75 0.20 2.37 1.15 2.83 3.19 4.02 0.36 0.04	T85S Contact 0.57 16.38 0.90 2.69 1.91 3.37 3.77 2.68 0.21 0.07	T91S Contact 66.16 0.55 16.31 0.61 2.84 3.78 3.78 3.78 0.27 0.05	T96S Contact 70.37 0.48 14.65 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04
Sample Unit SiO2 TiO2 A 12O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12 2.97 4.11 0.81 0.05 1354 19 64	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04 2051 17 47 10	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.43 0.07	T50AS Contact 63.94 0.65 17.76 0.28 3.76 2.19 3.43 3.29 3.71 0.45 0.05	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.56 0.06	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 3.10 5.15 0.05 0.03 1378 66 16 37	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94 0.08	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.43 3.46 0.32 0.06 1195 16 23 6	T73S Contact 67.51 0.59 16.75 0.20 2.37 1.15 2.83 3.19 4.02 0.36 0.04	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91 3.37 2.66 0.21 0.07 1090 52 50 34	T91S Contact 66.16 0.65 16.31 0.81 3.03 1.61 2.84 3.78 3.76 0.27 0.05	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04 363 40 50
Sample Unit SiO2 TiO2 A 12O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12 2.97 4.11 0.81 0.05 1354 19 64 4 16	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04 2051 17 47 10 15	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.43 0.07	T50AS Contact 63.94 0.65 17.76 0.28 3.76 2.19 3.43 3.29 3.71 0.45 0.05	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.56 0.06 1537 23 34 11	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 3.10 5.15 0.05 0.03 1378 66 16 37	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.85 5.28 0.94 0.08 1627 90 32 50 47	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.43 3.46 0.32 0.06 1195 16 23 6 10	T73S Contact 67.51 0.59 16.75 0.20 2.37 1.15 2.83 3.19 4.02 0.36 0.04 1203 54 54 26 24	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91 3.37 3.77 2.66 0.21 0.07 1090 52 50 34 n.d	T91S Contact 66.16 0.65 16.31 0.81 3.03 1.61 2.84 3.78 3.78 0.27 0.05 1454 3.5 45 19 n.d	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04 363 40 50 25 r.d
Sample Unit SiO2 TiO2 A12O3 FeO MgO CaO Na2O P2O5 MnO Ba Ce Cr La Nd Ni	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12 2.97 4.11 0.81 0.05 1354 19 64 4 16 23	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04 2051 17 47 10 15 18	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.36 0.43 0.07 1431 42 28 21 17 9	T50AS Contact 63.94 0.65 17.76 2.19 3.28 3.76 2.19 3.23 3.29 3.71 0.45 0.05	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 4.05 0.56 0.06 1537 23 34 11 15 12	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 3.10 5.15 0.05 0.03 1378 66 16 37 31 8	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94 0.08 1627 90 32 50 47 12	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.43 3.46 0.32 0.06 1195 16 23 6 10 9	T73S Contact 67.51 0.59 16.75 0.20 2.37 1.15 2.83 3.19 4.02 0.36 0.04 1203 54 54 28 24 26 24 8	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91 3.37 3.77 2.66 0.21 0.07 1090 52 50 34 n.d 33	T91S Contact 66.16 0.65 16.31 3.03 1.61 2.84 3.78 3.76 0.27 0.05	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04 363 40 50 25 n.d 32
Sample Unit SiO2 TiO2 A12O3 Fe2O3 Fe2O3 Fe2O MgO CaO Na2O P2O5 MnO Ba Ce Cr La Nd Ni Pb	T31S Contact 56.89 0.86 20.10 3.58 4.12 2.97 4.11 0.81 0.05 1354 19 64 4 16 23 33	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04 2051 17 47 10 15 18 41	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.43 0.07 1431 42 28 21 1431 9 22	T50AS Contact 63.94 0.65 17.76 2.19 3.43 3.29 3.71 0.45 0.05 1223 47 32 25 24 11 20	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.56 0.06 1537 23 34 11 15 22 22	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 3.10 5.15 0.05 0.03 1378 66 16 37 31 8 39	T69S Contact 60.07 18.20 1.04 3.55 2.25 3.35 2.25 3.35 5.28 0.94 0.08 1627 90 32 50 47 12 30	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.43 3.46 0.32 0.06 1195 16 23 6 10 9 23	T73S Contact 67.51 0.59 16.75 2.83 3.19 4.02 0.36 0.04 1203 54 54 26 24 8 28	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91 3.37 3.77 2.66 0.21 0.07 1090 52 50 34 n.d	T91S Contact 66.16 0.55 16.31 3.03 1.61 2.84 3.78 0.27 0.05 1454 35 45 19 n.d	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04 363 40 50 25 n.d 32 n.d
Sample Unit SiO2 TiO2 A12O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Fb	T31S Contact 56.89 0.86 20.10 3.58 4.12 2.97 4.11 0.81 0.05 1354 19 64 4 16 23 33 132	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04 2051 17 47 10 15 18 41 144	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.43 0.07 1431 42 28 21 17 9 22 127	T50AS Contact 63.94 0.65 17.76 2.19 3.43 3.29 3.71 0.45 0.05 1223 47 32 25 24 11 20 110	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.56 0.06 1537 23 34 11 15 12 22 107	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 3.10 5.15 0.05 0.03 1378 66 16 37 31 8 8 39 114	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94 0.08 1627 90 32 50 47 12 30 136	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.46 0.32 0.06 1195 16 23 6 10 9 23 100	T73S Contact 67.51 0.59 16.75 2.83 3.19 4.02 0.36 0.04 1203 54 54 26 24 8 28 103	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91 3.37 3.77 2.66 0.21 0.07 1090 52 50 34 n.d 33 n.d 92	T91S Contact 66.16 0.55 16.31 3.03 1.61 2.84 3.78 0.27 0.05 1454 35 45 19 n.d 26 n.d 94	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04 363 40 50 25 n.d 32 n.d 63
Sample Unit SiO2 TiO2 A12O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ca Ca Ca Ca Ca Ca Ca Ca Ca Ca Ca Sa Ho Sa Sa Sa Sa Sa Sa Sa Sa Sa Sa Sa Sa Sa	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12 2.97 4.11 0.81 0.05 1354 19 64 4 16 23 33 132 18	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04 2051 17 47 10 15 18 41 144 16	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.43 0.07 1431 42 28 21 17 9 22 127 5	T50AS Contact 63.94 0.65 17.76 2.19 3.43 3.29 3.71 0.45 0.05 1223 47 32 25 24 11 20 110 8	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.56 0.06 1537 23 34 11 15 12 22 107 4	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 3.10 5.15 0.05 0.03 1378 66 16 37 31 8 9 114,4	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94 0.08 1627 90 32 50 47 12 30 136 9	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.46 0.32 0.06 1195 16 23 6 10 9 23 100 5	T73S Contact 67.51 0.59 16.75 2.83 3.19 4.02 0.36 0.04 1203 54 54 26 24 8 28 103 7	T85S Contact 0.57 16.38 0.90 2.69 1.91 3.37 3.77 2.66 0.21 0.07 1090 52 50 34 n.d 33 n.d 92 10	T91S Contact 66.16 0.55 16.31 3.03 1.61 2.84 3.78 3.78 3.78 0.27 0.05 1454 35 45 19 n.d 26 n.d 94 8	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04 363 40 50 25 n.d 32 n.d 63 8
Sample Unit SiO2 TiO2 A12O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb Sc Sr Th	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12 2.97 4.11 0.81 0.05 1354 19 64 4 16 23 33 132 18 741	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04 2051 17 47 10 15 18 41 144 16 766	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.43 0.07 1431 42 28 21 17 9 22 127 5 603	T50AS Contact 63.94 0.65 17.76 2.19 3.43 3.29 3.71 0.45 0.05 1223 47 32 25 24 11 20 110 8 666	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.56 0.06 0.06 0.06 0.06 0.06 0.06 0	T65S Contact 70.06 0.39 15.61 0.19 1.22 0.83 1.40 3.10 5.15 0.05 0.03 1378 66 16 37 31 8 9 9 114, 4 424	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94 0.08 0.94 0.08 1627 90 32 50 47 12 30 136 9 538	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.46 0.32 0.06 1195 16 23 6 10 9 23 100 5 526	T73S Contact 67.51 0.59 16.75 2.83 3.19 4.02 0.36 0.04 1203 54 54 26 24 8 8 28 103 7 522	T85S Contact 0.57 16.38 0.90 2.69 1.91 3.37 3.77 2.66 0.21 0.07 1090 52 50 34 n.d 33 n.d 92 10 717	T91S Contact 66.16 0.55 16.31 3.03 1.61 2.84 3.78 3.78 3.78 0.27 0.05 1454 35 45 19 n.d 26 n.d 94 8 683	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04 363 40 50 25 n.d 32 n.d 32 n.d 32 448
Sample Unit SiO2 TiO2 A12O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Fib Sc Sr Th	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12 2.97 4.11 0.05 1354 19 64 4 16 23 33 132 18 741 1	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04 2051 17 47 10 15 18 41 144 16 766 1	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.47 3.36 0.47 1.42 2.88 2.1 17 9 22 2.8 21 17 9 22 2.63 6.03 6.5 5.57 5.57 5.57 5.57 5.57 5.57 5.57	T50AS Contact 63.94 0.65 17.76 0.28 3.76 2.19 3.43 3.29 3.71 0.45 0.05 1223 47 32 25 24 11 20 110 8 666 10	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.56 0.06 0.06 1537 23 34 11 15 12 22 23 34 11 15	T65S Contact 70.06 0.39 15.61 0.19 1.22 0.83 1.40 3.10 5.15 0.05 0.03 1378 66 16 37 31 8 39 114, 4 424 18	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94 0.08 1627 90 32 50 47 12 30 136 9 538 18	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.43 3.43 0.32 0.06 1195 16 23 6 10 9 23 100 5 526 4	T73S Contact 67.51 0.59 16.75 0.20 2.37 1.15 2.83 3.19 4.02 0.36 0.04 1203 54 54 26 24 8 28 28 28 103 7 522 11	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91 3.37 3.77 2.66 0.21 0.07 1090 52 50 34 n.d 33 n.d 33 n.d 92 10 717 n.d	T91S Contact 66.16 0.55 16.31 0.81 3.03 1.61 2.84 3.78 3.78 3.78 0.27 0.05 1454 45 19 n.d 26 n.d 28 n.d 8 8 883 n.d	T96S Contact 70.37 0.48 14.65 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04 363 40 50 25 n.d 32 n.d 32 n.d 63 8 446 n.d
Sample Unit SiO2 TiO2 A12O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Bb Sc Sr Th V V	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12 2.97 4.11 0.81 0.05 1354 19 64 4 16 23 33 132 18 741 1 98 64	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04 2051 17 47 10 15 18 41 144 16 766 1 86	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.43 0.07 1431 42 28 21 17 9 22 127 5 603 6 51	T50AS Contact 63.94 0.65 17.76 0.28 3.76 2.19 3.43 3.29 3.71 0.45 0.05 1223 47 32 25 24 11 20 110 8 666 10 63 24	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.56 0.06 1537 23 34 11 15 12 23 34 11 15 12 22 107 4 698 2 64	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 5.15 0.05 0.03 1378 66 16 66 16 67 31 8 39 114 4 424 18 30	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94 0.08 1627 90 32 50 47 12 30 136 9 538 18 69	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.57 1.76 2.57 3.43 3.46 0.32 0.06 1195 16 23 100 9 23 100 5 526 4 4	T73S Contact 0.59 16.75 0.20 2.37 1.15 2.83 3.19 4.02 0.36 0.04 1203 54 54 26 24 8 28 103 7 522 11 4.52 21	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91 3.77 2.66 0.21 0.07 1090 52 50 34 n.d 33 n.d 92 10 717 n.d 64	T91S Contact 66.16 0.65 16.31 0.81 3.03 1.61 2.84 3.78 3.76 0.27 0.05 1454 35 45 19 n.d 26 n.d 94 8 683 n.d 57	T96S Contact 70.37 0.48 14.65 0.79 2.41 1.40 2.45 3.45 2.31 0.04 363 40 50 25 n.d 32 n.d 32 n.d 32 n.d 32 n.d 32 n.d 32 n.d 32
Sample Unit SiO2 TiO2 A12O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Sc Sr Th V Y Zn	T31S Contact 56.89 0.86 20.10 3.58 4.12 2.97 4.11 0.81 0.05 1354 19 64 4 16 23 33 132 18 741 1 98 66	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04 2051 17 47 10 15 18 41 144 16 766 1 86 66	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.43 0.07 1431 42 28 21 27 5 603 6 51 18 60	T50AS Contact 63.94 0.65 17.76 2.19 3.76 2.19 3.76 2.19 3.71 0.45 0.05 1223 47 32 25 24 11 20 110 8 666 10 63 24 7	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.56 0.06 1537 23 34 11 15 12 22 107 4 698 2 64 35 62	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 5.15 0.05 0.03 1378 66 16 37 31 8 39 114 4 424 18 30 15 24	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94 0.08 1627 90 32 50 80 47 12 30 136 9 538 18 69 59	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.43 3.46 0.32 0.06 1195 16 23 6 10 9 23 100 5 526 4 46 4 55	T73S Contact 67.51 0.59 16.75 2.83 3.19 4.02 0.36 0.04 1203 54 54 26 24 8 28 103 7 522 11 45 26 6 4	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91 3.37 2.66 0.21 0.07 52 50 34 n.d 33 n.d 92 10 0 717 n.d 64 5 6	T91S Contact 66.16 0.65 16.31 3.03 1.61 2.84 3.78 3.76 0.27 0.05 1454 3.5 45 19 n.d 26 n.d 94 8 8683 n.d 57 31 6	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40 2.45 3.45 3.45 3.45 0.04 363 40 50 25 n.d 32 n.d 63 8 446 n.d 56 4
Sample Unit SiO2 A12O3 Fe2O3 FeO MgO CaO Na2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Bb Rb Sc Sr Th V Y Zn Zr	T31S Contact 56.89 0.86 20.10 3.58 4.12 2.97 4.11 0.81 0.05 1354 19 64 4 16 23 33 132 18 741 1 98 66 95	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04 2051 17 47 10 15 18 41 144 16 766 1 86 66 85 186	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.36 0.43 0.07 1431 42 28 21 17 9 22 127 5 603 6 51 18 60 250	T50AS Contact 63.94 0.65 17.76 2.19 3.76 2.19 3.76 2.19 3.71 0.45 0.05 1223 47 32 25 24 11 20 110 8 666 10 63 24 78 272	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.56 0.06 1537 23 34 11 15 12 22 107 4 698 2 64 35 2 82 280	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 3.10 5.15 0.05 0.03 1378 66 16 37 31 8 39 114, 4 224 18 30 15 24	T69S Contact 60.07 0.77 18.20 1.04 3.55 2.85 5.28 0.94 0.08 1627 90 32 50 8 5 28 5.28 0.94 0.08	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.43 3.46 0.32 0.06 1195 16 23 6 10 9 23 100 5 526 4 46 4 5 523	T73S Contact 67.51 0.59 16.75 2.83 3.19 4.02 0.36 0.04 1203 54 54 26 24 8 28 103 7 522 11 45 26 54 24	T85S Contact 0.7.24 0.57 16.38 0.90 2.69 1.91 3.77 2.66 0.21 0.07 1090 52 50 34 n.d 33 n.d 92 10 717 n.d 64 5 5	T91S Contact 66.16 0.65 16.31 3.03 1.61 2.84 3.78 3.76 0.27 0.05 1454 3.5 45 19 n.d 26 n.d 94 8 683 n.d 57 31 62	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04 363 40 50 25 n.d 32 n.d 63 8 446 n.d 56 4 58 42
Sample Unit SiO2 TiO2 A12O3 FeO MgO CaO Na2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb Sc Sr Th V Y Zn Zr Cu	T31S Contact 56.89 0.86 20.10 3.58 4.12 2.97 4.11 0.81 0.05 1354 19 64 4 16 23 33 132 18 741 1 98 66 95 196 95 196 n.d	T31S Contact 57.37 0.79 19.39 0.84 3.49 3.33 3.68 2.69 5.45 0.79 0.04 2051 17 47 10 15 18 41 144 16 766 6 1 86 66 85 186 6 6 85 186 0.10	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.36 0.43 0.07 1431 42 28 21 17 9 22 127 5 603 6 51 18 60 250 n.d	T50AS Contact 63.94 0.65 17.76 2.19 3.76 2.19 3.76 2.19 3.71 0.45 0.05 1223 47 32 25 24 11 20 110 8 666 10 63 24 78 272 2,nd	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.56 0.06 1537 23 34 11 15 12 22 107 4 698 2 64 35 82 280 n.d	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 3.10 5.15 0.05 0.03 1378 66 16 37 31 8 39 114, 4 24 18 30 15 24 126 n.d	T69S Contact 60.07 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94 0.08 1627 90 32 50 47 12 30 136 9 538 18 69 538 18 69 59 79 312 n.d	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.31 3.43 3.46 0.32 0.06 1195 16 23 0.06 1195 16 23 100 5 526 4 4 6 4 5 526 4 5 223 n.d	T73S Contact 67.51 0.59 16.75 2.83 3.19 4.02 0.36 0.04 1203 54 54 26 24 28 103 7 522 11 45 26 52 11 45 26 54 26 103 7	T85S Contact 67.24 0.57 16.38 0.90 2.69 1.91 3.37 3.77 2.68 0.21 0.07 1090 52 50 34 n.d 33 n.d 92 10 717 n.d 64 5 5 50 55 125	T91S Contact 66.16 0.55 16.31 3.03 1.61 2.84 3.78 3.78 0.27 0.05 1454 35 45 19 n.d 28 n.d 94 8 683 n.d 57 31 652 97	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04 363 40 50 25 n.d 63 8 446 n.d 56 4 56 4 56 4 56 4 56
Sample Unit SiO2 TiO2 A12O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb Sc Sr Th V Y Zn Zr Cu Li	T31S Contact 56.89 0.86 20.10 0.62 4.10 3.58 4.12 2.97 4.11 0.05 1354 19 64 4 16 23 33 132 18 741 1 98 66 95 196 n.d n.d	T31S Contact 57.37 0.79 19.39 0.84 3.33 3.68 2.69 5.45 0.79 0.04 2051 17 47 10 15 18 41 144 16 766 1 86 66 85 186 n.d n.d	T42S Contact 67.57 0.57 16.60 0.44 2.68 1.72 2.88 3.49 3.36 0.43 0.07 1431 42 28 21 17 9 22 127 5 603 6 51 18 60 250 n.d n.d	T50AS Contact 63.94 0.65 17.76 2.19 3.43 3.29 3.71 0.45 0.05 1223 47 32 25 24 11 20 110 8 666 10 63 24 78 272 n.d n.d	T52S Contact 61.71 0.69 18.08 0.76 3.67 2.23 3.44 3.36 4.05 0.56 0.06 0.06 0.06 0.06 0.06 0.06 0	T65S Contact 70.06 0.39 15.81 0.19 1.22 0.83 1.40 5.15 0.05 0.03 1378 66 16 66 16 67 31 8 39 114 4 424 18 30 15 24 126 n.d n.d	T69S Contact 60.07 18.20 1.04 3.55 2.25 3.35 2.85 5.28 0.94 0.08 0.94 0.08 1627 90 32 50 47 12 30 136 9 538 18 69 538 18 69 538 18 69 59 512 n.d	T72S Contact 69.26 0.49 15.95 0.50 2.57 1.76 2.57 1.76 2.57 3.43 3.46 0.32 0.06 1195 16 23 100 9 23 100 5 526 4 46 4 55 223 n.d n.d	T73S Contact 67.51 0.59 16.75 2.83 3.19 4.02 0.36 0.04 1203 54 54 26 24 8 8 28 103 7 522 11 4.5 22 11 4.5 26 24 8 28 103 7 522 11 4.5 54 26 24 8 103 7 522 11 15 54 54 54 54 54 54 54 54 54 54 54 54 54	T85S           Contact           67.24           0.57           16.38           0.90           2.69           1.91           3.77           2.66           0.21           0.07           1090           52           50           34           n.d           33           n.d           33           n.d           50           10           717           n.d           64           5           125           25	T91S Contact 66.16 0.65 16.31 0.81 3.03 1.61 2.84 3.78 3.76 0.27 0.05 1454 35 45 10 n.d 26 n.d 94 8 683 n.d 57 31 60 52 97 35	T96S Contact 70.37 0.48 14.55 0.79 2.41 1.40 2.45 3.45 2.31 0.05 0.04 363 40 50 25 n.d 32 n.d 32 n.d 32 n.d 53 8 446 n.d 58 42 108 51

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Sample	T33S	T375	T113S	T116S	T118S	T121S	T126S	T127S	T213S	T222S	T224S	T234S
Unit	Contact	Contact	Contact	Contact	Contact	Contact	Contact	Contact	Contact	Contact	Contact	Contact
SiO2	67.82	56.75	66.10	63.88	71.89	68.75	64.53	70.01	66.89	71.11	67.61	69.98
TiO2	0.67	0.88	0.83	0.69	0.44	0.56	0.68	0.65	0.55	0.40	0.55	0.44
A1203	16 44	20.16	16 67	16 50	14 53	15.81	18.08	14 20	16 15	14 75	15.01	15.00
AIZU3	10.44	20.10	10.07	10.09	14.00	15.01	10.90	14.20	10.15	14.75	15.91	15.90
Fe2O3	0.61	0.80	1.27	1.26	0.74	0.77	1.11	0.93	1.16	0.74	0.81	0.80
FeO	2.68	4,04	2.88	3.32	2.08	2.67	3.31	2.55	2.66	1.79	2.35	2.15
MnO	1.72	3.56	1.35	1.86	1.34	1.49	1.77	1.41	1.60	1.18	1.38	1.32
(ng0	0.10	4.00	0.00	0.00	0.70	0.04	0 4 4	0.05	0.00	0.00	0.70	0.00
CaU	3.19	4.08	2.33	3.58	2.73	3.01	3.14	2.05	2.92	2.09	2.78	2.89
Na2O	3.06	3.07	3.26	3.67	3.51	3.75	3.62	3.09	4.04	3.70	3.81	4.11
K2O	2.63	4.26	4.01	3.04	2.23	1.99	3.39	3.55	2.74	1.98	3.84	1.48
P2O5	0.18	0.81	0.01	0.25	0.08	0.12	0.12	0.07	0.09	0.13	0.24	0.08
Mac	0.04	0.05	0.02	0.06	0.02	0.05	0.05	0.05	0.05	0.04	0.06	0.04
	0.04	0.05	0.03	0.00	0.05	0.03	0.00	0.00	0.05	0.04	0.00	0.04
								· · · ·				
·			1007		407	704	4004	1004	000		4404	000
Ba	506	1352	1225	1440	497	/24	1364	1304	836	693	1494	336
Ce	47	19	166	37	39	86	102	132	163	62	36	47
Cr	50	67	41	47	38	39	44	36	42	38	36	39
la	24	G	109	20	24	61	62	88	92	44	24	30
Na		, in										
NO	21	13	n.a	n.a	n.a	n.0	n.a	n.a	1.0	n.a	n.a	n.G
Ni	15	24	27	32	30	27	32	28	29	25	25	. 27
Pb	22	35	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d 🦾	n.d
Bb	85	135	147	72	62	31	62	58	90	45	110	63
5.		100		~ _	~	6	10		40.			
30	12	17	14	8	8	Ŭ	10	8	10	0	4	4
Sr	642	741	563	745	564	689	657	521	494	543	620	468
Th	. 8	3	n.đ	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
v	62	96	51	72	49	64	65	53	57	45	50	52
÷.	0.0					0.0			0.0	10	10	
T	20	60	18	22	1	20	17	10	23	10	10	o
Zn	64	98	- 71	70	52	48	66	46	64	44	56	49
Zr	205	190	49	46	72	52	53	47	49	38	41	42
Cu .	n d	n d	107	92	169	92	113	99	264	392	128	122
		in al		00	0.0			20	0.1	40	140	
L1	n.o	n.a	30	30	20	30	. 30	30	01	40	113	/ 5
	•									2		$(F_{i}, \hat{f}_{i})$
Sample	T113S	T116S	T118S	T121S	T126S	T127S	T2135	T222S	T224S	T234S	T249S	T253S
Unit	Contact	Contact	Contact	Contact	Contact	Contact	Contact	Contact	Contact	Contact	Contact	Contact
0.111	Gomaon	Contaot	0 Dinia di	e entra et	••••••			•••••••••••••••••••••••••••••••••••••••	••••••••••	••••••••••	Contact	Contaot
	· · · · · ·											·
SiO2	66.10	63.88	71.89	68.75	64.53	70.01	66.89	71.11	67.61	69.98	66.70	63.76
TiO2	0.83	0.69	0.44	0.56	0.68	0.65	0.55	0.40	0.55	0.44	0.49	0.60
A1203	16 67	16 50	14 53	15.81	16.96	14.20	16 15	14 75	15.91	15.90	16 27	16.97
F-000	1 07	10.00	0.74	0.77	4 4 4	0.00	4 4 6	0.74	0.01	0.00		0.00
Fe2O3	1.27	1.26	0.74	.0.77	1.14	0.83	1.10	0.74	0.81	0.80	0.71	0.59
FeO	2.88	3.32	2.08	2.67	3.31	2.55	2.66	1.79	2.35	2.15	2.73	2.96
MgO	1.35	1.86	1.34	1.49	1.77	1 4 1	4 80		1 2 9	1 20		1.74
<u> </u>	2.23					1171	1.00	1.18	1.30	1.36	1.41	
	- <b>-</b>	3 6 0	272	3.01	3 14	2.05	202	1.18	2 78	2 80	1.41	3 1 2
Na2O	~ ~ ~	3.59	2.73	3.01	3.14	2.05	2.92	1.18	2.78	2.89	1.41	3.02
K20	3.26	3.59 3.67	2.73	3.01 3.75	3.14 3.62	2.05 3.09	2.92 4.04	1.18 2.69 3.70	2.78 3.81	2.89	1.41 2.84 3.85	3.02 3.79
	3.26 4.01	3.59 3.67 3.04	2.73 3.51 2.23	3.01 3.75 1.99	3.14 3.62 3.39	2.05 3.09 3.55	2.92 4.04 2.74	1.18 2.69 3.70 1.98	2.78 3.81 3.84	2.89 4.11 1.48	1.41 2.84 3.85 3.63	3.02 3.79 4.33
P2O5	3.26 4.01 0.01	3.59 3.67 3.04 0.25	2.73 3.51 2.23 0.08	3.01 3.75 1.99 0.12	3.14 3.62 3.39 0.12	2.05 3.09 3.55 0.07	2.92 4.04 2.74 0.09	1.18 2.69 3.70 1.98 0.13	2.78 3.81 3.84 0.24	2.89 4.11 1.48 0.08	1.41 2.84 3.85 3.63 0.21	3.02 3.79 4.33 0.29
P2O5	3.26 4.01 0.01	3.59 3.67 3.04 0.25	2.73 3.51 2.23 0.08	3.01 3.75 1.99 0.12	3.14 3.62 3.39 0.12	2.05 3.09 3.55 0.07	2.92 4.04 2.74 0.09	1.18 2.69 3.70 1.98 0.13 0.04	2.78 3.81 3.84 0.24	2.89 4.11 1.48 0.08	1.41 2.84 3.65 3.63 0.21	3.02 3.79 4.33 0.29
P2O5 MnO	3.26 4.01 0.01 0.03	3.59 3.67 3.04 0.25 0.06	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05	3.14 3.62 3.39 0.12 0.05	2.05 3.09 3.55 0.07 0.05	2.92 4.04 2.74 0.09 0.05	1.18 2.69 3.70 1.98 0.13 0.04	2.78 3.81 3.84 0.24 0.06	2.89 4.11 1.48 0.08 0.04	1.41 2.84 3.85 3.63 0.21 0.04	3.02 3.79 4.33 0.29 0.05
P2O5 MnO	3.26 4.01 0.01 0.03	3.59 3.67 3.04 0.25 0.06	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05	3.14 3.62 3.39 0.12 0.05	2.05 3.09 3.55 0.07 0.05	1.60 2.92 4.04 2.74 0.09 0.05	1.18 2.69 3.70 1.98 0.13 0.04	2.78 3.81 3.84 0.24 0.06	2.89 4.11 1.48 0.08 0.04	1.41 2.84 3.85 3.63 0.21 0.04	3.02 3.79 4.33 0.29 0.05
P2O5 MnO	3.26 4.01 0.01 0.03	3.59 3.67 3.04 0.25 0.06	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05	3.14 3.62 3.39 0.12 0.05	2.05 3.09 3.55 0.07 0.05	1.60 2.92 4.04 2.74 0.09 0.05	1.18 2.69 3.70 1.98 0.13 0.04	2.78 3.81 3.84 0.24 0.06	1.32 2.89 4.11 1.48 0.08 0.04	1.41 2.84 3.85 3.63 0.21 0.04	3.02 3.79 4.33 0.29 0.05
P2O5 MnO	3.26 4.01 0.01 0.03	3.59 3.67 3.04 0.25 0.06	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05	3.14 3.62 3.39 0.12 0.05	2.05 3.09 3.55 0.07 0.05	1.60 2.92 4.04 2.74 0.09 0.05	1.18 2.69 3.70 1.98 0.13 0.04	2.78 3.81 3.84 0.24 0.06	1.32 2.89 4.11 1.48 0.08 0.04	1.41 2.84 3.85 3.63 0.21 0.04	3.02 3.79 4.33 0.29 0.05
P2O5 MnO Ba	3.26 4.01 0.01 0.03	3.59 3.67 3.04 0.25 0.06	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05	3.14 3.62 3.39 0.12 0.05	2.05 3.09 3.55 0.07 0.05	1.60 2.92 4.04 2.74 0.09 0.05	1.18 2.69 3.70 1.98 0.13 0.04	2.78 3.81 3.84 0.24 0.06	2.89 4.11 1.48 0.08 0.04	1.41 2.84 3.85 3.63 0.21 0.04	3.02 3.79 4.33 0.29 * 0.05
P2O5 MnO Ba	3.26 4.01 0.01 0.03 1225 166	3.59 3.67 3.04 0.25 0.06	2.73 3.51 2.23 0.08 0.03 497 39	3.01 3.75 1.99 0.12 0.05	3.14 3.62 3.39 0.12 0.05	2.05 3.09 3.55 0.07 0.05 1304 132	1.60 2.92 4.04 2.74 0.09 0.05 836	1.18 2.69 3.70 1.98 0.13 0.04 693 62	1.38 2.78 3.81 3.84 0.24 0.06	1.32 2.89 4.11 1.48 0.08 0.04 336 47	1.41 2.84 3.85 3.63 0.21 0.04	3.02 3.79 4.33 0.29 * 0.05
P2O5 MnO Ba Ce	3.26 4.01 0.03 1225 166	3.59 3.67 3.04 0.25 0.06 1440 37	2.73 3.51 2.23 0.08 0.03 497 39	3.01 3.75 1.99 0.12 0.05 724 86	3.14 3.62 3.39 0.12 0.05	2.05 3.09 3.55 0.07 0.05	1.60 2.92 4.04 2.74 0.09 0.05 836 163	1.18 2.69 3.70 1.98 0.13 0.04 693 693 62	1.38 2.78 3.81 3.84 0.24 0.06	1.32 2.89 4.11 1.48 0.08 0.04 336 47	1.41 2.84 3.85 3.63 0.21 0.04 1800 24	3.02 3.79 4.33 0.29 0.05 2210 28
P2O5 MnO Ba Ce Cr	3.26 4.01 0.03 1225 166 41	3.59 3.67 3.04 0.25 0.06 1440 37 47	2.73 3.51 2.23 0.08 0.03 497 39 38	3.01 3.75 1.99 0.12 0.05 724 86 39	3.14 3.62 3.39 0.12 0.05 1364 102 44	2.05 3.09 3.55 0.07 0.05 1304 132 36	1.60 2.92 4.04 2.74 0.09 0.05 836 163 42	1.18 2.69 3.70 1.98 0.13 0.04 693 693 62 38	1.33 2.78 3.81 3.84 0.24 0.06 1494 36 36	1.32 2.89 4.11 1.48 0.08 0.04 336 47 39	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39	3.02 3.79 4.33 0.29 0.05 2210 28 44
P2O5 MnO Ba Ce Cr La	3.26 4.01 0.03 1225 166 41 109	3.59 3.67 3.04 0.25 0.06 1440 37 47 20	2.73 3.51 2.23 0.08 0.03 497 39 38 24	3.01 3.75 1.99 0.12 0.05 724 86 39 61	3.14 3.62 3.39 0.12 0.05 1364 102 44 62	2.05 3.09 3.55 0.07 0.05 1304 132 36 88	836 163 422 4.04 0.09 0.05	1.18 2.69 3.70 1.98 0.13 0.04 693 62 38 44	1.38 2.78 3.81 3.84 0.24 0.06 1494 36 38 24	1.32 2.89 4.11 1.48 0.08 0.04 336 47 39 30	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14	3.02 3.79 4.33 0.29 0.05 2210 28 44 15
P2O5 MnO Ba Ce Cr La Nd	3.26 4.01 0.03 1225 166 41 109 n.d	3.59 3.67 3.04 0.25 0.06 1440 37 47 20 n.d	2.73 3.51 2.23 0.08 0.03 497 39 38 24 n.d	3.01 3.75 1.99 0.12 0.05 724 86 39 61 n.d	3.14 3.62 3.39 0.12 0.05 1364 102 44 62 n.d	2.05 3.09 3.55 0.07 0.05 1304 132 36 88 n.d	1.60 2.92 4.04 2.74 0.09 0.05 836 163 42 92 n.d	1.18 2.69 3.70 1.98 0.13 0.04 693 693 62 38 44 n.d	1.38 2.78 3.81 3.84 0.24 0.06 1494 36 36 24 n.d	1.32 2.89 4.11 1.48 0.08 0.04 336 47 39 30 n.d	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14 n.d	3.02 3.79 4.33 0.29 0.05 2210 28 44 15 n.d
P2O5 MnO Ba Ce Cr La Nd Ni	3.26 4.01 0.03 1225 166 41 109 n.d 27	3.59 3.67 3.04 0.25 0.06 1440 37 47 20 n.d	2.73 3.51 2.23 0.08 0.03 497 39 38 24 n.d	3.01 3.75 1.99 0.12 0.05 724 86 39 61 n.d	3.14 3.62 3.39 0.12 0.05 1364 102 44 62 n.d 32	2.05 3.09 3.55 0.07 0.05 1304 132 36 88 n.d 28	1.60 2.92 4.04 2.74 0.09 0.05 836 163 42 82 82 n.d	1.18 2.69 3.70 1.98 0.13 0.04 693 62 38 44 n.d	1.38 2.78 3.81 3.84 0.24 0.06 1494 36 36 24 n.d	2.89 4.11 1.48 0.08 0.04 336 47 39 30 n.d 27	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14 n.d	3.02 3.79 4.33 0.29 0.05 2210 28 44 15 n.d 29
P2O5 MinO Ba Ce Cr La Nd Ni	3.26 4.01 0.03 1225 166 41 109 n.d 27	3.59 3.67 3.04 0.25 0.06 1440 37 47 20 n.d 32	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05 724 86 39 61 n.d 27	3.14 3.62 3.39 0.12 0.05 1364 102 44 62 n.d 32	2.05 3.09 3.55 0.07 0.05	1.60 2.92 4.04 2.74 0.09 0.05 836 163 42 92 n.d 29	1.18 2.69 3.70 1.98 0.13 0.04 693 62 38 44 n.d 25	1494 36 36 36 24 1494	2.89 2.89 4.11 1.48 0.08 0.04 336 47 39 30 n.d 27	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14 n.d 27	3.02 3.79 4.33 0.29 0.05 2210 28 44 15 n.d 29
P2O5 MnO Ba Ce Cr La Nd Ni Pb	3.26 4.01 0.01 0.03 1225 166 41 109 n.d 27 n.d	3.59 3.67 3.04 0.25 0.06 1440 37 47 20 n.d 32 n.d	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05 724 86 39 61 n.d 27 n.d	3.14 3.62 3.39 0.12 0.05 1364 102 44 62 n.d 32 n.d	2.05 3.09 3.55 0.07 0.05 1304 132 36 88 n.d 28 n.d	1.60 2.92 4.04 2.74 0.09 0.05 836 163 42 92 n.d 29 n.d	1.18 2.69 3.70 1.98 0.13 0.04 693 62 38 44 n.d 25 n.d	1.38 2.78 3.81 3.84 0.24 0.06 1494 36 38 24 n.d 25 n.d	2.89 4.11 1.48 0.08 0.04 336 47 39 30 n.d 27 n.d	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14 n.d 27 n.d	3.02 3.79 4.33 0.29 * 0.05 * 0.05 * 2210 28 44 15 n.d 29 n.d
P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb	3.26 4.01 0.01 0.03 1225 166 41 109 n.d 27 n.d 147	3.59 3.67 3.04 0.25 0.06 1440 37 47 20 n.d 32 n.d 32	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05 724 88 39 61 n.d 27 n.d 31	3.14 3.62 3.39 0.12 0.05 1364 102 44 62 n.d 32 n.d 62	2.05 3.09 3.55 0.07 0.05 1304 132 36 88 n.d 28 n.d 58	1.60 2.92 4.04 2.74 0.09 0.05 836 163 42 82 nd 29 nd 90	1.18 2.69 3.70 1.98 0.13 0.04 693 62 38 44 n.d 25 n.d 45	1.38 2.38 3.81 3.84 0.24 0.06 1494 36 36 24 n.d 25 n.d 110	2.82 4.11 1.48 0.08 0.04 336 47 39 30 n.d 27 n.d 63	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14 n.d 27 n.d 154	3.02 3.79 4.33 0.29 7 0.05 2210 28 44 15 n.d 165
P2O5 MnO Ba Ce Cr La Nd Ni Pb Sc	3.26 4.01 0.01 0.03 1225 166 41 109 n.d 27 n.d 27 n.d 147	3.59 3.67 3.04 0.25 0.06 1440 37 47 20 n.d 32 n.d 32 n.d 72 8	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05 724 86 39 61 n.d 27 n.d 31 6	3.14 3.62 3.39 0.12 0.05 1364 102 44 62 n.d 32 n.d 32 n.d 52 10	2.05 3.09 3.55 0.07 0.05 1304 132 36 88 n.d 28 n.d 28 n.d 58	836 163 2.92 4.04 2.74 0.09 0.05 836 163 42 82 82 82 n.d 29 n.d 29 n.d 29 10	1.18 2.69 3.70 1.98 0.13 0.04 693 62 38 62 38 44 n.d 25 n.d 45 5	1.38 3.81 3.84 0.24 0.06 1494 36 36 24 n.d 25 n.d 110 4	2.89 2.89 4.11 1.48 0.08 0.04 336 47 39 30 n.d 27 n.d 63 8	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14 n.d 27 n.d 154 8	3.02 3.79 4.33 0.29 7 0.05 2210 28 44 15 n.d 29 n.d 165 6
P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb Sc	3.26 4.01 0.01 0.03 1225 166 41 109 n.d 27 n.d 147 147 143	3.59 3.67 3.04 0.25 0.06 1440 37 47 20 n.d 32 n.d 72 8 745	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05 724 86 39 61 n.d 27 n.d 31 6 889	3.14 3.62 3.39 0.12 0.05 1364 102 44 62 n.d 32 n.d 62 10 657	2.05 3.09 3.55 0.07 0.05 1304 132 36 88 n.d 28 n.d 58 8 521	1.60 2.92 4.04 2.74 0.09 0.05 836 163 42 92 n.d 29 n.d 90 10	1.18 2.69 3.70 1.98 0.13 0.04 693 62 38 44 n.d 25 n.d 45 5 43	1.78 2.78 3.81 3.84 0.24 0.06 1494 36 38 24 n.d 25 n.d 110 4 20	2.89 4.11 1.48 0.08 0.04 336 47 39 30 n.d 27 n.d 63 8 468	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14 d 27 n.d 154 8 744	3.02 3.79 4.33 0.29 0.05 2210 28 44 15 n.d 29 n.d 165 6 838
P2O5 MnO Ba Ce Cr La Ni Pb Rb Sc Sr Th	3.26 4.01 0.01 0.03 1225 166 41 109 n.d 27 n.d 147 14 563	3.59 3.67 3.04 0.25 0.06 1440 37 47 20 n.d 32 n.d 72 8 745	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05 724 88 39 61 n.d 31 6 889 31	3.14 3.62 3.39 0.12 0.05 1364 102 44 62 n.d 62 10 657	2.05 3.09 3.55 0.07 0.05 1304 132 36 88 n.d 28 n.d 58 8 52	1.60 2.92 4.04 2.74 0.09 0.05 836 163 42 92 nd 90 10 494	1.18 2.69 3.70 1.98 0.13 0.04 693 62 38 44 n.0 45 5 543	1.38 2.78 3.81 3.84 0.24 0.06 36 36 24 n.d 110 4 620	2.89 4.11 1.48 0.08 0.04 336 47 39 30 n.d 63 8 468 8	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14 nd 27 n.d 154 8 744	3.02 3.79 4.33 0.29 7 0.05 2210 28 44 15 n.d 165 6 838 6
P2O5 MnO Ba Ce Cr La Nd Ni Pb Pb Sc Sc Sr Th	3.26 4.01 0.03 1225 166 41 109 n.d 27 n.d 147 14 563 n.d	3.59 3.67 3.04 0.25 0.06 1440 37 47 47 47 20 n.d 32 n.d 72 8 745 n.d	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05 724 86 39 61 n.d 27 n.d 31 6 889 n.d	3.14 3.62 3.39 0.12 0.05 1364 102 44 62 n.d 32 n.d 62 10 657 n.d	2.05 3.09 3.55 0.07 0.05 1304 132 36 88 n.d 28 n.d 28 n.d 58 8 521 n.d	2.92 4.04 2.74 0.09 0.05 836 163 42 82 82 90 nd 29 nd 29 nd 29 10 494 nd	1.18 2.69 3.70 1.98 0.13 0.04 693 62 38 44 r.d 25 r.d 45 5 543 r.d	1494 36 36 24 0.06 1494 36 24 n.d 25 n.d 25 n.d 10 4 620 n.d	2.89 2.89 4.11 1.48 0.08 0.04 336 47 39 30 n.d 27 n.d 63 8 468 n.d	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14 n.d 27 n.d 154 8 744 n.d	3.02 3.79 4.33 0.29 0.05 2210 28 44 15 n.d 165 6 838 n.d
P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb Sc Th V	3.26 4.01 0.03 1225 166 41 109 n.d 27 n.d 147 14 563 n.d 51	3.59 3.67 3.04 0.25 0.06 1440 37 47 20 n.d 32 n.d 72 8 745 n.d 72	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05 724 86 39 61 n.d 27 n.d 31 6 8 80 84	3.14 3.62 3.39 0.12 0.05 1364 102 44 62 n.d 32 n.d 65 10 657 n.d 65	2.05 3.09 3.55 0.07 0.05 1304 132 36 88 n.d 28 n.d 58 8 521 n.d 53	1.60 2.92 4.04 2.74 0.09 0.05 836 163 42 92 n.d 29 n.d 90 10 494 n.d 57	1.18 2.69 3.70 1.98 0.13 0.04 693 62 38 44 n.d 25 n.d 45 5 543 n.d 45	1.38 2.78 3.81 3.84 0.24 0.06 1494 36 38 24 n.d 25 n.d 110 4 620 n.d 50	2.89 2.89 4.11 1.48 0.08 0.04 336 47 39 30 n.d 27 n.d 63 8 468 n.d 52	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14 n.d 27 n.d 154 8 744 n.d 51	3.02 3.79 4.33 0.29 0.05 2210 28 44 15 n.d 165 6 838 n.d 57
P2O5 MnO Ba Ce Cr La Nd Ni Pb Sc Sr Th V Y	3.26 4.01 0.03 1225 166 41 109 n.d 27 n.d 27 n.d 147 14 563 n.d 151 18	3.59 3.67 3.04 0.25 0.06 1440 37 47 20 n.d 32 n.d 72 8 745 n.d 72 22	2.73 3.51 2.23 0.03	3.01 3.75 1.99 0.12 0.05 724 86 39 61 n.d 31 6 689 n.d 31 6 689 n.d 27	3.14 3.62 3.39 0.12 0.05 1364 102 44 62 n.d 62 10 657 n.d 65 17	2.05 3.09 3.55 0.07 0.05 1304 132 36 88 n.d 28 n.d 58 8 521 n.d 53 10	1.60 2.92 4.04 2.74 0.09 0.05 836 163 42 92 nd 90 10 494 nd 57 23	1.18 2.69 3.70 1.98 0.13 0.04 693 62 38 44 n.0 45 5 543 n.0 45 5 543 n.0	1494 3.81 3.84 0.24 0.06 1494 36 36 24 n.d 25 n.d 25 n.d 110 4 620 n.d 50 10	2.89 2.89 4.11 1.48 0.08 0.04 336 47 39 30 n.d 27 n.d 63 8 468 n.d 52 8	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14 nd 27 nd 154 8 744 nd 51 26	3.02 3.79 4.33 0.29 7 0.05 7 0.05 7 2210 28 44 15 n.d 165 6 838 n.d 165 6 838 n.d 19
P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb Sc Sr Th V Y Zn	3.26 4.01 0.01 0.03 1225 166 41 109 n.d 27 n.d 27 n.d 147 14 563 n.d 51 18 71	3.59 3.67 3.04 0.25 0.06 1440 37 47 47 8 745 n.d 72 8 745 n.d 72 22 2	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05 724 86 39 61 n.d 27 n.d 31 6 889 n.d 64 20 0.48	3.14 3.62 3.39 0.12 0.05 1364 102 44 62 n.d 62 10 657 n.d 65 17 66	2.05 3.09 3.55 0.07 0.05 1304 132 36 88 n.d 28 n.d 28 n.d 53 521 n.d 53 10 46	836 163 836 163 42 836 163 42 82 82 90 10 494 n.d 57 23 64	1.18 2.69 3.70 1.98 0.13 0.04 693 62 38 44 r.d 25 r.d 45 5 543 r.d 45 10 44	1494 3.81 3.84 0.24 0.06 1494 36 36 24 n.d 25 n.d 25 n.d 50 10 56	2.89 2.89 4.11 1.48 0.08 0.04 336 47 39 30 n.d 27 n.d 63 8 468 n.d 52 6 8	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14 n.d 27 n.d 154 8 744 n.d 51 26 61	3.02 3.79 4.33 0.29 7 0.05 2210 28 44 15 n.d 29 n.d 165 838 n.d 57 19 59
P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb Sc Th V Y Zn Zr	3.26 4.01 0.01 0.03 1225 166 41 109 n.d 147 14 563 n.d 51 18 71	3.59 3.67 3.04 0.25 0.06 1440 37 47 20 n.d 32 n.d 72 8 745 72 22 70	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05 724 86 39 61 n.d 31 6 8 68 9 n.d 64 20 48	3.14 3.62 3.39 0.12 0.05 1364 102 44 62 n.d 62 10 657 n.d 65 17 66	2.05 3.09 3.55 0.07 0.05 1304 132 36 88 n.d 28 n.d 58 8 521 n.d 53 10 46	1.60 2.92 4.04 2.74 0.09 0.05 836 163 42 92 n.d 29 n.d 29 n.d 90 10 494 n.d 57 23 64	1.18 2.69 3.70 1.98 0.13 0.04 693 62 38 44 0.04 693 62 38 44 5 5 543 n.d 45 10 45	1.38 2.78 3.81 3.84 0.24 0.06 1494 36 38 24 n.d 25 n.d 110 4 25 n.d 110 50 10 56	2.82 2.82 4.11 1.48 0.08 0.04 336 47 39 30 n.d 27 n.d 63 8 468 n.d 52 6 49	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14 n.d 27 n.d 154 8 744 n.d 51 26 61	3.02 3.79 4.33 0.29 0.05 2210 28 44 15 n.d 165 6 838 n.d 57 19 59
P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb Sc Sr Th V Y Zn Zr Zr	3.26 4.01 0.01 0.03 1225 166 41 109 n.d 27 n.d 27 n.d 147 14 563 n.d 51 18 71 49	3.59 3.67 3.04 0.25 0.06 1440 37 47 20 n.d 32 n.d 72 8 745 n.d 72 22 270 46	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05 724 88 39 61 n.d 31 6 689 n.d 31 6 689 n.d 48 52	3.14 3.62 3.39 0.12 0.05 1364 102 44 62 n.d 62 10 657 n.d 65 17 66 53	2.05 3.09 3.55 0.07 0.05 1304 132 36 88 n.d 28 n.d 58 8 521 n.d 58 8 521 n.d 53 10 46 47	1.60 2.92 4.04 2.74 0.09 0.05 836 163 42 92 n.d 29 n.d 29 n.d 29 n.d 29 10 494 n.d 57 23 64 49	1.18 2.69 3.70 1.98 0.13 0.04 693 62 38 44 n.0 45 5 543 n.0 45 5 543 n.0 45 10 44 38	1494 3.81 3.84 0.24 0.06 1494 36 36 24 n.d 25 n.d 25 n.d 25 n.d 110 4 620 n.d 56 41	2.89 2.89 4.11 1.48 0.08 0.04 336 47 39 30 n.d 27 n.d 63 8 468 n.d 52 6 49 42	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14 nd 154 8 744 nd 154 8 744 nd 154 8 128 61	3.02 3.79 4.33 0.29 7 0.05 7 0.05 7 2210 28 44 15 n.d 165 6 838 n.d 165 6 838 n.d 19 59 59
P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb Sc Sr Th V Y Zn Zr CJ	3.26 4.01 0.01 0.03 1225 166 41 109 n.d 27 n.d 27 n.d 147 14 563 n.d 51 18 71 49 107	3.59 3.67 3.04 0.25 0.06 1440 37 47 47 72 0.d 32 n.d 72 8 745 n.d 72 22 2 2 2 70 46 92	2.73 3.51 2.23 0.08 0.03	3.01 3.75 1.99 0.12 0.05 724 86 39 61 n.d 27 n.d 689 n.d 64 20 48 52 92	3.14 3.62 3.39 0.12 0.05 1364 102 44 62 n.d 62 10 657 n.d 65 17 66 53 113	2.05 3.09 3.55 0.07 0.05 1304 132 36 88 n.d 28 n.d 28 n.d 53 10 46 47 99	836 163 4.04 2.74 0.09 0.05 836 163 42 82 82 82 82 82 82 82 84 29 84 90 10 494 84 82 84 92 84	1.18 2.69 3.70 1.98 0.13 0.04 693 62 38 44 r.d 25 r.d 45 5 543 r.d 45 10 45 38 392	1494 3.81 3.84 0.24 0.06 1494 36 36 24 n.d 25 n.d 25 n.d 10 4 620 n.d 50 10 56 41 128	2.89 2.89 4.11 1.48 0.08 0.04 336 47 39 30 n.d 27 n.d 63 8 468 n.d 52 8 468 n.d 52 8 49 42 122	1.41 2.84 3.85 3.63 0.21 0.04 1800 24 39 14 n.d 27 n.d 154 8 744 n.d 51 26 61 40 140	3.02 3.79 4.33 0.29 0.05 2210 28 44 15 n.d 29 n.d 165 6 838 n.d 57 19 59 51 110

Sample Unit	T35AT Trans	T35BT Trans	T44T Trans	T59T Trans	T92T Trans	T93T Trans	T94T Trans	T95T Trans	T97T Trans	T102T Trans	T103T Trans	T278T Trans
SiOa	62.00	62.03	61 60	62.07	64.02	60.08	65 10	64 06	87 40	69.90	60 7E	57.00
TiO2	0.66	0.68	0.65	0.59	0.63	0.50	0.66	0.70	07.49	03.30	02.75	0.94
AI2O3	17.47	18.28	17.96	17.12	16.16	14.71	16.44	16.59	15.41	16.78	17.10	18.73
Fe2O3	0.79	0.67	0.57	0.79	1.06	0.58	1.06	0.89	0.94	1.05	1.68	1.73
FeO	2.97	3.11	3.92	3.00	2.98	1.97	2.53	2.92	2.13	3.18	2.87	4.01
MgO	2.49	2.74	2.48	2.11	1.67	1.18	1.65	1.65	1.39	1.81	1.99	3.13
CaO	3.61	4.05	3.48	3.12	3.19	2.77	2.72	3.38	3.03	3.39	3.53	4.23
Na2O	3.51	3.55	3.14	3.74	4.00	4.05	4.06	4.17	3.95	4.36	4.21	4.47
K2O	2.78	2.84	4.61	3.56	3.79	2.25	4.93	3.30	3.16	3.86	3.84	2.84
P2O5	0.32	0.30	0.52	0.27	0.32	0.15	0.30	0.26	0.17	0.28	0.28	0.34
MnO	0.07	0.07	0.06	0.09	0.10	0.03	0.06	0.07	0.05	0.09	0.07	0.09
Ва	1051	938	2212	1591	1601	705	2030	1546	1375	1990	1560	983
Ce	51 -	20	20	18	26	56	46	55	130	71	61	68
Cr	50	52	36	30	26	34	43	41	43	42	44	65
La	33	8	11	9	17	36	31	36	96	45	37	39
Nd	22	9	13	12	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
Ni	16	17	14	14	29	25	27	29	91	32	30	47
Pb	19	19	17	16	n.d	n.d	n.d	n.d	n.đ	n.d	n.d	n.d
Hb ·	87	91	150	110	157	37	86	95	67	108	111	128
SC	6	6	6	7	6	7	5	7	6	9	8	14
. Sr Th	/62	917	833	000	/10	555	/50	/36	005	768	726	928
TA V	69	73	70	ۍ ۲۹	0.0	n.u 4.6	5.9	61	. 84	6.4	72	105
Ŷ.	8	8	19	24	4	9	14	14	17	31	12	26
Żn	66	66	90	68	69	41	58	66	52	69	72	94
Zr	179	200	295	268	53	43	42	50	42	49	51	54
Cu	n.d	n.đ	n.d	n.d	121	109	137	85	94	81	87	225
Li	n.d	n.d	n.d	n.d	61	58	85	111	91	115	123	53
Samola	T110T	T111T	TIIAT	T115T	T122T	T123T	T125T	T128T	T120T	T133T	T135T	TIBOT
Unit	Trans	Trans	Trans	Trans	Trans	Trans	Trans	Trans	Trans	Trans	Trans	Trans
SiO2	64.99	63:84	64.18	64.50	59.39	65.29	68.01	64.12	61.91	64.21	65.72	67.51
TIO2	0.64	0.67	0.58	0.59	0.76	0.62	0.50	0.62	0.92	0.63	0.70	0.35
AI2O3	16.61	17.33	16.33	17.01	18.25	16.09	15.74	16.05	17.22	15.67	16.14	15.87
Fe2O3	1.22	1.23	1.34	1.35	1.59	1.35	0.76	1.58	1.59	1.45	1.27	0.85
FeO	3.64	3.04	2.50	2.87	3.46	2.48	2.24	2.96	3.14	3.02	2.61	1.67
MgO	1.75	1.90	1.66	1.69	2.01	1.61	1.34	1.83	1.89	1.89	1.81	1.77
CaO	3.34	3.76	2.87	2.92	2.87	3.15	2.67	3.42	3.41	3.41	2.59	1.83
Na2O	3.73	3.92	4.22	4.80	4.21	3.93	4.50	3.95	3.96	3.96	3.84	3.81
K20	2.96	2.84	3.89	4.03	4.58	3.38	2.53	3.23	4.33	4.33	4.47	4.48
P205	0.27	0.28	0.25	0.28	0.39	0,23	0.20	0.27	0.37	0.37	0.32	0.19
	0.05	0.07	0.06	0.07	0.08	0.00	0.08	0.07	0,08	0.06	0.05	1.06
Ba	1158	1585	1599	1181	1492	1436	1427	1506	1187	1633	1467	1566
Ce	54	54	39	38	40	30	24	45	40	29	30	58
Cr	42	51	41	37	46	41	36	43	40	40	48	45
La	31	30	24	22	21	17	:- 15	28	28	16	17	40
Nd	n.d	n.d	n.d	n.d	n.d	n.đ	n.d	n.d	n.d	n.d	n.d	n.d
Ni	29	32	28	28	31	29	24	30	33	31	29	4.4
Pb	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
Rb	57	34	99	87	117	100	163	54	70	151	85	141
Sc	8	. 11	5	. 7	8	5	11	12	6	8	5	10
Sr TL	684	822	766	600	648	719	629	764	854	817	655	865
in V	n.a	n.a 79	n.Q	n.a #0	n.0	n.0	n.0 4 4	n.a	100	n.0	0.0 64	n.a
v						a ¥	* 0	88	102	00	00	44
	65	20	14	12	0.¢	4.4	10	1.0	10		0.0	· • • • •
Zn	65 18 56	20	11	15 84	25	11	19	16	10	14 78	20	14
Zn Zr	65 18 56 59	20 70 58	11 66 54	15 84 43	25 83 51	11 57 52	19 51 64	16 67 68	10 68 56	14 75 45	20 63 52	14 48 49
Zn Zr Cu	65 18 56 59 102	20 70 58 79	11 66 54 97	15 84 43 99	25 83 51 59	11 57 52 83	19 51 64 104	16 67 68 99	10 68 56 87	14 75 45 114	20 63 52 72	14 48 49 47

Sample Unit	T193T Trans	T215T Trans	T216T Trans	T217T Trans	T218T Trans	T223T Trans	T226T Trans	T228T Trans	T229T Trans	T230T Trans	T231T Trans	T232T Trans
SiO2	66.12	64.55	65.51	65.87	64.45	65.38	64.60	65.32	66.65	63.29	63.63	64.15
TiO2	0.75	0.63	0.66	0.66	0.66	0.67	0.66	0.66	0.68	0.69	0.76	0.67
AI2O3	14.46	16.08	16.57	16.25	16.06	16.30	15.71	16.18	15.64	15.96	16.97	16.78
Fe2O3	1.11	1.26	1.09	1.44	1.11	0.85	1.03	1.18	1.00	1.65	1.03	1.26
FeO	2.99	2.69	2.70	2.63	2.83	2.60	3.22	2.68	2.28	2.51	2.85	2.69
MgO	2.63	1.68	1.57	1.68	1.65	1.58	1.55	1.56	1.59	1.68	1.73	1.74
CaO	2.12	3.15	3.13	3.21	2.80	3.05	3.27	3.25	3.20	3.17	3.24	3.12
Na2O	3.56	3.79	3.79	3.73	3.99	4.65	3.86	4.08	4.18	4.05	4.68	3.87
R2OF	4.31	3.98	3.32	3.62	3.17	2.20	3.40	3.37	3.04	3.76	2.97	3.82
Ma	0.24	0.26	0.20	0.20	0.25	0.11	0.39	0.20	0.23	0.25	0.27	0.24
	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.07	0.05	0.08
											· ·	
Ba	1288	1649	1579	1557	1488	1870	664	1216	1644	1589	1308	1717
Ce	72	32	41	31	65	41	127	47	49	38	69	102
Cr	67	42	42	40	42	44	38	40	39	44	42	47
La	49	20	24	20	43	23	85	31	29	18	44	71
Nd	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
Ni	58	30	30	30	29	32	28	30	30	30	28	. 30
Pb	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
MD 50	92	119	12/	89	84	<i>''</i>	64	55	88	141	56	86
Sr.	040	657	5 677	720		794	698	645	0 646	700	696	700
Th	nd	- n.d	n d	n.d	. n.d	n.d	n.d	040 h.d	- n.d	n.d	000	nd -
V	70	59	62	65	55	64	52	53	54	58	58	63
Y	9	12	12	8	11	14	11	10	19	50	13	13
Zn	67	62	59	72	66	68	57	54	67	64	53	68
Zr	73	43	45	45	46	51	39	43	45	47	47	43
Cu	225	110	97	278	315	368	528	446	109	246	98	162
Li	35	77	89	93	83	90	74	72	122	94	98	40
Sample	тозат	TODAT	T235T	T945T	T247T		T471	T481	T531	T541	T791	T811
		12341										
Unit	Trans	Trans	Trans	Trans	Trans		Hb-bear	Hb-bear	Hb-bear	Hb-bear	Hb-bear	Hb-bear
Unit SiO2	Trans	Trans	Trans	Trans 61.85	Trans		Hb-bear	Hb-bear	Hb-bear	Hb-bear	Hb-bear	Hb-bear
Unit SiO2 TiO2	Trans 65.52	63.76	Trans 63.05	Trans 61.85 0.75	Trans 64.69 0.67	nor Sector Sector Sector	Hb-bear 62.31 0.72	Hb-bear 63.77 0.70	Hb-bear 63.96 0.73	Hb-bear 64.42 0.68	Hb-bear 66.16 0.58	Hb-bear 67.04
Unit SiO2 TiO2 Al2O3	Trans 65.52 0.58 15.74	63.76 0.73	Trans 63.05 0.69 16.60	Trans 61.85 0.75 17.45	Trans 64.69 0.67 16.42		Hb-bear 62.31 0.72 17.26	Hb-bear 63.77 0.70 17.22	Hb-bear 63.96 0.73 17.44	Hb-bear 64.42 0.68 16.52	Hb-bear 66.16 0.58 15.72	Hb-bear 67.04 0.57 16.31
Unit SiO2 TiO2 Al2O3 Fe2O3	Trans 65.52 0.58 15.74 1.12	63.76 0.73 17.26 1.03	Trans 63.05 0.69 16.60 1.52	Trans 61.85 0.75 17.45 1.79	Trans 64.69 0.67 16.42 0.77		Hb-bear 62.31 0.72 17.26 1.47	Hb-bear 63.77 0.70 17.22 1.24	Hb-bear 63.96 0.73 17.44 1,47	Hb-bear 64.42 0.68 16.52 1.16	Hb-bear 66.16 0.58 15.72 1.38	Hb-bear 67.04 0.57 16.31 1.06
Unit SiO2 TiO2 Al2O3 Fe2O3 FeO	Trans 65.52 0.58 15.74 1.12 2.29	63.76 0.73 17.26 1.03 2.91	Trans 63.05 0.69 16.60 1.52 2.51	Trans 61.85 0.75 17.45 1.79 2.70	Trans 64.69 0.67 16.42 0.77 2.73		Hb-bear 62.31 0.72 17.26 1.47 2.71	Hb-bear 63.77 0.70 17.22 1.24 2.64	Hb-bear 63.96 0.73 17.44 1.47 2.83	Hb-bear 64.42 0.68 16.52 1.16 2.57	Hb-bear 66.16 0.58 15.72 1.38 1.89	Hb-bear 67.04 0.57 16.31 1.06 2.24
Unit SiO2 TiO2 Al2O3 Fe2O3 FeO MgO	Trans 65.52 0.58 15.74 1.12 2.29 1.47	63.76 0.73 17.26 1.03 2.91 1.56	Trans 63.05 0.69 16.60 1.52 2.51 1.66	Trans 61.85 0.75 17.45 1.79 2.70 1.94	Trans 64.69 0.67 16.42 0.77 2.73 1.53		Hb-bear 62.31 0.72 17.26 1.47 2.71 2.26	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20	Hb-bear 66.16 0.58 15.72 1.38 1.89 1.38	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60
Unit SiO2 TiO2 Al2O3 Fe2O3 FeO MgO CaO	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10	63.76 0.73 17.26 1.03 2.91 1.56 3.45	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86		Hb-bear 62.31 0.72 17.26 1.47 2.71 2.26 3.70	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43	Hb-bear 63.96 0.73 17.44 1,47 2.83 2.28 3.66	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23	Hb-bear 66.16 0.58 15.72 1.38 1.89 1.38 2.74	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66
Unit SiO2 TiO2 Al2O3 Fe2O3 FeO MgO CaO Na2O	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07	Trans           63.76           0.73           17.26           1.03           2.91           1.56           3.45           4.14	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92		Hb-bear 62.31 0.72 17.26 1.47 2.71 2.26 3.70 3.53	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56	Hb-bear 66.16 0.58 15.72 1.38 1.89 1.38 2.74 3.79	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66 3.41
Unit SiO2 TiO2 Al2O3 FeQ MgO CaO Na2O K2O	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43	Trans           63.76           0.73           17.26           1.03           2.91           1.56           3.45           4.14           3.44	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79 3.82	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97		Hb-bear 62.31 0.72 17.26 1.47 2.71 2.26 3.70 3.53 4.16	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23	Hb-bear 66.16 0.59 15.72 1.38 1.89 1.38 2.74 3.79 4.43	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66 3.41 4.42
Unit SiO2 TiO2 Al2O3 FeQ MgO CaO Na2O K2O P2O5	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23	Trans           63.76           0.73           17.26           1.03           2.91           1.56           3.45           4.14           3.44	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91 0.27	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79 3.82 0.28	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26		Hb-bear 62.31 0.72 17.26 1.47 2.71 2.26 3.70 3.53 4.16 0.41	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15 0.38	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30	Hb-bear 66.16 0.59 15.72 1.38 1.89 1.38 2.74 3.79 4.43 0.20	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66 3.41 4.42 0.20
Unit SiO2 TiO2 AI2O3 FeO3 FeO MgO CaO Na2O K2O P2O5 MnO	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.06	63.76 0.73 17.26 1.03 2.91 1.56 3.45 4.14 3.44 0.28 0.07	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91 0.27 0.07	61.85           0.75           17.45           1.79           2.70           1.94           3.78           3.79           3.82           0.28           0.07	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26 0.05		Hb-bear 62.31 0.72 17.26 1.47 2.71 2.26 3.50 3.53 4.18 0.41 0.07	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.06	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15 0.38 0.07	Hb-bear 64.42 0.68 16.52 1.16 2.57 3.23 3.56 4.23 0.30 0.06	Hb-bear 66.16 0.58 15.72 1.38 1.89 1.38 2.74 3.79 4.43 0.20 0.06	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66 3.41 4.42 0.20 * 0.06
Unit SiO2 TiO2 AI2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.06	63.76 0.73 17.26 1.03 2.91 1.56 3.45 4.14 3.44 0.28 0.07	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91 0.27 0.07	61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79 3.82 0.28 0.07	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26 0.05		Hb-bear 62.31 0.72 17.28 1.47 2.71 2.26 3.70 3.53 4.16 0.41 0.07	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.06	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15 0.38 0.07	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30 0.06	Hb-bear 66.16 0.58 15.72 1.38 1.89 1.38 2.74 3.79 4.43 0.20 0.06	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66 3.41 4.42 0.20 4 0.06
Unit SiO2 TiO2 Al2O3 Fe2O3 FeO MgO CeO Na2O K2O P2O5 MnO Ba	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.06	12341 Trans 63.76 0.73 17.26 1.03 2.91 1.56 3.45 4.14 3.44 0.28 0.07	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91 0.27 0.07	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79 3.82 0.28 0.07	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26 0.05		Hb-bear 62.31 0.72 17.26 1.47 2.71 2.26 3.70 3.53 4.16 0.41 0.07 2271	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.06	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15 0.38 0.07 1842	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.26 4.23 0.30 0.06 1809	Hb-bear 66.16 0.58 15.72 1.38 1.38 1.38 2.74 3.79 4.43 0.20 0.06	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66 3.41 4.42 0.20 9 0.06
Unit SiO2 TiO2 Al2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.06	12341 Trans 63.76 0.73 17.26 1.03 2.91 1.56 3.45 4.14 3.45 0.07 1708 53	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 0.27 0.07	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79 3.82 0.28 0.07	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26 0.05		Hb-bear 62.31 0.72 17.26 1.47 2.71 2.26 3.70 3.53 4.16 0.41 0.07 2271 41	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.06 2103 54	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.56 4.15 0.38 0.07 1842 51	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30 0.06	Hb-bear 66.16 0.59 15.72 1.38 1.89 1.38 2.74 3.79 4.43 0.20 0.06	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66 3.41 4.42 0.20 7 0.06
Unit SiO2 TiO2 Al2O3 Fe2O3 FeO MgO CaO Na2O R2O P2O5 MnO Ba Ce Cr	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.06	12341 Trans 63.76 0.73 17.26 1.03 2.91 1.56 3.45 4.14 3.44 0.28 0.07 1708 53 42	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91 0.27 0.07	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79 3.82 0.28 0.07	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26 0.05		Hb-bear 62.31 0.72 17.26 3.70 3.53 4.16 0.41 0.07 2271 41 32	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.06 2103 54 27	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15 0.38 0.07 1842 51 29	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30 0.06 1809 48 31	Hb-bear 66.16 0.58 15.72 1.38 1.89 1.38 2.74 3.79 4.43 0.20 0.06	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.86 3.41 4.42 0.20 4 0.06 2442 73 42
Unit SiO2 TiO2 Al2O3 Fe2O3 FeO MgO CaO Na2O R2O P2O5 MnO Ba Ce Cr La	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.06	12341 Trans 63.76 0.73 17.26 1.03 2.91 1.56 3.45 4.14 3.45 4.14 0.28 0.07 1708 53 42 31	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91 0.27 0.07	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79 3.82 0.28 0.07	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26 0.05		Hb-bear 62.31 0.72 17.26 3.70 3.53 4.16 0.41 0.07 2271 41 32 28	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.06 2103 54 27 36	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15 0.38 0.07 1842 51 29 32	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30 0.06 1809 48 31 37	Hb-bear 66.16 0.58 15.72 1.38 1.89 1.38 2.74 3.79 4.43 0.20 0.06 1480 77 39 52	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.86 3.41 4.42 0.20 4 0.20 4 0.06 2442 73 42 53
Unit SiO2 TiO2 AI2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ca Cr La Nd	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.06 1430 67 40 47 40	12341 Trans 63.76 0.73 17.26 1.03 2.91 1.56 3.45 4.14 3.44 0.28 0.07 1708 53 42 31 n.d	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91 0.27 0.07 1739 67 44 41 n.d	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79 3.82 0.28 0.07 1707 63 51 40 r.d	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26 0.05 1378 37 41 22 n.d		Hb-bear 62.31 0.72 17.26 3.70 3.53 4.16 0.41 0.07 2271 41 32 28 19	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.06 2103 54 27 36 25	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15 0.38 0.07 1842 51 29 32 24	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30 0.06 1809 48 31 37 23	Hb-bear 66.16 0.59 15.72 1.38 1.89 1.38 2.74 3.79 4.43 0.20 0.06 1480 77 39 52 n.d	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66 3.41 4.42 0.20 4.00 2.442 7.3 4.2 5.3 n.d
Unit SiO2 TiO2 Al2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MinO Ba Ca Cr La Nd Ni	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.06 1430 67 40 47 n.d 28	12341 Trans 63.76 0.73 17.26 1.03 2.91 1.56 3.45 4.14 3.45 4.14 3.44 0.28 0.07 1708 53 42 31 n.d 31	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91 0.27 0.07	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79 3.82 0.28 0.07 1707 63 51 40 n.d 34	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26 0.05 1378 37 41 22 n.d 29		Hb-bear 62.31 0.72 17.26 3.70 3.53 4.16 0.41 0.07 2271 41 32 28 19 12	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.08 2103 54 27 36 25 11	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15 0.38 0.07 1842 51 29 32 24 13	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30 0.06 1809 48 31 37 23 13	Hb-bear 66.16 0.59 15.72 1.38 1.89 1.38 2.74 3.79 4.43 0.20 0.06 77 39 52 n.d 28	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66 3.41 4.42 0.20 0.06 2442 73 42 53 n.d 28 24
Unit SiO2 TiO2 Al2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MinO Ba Ca Cr La Nd Ni Pb	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.06 1430 67 40 47 n.d 28 n.d	12341 Trans 63.76 0.73 17.26 1.03 2.91 1.56 3.45 4.14 3.45 4.14 3.44 0.28 0.07 1708 53 42 31 n.d 31 n.d	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91 0.27 0.07 1739 67 44 41 n.d 34 n.d	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79 3.82 0.28 0.07 1707 63 51 40 n.d 34 n.d	Trans 64.69 0.67 16.42 0.77 1.53 2.86 3.92 3.97 0.26 0.05 1378 37 41 22 n.d 29 n.d		Hb-bear 62.31 0.72 17.26 1.47 2.71 2.26 3.70 3.53 4.16 0.41 0.07 2271 41 32 28 19 12 18 8 72	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.06 2103 54 27 36 25 11 21	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15 0.38 0.07 1842 51 29 32 24 13 21	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30 0.06 1809 48 31 37 23 13 21 72	Hb-bear 66.16 0.58 15.72 1.38 1.89 1.38 2.74 4.43 0.20 0.06 1480 77 39 52 n.d 28 n.d	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66 3.41 4.42 0.20 0.06 22442 73 42 53 n.d 28 n.d 28 n.d
Unit SiO2 TiO2 Al2O3 Fe2O3 FeO MgO CeO Na2O K2O P2O5 MinO Ba Ce Cr La Nd Ni Pb Rb	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.06 1430 67 40 47 40 47 40 47 40 47 40 47 62 8 n.d 62	12341 Trans 63.76 0.73 17.26 1.03 2.91 1.56 3.45 4.14 3.45 4.14 3.44 0.28 0.07 1708 53 42 31 n.d 31 n.d 17.6	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.91 0.27 0.07 1739 67 44 41 n.d 34 n.d 88	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.78 3.78 3.78 3.82 0.28 0.07 1707 63 51 40 n.d 34 n.d 75	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26 0.05 1378 37 41 22 n.d 73		Hb-bear 62.31 0.72 17.26 1.47 2.71 2.26 3.70 3.53 4.18 0.41 0.07 2271 41 32 28 19 12 18 72	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.06 2103 54 27 36 25 11 21 76	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15 0.38 0.07 1842 51 29 32 24 13 21 71	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30 0.06 1809 48 31 37 23 13 21 73 5	Hb-bear 66.16 0.58 15.72 1.38 1.89 1.38 2.74 3.79 4.43 0.20 0.06 1480 77 39 52 n.d 28 n.d 83	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66 3.41 4.42 0.20 9 0.06 22442 73 42 53 n.d 28 n.d 28 n.d 5
Unit SiO2 TiO2 Al2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ca Ca Cr La Nd Ni Pb Rb Sc Sr	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.06 1430 67 40 47 n.d 28 n.d 62 6	12341 Trans 63.76 0.73 17.26 1.03 2.91 1.56 3.45 4.14 3.45 4.14 0.28 0.07 1708 53 42 31 n.d 176 6 745	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91 0.27 0.07 1739 67 44 41 n.d 88 6 67	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79 3.82 0.28 0.07 1707 63 51 40 n.d 34 n.d 75 8 8	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26 0.05 1378 37 41 22 n.d 73 7 599		Hb-bear 62.31 0.72 17.26 1.47 2.71 2.26 3.70 3.53 4.16 0.41 0.07 2271 41 32 28 19 12 18 72 18 72 5 5	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.06 2103 54 27 36 25 11 21 76 5 812	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15 0.38 0.07 1842 51 29 32 24 13 21 71 6 803	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30 0.06 1809 48 31 37 23 13 21 73 5 743	Hb-bear 66.16 0.58 15.72 1.38 1.89 1.38 2.74 3.79 4.43 0.20 0.06 1480 77 39 52 n.d 83 6 20	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66 3.41 4.42 0.20 7.006 22442 7.3 42 5.3 n.d 2.8 n.d 6.1 5.5 8.88
Unit SiO2 TiO2 Al2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb Sc Sr Th	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.06 1430 67 40 47 n.d 62 6 69 69 69 69	12341 Trans 63.76 0.73 17.26 1.03 2.91 1.56 3.45 4.14 3.45 4.14 0.28 0.07 1708 53 42 31 n.d 176 6 745 n.d	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91 0.27 0.07 1739 67 44 41 n.d 88 6 751 n.d	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79 3.82 0.28 0.07 1707 63 51 40 n.d 75 8 769 0.4	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.97 0.26 0.05 1378 37 41 22 n.d 73 7 599 n.d		Hb-bear 62.31 0.72 17.26 3.70 3.53 4.16 0.41 0.07 2271 41 32 28 19 12 18 72 5 836 5	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.06 2103 54 27 36 25 11 21 76 5 8122 8	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.56 4.15 0.38 0.07 1842 51 29 32 24 13 21 71 6 803 8	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30 0.06 1809 48 31 37 23 13 21 73 5 743 7	Hb-bear 66.16 0.58 15.72 1.38 1.89 1.38 2.74 3.79 4.43 0.20 0.06 77 39 52 n.d 83 6 6 620 n.d	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66 3.41 4.42 0.20 7 0.06 2442 73 42 53 n.d 61 5 868 n.d
Unit SiO2 TiO2 Al2O3 Fe2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb Sc Sr Th V	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.40 0.23 0.06 1430 67 40 47 n.d 62 6 6 696 n.d 52	12341 Trans 63.76 0.73 17.26 1.03 2.91 1.56 3.45 4.14 3.45 4.14 0.28 0.07 1708 53 42 31 n.d 176 6 745 n.d 176 55	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91 0.27 0.07 1739 67 44 41 n.d 88 6 751 n.d 64	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79 3.82 0.28 0.07 1707 63 51 40 r.d 34 r.d 75 8 769 r.d 72	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26 0.05 1378 37 41 22 n.d 73 7 599 n.d 55		Hb-bear 62.31 0.72 17.26 3.70 3.53 4.16 0.41 0.07 2271 41 32 28 19 12 18 72 5 836 5 68	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.06 2103 54 27 36 25 11 21 76 5 812 8 60	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15 0.38 0.07 1842 51 29 32 24 13 21 71 6 803 8 67	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30 0.06 1809 48 31 37 23 13 21 73 5 743 7 59	Hb-bear 66.16 0.59 15.72 1.38 1.89 1.38 2.74 3.79 4.43 0.20 0.06 1480 77 39 52 n.d 83 6 620 n.d 83 6	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66 3.41 4.42 0.20 7.006 22442 7.3 42 5.3 n.d 61 5 868 n.d 61 5
Unit SiO2 TiO2 AI2O3 Fe2O3 FeO MgO CaO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb Sc Sr Th V Y	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.23 0.26 67 40 47 n.d 62 6 696 n.d 52 6	12341 Trans 63.76 0.73 17.26 1.03 2.91 1.56 3.45 4.14 3.45 4.14 3.45 4.14 0.28 0.07 1708 53 42 31 n.d 176 6 745 n.d 65 745 n.d 65 13	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91 0.27 0.07 1739 67 44 41 n.d 34 n.d 88 6 751 n.d 64 12	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79 3.82 0.28 0.07 1707 63 51 40 n.d 75 8 769 n.d 72 17	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26 0.05 1378 37 41 22 n.d 73 7 599 n.d 55 14		Hb-bear 62.31 0.72 17.26 3.70 3.53 4.16 0.41 0.07 2271 41 32 28 19 12 28 19 12 5 836 5 68 6 8	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.06 2103 54 27 36 25 11 21 76 5 812 8 60 13	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15 0.38 0.07 1842 51 29 32 24 13 21 71 6 803 8 67 14	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30 0.06 1809 48 31 37 23 13 21 73 5 743 7 59 14	Hb-bear 66.16 0.59 15.72 1.38 1.89 1.38 2.74 3.79 4.43 0.20 0.06 1480 77 39 52 n.d 28 n.d 83 6 620 n.d 49 12	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.86 3.41 4.42 0.20 4 0.20 4 0.20 4 0.20 4 0.20 4 0.20 5 3.41 0.20 4 0.50 1.06 2.44 0.57 1.06 2.44 0.57 1.06 2.44 0.50 1.06 2.44 0.50 1.06 2.44 0.20 4 0.06 2.44 0.20 4 0.20 5 0.06 2.55 1.06 0.57 1.06 2.44 0.20 5 0.06 2.56 3.41 0.20 5 0.06 2.56 3.41 0.20 5 0.06 5 1.06 0.57 1.06 0.57 1.06 0.57 1.06 0.57 1.06 0.57 1.06 0.06 5 0.06 5 0.06 1.06 0.06 1.06 0.06 1.06 0.06 1.06 0.06 1.06 0.06 1.06 0.06 1.06 0.06 1.06 0.06 1.06 0.06 1
Unit SiO2 TiO2 Al2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ca Cr La Nd Ni Pb Rb Sc Sr Th V Y Zn	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.06 1430 67 40 47 n.d 28 n.d 62 6 696 n.d 52 11 52	12341 Trans 63.76 0.73 17.26 1.03 2.91 1.56 3.45 4.14 3.45 4.14 3.44 0.28 0.07 1708 53 42 31 n.d 31 n.d 31 745 n.d 6 745 n.d 65 359	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91 0.27 0.07 1739 67 44 41 n.d 34 n.d 88 6 751 n.d 64 12 65	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.79 3.82 0.28 0.07 1707 63 51 40 n.d 75 8 769 n.d 72 17 71	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26 0.05 1378 37 41 22 n.d 73 7 599 n.d 55 14 58		Hb-bear 62.31 0.72 17.26 3.70 3.53 4.16 0.41 0.07 2271 41 32 28 19 12 28 19 12 5 836 5 68 4 14 67	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.08 2103 54 27 36 25 11 21 76 5 812 8 60 13 61	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15 0.38 0.07 1842 51 29 32 24 13 21 71 6 803 8 67 14 74	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30 0.06 1809 48 31 37 23 13 21 73 5 743 7 59 14 83	Hb-bear 66.16 0.59 15.72 1.38 1.89 1.38 2.74 3.79 4.43 0.20 0.06 1480 77 39 52 n.d 28 n.d 83 6 620 n.d 49 12 56	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.86 3.41 4.42 0.20 4.00 2.442 73 42 53 n.d 61 5 868 n.d 55 14 49
Unit SiO2 TiO2 AI2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ca Cr La Nd Ni Pb Rb Sc Sr Th V Y Zn Zr	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.06 1430 67 40 47 n.d 28 n.d 62 6 696 n.d 52 11 52 40	1708 53 17.26 1.03 2.91 1.56 3.45 4.14 3.45 5.3 4.14 3.17 5.3 4.14 3.17 5.3 4.14 3.17 5.3 4.14 3.17 5.3 4.14 3.17 5.3 4.14 3.17 5.3 4.14 3.17 5.3 4.14 3.17 5.3 4.14 3.17 5.3 4.14 5.3 4.14 3.17 5.3 4.14 5.3 4.14 5.3 4.14 5.3 4.14 5.3 4.14 5.3 4.14 5.3 4.14 5.3 4.14 5.3 4.14 5.3 4.14 5.3 4.14 5.3 4.14 5.3 4.14 5.3 4.14 5.3 4.14 5.3 4.14 5.3 5.3 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.80 3.91 0.27 0.07 1739 67 44 41 n.d 34 n.d 88 6 751 n.d 64 12 65 46	Trans 61.85 0.75 17.45 1.94 3.78 3.79 3.82 0.28 0.07 1707 63 51 40 n.d 34 n.d 34 n.d 34 n.d 75 8 769 n.d 72 171 46	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26 0.05 1378 37 41 22 n.d 29 n.d 55 14 55 14 58 43		Hb-bear 62.31 0.72 17.26 1.47 2.71 2.26 3.70 3.53 4.16 0.41 0.07 2271 41 32 28 19 12 18 72 5 836 5 68 14 67 306	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.51 4.32 0.36 0.06 2103 54 27 36 25 11 21 76 5 812 8 60 13 92	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.64 4.15 0.38 0.07 1842 51 29 32 24 13 21 71 6 803 8 67 14 4.74 305	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30 0.06 1809 48 31 37 23 13 21 73 5 743 7 59 14 83 294	Hb-bear 66.16 0.58 15.72 1.38 1.89 1.38 2.74 4.43 0.20 0.06 77 39 52 n.d 28 n.d 83 6 6 620 n.d 49 12 56 56	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.64 3.41 4.42 0.20 7.3 4.2 7.3 4.2 5.3 n.d 2.8 n.d 5.5 868 n.d 5.5 14 4.9 4.3
Unit SiO2 TiO2 Al2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MinO Ba Ca Ca P2O5 MinO Ba Ca Ca Ca Sa Th V V Y Zn Zr Cu	Trans 65.52 0.58 15.74 1.12 2.29 1.47 3.10 4.07 3.43 0.23 0.06 1430 67 40 47 40 47 40 47 40 47 40 47 40 47 40 47 52 11 52 40 257	1708 53 17.26 1.03 2.91 1.56 3.45 4.14 3.45 4.14 3.45 4.14 3.45 4.14 3.44 0.28 0.07 1708 53 42 31 n.d 31 n.d 31 n.d 55 55 203	Trans 63.05 0.69 16.60 1.52 2.51 1.66 3.50 3.91 0.27 0.07 1739 67 44 41 n.d 88 67 751 n.d 84 12 85 46 238	Trans 61.85 0.75 17.45 1.79 2.70 1.94 3.78 3.78 3.79 3.82 0.28 0.07 1707 63 51 40 n.d 75 8 769 n.d 72 17 71 46 177	Trans 64.69 0.67 16.42 0.77 2.73 1.53 2.86 3.92 3.97 0.26 0.05 		Hb-bear 62.31 0.72 17.26 1.47 2.71 2.26 3.70 3.53 4.18 0.41 0.07 2271 41 32 28 19 12 18 72 18 72 5 836 5 68 14 67 306 n.d	Hb-bear 63.77 0.70 17.22 1.24 2.64 2.04 3.43 3.51 4.32 0.36 0.06 2103 54 27 36 25 11 21 76 5 812 8 60 13 61 292 n.d	Hb-bear 63.96 0.73 17.44 1.47 2.83 2.28 3.66 3.54 4.15 0.38 0.07 1842 51 29 32 24 13 21 71 6 803 8 67 14 74 305 n.d	Hb-bear 64.42 0.68 16.52 1.16 2.57 2.20 3.23 3.56 4.23 0.30 0.06 1809 48 31 37 23 13 21 73 5 743 7 59 14 83 294 n.d	Hb-bear 66.16 0.58 15.72 1.38 1.89 1.38 2.74 3.79 4.43 0.20 0.06 77 39 52 n.d 28 n.d 83 6 620 n.d 49 12 56 56 155	Hb-bear 67.04 0.57 16.31 1.06 2.24 1.60 2.66 3.41 4.42 0.20 7.3 42 7.3 42 7.3 42 5.3 n.d 28 n.d 61 5 868 8 n.d 55 14 43 110

Sample Unit	T831 Hb-bear	T861 Hb-bear	T881 Hb-bear	T891 Hb-bear	T901 Hb-bear	T981 Hb-bear	T991 Hb-bear	T1001 Hb-bear	T1041 Hb-bear	T1051 Hb-bear	T1061 Hb-bear	T21 Hb-bear
SiO2	64.05	61.83	65.56	63.20	63.08	63.98	64.08	63.72	62.95	64.78	62.93	64.21
TiO2	0.69	0.81	0.70	0.73	0.66	0.76	0.87	0.71	0.67	0.73	0.73	0.54
AI2O3	15.92	16.71	16.63	16.68	16.23	16.47	17.18	15.99	17.10	16.24	16.54	16.55
Fe2O3	1.26	1.76	1.44	1.73	1.58	1.54	1.41	1.59	1.62	1.82	1.81	0.93
FeO	2.79	3.07	2.83	2.38	2.29	2.62	2.25	2.42	2.32	2.33	2.41	2.37
MgO	2.05	2.49	1.82	1.98	1.58	1.83	1.99	1./1	1.63	1./1	1.75	2.52
Na2O	3.51	4.05	3.08	2.03	3.43	3.53	4.04	3.40	3.52	3.07	3.50	3.42
K2O	4.27	3.50	4.00	4.61	4 00	3.79	4.31	3.83	4.14	4.72	4 15	4 25
P2O5	0.25	0.28	0.28	0.26	0.24	0.27	0.28	0.26	0.26	0.25	0.25	0.30
MnO	0.07	0.07	0.06	0.07	0.06	0.07	0.08	0.07	0.07	0.07	0.07	0.07
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Ba	2142	1889	2111	2093	1921	1680	2189	1538	1976	2113	1974	1879
Ce	72	57	59	67	62	59	79	63	66	64	72	69
Cr	51	60	42	44	48	44	49	46	45	41	44	73
La	46	33	39	45	40	39	52	39	44	40	44	36
Nd	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
Ni	35	40	29	28	28	31	31	31	29	30	30	. 40
Pb	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	. n.d	n.d
HD Ca	53	55	52	84	50	91	11	50	52	50	51	89
Sr	836	9	010	823	860	742	763	702	876	819	836	1192
Th	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
v	70	85	68	64	62	65	69	63	63	66	69	63
Y	16	18	12	16	13	1.5	16	13	13	15	16	· 16 ·
Zn	66	74	65	58	60	59	54	64	56	66	65	57
Zr	51	57	54	60	53	52	57	55	55	63	48	200
Cu	124	101	124	90	133	113	141	99	90	85	125	n.đ
Li	28	36	24	53	20	108	64	80	42	30	31	n.d
Sample	T41	T61	T121	T161	T191	T201	T26A	T231	T24AI	T36I	T38	T39AI
Sample Unit	T41 Hb-bear	T61 Hb-bear	T121 Hb-bear	T161 Hb-bear	T191 Hb-bear	T201 Hb-bear	T26A Hb-bear	T231 Hb-bear	T24Al Hb-bear	T36I Hb-bear	T38I Hb-bear	T39Al Hb-bear
Sample Unit SiO2	T41 Hb-bear	T61 Hb-bear 67.57	T121 Hb-bear	T161 Hb-bear	T191 Hb-bear 64.27	T201 Hb-bear 71.28	T26A Hb-bear 64.22	T231 Hb-bear	T24Al Hb-bear	T36I Hb-bear	T38I Hb-bear 61.97	T39AI Hb-bear
Sample Unit SiO2 TiO2	T41 Hb-bear 68.58 0.35	T61 Hb-bear 67.57 0.55	T121 Hb-bear 65.49 0.69	T161 Hb-bear 69.54 0.46	T191 Hb-bear 64.27 0.65	T201 Hb-bear 71.28 0.46	T26A Hb-bear 64.22 0.72	T231 Hb-bear 62.39 0.72	T24Al Hb-bear 68.07 0.52	T36i Hb-bear 60.4 0.81	T381 Hb-bear 61.97 0.76	T39Ai Hb-bear 60.05 0.8
Sample Unit SiO2 TiO2 Al2O3	T41 Hb-bear 68.58 0.35 14.77	T61 Hb-bear 67.57 0.55 16.08	T121 Hb-bear 65.49 0.69 16.78	T161 Hb-bear 69.54 0.46 15.2	T191 Hb-bear 64.27 0.65 16.36	T201 Hb-bear 71.28 0.46 15.4	T26A Hb-bear 64.22 0.72 16.74	T231 Hb-bear 62.39 0.72 16.18	T24Al Hb-bear 68.07 0.52 15.33	T36I Hb-bear 60.4 0.81 16.9	T381 Hb-bear 61.97 0.76 17.51	T39Al Hb-bear 60.05 0.8 18,46
Sample Unit SiO2 TiO2 Al2O3 Fe2O3	T41 Hb-bear 68.58 0.35 14.77 0.36	T61 Hb-bear 67.57 0.55 16.08 1.09	T121 Hb-bear 65.49 0.69 16.78 1.61	T161 Hb-bear 69.54 0.46 15.2 0.75	T191 Hb-bear 64.27 0.65 16.36 1.28	T201 Hb-bear 71.28 0.46 15.4 0.7	T26A Hb-bear 64.22 0.72 16.74 1.53	T231 Hb-bear 62.39 0.72 16.18 1.57	T24Al Hb-bear 68.07 0.52 15.33 1.06	T36I Hb-bear 60.4 0.81 16.9 1.3	T381 Hb-bear 61.97 0.76 17.51 0.99	T39Al Hb-bear 60.05 0.8 18.46 1.38
Sample Unit SiO2 TiO2 Al2O3 Fe2O3 Fe0	T41 Hb-bear 68.58 0.35 14.77 0.36 1.47	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32	T24Ai Hb-bear 68.07 0.52 15.33 1.06 1.59	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46	T381 Hb-bear 61.97 0.76 17.51 0.99 3.33	T39AI Hb-bear 60.05 0.8 18.46 1.38 3.41
Sample Unit SiO2 TiO2 Al2O3 Fe2O3 Fe0 MgO	T41 Hb-bear 68.58 0.35 14.77 0.36 1.47 1.74	T61 Hb-bsar 67.57 0.55 16.08 1.09 1.64 1.47	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85	T181 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2	T24Ai Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12	T381 Hb-bear 61.97 0.76 17.51 0.99 3.33 2.76	T39Ai Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CeO	T41 Hb-bear 68.58 0.35 14.77 0.36 1.47 1.74 2.36	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09	T201 Hb-bear 71.28 0.48 15.4 0.7 1.52 1.11 2.1	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29	T24Ai Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17	T381 Hb-bear 61.97 0.76 17.51 0.99 3.33 2.76 4.17	T39Ai Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71
Sample Unit SiO2 TiO2 Al2O3 FeO MgO CeO Na2O	T41 Hb-bear 68.58 0.35 14.77 0.36 1.47 1.74 2.36 3.77	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21	T24Ai Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.92	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44	T38I Hb-bear 61.97 0.76 17.51 0.99 3.33 2.76 4.17 3.5	T39Al Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.61
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CeO Na2O K2O F2O5	T41 Hb-bear 68.58 0.35 14.77 0.36 1.47 1.74 2.36 3.77 3.9 0.2	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21 0.27	T24Ai Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54	T381 Hb-bear 61.97 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42	T39Ai Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.61 3.42 0.32
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CaO Na2O K2O K2O F2O5 MnO	T41 Hb-bear 68.58 0.35 14.77 0.36 1.47 1.74 2.36 3.77 3.9 0.2 0.04	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21 0.27 0.07	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16 0.06	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07	T381 Hb-bear 61.97 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07	T39Ai Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.61 3.42 0.32
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CaO Na2O K2O P2O5 MnO	T41 Hb-bear 68.58 0.35 14.77 0.36 1.47 1.74 2.36 3.77 3.9 0.2 0.04	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06	T181 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21 0.27 0.07	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16 0.06	T36i Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07	T381 Hb-bear 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07	T39Ai Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 3.41 3.61 3.42 0.32 0.08
Sample Unit SiO2 TiO2 AI2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO	T41 Hb-bear 68.58 0.35 14.77 0.36 1.47 1.74 2.36 3.77 3.9 0.2 0.04	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06	T181 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21 0.27 0.07	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16 0.06	T36i Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07	T381 Hb-bear 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07	T39Ai Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.61 3.42 0.32 0.08
Sample Unit SiO2 TiO2 AI2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO	T41 Hb-bear 68.58 0.35 14.77 0.36 1.47 1.74 2.36 3.77 3.9 0.2 0.04	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06	T181 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21 0.27 0.07	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16 0.06	T36i Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07	T381 Hb-bear 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07	T39Ai Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.61 3.42 0.32 0.08
Sample Unit SiO2 TiO2 AI2O3 Fe2O3 FeO Na2O K2O P2O5 MnO Ba Ca	T41 Hb-bear 68.58 0.35 14.77 1.74 2.36 3.77 3.9 0.2 0.04	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.67 4.21 0.27 0.07	T24AI Hb-bear 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16 0.06	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07	T381 Hb-bear 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07	T39AI Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 3.41 3.41 3.41 3.61 3.42 0.32 0.08
Sample Unit SiO2 TiO2 Al2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Ce Cr	T41 Hb-bear 68.58 0.35 14.77 1.74 2.36 3.77 3.9 0.2 0.04	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06 1212 64	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06 2036 54	T181 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05	T191 Hb-bear 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21 0.27 0.07	T24AI Hb-bear 0.52 15.33 1.06 1.59 1.43 2.16 3.66 3.66 4.83 0.16 0.06	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07 1179 66	T381 Hb-bear 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07 2440 61	T39AI Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.61 3.42 0.32 0.08
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La	T41 Hb-bear 68.58 0.35 14.77 1.74 2.36 3.77 3.9 0.2 0.04	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06 1212 64 15	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06 2036 54 26 54 26 54	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05	T26A Hb-bear 64.22 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.67 4.21 0.27 0.07 1543 57 19 31	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16 0.06	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07 1179 66 59 37	T381 Hb-bear 0.76 17.51 0.99 3.33 2.76 4.17 3.8 0.42 0.07 2440 61 537	T39AI Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.61 3.42 0.32 0.08
Sample Unit SiO2 TiO2 AI2O3 Fe2O3 Fe2O MgO CaO Na2O P2O5 MnO Ba Ce Cr La Nd	T41 Hb-bear 68.58 0.35 14.77 1.74 2.36 3.77 3.9 0.2 0.04	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06 1212 64 15 41 15 41 24	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06 2036 54 26 34 26 34	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05 923 73 18 43 27	T26A Hb-bear 64.22 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07 1437 52 23 36 23	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21 0.27 0.07 1543 57 19 31 25	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16 0.06 1173 73 20 43 29	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07 1179 66 59 37 30	T381 Hb-bear 61.97 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07 2440 61 55 37 25	T39AI Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.42 0.32 0.08
Sample Unit SiO2 TiO2 AI2O3 Fe2O3 Fe2O3 Fe2O Na2O R2O R2O R2O R2O5 MnO Ba Ce Cr La Nd Ni	T41 Hb-bear 68.58 0.35 14.77 1.74 2.36 3.77 3.9 0.2 0.04 1255 53 46 26 22 24	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06 1212 64 15 41 24 10	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06 2036 54 26 34 26 34 23 12	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05 923 73 18 43 27 8	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07 1437 52 23 36 23 36 23 36	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21 0.27 0.07 1543 57 19 31 25 10	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16 0.06 1173 73 20 43 29 7	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07 1179 66 59 37 30 20	T381 Hb-bear 61.97 0.76 17.51 0.99 3.33 2.76 4.17 3.8 0.42 0.07 2440 61 55 37 25 21	T39Ai Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.41 4.71 3.42 0.32 0.08
Sample Unit SiO2 TiO2 AI2O3 Fe2O3 Fe2O3 CaO Na2O P2O5 MnO Ba Ca Ca Cr La Nd Ni Pb	T41 Hb-bear 68.58 0.35 14.77 1.74 2.36 3.77 3.9 0.2 0.04 1255 53 46 26 22 24 18	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06 1212 64 15 41 24 10 22	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06 2036 54 26 34 26 34 21 20	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05 923 73 18 43 27 8 22	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07 1437 52 23 36 23 36 23 36 23 36 20	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21 0.27 0.07 1543 57 19 31 25 10 19	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.18 0.06 1173 73 20 43 29 7 23	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07 1179 66 59 37 30 20 18	T381 Hb-bear 61.97 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.6 0.42 0.07 2440 61 55 37 25 21 18	T39AI Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.41 4.71 3.42 0.32 0.08
Sample Unit SiO2 TiO2 AI2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb	T41 Hb-bear 68.58 0.35 14.77 1.74 2.36 3.77 3.9 0.2 0.04 1255 53 46 26 22 24 18 83	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06 1212 64 15 41 24 15 41 24 10 22 90	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06 2036 54 26 34 23 12 20 76	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05 923 73 18 43 27 8 22 92	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07 1437 52 23 36 23 36 23 36 20 84	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21 0.27 0.07 1543 57 19 31 25 10 19 83	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16 0.06 1173 73 20 43 29 7 23 93	T36i Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07 1179 66 59 37 30 20 18 74	T381 Hb-bear 61.97 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07 2440 61 55 37 25 21 18 73	T39AI Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.41 4.71 3.42 0.32 0.08 1907 62 58 37 27 21 19 74
Sample Unit SiO2 TiO2 AI2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ca Ca Cr La Nd Ni Pb Fb Sc	T41 Hb-bear 68.58 0.35 14.77 0.36 1.47 1.74 2.36 3.77 3.9 0.2 0.04 1255 53 46 26 22 24 18 83 2	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06 1212 64 15 41 24 10 22 90 4	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06 2036 54 26 34 23 12 20 76 5	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08 1437 67 24 40 26 10 21 90 4	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05 923 73 18 43 27 8 22 92 3	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07 1437 52 23 36 23 10 20 84 5	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21 0.27 0.07 1543 57 19 31 25 10 19 83 4	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16 0.06 1173 73 20 43 29 7 23 93 1	T36i Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07 1179 66 59 37 30 20 18 74 8	T381 Hb-bear 61.97 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07 2440 61 55 37 25 21 18 73 5	T39Ai Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.61 3.42 0.32 0.08 1907 62 58 37 27 21 19 74 9
Sample Unit SiO2 TiO2 AI2O3 Fe2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ca Ca Ca Ca Ca Ca Ca Ca Ca Ca Ca Ca Ca	T41 Hb-bear 68.58 0.35 14.77 0.36 1.47 1.74 2.36 3.77 3.9 0.2 0.04 1255 53 46 26 22 24 18 83 2 822	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06 1212 64 15 41 24 10 22 90 4	T121 Hb-bear 65.49 0.69 16.78 1.61 1.85 3.32 3.48 4.42 0.21 0.06 2036 54 26 34 23 12 20 76 5 749	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08 1437 67 24 40 26 10 21 90 4 621	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05 923 73 18 43 27 8 292 3 383	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07 1437 52 23 36 23 10 20 84 5 634	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.67 4.21 0.27 0.07 1543 57 19 31 25 10 19 83 4 654	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16 0.06 11173 73 20 43 29 7 23 93 1 478	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07 1179 66 59 37 30 20 18 74 8 871	T381 Hb-bear 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07 2440 61 55 37 25 21 18 73 5 934	T39AI Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 3.41 3.41 3.41 3.41 3.61 3.42 0.32 0.08 1907 62 58 37 27 21 19 74 9 74 9 977
Sample Unit SiO2 TiO2 Al2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Bb Sc Sr Th	T41 Hb-bear 68.58 0.35 14.77 1.74 2.36 3.77 3.9 0.2 0.04 1255 53 46 26 22 24 18 83 2 822 9	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06 1212 64 15 41 24 10 22 90 04 494 7	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06 54 2036 54 20 74 5 749 6	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.6 0.11 0.05 1034 77 17 45 31 8 23 96 2 400 7	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08 1437 67 24 40 26 10 21 90 90 4 621 6	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05 923 73 18 43 27 8 22 92 3 383 8 6	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07 1437 52 23 36 23 10 20 84 5 634 4	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.67 4.21 0.27 0.07 1543 57 19 31 25 10 19 83 4 654 57	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 3.66 4.83 0.16 0.06 1173 73 20 43 29 7 23 93 1 478 9	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07 1179 66 59 37 30 20 18 74 8 871 9	T381 Hb-bear 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07 2440 61 55 37 25 21 18 73 5 934 7	T39AI Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.61 3.42 0.32 0.08 1907 62 58 37 27 21 19 74 9 77 7
Sample Unit SiO2 TiO2 Al2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba C2 Cr La Nd Ni Pb Rb Sc Sr Th V V	T41 Hb-bear 68.58 0.35 14.77 1.74 2.36 3.9 0.2 0.04 1255 53 46 26 22 24 18 83 2 822 9 42	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06 1212 64 15 41 124 10 22 90 04 494 7 45	T121 Hb-bear 65.49 0.69 16.78 3.32 3.48 4.42 0.21 0.06 54 2036 54 20 6 5 749 6 6 6 6	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05 1034 77 17 45 31 8 23 96 2 400 7 35	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08 1437 67 24 40 26 10 21 90 91 91 92 4 6 6 6 0 4	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05 923 73 18 43 27 8 22 92 3 383 8 3383 8 33	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07 1437 52 23 36 23 10 20 84 5 634 4 5	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21 0.27 0.07 1543 57 19 83 31 25 10 19 83 4 654 5 67	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 3.66 4.83 0.16 0.06 1173 73 20 43 29 7 23 93 1 478 9 42	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07 1179 66 59 37 30 20 18 74 8 871 9 86	T381 Hb-bear 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07 2440 61 55 37 25 21 18 73 5 934 7 7 76	T39AI Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.61 3.42 0.32 0.08 1907 62 58 37 27 21 19 74 9 977 7 87
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb Rb Sc Sr Th V Y Y	T41 Hb-bear 68.58 0.35 14.77 1.74 2.36 3.77 3.9 0.2 0.04 1255 53 46 22 24 18 83 2 24 18 83 2 822 9 42 9	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06 1212 64 15 4.31 22 90 4 90 4 94 7 45 120	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06 54 2036 54 26 34 26 34 26 34 26 5 749 6 6 6 8 8 5	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05 1034 77 17 45 31 8 23 96 2 400 7 35 128	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08 1437 67 24 40 26 10 21 90 4 621 6 60 11 1 6	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05 923 73 18 43 27 8 22 92 3 383 8 383 8 33 8 33 8	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07 1437 52 23 36 23 10 20 84 5 634 4 65 10 20	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.67 4.21 0.27 0.07 1543 57 19 31 25 10 19 83 4 55 10 19 83 4 55 67 12 2 5 7	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16 0.06 11773 73 20 43 29 7 23 93 1 478 9 42 13 44	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07 1179 66 59 37 30 20 18 74 8 871 9 86 21 77	T381 Hb-bear 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07 2440 61 55 37 25 21 18 73 5 934 7 76 17 76	T39AI Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.61 3.42 0.32 0.08 1907 62 58 37 27 21 19 74 9 9 977 7 87 19 77
Sample Unit SiO2 AI2O3 FeO MgO CaO Na2O Na2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Rb Sc Sr Th V Y Zn Zr	T41 Hb-bear 68.58 0.35 14.77 1.74 2.36 3.7 0.2 0.2 0.04 1255 53 46 26 22 24 18 83 2 2 82 24 18 83 2 9 42 9 26 29	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06 1212 64 15 4.31 0.2 0.06 1212 64 15 41 10 22 90 4 90 4 90 4 94 90 21 2 60 20 20 20 20 20 20 20 20 20 20 20 20 20	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06 2036 54 26 34 26 34 26 34 26 34 26 34 26 34 26 34 26 34 26 34 20 76 5 749 6 6 6 8 5 5 288	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05 1034 77 17 45 31 8 23 96 2 400 7 35 12 35 12 31	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08 1437 67 24 40 26 10 21 90 4 621 6 60 11 551	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05 923 73 18 4.3 27 8 22 92 3 822 92 3 833 8 3383 8 33 8 30 204	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07 1437 52 23 36 20 84 5 634 4 65 10 634 4 65	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21 0.27 0.07 1543 57 19 31 25 10 19 83 4 654 5 67 12 654 5 67	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16 0.06 1173 73 20 43 29 7 23 93 1 478 9 42 13 44 220	T36I Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07 1179 66 59 37 30 20 18 74 8 871 9 86 21 77 288	T381 Hb-bear 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07 2440 61 55 37 25 21 18 73 5 934 7 76 17 69 255	T39AI Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.42 0.32 0.08 1907 62 58 37 27 21 19 74 9 77 87 19 74 9 77 87
Sample Unit SiO2 AI2O3 Fe2O3 Fe2O Na2O Na2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Fb Fb Sc Sr Th V Y Zn Zr Cu	T41 Hb-bear 68.58 0.35 14.77 1.74 2.36 3.77 3.9 0.2 0.04 1255 53 46 26 22 24 18 83 2 822 24 18 83 2 822 9 42 9 42 9 26 139 0,0	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06 1212 64 15 41 10 22 90 4 4 90 4 4 90 4 4 90 4 5 12 12 60 213 n.d	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06 54 2036 54 26 34 26 34 26 34 20 76 5 749 6 6 6 8 59 288 8 n.d	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05 1034 77 17 45 31 8 23 96 2 400 7 35 12 38 178 8 7	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08 1437 67 24 40 26 10 21 90 4 21 90 4 6 10 21 90 4 6 11 56 6 0 11 56	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05 923 73 18 43 27 8 22 92 3 8822 92 3 883 8 33 8 39 204 n.d	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07 1437 52 23 36 20 84 5 634 4 5 634 4 65 10 66 8278 n.d	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21 0.27 0.07 1543 57 19 31 25 10 19 83 4 65 67 12 62 258 n.d	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16 0.06 1173 73 20 43 29 7 23 93 1 478 9 42 13 44 220 n.d	T36i Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.46 3.72 0.54 0.07 1179 66 59 37 30 20 18 74 8 871 9 86 21 77 288 n.d	T381 Hb-bear 61.97 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07 2440 61 55 37 25 21 18 73 5 934 7 76 17 69 34 7 76 17 69 55 5 n.d	T39AI Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.42 0.32 0.08 1907 62 58 37 27 21 19 74 9 977 7 87 19 77 87 19 77 87 19 77 87 19
Sample Unit SiO2 TiO2 AI2O3 Fe2O3 Fe2O Na2O Na2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Fb Sc Sr Th V Y Zn Zr Cu Li	T41 Hb-bear 68.58 0.35 14.77 1.74 2.36 3.77 3.9 0.2 0.04 1255 53 46 26 224 18 83 2 822 24 18 83 2 822 8 9 42 9 42 9 9 42 9 9 26 139 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	T61 Hb-bear 67.57 0.55 16.08 1.09 1.64 1.47 2.51 3.68 4.31 0.2 0.06 1212 64 15 41 22 90 4 499 7 5 12 60 213 n.d 0.213 n.d	T121 Hb-bear 65.49 0.69 16.78 1.61 2.31 1.85 3.32 3.48 4.42 0.21 0.06 54 2036 54 26 34 26 34 26 34 20 76 5 749 6 6 6 8 59 288 8 n.d n.d	T161 Hb-bear 69.54 0.46 15.2 0.75 1.45 1.06 2.1 3.62 4.96 0.11 0.05 1034 77 17 45 31 8 23 96 2 400 7 35 12 38 178 8 7	T191 Hb-bear 64.27 0.65 16.36 1.28 2.23 1.92 3.09 3.77 4.31 0.21 0.08 1437 67 24 40 26 10 21 90 4 10 21 90 4 10 21 90 4 11 56 10 6 0 11 56 10 6 10 10 10 10 10 10 10 10 10 10 10 10 10	T201 Hb-bear 71.28 0.46 15.4 0.7 1.52 1.11 2.1 3.63 4.77 0.14 0.05 923 73 18 43 27 8 22 92 3 8 22 92 3 8 383 8 33 8 39 204 n.d n.d	T26A Hb-bear 64.22 0.72 16.74 1.53 2.4 2.11 3.25 3.77 4.02 0.3 0.07 1437 52 23 36 23 36 23 36 23 36 23 36 20 84 5 634 4 65 10 66 8278 n.d n.d	T231 Hb-bear 62.39 0.72 16.18 1.57 2.32 2 3.29 3.67 4.21 0.27 0.07 1543 57 19 31 25 10 19 83 4 83 4 85 67 12 62 258 8 n.d n.d	T24AI Hb-bear 68.07 0.52 15.33 1.06 1.59 1.43 2.16 3.66 4.83 0.16 0.06 1173 73 20 43 29 7 23 93 1 478 9 42 13 44 20 0 n.d 100 100 100 100 100 100 100 100 100 10	T36i Hb-bear 60.4 0.81 16.9 1.3 3.46 3.12 4.17 3.44 3.72 0.54 0.07 1179 66 59 37 30 20 18 74 8 871 9 86 21 77 288 n.d n.d	T381 Hb-bear 61.97 0.76 17.51 0.99 3.33 2.76 4.17 3.5 3.8 0.42 0.07 2440 61 55 37 25 21 18 73 5 934 7 76 17 69 255 n.d n.d	T39Ai Hb-bear 60.05 0.8 18.46 1.38 3.41 3.41 4.71 3.42 0.32 0.08 1907 62 58 37 27 21 19 74 9 977 7 87 19 77 87 19 77 87 19 77 87 19 77 87

Sample Unit	T39BI Hb-bear	T40I Hb-bear	T256I Hb-bear	T45l Hb-bear	T1071 Hb-bear	T108l Hb-bear	T1091 Hb-bear	T112I Hb-bear	T117I Hb-bear	T119  Hb-bear	T1201 Hb-bear	T1241 Hb-bear
SiO2	59.32	61.72	63.01	65.05	64.36	62.84	64.34	64.64	64.1	62.14	62.75	63.09
TiO2	0.86	0.72	0.73	0.6	0.74	0.71	0.75	0.55	0.77	0.78	0.77	0.71
AI2O3	18.26	17.86	17.11	16.59	16.86	17	16.55	16.76	16.73	16.45	16.94	17.18
Fe2O3	1.72	1.5	1.69	0.86	1.82	1.84	1./5	1.28	1.8	1.76	1.88	1.67
MoO	3.34	292	1 82	1.89	1.8	1.77	1.77	1.67	1.85	1.97	2.71	1.82
CaO	4.76	4.23	3.62	3.17	3.55	3.37	3.44	3.28	3.51	3.63	3.75	3.49
Na2O	3.5	3.47	3.93	3.38	3.79	3.9	3.91	4.09	3.95	4.14	4.06	4.35
K2O	3.5	3.17	4.14	4.26	4.1	4.18	4.14	3.89	3.67	4	3.92	3.89
P2O5	0.41	0.3	0.27	0.21	0.27	0.25	0.26	0.26	0.26	0.27	0.28	0.25
MinO	0.08	0.07	0.07	0.06	0.07	0.07	0.07	0.06	0.06	0.07	0.07	0.07
										•		
Ba	1890	1697	2017	1958	1836	1938	1870	1756	1742	2024	1895	2027
Ce	45	46	67	48	77	69	67	40	65	66	64	41
UT Is	29	30	43	34	44 50	44	47	43	49	49	40	42
Nd	23	18	n.d	19	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
Ni	21	17	31	13	31	29	30	29	30	31	31	. 30
Pb	17	18	n.d	20	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
Rb	73	79	66	72	53	56	64	71	69	79	65	97
Sc	7	6	7	. 4	8	7	7	11	6	8	8	8
Sr	971	921	880	764	811	832	834	703	909	881	892	860
UN .	8	8	n.a 71	9 54	- n.a 70	- n.a	n.a 88	n.a 62	75	73	. n.c 74	n.a 67
Ŷ	20	13	16	. 9	16	15	15	19	13	16	9	-11
Zn	81	78	66	59	65	55	64	65	62	64	63	62
Zr	309	297	52	263	53	60	66	56	58	55	48	52
Cu	n.d	n.d	119	n.d	82	64	86	111	70	79	74	104
Li	n.d	n.d	41	n.d	50	35	31	42	29	58	38	26
Sample	T130I	T131I	T1321	T134I	T2791	T1791	T183I	T184I	T185I	T1861	T1881	T1901
Sample Unit	T130I Hb-bear	T131I Hb-bear	T132I Hb-bear	T134I Hb-bear	T2791 Hb-bear	T179i Hb-bear	T183I Hb-bear	T184i Hb-bear	T185I Hb-bear	T186I Hb-bear	T188i Hb-bear	T1901 Hb-bear
Sample Unit SiO2	T130I Hb-bear 62.32	T1311 Hb-bear 62.00	T132I Hb-bear 62.78	T134I Hb-bear 62.39	T2791 Hb-bear 62.16	T179i Hb-bear 66.74	T183I Hb-bear 64.36	T184i Hb-bear 63.66	T185I Hb-bear 66.95	T186  Hb-bear 66.01	T1881 Hb-bear 68.98	T190! Hb-bear 65.22
Sample Unit SiO2 TiO2	T130I Hb-bear 62.32 0.72	T1311 Hb-bear 62.00 0.78	T1321 Hb-bear 62.78 0.73	T134I Hb-bear 62.39 0.80	T2791 Hb-bear 62.16 0.87	T179i Hb-bear 66.74 0.50	T183I Hb-bear 64.36 0.51	T184i Hb-bear 63.66 0.56	T185I Hb-bear 66.95 0.50	T1861 Hb-bear 66.01 0.47	T1881 Hb-bear 68.98 0.44	T190! Hb-bear 65.22 0.52
Sample Unit SiO2 TiO2 Al2O3	T130I Hb-bear 62.32 0.72 16.84	T1311 Hb-bear 62.00 0.78 16.87	T1321 Hb-bear 62.78 0.73 17.61	T134I Hb-bear 62,39 0.80 17.01	T2791 Hb-bear 62.16 0.87 17.72	T179i Hb-bear 66.74 0.50 15.23	T183I Hb-bear 64.36 0.51 16.43	T184i Hb-bear 63.66 0.56 16.11	T185I Hb-bear 66.95 0.50 14.94	T1861 Hb-bear 66.01 0.47 15.66	T1881 Hb-bear 68.98 0.44 14.65	T190! Hb-bear 65.22 0.52 15.16
Sample Unit SiO2 TiO2 Al2O3 Fe2O3	T130I Hb-bear 62.32 0.72 16.84 1.82	T131I Hb-bear 62.00 0.78 16.87 1.61	T132I Hb-bear 62.78 0.73 17.61 1.61	T134I Hb-bear 62.39 0.80 17.01 1.81	T2791 Hb-bear 62.16 0.87 17.72 1.49 2.70	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11	T184I Hb-bear 63.66 0.56 16.11 1.40 2.36	T185I Hb-bear 66.95 0.50 14.94 1.20 2.02	T1861 Hb-bear 66.01 0.47 15.66 1.14	T1881 Hb-bear 68.98 0.44 14.65 1.20	T190! Hb-bear 65.22 0.52 15.16 1.21
Sample Unit SIO2 TIO2 AI2O3 Fe2O3 FeO MoO	T1301 Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93	T131I Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98	T132I Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24	T184I Hb-bear 63.66 0.56 16.11 1.40 2.36 2.44	T185I Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04	T186i Hb-bear 66.01 0.47 15.66 1.14 1.94 2.07	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74	T190I Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28
Sample Unit SIO2 TIO2 AI2O3 FeO MgO CaO	T1301 Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26	T179 Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 3.05	T184i Hb-bear 63.66 0.56 16.11 1.40 2.36 2.44 3.40	T1851 Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80	T186/ Hb-bear 66.01 0.47 15.66 1.14 1.94 2.07 2.65	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31	T1901 Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72
Sample Unit SiO2 TiO2 Al2O3 FeO MgO CaO Na2O	T130I Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.30	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 3.05 3.91	T184i Hb-bear 63.66 0.56 16.11 1.40 2.36 2.44 3.40 4.13	T1851 Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80 3.98	T186/ Hb-bear 66.01 0.47 15.66 1.14 1.94 2.07 2.65 3.96	T188 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95	T1901 Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CaO Na2O K2O	T130I Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80	T132! Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.30 2.74	T179 Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 3.05 3.91 4.24	T184I Hb-bear 63.66 0.56 16.11 1.40 2.36 2.44 3.40 4.13 4.17	T1851 Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80 3.98 4.29	T1861 Hb-bear 66.01 0.47 15.66 1.14 1.94 2.07 2.65 3.96 4.31	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95 3.97	T1901 Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07
Sample Unit SiO2 TiO2 AI2O3 FeO AI2O3 FeO MgO CaO Na2O K2O P2O5	T1301 Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28	T1341 Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91 0.29	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.30 2.74 0.32	T1791 Hb-bear 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53 0.23	T1831 Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 3.05 3.91 4.24 0.24	T1841 Hb-bear 63.66 0.56 16.11 1.40 2.36 2.44 3.40 4.13 4.17 0.26	T1851 Hb-bear 66.95 0.50 14.94 1.20 2.04 2.04 2.80 3.98 4.29 0.22	T1861 Hb-bear 66.01 0.47 15.66 1.14 1.94 2.07 2.65 3.96 4.31 0.21	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95 3.97 0.19	T190! Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CaO Na2O K2O P2O5 MnO	T1301 Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07	T1311 Hb-bear 62.00 0.78 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91 0.29 0.08	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.28 4.30 2.74 0.32 0.08	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53 0.23 0.06	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 3.05 3.91 4.24 0.24 0.07	T184i Hb-bear 63.66 0.56 16.11 1.40 2.36 2.44 3.40 4.13 4.17 0.26 0.08	T185I Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07	T1861 Hb-bear 66.01 15.66 1.14 1.94 2.07 2.65 3.96 4.31 0.21 0.07	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95 3.97 0.19 0.05	T1901 Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 5.007
Sample Unit SiO2 TiO2 AI2O3 Fe2O3 Fe2O3 MgO CaO Na2O K2O P2O5 MnO	T130I Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91 0.29 0.08	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.30 2.74 0.32 0.08	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53 0.23 0.06	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 3.05 3.91 4.24 0.24 0.07	T184I Hb-bear 63.66 0.56 16.11 1.40 2.36 2.34 3.40 4.13 4.17 0.26 0.08	T185I Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07	T1861 Hb-bear 66.01 0.47 15.66 1.14 1.94 2.07 2.65 3.96 4.31 0.21 0.07	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95 3.97 0.19 0.05	T190! Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 5 0.07
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CaO Na2O K2O P2O5 MnO	T1301 Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07	T1311 Hb-bear 62.00 0.78 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91 0.29 0.08	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.30 2.74 0.32 0.08	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53 0.23 0.06	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 3.91 4.24 0.24 0.24 0.07	T184i Hb-bear 63.66 0.56 16.11 1.40 2.36 2.44 3.40 4.13 4.17 0.26 0.08	T185I Hb-bear 66.95 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07	T1861 Hb-bear 66.01 15.66 1.14 1.94 2.07 2.65 3.96 4.31 0.21 0.07	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95 3.97 0.19 0.05	T1901 Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 5.007
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba	T1301 Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91 0.29 0.08	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.30 2.74 0.32 0.08	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53 0.23 0.06	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 3.05 3.91 4.24 0.24 0.07	T184I Hb-bear 63.66 0.56 16.11 1.40 2.36 2.44 3.40 4.13 4.17 0.26 0.08	T185I Hb-bear 66.95 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07	T186I Hb-bear 66.01 15.66 1.14 1.94 2.07 2.65 3.96 4.31 0.21 0.07 3510	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.97 0.19 0.05	T1901 Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 7 0.07
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce	T1301 Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07 2160 60	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91 0.29 0.08	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.26 4.30 2.74 0.32 0.08	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.03 0.23 0.06	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 3.05 3.91 4.24 0.24 0.07	T184I Hb-bear 63.66 0.56 16.11 1.40 2.36 2.44 3.40 4.13 0.26 0.08 1870 85	T185I Hb-bear 66.95 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07	T186I Hb-bear 66.01 15.66 1.14 1.94 2.07 2.65 3.96 4.31 0.21 0.07 3510 83	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95 3.97 0.19 0.05	T1901 Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 7 0.07
Sample Unit SiO2 TiO2 AI2O3 FeO3 FeO CaO Na2O K2O P2O5 MnO Ba Ce Cr	T1301 Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07 2160 60 41	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07	T1341 Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91 0.29 0.08	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.26 4.30 2.74 0.32 0.08	T1791 Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.03 0.23 0.06	T183I Hb-bear 64.36 0.51 16.43 1.31 2.21 3.05 3.91 4.24 0.24 0.07	T184I Hb-bear 63.66 0.56 16.11 1.40 2.36 2.44 3.40 4.13 4.17 0.26 0.08 1870 85 61	T185I Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07	T186I Hb-bear 66.01 0.47 15.66 1.14 1.94 2.07 2.65 3.96 4.31 0.21 0.07 3510 83 59	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95 3.97 0.19 0.05	T1901 Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 4.07 0.24 4.07 0.24 4.07
Sample Unit SiO2 TiO2 AI2O3 FeO3 FeO CaO Na2O K2O P2O5 MnO Ba Ce Cr La	T130I Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07 2160 60 41 38	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07	T1341 Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91 0.29 0.08	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.26 4.30 2.74 0.32 0.08	T1791 Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.03 0.23 0.06 1756 87 52 55	T183I Hb-bear 64.36 0.51 16.43 1.31 2.21 3.05 3.91 4.24 0.24 0.07	T184I Hb-bear 63.66 0.56 16.11 1.40 2.36 2.44 3.40 4.13 0.26 0.08 1870 85 61 4.9	T185I Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07	T186I Hb-bear 66.01 0.47 15.66 1.14 1.94 2.07 2.65 3.96 4.31 0.21 0.07 3510 83 59 49	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.97 0.19 0.05	T1901 Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 4.07 0.24 4.07 0.24 4.07
Sample Unit SiO2 TiO2 AI2O3 FeOO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd	T130I Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07 2160 60 41 38 n.d	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07 1866 73 44 49 n.d	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91 0.29 0.08 1881 57 48 35 n.0	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.30 2.74 0.32 0.08	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53 0.23 0.06 1756 87 52 55 n.0	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 3.05 3.91 4.24 0.07 1949 83 58 50 n.6	T184I Hb-bear 63.66 0.56 16.11 1.40 2.36 2.44 3.40 4.13 4.17 0.26 0.08 1870 85 61 49 n.6	T185I Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07 1768 81 55 52 n.d	T1861 Hb-bear 66.01 0.47 15.66 1.14 1.94 2.07 2.65 3.96 4.31 0.21 0.07 3510 83 59 49 n.0	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.74 2.31 3.95 3.97 0.19 0.05 1378 69 51 39 n.d	T190! Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 7 0.24 7 0.07
Sample Unit SiO2 TiO2 Al2O3 FeO3 MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb	T130I Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07 2160 60 41 38 n.d 30 n.d	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07 1866 73 44 49 n.d 32 2.07	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07 1906 64 43 40 n.d 31 n.d	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91 0.29 0.08 1881 57 48 35 n.d 32 n.d	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.30 2.74 0.32 0.08 1331 80 58 50 n.d 45 50 n.d	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53 0.23 0.06 1756 87 52 55 n.d 49 n.d	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 3.05 3.91 4.24 0.07 1949 83 58 50 n.d 53 n.d	T184i Hb-bear 63.66 0.56 16.11 1.40 2.36 2.44 3.40 4.13 4.17 0.26 0.08 1870 85 61 49 n.d 58	T185I Hb-bear 66.95 0.50 14.94 1.20 2.04 2.02 2.04 2.80 3.98 4.29 0.22 0.07 1768 81 55 52 n.d 51 n.d	T1861 Hb-bear 66.01 0.47 15.66 1.14 1.94 2.07 2.65 3.96 4.31 0.21 0.07 3510 83 59 49 n.d 50 n.d	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.74 2.31 3.95 3.97 0.19 0.05 1378 69 51 39 n.d 48 n.d	T190! Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 7 0.24 7 0.07
Sample Unit SiO2 TiO2 AI2O3 FeOO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Bb	T130I Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07 2160 60 41 38 n.d 30 n.d 30 n.d 63	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07 1866 73 44 49 n.d 32 n.d 32 n.d	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07 1908 64 43 40 n.d 31 n.d 31 n.d	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91 0.29 0.08 1881 57 48 35 n.d 32 n.d 32 n.d 32 n.d	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.30 2.74 0.32 0.08 1331 80 58 50 n.d 45 n.d 45 n.d 120	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53 0.23 0.06 1756 87 52 55 n.d 49 n.d 83	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 3.05 3.91 4.24 0.07 1949 83 58 50 n.d 53 n.d 71	T184i Hb-bear 63.66 0.56 16.11 1.40 2.36 2.34 3.40 4.13 4.17 0.26 0.08 1870 85 61 49 n.d 58 n.d 58 n.d 78	T185I Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07 1768 81 55 52 n.d 51 n.d 83	T1861 Hb-bear 66.01 0.47 15.66 1.14 1.94 2.65 3.96 4.31 0.21 0.07 3510 83 59 49 n.d 50 n.d 50 n.d	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95 3.97 0.19 0.05 1378 69 51 39 n.d 48 n.d 89	T190! Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 7 0.24 7 0.07
Sample Unit SiO2 TiO2 AI2O3 FeOO MgO CaO Na2O K2O P2O5 MnO Ba CaO CaO R2O5 MnO Ba CaO CaO R2O5 MnO Ba CaO CaO R2O5 MnO	T130I Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07 2160 60 41 38 n.d 30 n.d 30 n.d 30 7	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07 1866 73 44 49 n.d 32 n.d 32 n.d 8	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07 1908 64 43 40 n.d 31 n.d 64 8	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91 0.29 0.08 1881 57 48 35 n.d 32 n.d 32 n.d 62 8	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.30 2.74 0.32 0.08 1331 80 58 50 n.d 4.5 n.d 4.5 n.d 120 15	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53 0.23 0.06 1756 87 52 55 n.d 49 n.d 83 7	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 0.24 0.07 1949 83 58 50 n.d 53 n.d 71 8	T184i Hb-bear 63.66 0.56 16.11 1.40 2.36 3.40 4.13 4.17 0.26 0.08 1870 85 61 49 n.d 58 n.d 58 n.d 78 9	T185I Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07 1768 81 55 52 n.d 51 n.d 83 8	T1861 Hb-bear 66.01 0.47 15.66 1.14 1.94 2.65 3.96 4.31 0.21 0.07 3510 83 59 49 n.d 50 n.d 50 n.d 78 7	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95 3.97 0.19 0.05 1378 69 51 39 n.d 48 n.d 89 6	T190! Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 4 0.07 1634 81 64 47 n.d 53 n.d 73 7
Sample Unit SiO2 TiO2 AI2O3 FeOO MgO CaO Na2O K2O P2O5 MnO Ba CaO CaO R2O F2O5 MnO Ba Ca CaO R2O F2O5 MnO	T1301 Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07 2160 60 41 38 n.d 30 n.d 30 n.d 37 909	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07 1866 73 44 49 n.d 32 n.d 43 8 8	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07 1908 64 43 40 n.d 31 n.d 64 8 8	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91 0.29 0.08 1881 57 4.8 35 n.d 32 n.d 32 n.d 32 8 59	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.30 2.74 0.32 0.08 1331 80 58 50 n.d 45 n.d 120 15 864	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53 0.23 0.06 1756 87 52 55 n.d 49 n.d 49 n.d 83 7 1114	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 0.24 0.07 1949 83 58 50 n.d 53 n.d 53 n.d 71 8 1220	T184i Hb-bear 63.66 0.56 16.11 1.40 2.36 3.40 4.13 4.17 0.26 0.08 1870 85 61 49 n.d 58 n.d 78 9 1311	T185I Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07 1768 81 55 52 n.d 51 n.d 81 1043	T1861 Hb-bear 66.01 0.47 15.66 1.14 1.94 2.07 2.65 3.96 4.31 0.21 0.07 3510 83 59 49 n.d 50 n.d 78 7 1170	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95 3.97 0.19 0.05 1378 69 51 39 n.d 48 n.d 89 6 962	T190! Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 4 0.07 1634 81 64 47 n.d 53 n.d 73 7 1143
Sample Unit SiO2 AI2O3 Fe2O3 Fe2O3 MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Fb Sc Sr Th	T1301 Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07 2160 60 41 38 n.d 30 n.d 63 7 909 n.d	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07 1866 73 4.4 49 n.d 32 n.d 32 n.d 8 8	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.28 0.28 0.07 1906 64 4.3 40 n.d 31 n.d 64 8 878 n.d	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91 0.29 0.08 1881 57 4.8 35 n.d 32 n.d 32 8 8 859 n.d	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.30 2.74 0.32 0.08 1331 80 58 50 n.d 45 n.d 15 864 n.d	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53 0.23 0.06 1756 87 52 55 n.d 49 n.d 83 7 1114 n.d	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 0.24 0.24 0.07 1949 83 58 50 n.d 53 n.d 71 8 1220 n.d	T184i Hb-bear 63.66 0.56 16.11 1.40 2.36 3.40 4.13 4.17 0.26 0.08 1870 85 61 49 n.d 58 n.d 58 n.d 58 n.d 58 1311 n.d	T185I Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07 1768 81 55 55 52 n.d 51 n.d 8 1043 n.d	T1861 Hb-bear 66.01 0.47 15.68 1.14 1.94 2.07 2.65 3.96 4.31 0.21 0.07 3510 83 59 49 n.d 50 n.d 7 1170 n.d	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95 3.97 0.19 0.05 1378 69 51 39 n.d 48 n.d 48 n.d 89 6 962 n.d	T190! Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 7 0.24 7 0.07 1634 81 64 47 n.d 53 n.d 7 1143 n.d
Sample Unit SiO2 AI2O3 Fe2O3 Fe2O3 MgO CaO Na2O K2O P2O5 MnO Ba CaO Cr La Nd Ni Pb Bb Sc Sr Th V V	T130I Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07 2160 60 41 38 n.d 30 n.d 63 7 909 n.d 66	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07 1866 73 4.01 3.80 0.28 0.07	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07 1906 64 4.0 .28 0.07	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 3.91 0.29 0.08 1881 57 4.8 35 n.d 32 n.d 32 8 8 859 n.d 79	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.30 2.74 0.32 0.08 1331 80 58 50 n.d 45 n.d 15 864 n.d 15 864 n.d 95	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53 0.23 0.06 1756 87 52 55 n.d 49 n.d 83 7 1114 n.d 60	T183I Hb-bear 64.36 0.51 16.43 1.31 2.11 2.24 0.24 0.24 0.07 1949 83 58 50 n.d 53 n.d 53 n.d 53 n.d 66	T184i Hb-bear 63.66 0.56 16.11 1.40 2.36 3.40 4.13 4.17 0.26 0.08 1870 85 61 49 n.d 58 n.d 58 n.d 58 n.d 78 9	T185I Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07 1768 81 55 55 52 n.d 51 n.d 83 1043 n.d 60	T1861 Hb-bear 66.01 0.47 15.68 1.14 1.94 2.65 3.96 4.31 0.21 0.07 3510 83 59 49 n.d 50 n.d 78 7 1170 n.d 59	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95 3.97 0.19 0.05 1378 69 51 39 n.d 48 n.d 48 n.d 89 6 962 n.d 53	T1901 Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 7.0.24 7.0.7 1634 81 64 47 n.d 73 n.d 73 1143 n.d 65 20
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Sc Sr Th V Y Zn	T1301 Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07 2160 60 41 38 n.d 30 n.d 63 7 909 n.d 66 14 4 a	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07 1866 73 44 9 r.d 32 n.d 32 n.d 38 8 848 n.d 73 14	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07 1906 64 4.31 n.d 31 n.d 64 8 878 n.d 71 16 64	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 3.91 0.29 0.08 1881 57 4.8 35 n.d 32 n.d 32 n.d 8 8 859 n.d 79 14	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.30 2.74 0.32 0.08 13311 80 58 50 n.d 45 n.d 120 15 864 n.d 95 289	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53 0.23 0.23 0.06 1756 87 52 55 55 n.d 49 n.d 83 7 1114 n.d 60 20 53	T183I Hb-bear 64.36 0.51 16.43 1.31 2.24 3.91 4.24 0.24 0.07 1949 83 58 50 n.d 53 n.d 71 8 1220 n.d 66 225	T184i Hb-bear 63.66 0.56 16.11 1.40 2.36 3.40 4.13 4.17 0.26 0.08 1870 85 61 49 n.d 58 n.d 58 n.d 78 9 1311 n.d 73 23 83	T185I Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07 1768 81 55 52 n.d 51 n.d 83 n.d 8 1043 n.d 60 200	T1861 Hb-bear 66.01 0.47 15.66 1.14 1.94 2.07 2.65 3.96 4.31 0.21 0.07 3510 83 59 49 n.d 50 n.d 78 7 1170 n.d 59 19	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95 3.97 0.19 0.05 1378 69 51 39 n.d 48 n.d 48 n.d 89 6 962 n.d 53 1154	T1901 Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 7 0.24 7 0.07 1634 81 64 47 n.d 73 n.d 73 1143 n.d 65 22 55
Sample Unit SiO2 TiO2 Al2O3 Fe2O3 Fe2O3 MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Sc Sr Th V Y Zn Zr Zr	T1301 Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07 2160 60 41 38 n.d 30 n.d 63 7 909 n.d 66 14 4 63 54	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07 1866 73 44 9 r.d 32 n.d 43 8 848 848 n.d 73 14 73 14 75	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07 1906 64 43 3 0.07 1906 64 43 1 n.d 31 n.d 64 8 878 n.d 71 16 64 54	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 3.91 0.29 0.08 1881 57 4.8 3.5 n.d 32 n.d 32 n.d 62 8 8 859 n.d 79 14 79 14 73	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.30 2.74 0.32 0.08 13311 80 58 50 n.d 45 n.d 120 15 864 n.d 95 28 864 n.d 95 28 865 4	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53 0.23 0.06 1756 87 52 55 55 n.d 49 n.d 83 7 1114 n.d 60 20 53 73	T183I Hb-bear 64.36 0.51 16.43 1.31 2.24 3.91 4.24 0.24 0.07 1949 83 58 50 n.d 53 n.d 71 8 1220 n.d 66 22 58 65	T184i Hb-bear 63.66 0.56 16.11 1.40 2.36 2.44 4.13 4.17 0.26 0.08 1870 85 61 49 n.d 58 n.d 78 9 1311 n.d 73 23 65	T185I Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07 1768 81 55 52 n.d 51 n.d 83 8 1043 n.d 60 20 47 70	T1861 Hb-bear 66.01 0.47 15.66 1.14 1.94 2.07 2.65 3.96 4.31 0.21 0.07 3510 83 59 49 n.d 50 n.d 78 7 1170 n.d 59 19 61 57	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95 3.97 0.19 0.05 1378 69 51 39 n.d 48 n.d 48 n.d 89 6 962 n.d 53 11 54 68	T1901 Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 7 0.24 7 0.07 1634 81 64 47 n.d 53 n.d 73 1143 n.d 65 22 55 566
Sample Unit SiO2 TiO2 AI2O3 Fe2O3 Fe2O3 MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Sc Sr Th V Y Zn Zr Cu	T1301 Hb-bear 62.32 0.72 16.84 1.82 2.43 1.93 2.89 4.07 4.51 0.25 0.07 2160 60 41 38 n.d 30 n.d 63 7 909 n.d 66 14 4 63 54 105	T1311 Hb-bear 62.00 0.78 16.87 1.61 3.00 1.98 3.77 4.01 3.80 0.28 0.07 1866 73 44 49 r.d 32 n.d 43 8 848 848 n.d 73 14 73 14 70 53 109	T1321 Hb-bear 62.78 0.73 17.61 1.61 2.77 1.92 3.76 4.26 4.24 0.28 0.07 1906 64 43 3 0.07 1906 64 43 1 n.d 31 n.d 64 8 878 n.d 71 16 64 54 142	T134I Hb-bear 62.39 0.80 17.01 1.81 3.04 2.10 3.65 4.08 3.91 0.29 0.08 1881 57 4.8 35 n.d 32 n.d 32 n.d 62 8 859 n.d 79 14 79 14 73 70	T2791 Hb-bear 62.16 0.87 17.72 1.49 3.70 2.86 4.26 4.30 2.74 0.32 0.08 13311 80 58 50 n.d 45 n.d 120 15 864 n.d 95 28 864 n.d 95 28 864 267	T179i Hb-bear 66.74 0.50 15.23 1.38 1.80 2.03 2.75 4.07 4.53 0.23 0.06 1756 87 52 55 55 n.d 49 n.d 83 7 1114 n.d 60 20 53 73 126	T183I Hb-bear 64.36 0.51 16.43 1.31 2.24 3.91 4.24 0.24 0.07 1949 83 58 50 n.d 53 n.d 53 n.d 71 8 1220 n.d 66 22 58 65 56	T184i Hb-bear 63.66 0.56 16.11 1.40 2.36 2.44 3.40 4.13 4.17 0.26 0.08 1870 85 61 49 n.d 58 n.d 78 9 1311 n.d 73 23 65 81	T185I Hb-bear 66.95 0.50 14.94 1.20 2.02 2.04 2.80 3.98 4.29 0.22 0.07 1768 81 55 52 n.d 51 n.d 83 8 1043 n.d 60 20 47 70 162	T1861 Hb-bear 66.01 0.47 15.66 1.14 1.94 2.07 2.65 3.96 4.31 0.21 0.07 3510 83 59 49 n.d 50 n.d 78 7 1170 n.d 59 19 61 57 109	T1881 Hb-bear 68.98 0.44 14.65 1.20 1.60 1.74 2.31 3.95 3.97 0.19 0.05 1378 69 51 39 n.d 48 n.d 48 n.d 89 6 962 n.d 53 11 54 68	T1901 Hb-bear 65.22 0.52 15.16 1.21 2.09 2.28 2.72 4.17 4.07 0.24 7 0.24 7 0.07 1634 81 64 47 n.d 53 n.d 7 1143 n.d 65 22 55 66 199

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Sample Unit	T191I Hb-bear	T192I Hb-bear	T194I Hb-bear	T198i Hb-bear	T199i Hb-bear	T204I Hb-bear	T205i Hb-bear	T206l Hb-bear	T214I Hb-bear	T2201 Hb-bear	T2211 Hb-bear	T227i Hb-bear
SiO2	64.86	64.11	65.43	63.66	65.43	66.54	67.71	65.50	64.05	63.29	65.98	64.55
TiO2	0.51	0.60	0.54	0.54	0.58	0.51	0.44	0.52	0.72	0.71	0.76	0.70
AI2O3	15.73	15.25	15.84	15.73	15.62	15.54	14.54	15.65	16.72	16.34	15.61	16.00
Fe2O3	1.09	1.35	1.42	1.26	1.08	1.12	1.08	1.25	1.61	1.77	1.50	1.26
FeO	2.19	2.56	2.16	2.20	2.55	2.04	1.77	2.14	2.49	2.33	2.58	2.70
MgO	2.22	2.5/	2.34	2.40	2.53	2.12	1.83	2.20	1.09	1.//	1./1	1.08
Na2O	2.00	4 26	3.07	3.00	4 50	4 12	3 80	3.10	3.73	3 74	3.15	3.20
K20	3.82	3 54	4.01	4.34	4.14	4.49	4.07	3.93	3.76	4.19	3.51	3.80
P2O5	0.24	0.27	0.26	0.24	0.25	0.22	0.20	0.25	0.28	0.28	0.23	0.29
MnO	0.07	0.07	0.08	0.07	0.07	0.06	0.06	0.07	0.07	0.07	0.06	0.07
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Ba	1677	1497	1875	1864	1649	1769	1158	1716	1707	1787	1486	1730
Ce	77	78	80	72	. 75	74	65	77	73	58	100	72
Cr	64	70	61	63	71	59	59	67	46	47	47	46
La	44	48	44	45	- 46	45	39	43	43	37	69	46
Nd	n.d	n.d	n.d	n.ď	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
Ni	55	65	61	57	60	54	50	58	32	32	31	. 31
Pb	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	ំ n.d
HD So	/3	40		82	2/8	8/	600	73	97 19			710
Sr	866	1228	1194	1177	1200	1142	1009	1146	768	745	705	727
Th	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
v	66	74	69	67	71	61	54	65	66	62	65	64
Y ·	19	18	24	18	20	17	15	18	15	13	16	16
Zn	52	64	65	56	60	53	46	56	62	65	70	62
Zr	64	65	65	60	67	69	64	63	44	52	60	50
Cu	142	180	218	239	126	230	287	315	264	359	126	539
Li	21	18	16	20	25	19	17	17	81	70	88	88
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Sample	72361	T2371	T2501	Ť251I	T2521	T2541	T2551					
Sample	T236I Hb-bear	T237i Hb-bear	T250i Hb-bear	T251I Hb-bear	T252i Hb-bear	T254I Hb-bear	T255i Hb-bear					
Sample Unit	T236i Hb-bear	T237i Hb-bear	T250l Hb-bear	T251I Hb-bear	T252l Hb-bear	T254I Hb-bear	T255i Hb-bear					
Sample Unit SiO2	T2361 Hb-bear 64.29	T2371 Hb-bear 63.62	T250i Hb-bear 64.82	T251I Hb-bear 62.79	T252I Hb-bear 70.22	T2541 Hb-bear 62.37	T2551 Hb-bear 63.40					
Sample Unit SiO2 TiO2	T236  Hb-bear 64.29 0.69	T2371 Hb-bear 63.62 0.66	T2501 Hb-bear 64.82 0.69	T2511 Hb-bear 62.79 0.73	T2521 Hb-bear 70.22 0.33	T254I Hb-bear 62.37 0.68	T2551 Hb-bear 63.40 0.69			in an A		
Sample Unit SiO2 TiO2 Al2O3	T2361 Hb-bear 64.29 0.69 16.58	T237i Hb-bear 63.62 0.66 16.09	T2501 Hb-bear 64.82 0.69 15.57	T2511 Hb-bear 62.79 0.73 16.68	T252I Hb-bear 70.22 0.33 13.41	T254I Hb-bear 62.37 0.68 17.67	T2551 Hb-bear 63.40 0.69 16.45					
Sample Unit SiO2 TiO2 AI2O3 Fe2O3	T2361 Hb-bear 64.29 0.69 16.58 1.31	T237i Hb-bear 63.62 0.66 16.09 1.33	T250l Hb-bear 64.82 0.69 15.57 1.61	T2511 Hb-bear 62.79 0.73 16.68 1.65	T252l Hb-bear 70.22 0.33 13.41 0.38	T254I Hb-bear 62.37 0.68 17.67 1.32	T2551 Hb-bear 63.40 0.69 16.45 1.44			n an an An An An An An Airtín An Airtín An An An An		
Sample Unit SiO2 TiO2 AI2O3 Fe2O3 Fe0	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46	T237i Hb-bear 63.62 0.66 16.09 1.33 2.51	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63	T252l Hb-bear 70.22 0.33 13.41 0.38 1.20	T254I Hb-bear 62.37 0.68 17.67 1.32 2.82	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66					
Sample Unit SiO2 TiO2 AI2O3 Fe2O3 FeO MgO CaO	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26	T237i Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75	T252I Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25	T254I Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.97					
Sample Unit SiO2 TiO2 AI2O3 Fe2O3 Fe0 Mg0 CaO Na2O	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18	T237i Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13	T252I Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78	T254I Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64 4.22	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91					
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CaO Na2O K2O	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03	T237i Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.34	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14	T2521 Hb-bear 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36	T254I Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38					
Sample Unit SiO2 TiO2 Al2O3 FeO MgO CeO Na2O K2O P2O5	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25	T237i Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.34 0.24	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27	T252I Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12	T2541 Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25					
Sample Unit SiO2 TiO2 Al2O3 FeO MgO CaO Na2O P2O5 MnO	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06	T2371 Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25 0.07	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.47 0.24 0.07	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07	T252I Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05	T2541 Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07					
Sample Unit SiO2 TiO2 Al2O3 FeO MgO CaO Na2O P2O5 MnO	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06	T2371 Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25 0.07	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.47 0.24 0.07	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05	T2541 Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07					
Sample Unit SiO2 TiO2 Al2O3 FeO MgO CeO Na2O P2O5 MnO	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06	T237i Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25 0.07	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.47 0.24 0.07	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05	T2541 Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07					
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CeO Na2O P2O5 MnO	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06	T237i Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25 0.07	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.47 0.24 0.07	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05	T2541 Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07					
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CeO Na2O Na2O Na2O Na2O Na2O Na2O Na2O Sa MnO	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06	T237i Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25 0.07	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.05 3.87 3.47 3.34 0.24 0.07	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05	T2541 Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07					
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CaO Na2O Na2O Na2O K2O P2O5 MnO Ba Ca	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06	T237i Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25 0.07	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.34 0.24 0.07	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 3.75 4.13 4.14 0.27 0.07 2123 55	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05	T2541 Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07 2202 56					
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06	T2371 Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.17 4.19 0.25 0.07	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.34 0.24 0.07	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07 2123 65 45	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05 736 56 24	T2541 Hb-bear 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07 2246 54 48	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07 2202 56 49					
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CeO Na2O Na2O Na2O Na2O P2O5 MnO Ba Ce Cr La	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06	T2371 Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25 0.07	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.34 0.24 0.07 1744 63 52 36	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07 2123 65 45 40	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05 736 56 24 39	T2541 Hb-bear 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07 2246 54 4.6 37	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07 2202 56 49 36	1999年,1999年,1999年,1999年,1999年 1999年,第二次1月1日,1999年,1999年,1999年 1999年,1999年,1999年,1999年,1999年,1999年				
Sample Unit SiO2 TiO2 Al2O3 FeO MgO CeO Na2O P2O5 MnO Ba Ce Cr La Nd	T2361 Hb-bear 64.29 0.658 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06 1717 70 38 4.8 8.0	T2371 Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25 0.07 1795 66 43 42 n.d	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.34 0.24 0.07 1744 63 52 36 n.d	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07 2123 65 45 40 0.07	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05 736 56 24 39 n.d	T2541 Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07 2246 54 54 8 37 n.d	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07 2202 56 49 36 n.d					
Sample Unit SiO2 TiO2 Al2O3 FeO MgO CeO Na2O P2O5 MnO Ba Ce Cr La Nd Ni	T2361 Hb-bear 64.29 0.659 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06 1717 70 38 4.8 8.04 29	T2371 Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25 0.07 1795 66 43 42 .7 .0 .7	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.34 0.24 0.07 1744 63 52 36 n.d 37	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07 2123 65 4.5 4.5 4.5 4.5 4.5 4.5 4.5 4.5 4.5 4.	T2521 Hb-bear 70.22 0.33 13.41 0.72 1.25 3.78 5.36 0.12 0.05 736 56 24 39 n.d 18	T2541 Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07 2246 54 48 37 n.d 31	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07 2202 56 49 36 n.d 31	· · · · · · · · · · · · · · · · · · ·				
Sample Unit SiO2 TiO2 Ai2O3 FeO MgO CeO Na2O P2O5 MnO Ba Ce Cr La Nd Ni Pb	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06 1717 70 38 4.8 8 n.d 29 n.d	T2371 Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.19 0.25 0.07 1795 66 43 42 4.3 42 1795 66 43 43 42 1.31 n.d	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.37 3.34 0.24 0.07 1744 63 52 36 n.d 37 n.d	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07 2123 65 45 40 n.d 30 n.d	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05 736 56 24 39 n.d 18 n.d	T2541 Hb-bear 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07 2246 54 48 37 n.d 31 n.d	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07 2202 56 49 36 n.d 31 n.d	·····································				
Sample Unit SiO2 TiO2 Ai2O3 FeO MgO CeO Na2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Fb	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06 1717 70 38 48 n.d 29 n.d 61	T2371 Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25 0.07 1795 66 43 42 n.d 31 n.d 65	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.37 3.34 0.24 0.07 1744 63 52 36 n.d 37 n.d 52	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07 2123 65 45 40 n.d 30 n.d 65	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05 736 56 24 39 n.d 18 n.d 140	T2541 Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07 2246 54 46 37 n.d 31 n.d 92	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07 2202 56 49 36 n.d 31 n.d 56	·····································				
Sample Unit SiO2 TiO2 Al2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Fb Sc	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06 1717 70 38 48 n.d 29 n.d 61 7	T2371 Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25 0.07 1795 66 43 42 n.d 31 n.d 65 7	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.47 3.47 0.24 0.07 1744 63 52 36 n.d 52 8 2.12 8	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07 2123 65 45 40 n.0 65 8 0 0.01	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05 736 56 24 39 n.d 18 n.d 140 4 20	T2541 Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07 2246 54 46 37 n.d 92 7 0.02	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07 2202 56 49 36 n.d 56 7					
Sample Unit SiO2 TiO2 Al2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Fb Sc Sr Th	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06 1717 70 38 48 n.d 29 n.d 61 7 771	T2371 Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25 0.07 1795 66 43 42 n.d 31 n.d 65 7 779	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.47 0.24 0.07 1744 63 52 36 n.d 52 8 8 812 2	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07 2123 65 45 40 n.d 65 8 8 865	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.378 5.378 5.378 5.378 5.378 5.378 5.378 5.378 5.378 5.4 1.20 0.72 1.25 3.78 5.378 5.4 1.20 0.72 1.25 3.78 5.6 2.4 3.9 n.4 1 8 1.41 0.42 0.72 1.25 3.78 5.6 2.4 3.9 n.41 0.42 0.72 1.25 3.78 5.6 2.4 0.42 0.72 1.25 3.78 5.6 0.12 0.41 0.41 0.72 1.25 3.78 5.6 0.12 0.41 0.41 0.41 0.42 0.72 1.25 3.78 5.6 0.12 0.41 0.41 0.41 0.41 0.42 0.72 1.25 3.78 5.6 0.12 0.41 0.41 0.45 3.78 5.6 2.4 0.41 0.45 0.41 0.45 0.42 0.41 0.45 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42	T2541 Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07 2246 54 46 37 n.d 92 7 949 9.4	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07 2202 56 49 36 n.d 31 n.d 56 7 885					
Sample Unit SiO2 TiO2 Al2O3 FeO MgO CeO Na2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Fb Sc Sr Th V	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06 1717 70 38 48 n.d 29 n.d 61 7 771 n.d 61 7	T237i Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25 0.07 1795 66 43 42 n.d 31 n.d 65 7 779 n.d	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.47 0.24 0.07 1744 63 52 36 n.d 37 n.d 52 8 812 n.d 72	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07 2123 65 45 40 n.d 30 65 8 865 n.d 65 8	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05 736 56 24 39 n.05 736 56 24 39 n.0 140 4 293 n.0 140	T2541 Hb-bear 62.37 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07 2246 54 48 37 n.d 31 n.d 92 7 949 n.d 66	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07 2202 56 49 36 n.d 31 n.d 56 7 885 n.d 68					
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CaO Na2O K2O P2O5 MnO Ba CeO Cr La Nd Ni Pb Rb Sc Sr Th V Y	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06 1717 70 38 48 n.d 29 n.d 61 7 7711 n.d 62 214	T2371 Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25 0.07 1795 66 43 42 n.d 31 n.d 65 7 7779 n.d 62	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.34 0.24 0.07 1744 63 52 36 n.d 37 n.d 52 36 n.d 37 n.d 52 38 8 812 n.d 72 17	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07 2123 65 4.5 40 n.d 30 n.d 65 8 865 n.d 66 14	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05 736 5.6 24 39 n.d 18 n.d 140 4 293 n.d 23 14	T2541 Hb-bear 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07 2246 54 48 37 n.d 31 n.d 92 949 n.d 66 12	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.21 4.38 0.25 0.07 2202 56 49 36 n.d 31 n.d 56 7 885 n.d 68 12					
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CeO Na2O Na2O Na2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Fb Sc Sr Th V Y Zn	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06 1717 70 8 8 4.8 n.d 29 n.d 61 7 7771 n.d 62 14 62	T2371 Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.17 4.19 0.25 0.07 1795 66 43 42 n.d 31 n.d 65 7 779 n.d 62 43	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.34 0.24 0.07 1744 63 52 36 n.d 37 n.d 52 36 n.d 37 n.d 52 8 8 812 n.d 72 17 66	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07 2123 65 45 40 n.d 30 n.d 65 8 8 865 n.d 66 14 63	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05 736 56 56 24 39 n.d 18 n.d 18 n.d 18 n.d 23 1.41 36	T2541 Hb-bear 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07 2246 54 4.6 37 n.d 31 n.d 31 n.d 92 7 949 n.d 66 12 63	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07 2202 56 49 36 n.d 31 n.d 56 7 885 n.d 68 12 61	· · · · · · · · · · · · · · · · · · ·				
Sample Unit SiO2 TiO2 Al2O3 FeO MgO CeO Na2O K2O P2O5 MnO Ba Ce Cr La Nd Ni Pb Fb Sc Sr Th V Y Y Zn Zr	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06 1717 70 38 4.8 n.d 29 n.d 61 7 771 n.d 62 14 62 51	T2371 Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.19 0.25 0.07 1795 66 43 42 n.d 31 n.d 65 7 7 779 n.d 62 14 4 63 45	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.34 0.24 0.07 1744 63 52 36 n.d 37 n.d 52 8 8 812 n.d 72 17 66 54	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07 2123 65 45 40 n.d 30 n.d 65 8 8 865 n.d 66 14 63 50	T2521 Hb-bear 70.22 0.33 13.41 0.38 1.20 0.72 1.25 3.78 5.36 0.12 0.05 736 56 24 39 n.d 18 n.d 18 n.d 18 n.d 18 n.d 18 n.d 18 3.64 12 3.64 18 1.20 3.64 18 1.20 3.64 1.20 3.64 1.20 3.64 1.20 3.72 1.25 3.78 5.36 0.12 0.05 7.26 7.36 5.41 0.12 0.05 7.26 7.36 7.36 7.36 7.36 7.36 7.36 7.36 7.3	T2541 Hb-bear 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07 2246 54 4.6 31 n.d 31 n.d 31 n.d 949 n.d 66 12 63 48	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 3.27 3.91 4.38 0.25 0.07 2202 56 49 36 n.d 31 n.d 56 7 885 n.d 68 12 61 53					
Sample Unit SiO2 TiO2 AI2O3 FeO MgO CeO Na2O P2O5 MnO Ba Ca Cr La Nd Ni Pb Bb Sc Sr Th V Y Zn Zr Cu	T2361 Hb-bear 64.29 0.69 16.58 1.31 2.46 1.67 3.26 4.18 4.03 0.25 0.06 1717 70 38 4.8 n.d 29 n.d 61 7 7771 n.d 62 14 4.2 51 196	T2371 Hb-bear 63.62 0.66 16.09 1.33 2.51 1.66 3.27 4.19 0.25 0.07 1795 66 43 42 n.d 31 n.d 65 7 779 n.d 62 14 43 45 174	T2501 Hb-bear 64.82 0.69 15.57 1.61 2.51 2.05 3.87 3.47 3.34 0.24 0.07 1744 63 52 36 n.d 37 n.d 52 8 8 812 n.d 72 17 65 54 197	T2511 Hb-bear 62.79 0.73 16.68 1.65 2.63 1.78 3.75 4.13 4.14 0.27 0.07 2123 65 45 40 n.d 30 n.d 65 8 8 865 n.d 66 14 4 63 50 249	T2521 Hb-bear 70.22 0.33 13.41 0.72 1.25 3.78 5.36 0.12 0.05 736 56 24 39 n.d 18 n.d 18 n.d 18 n.d 140 4 23 14 46 49 243	T2541 Hb-bear 0.68 17.67 1.32 2.82 1.85 3.64 4.22 4.18 0.24 0.07 2246 54 4.6 37 n.d 31 n.d 31 n.d 92 7 949 n.d 66 12 63 48 69	T2551 Hb-bear 63.40 0.69 16.45 1.44 2.66 1.86 3.27 3.91 4.38 0.25 0.07 2202 56 49 36 n.d 31 n.d 56 7 885 n.d 68 12 61 53 120					

# APPENDIX 3.2 : ROSSES PLUTON (MERCY 1957)

Sample Unit	87P Porp	82P Porp	26P Porp	9(1) Porp	9(2) Porp	95 Porp	96 Porp	98P Porp	104P Porp	99P Porp	108P Porp	18P Porp
SiO2	70.10	70.80	70.00	72 80	71 40	71 80	73 60	71 60	71 40	70 10	70.00	70.00
102	0.10	0.00	0.00	0.16	0.12	0.95	0 34	0 10	0.20	12.10	/0.80	/0.80
A1203	15.00	15.30	16.80	13.50	12 80	14 90	14 30	14 70	19 70	14 20	14 20	14 60
Fe2O3	0.72	0.83	0.82	0.46	0.75	0.78	0.88	0.75	1 00	0 42	1 20	0.06
FeO	1.60	1.50	1.60	1.90	1.40	1.10	1.10	1.40	0.86	1.60	0.97	1 30
Fe(tot)	2.50	2.50	2.60	1.30	2.30	2.00	2.10	2.30	2.00	2.20	2.30	2 40
MnO	0.03	0.04	0.04	0.02	0.03	0.03	0.02	0.03	0.03	0.04	0.04	0.04
MaQ	1 00	0.04	1 20	0.75	0.00	0.86	0.78	0.00	0.00	0.04	0.04	0.73
CaO	1.70	1.90	1.30	2.00	1.80	2.60	1.70	2 60	2 00	2.60	2 20	2 50
Na2O	4 20	4 30	4 30	4 40	4 40	4 10	4 20	4 50	4 60	4.20	4.80	4 40
K20	4 50	4 60	4 20	4.00	4.40	3 10	3.80	3 10	3 90	3 20	9.70	3 30
P205	0.16	0.14	0.16	0.13	0.12	0.09	0.10	0 10	0.00	0.00	0.11	0.11
Total	99 54	100.83	100.93	99.06	98.86	99 73	00 0A	00.00	98 73	49 80	00.10	00 08
	00.04	100.00		00.00	00.00	00.70			00.70	50.00	00.00	88.00
Sample	15P	16P	106P	25P	159P	2P	37P	38P	39P	40P	28P	
Unit	Porp	Рогр	Porp	Porp	Porp	Porp	Porp	Porp	Porp	Porp	Porp	
SiO2	71.90	71.00	70.80	70.30	71.60	71.30	72.60	72.60	73.10	71.60	72.70	
TIO2	0.31	0.60	0.28	0.55	0.31	0.28	0.26	0.20	0.18	0.28	0.41	
AI2O3	14.60	14.30	14.40	14.20	15.40	15.30	14.50	14.50	15.30	15.30	14.60	
Fe2O3	0.77	0.87	0.66	0.80	0.87	0.58	0.58	0.68	0.72	0.58	0.25	
FeO	1.20	1.20	1.30	1.80	1.20	1.30	1.10	1.10	0.88	1.30	1.40	
Fe(tot)	2.10	2.20	2.10	2.80	2.20	2.00	1.80	1.90	1.70	2.00	1.80	
MnO	0.04	0.07	0.04	0.05	0.02	0.03	0.03	0.03	0.02	0.04	0.03	
MgO	0.77	0.89	0.90	0.76	0.88	0.86	0.69	0.66	0.52	0.82	0.74	
CaO	2.70	2.70	2.30	2.90	2.70	1.90	1.80	1.90	1.70	1.90	2.30	
Na2O	4.10	4.70	4.70	4.50	4.20	4.10	4.30	4.20	3.90	4.10	4.40	
K2O	2.90	3.50	3.50	3.20	3.00	4.60	4.30	4.00	4.20	4.40	3.50	
P2O5	0.09	0.10	0.10	0,19	0.12	0.12	0.10	0,10	0.09	0.13	0.11	
Total	99.51	100.06	98.98	99.25	100.30	100.35	100.26	99.97	100.61	100.43	100.44	
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Sample	258G1A	150G1A	153G1A	141G1A	147G1A	22G1A	126G1	68G1	10G1	9G1	74G1	17
Unit	G1	G1	G1	G1	G1	G1	G1	G1	G1	G1	G1	G1
SIO2	69.70	74.90	74.80	73.90	72.10	73.60	72.90	73.90	72.80	74.00	74.30	73.20
TiO2	0.26	0.14	0.14	0.15	0.33	0.19	0.22	0.19	0.24	0.20	0.14	0.20
A1203	15.80	13.90	13.90	14.20	14.80	13.50	14.30	13.30	14.50	14.40	13.00	13.70
Fe2O3	0.52	0.15	0,28	0.26	0.44	0.37	0.57	0.54	0.59	0.59	0.52	0.62
FeO	1.60	0.77	0.74	0.76	1.50	0.93	0.84	0.87	1.00	0.64	0.61	0.70
Fetot	2.30	1.00	1.10	1.10	2.10	1.40	1.50	1.50	1.70	1.20	1.20	1.40
MnO	0.04	0.03	0.01	0.02	0.06	0.02	0.04	0.05	0.03	0.05	0.02	0.03
MgO	0.84	0,41	0.34	0.36	0.91	0.47	0.67	0.52	0.79	0.63	0.39	0.57
CaO	2.40	0.91	0.82	0.82	1.60	1.50	0.84	1.40	1.40	0.97	0.82	0.78
Na2O	4.40	4.10	4.20	4.00	4.20	4.00	4.00	4.20	4.00	3.80	4.00	4.00
K20	3.20	5.10	5.00	5.10	4.10	4.10	4.90	4.20	4.80	4.50	4.60	4.70
P2O5	0.12	0.07	0.08	0.08	0.12	0.07	0.10	0.05	0.10	0.05	0.05	0.07
Total	98.88	100.48	100.31	99.65	100.16	98.75	99.38	99.22	100.25	99.83	98.45	98.57
		4 - 4										
Sample	23G1	110G1	116G1	256G1	256G1	149G1	261G1	26G1	123G1	67G2	121G2	8G2
Unit	G1	G1	G1	G1	G1	G1	G1	G1	Gt	G2	: G2	G2 -
SIO2	73.10	74.80	72.60	72.60	72.70	73.40	72.00	70.20	73.70	74.40	74.50	74.70
TIO2	0.18	0.19	0.28	0.20	0.24	0.21	0.30	0.30	0.22	0.21	0.20	0.20
A1203	13.60	13.60	14.40	14:10	14.30	14.20	15.40	15.00	14.30	13.50	14.10	13.10
Fe2O3	0.50	0.40	0.59	0.48	0.48	0.55	0.60	0.98	0.49	0.69	0.50	0.77
FeO ,	0.63	0.72	1.00	1.10	1.10	0.94	0.90	1.10	1.00	1.00	0.81	0.75
Fetot	1.20	1.20	1.70	1.70	1.70	1.60	1.60	2.20	1.60	1.80	1.40	1.60
MnO	0.02	0.03	0.02	0.02	0.03	0.04	0.04	0.04	0.04	0.10	0.02	0.03
MgO	0.64	0.56	0.68	0.70	0.69	0.80	0.71	0.63	0.66	0.65	0.57	0.56
CeO	1.20	0.79	1.10	1.70	1.70	0.94	1.10	2.20	1.00	0.63	0.71	0.79
Na2O	4.00	4.00	4.10	3.80	3.90	4.10	4.00	4.10	4.20	3.80	4.10	3.40
K20	4.90	5.10	5.10	4.20	4.40	4.20	5.10	4.70	4.50	4.50	5.00	4.30
P2O5	0.06	0.08	0.08	0.08	0.10	0.09	0.11	0.13	0.09	0.07	0.08	0.05
Total	98.83	100.27	99.93	98.98	99.64	99.47	100.26	99.38	100.20	99.55	100.59	98.65
										r diyata		an dha An Shin
Sample Unit	7G2 G2	13G2 G2	24G2 G2	111G2 G2	145G2 G2	128G2 G2	148G2 G2	122G2 G2	118G3 G3	6G3 G3	14G3 G3	290G3 G3
	<b></b>											
SIC2	73.70	75.10	78.50	74.20	71.40	73.20	72.20	73.90	74.20	74.30	74.00	74.20
1102	0.16	0.13	0.17	0.20	0.25	0.24	0.22	0.13	0.20	0.21	0.19	0.25
A1203	14.80	13.70	12.30	13.30	14.60	13.80	14.20	14.60	12.70	14.70	13.70	13.10
Fe2O3	0.47	0.36	0.43	0.64	U.58	0.68	0.66	0.41	0.45	0.55	0.55	0.54
rec	0.66	0.52	0.60	U.78	1.10	1.10	U.94	0.39	U.77	0.68	0.77	0.69
retot	1.20	0.94	1.10	1.50	1.80	1.90	1.70	0.84	1.30	1.30	1.40	1.30
MnO	0.04	0.05	0.04	0.03	0.03	0.03	0.04	0.03	0.03	0.04	0.03	0.04
MgO .	0.54	0.47	0.35	0.58	0.76	0.69	0.69	0.37	0.50	0.61	0.57	0.52
CaO	0.94	0.89	1.10	0.84	1.40	1.40	1.10	0.87	1.10	U.84	1.10	0.82
Nazu	4.00	4.10	4.20	4.00	4.20	3.50	4.10	3.80	3.80	3.60	4,20	4.40
DOCE -	4.80	4.60	. 4.00	4.70	4.70	4.20	4.7U	0.20	4.80	4.20	4.00	9.70
Totel	0.05	0.05	100 94	0.05	0.08	0.10	0.08	0.04	100.05	100.00	0.00	0.10
i Utati	100.10	00.0/	100.34	97.JZ	88.I	9Q.84	00.00	03.04	100.08	100.58	99.70	98.3D

## APPENDIX 3.2 : CONTINUED - ROSSES PLUTON

Sample	273G3	5(1)G4	5(2)G4	5(3)G4	12G4	29G4	1MG	2MG	47MG	53MG	65MG	45MG
Unit	G3	G4	G4	G4	G4	G4	Mg	Mg	Mg	Mg	Mg	Mg
						· · ·			*++			
SiO2	75.20	76.30	76.60	77.00	75.60	76.70	75.60	75.00	73.80	73.70	76.90	70.70
TIO2	0.15	0.11	0.10	0.04	0.10	0.11	0.09	0.08	0.15	0.15	0.05	0.24
AI2O3	13.70	13.60	13.70	12.10	13.90	12.70	14.30	13.90	14.20	13.90	12.40	14.20
Fe2O3	0.42	0.51	0.51	0.23	0.51	0.33	0.28	0.27	0.61	0.31	0.27	0.56
FeO	0.61	0.36	0.14	0.14	0.28	0.16	0.45	0.40	0.53	0.58	0.22	1.30
Fetot	1.10	0.91	0.67	0.39	0.82	0.51	0.78	0.71	1.20	0.95	0.51	2.00
MnO	0.03	0.05	0.01	0.01	0.04	0.11	0.01	0.04	0.01	0.01	0.07	0.03
MgO	0.40	0.46	0.30	0.18	0.30	0.16	0.30	0.26	0.32	0.32	0.19	0.84
CaO	0.70	0.47	0.46	0.38	0.47	0.19	0.47	0.59	0.40	0.51	0.52	1.50
Na2O	4.00	3.80	3.40	3.60	4.00	4.30	3.50	3.70	3.90	3.60	4.00	4.00
K2O	4.40	4.60	4.60	5.20	4.70	5.00	5.20	5.00	5.60	6.80	5.00	4.60
P205	0.05	0.09	0.07	0.04	0.04	0.02	0.10	0.08	0.11	0.12	0.01	0.13
Total	99.66	100.35	99.89	98.92	99.94	99.78	101.00	100.00	100.50	100.70	100.20	98.90
			1.1		a server							
Semple	A3MG	60MG	51MG	59M(3	59(1)	61MG	102MG	103MG	1944	103MG	21MG	100MG
Unit	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Mo	Ma	Ma
01111	(*1 <b>9</b>				14.8	14.9		1118		1418	1418	141 <b>9</b>
SiO2	74 10	74 20	72 80	72 40	73 70	73 70	72 00	74 20	74 70	79 70	75 50	75 40
TIO2	0 11	0.18	0.22	0.15	0.21	0.18	0.23	0 11	0 10	0.18	0.00	0.05
AIDOR	13.60	19 10	14 30	14 10	13 70	13.60	14.00	16 30	19.00	12 40	15.00	13.00
5-203	0.34	0.40	0.60	0.34	0.48	0.00	0.27	0.49	0.98	0.24	0.94	0.24
EeO	0.69	0.40	0.00	0.87	1 10	0.40	1 20	0.90	0.30	0.34	0.18	0.24
Fetot	1 10	1 20	1.50	1.30	1 70	1 40	1.60	0.84	0.92	1 30	0.10	0.22
MnO	0.02	0.04	0.05	0.03	0.04	0.02	0.04	0.07	0.02	0.03	0.04	0.40
MaQ	0.02	0.47	0.00	0.48	0.64	0.55	0.71	0.25	0.02	0.03	0.017	0.03
C-C-C	0.52	1.00	0.00	0.70	1 30	0.00	1 40	0.60	0.23	0,73	0.17	0.10
Nego	4.40	4.00	9.00	4 00	4 00	3 80	4 20	4 20	1 4 60	0.90	0.40	4.00
Kazo	#.10	4.20	4 70	4.00	4.40	8 20	4.00	4.20	4.00	4.10	3.00	4.00
DOCE	0.00	4.00	4.70	4.00	0.12	0.20	0.04	0.07	4.00	4.20	· 4.40	4.80
F200	0.02	0.00	0.00	0.00	100.02	0.00	00.04	101.07	0.00	0.00	100.03	0.02
IVia	99.00	99.00	89.10	90.00	100.00	00.00	69.30	101.00	80.70	39.10	100.40	88.70
										100		
$\rho_{\rm eff} = \rho_{\rm eff}$								1.1		1.128-1		
Semple	73MG	B4MG	85MG	ROMG	131MG	160MG	164MG			1.1.		
Linit	Mo	Ma	Ma	Ma	Mn	Ma	Ma					
0	1412	1412			1118	· · · · · · · · · · · · · · · · · · ·				1.4	1. 1. 1. 1.	
SIO2	75.30	71 50	75 40	74 10	75.40	72 40	75 80					~
TIO2	0.00	A 18	0.08	0.32	0 11	0.24	0.10	· · · ·				
A1203	13 30	15.00	13.40	15.00	14 10	14 30	13.60					
Eng()g	0.41	0.60	0.40	0.46	0.76	0.97	0.10		- 1	1997 - 1997 - 1997 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -		11.11
FOR US	0.90	1.00	0.90	0.40	0.70	1 00	0.18			N 11		
Folat	0.38	1.00	0.20	1 10	0.18	1 70	0.41		1.11	ente November 1	1.1.1.1.1	
F 9101	0.04	0.02	0.04	0.02	0.00	0.00	0.00				1.1	
	0.01	0.02	0.02	0.03	0.02	0.02	0.02				11 - F F.	
MgU	0.33	0,09	0.10	0.40	0.23	0.71	0.23		5 - 11 - A			
UBU -	0.50	1.20	0,00	0.57	0.00	0.08	0.49				1.14	
N82O	4.50	4.10	4.40	3.80	4.00	4.20	3.60			1. A. A. A.		
K20	4.80	4.60	5.10	0.40	4,80	4.90	6.10				4	
P205	0.05	0.14	0.04	0.07	0.06	0.16	0.02		ang sa	a philippi		
Total	100.40	99.90	100.30	101.40	100.90	100.20	100.80	1.1			1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	

# APPENDIX 3.3 : ARDARA PLUTON (YARR 1991)

Sample	Y43	Y861	Y862	Y863	Y864	Y866	Y1262	Y1265	Y1266
Unit	Outer	Outer	Outer	Outer	Outer	Outer	Outer	Outer	Outer
SIO2	63.50	64.00	63.30	64.10	62.10	63.70	61.80	61.40	63.40
TIO2	0.79	0.80	0.78	0.82	0.79	0.80	0.80	0.90	0.84
Al2O3	16.59	17.00	16.69	16.56	16.48	16.70	17.33	17.51	17.31
Fe(tot)	4.46	4.10	4.24	4.30	4.57	5.46	4.96	5.31	4.91
MnO	0.06	0.10	0.07	0.07	0.07	0.06	0.08	0.09	0.07
MgO	1.88	1.60	1.63	1.83	2.12	1.83	2.20	2.59	2.27
CaO	3.44	3.40	3.45	3.03	3.26	3.38	4.09	4.16	3.84
Na2O	4.30	4.10	4.10	4.10	4.20	4.10	4.80	4.50	4.40
K2O	3.93	4.00	4.28	4.54	4.17	4.04	3.50	3.55	3.69
P2O5	0.29	0.30	0.30	0.31	0.31	0.28	0.30	0.29	0.30
LOI	0.80	0.20	1.40	1.00	2.20	0.80	0.80	0.60	0.00
Total	100.04	99.60	100.44	100.87	100.46	100.14	100.93	101.18	101.02
Nb	17 👘	22	24	21	18	21	13	15	15
Zr	287	408	360	360	313	304	188	200	221
Y	24	27	28	31	29	26	22	24	23
Sr	441	423	428	420	498	446	582	600	556
Rb	204	202	211	227	193	208	142	129	156
Th	23	31	35	34	31	27	21	20	19
Pb	35	30	40	39	36	36	38	27	35
Zn	62	52	55	58	59	61	63	69	66
Cu	<2	24	34	46	25	39	24	52	41
NI	24	19	22	20	22	24	28	30	29
Cr	<2	22	29	25	34	27	41	43	40
V	106	103	98	97	105	102	109	124	112
Ba	<5	724	659	667	696	642	728	819	680
Hf	<5	9	8	9	8	8	5	5	6
Ce	112	70	113	137	122	100	55	88	94
La	<5	15	44	64	55	39	30	3.6	43

Sample	Y1364	Y8610	Y49	Y8611/	Y8612	Y8613	Y1264	Y1365	Y1367	Y965	Y2153
Unit	int'mde	int'mde	intimde	int'mde	Int'mde	Int'mde	int'mde	Int'mde	Int'mde	Int'mde	int'mde
SIO2	64.72	64.23	63.91	61.68	61.79	61.72	64.05	67.67	64.31	68.55	66.91
TIO2	0.86	0.66	0.61	0.65	0.71	0.71	0.75	0.45	0.56	0.38	0.53
A1203	13.63	15.87	16.28	17.07	17.04	16.35	16.97	16.45	16.16	15.58	15.91
Fa(tot)	3.90	4 14	4 20	4.77	4.75	5.14	4.59	3.09	4 15	2.61	3 64
MnO	0.06	0.06	0.08	0.08	0.82	0.09	0.07	0.05	0.07	0.05	0.08
MaQ	2 16	1.80	2.54	3.26	2.57	3.37	2.30	1.69	2.31	1.85	2:22
<u> </u>	3 20	3 37	3 45	3 27	3.81	4 17	3 68	2 74	2 79	2 00	3.04
Na2O	A A 2	4 21	4 80	4 03	4 27	4 26	4 37	A 35	1 31	4 51	A 00
KOO	2 66	. 9 0 9	3 30	3 60	2 17	3.04	3 46	3 05	4.05	9.75	- 2 AA
DOOF	0.00	0.00	0.05	0.00	0.17	0.04	0.40	0.00	4.00	0.10	0 17
P205	0.20	1.00	0.24	1.23	0.24	1 00	0.20	0.10	0,2	0.13	0.17
	0.80	1.00	100.00	00.05	1.00	1.00	104 50	100.2	1.0	0.0	10.2
IOTAI	99.93	100.22	100.18	88.90	100.86	100.27	101.50	100.8	100.5	100.3	100.3
									i i sete		
Nb	9	15	10	0	14	14	14	7	10	12	6
Zr	150	205	170	157	144	125	171	124	158	104	120
Y	18	19	22	17	13	13	20	16	20	17	19
Sr	579	520	611	593	615	632	594	562	515	571	619
Rb	120	132	118	134	104	109	148	136	141	113	106
Th	9	30	22	5	18	11	16	10	15	14	7
Ph	31	36	41	25	35	23	33	31	30	17	24
Zn	50	53	62	61	59	67	65	41	48	38	73
Cu .	35	19	33	29	27	35	23	10.	52	10	53
Ni	30	24	35	39	18	45	29	26	29	25	31
Cr ·	59	30	70	89	42	102	44	48	63	56	74
Ň	88	nd	96	101	109	121	104	63	97	49	67
Ra	736	nd	761	732	601	651	633	760	800	761	409
Hf		nd	8	4	5	507	5	5	5	4	-403
Co.	76	nd	53	64	69	62	72	30	57	45	48
la .	33	nd	33	31	31	30	20	18	20	27	0
-a			00							<b></b> .	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

# APPENDIX 3.3 : CONTINUED - ARDARA

Sample	Y37/	Y90	Y94	Y961	Y962	Y963	Y8615	Y8616
Unit	Inner	Inner	Inner	Inner	Inner	Inner	Inner	Inner
SIO2	71.88	69.37	70.66	75.86	67.37	68.43	69.25	66.89
TIO2	0.26	0.33	0.23	0.05	0.26	0.34	0.26	0.35
AI2O3	15.62	15.23	15.4	13.43	15.19	15.59	16.14	15.56
Fe(tot)	1.89	· 2.55	1.76	0.7	2.09	1.47	2.08	2.57
MnO	0.04	0.06	0.06	0.02	0.05	0.05	0.05	0.05
MgO	1.07	1.48	0.94	0.25	1.57	1.57	1.14	1.8
CaO	1.2	1.67	1.22	0.66	1.6	2.45	1.79	2.1
Na2O	5.41	5.08	4.91	4.01	4.87	4.61	4.45	4.78
K20	3.08	3.04	3.57	4.53	3	3.59	3	3
P2O5	0.06	0.1	0.09	O	0.1	0,13	0.1	0.11
LOI	1.4	1	0.8	0.2	3.6	0.8	1	2.8
Total	101.77	99.9	99.81	99.82	99.85	99.21	99.4	100.18
	1.1							
Nb	7	7	7	4	5	. 9	10	11
Zr	- 90	91	79	57	87	120	108	101
Y	. 6	10	- 8	. 9	10	15	6	. 7
Sr	431	527	499	206	536	548	505	554
Rb	68	95	103	125	94	123	92	98
Th	. 13	15	13	7	9	15	14	6
Pb	: 17	32	32	42	23	33	38	38
Zn	41	54	39	5	45	45	.39	40
Cu	12	42	16	20	19	14	21	46
NI	20	19	16	- 5	18	25	17	23
Or .	27	40	19	<2	32	55	30	47
V	36	57	30	11	36	53	34	44
Ba	514	567	830	594	536	623	449	616
Hf	5	4	4	2	. 4	. 4	4	4
Ca	35	32	30	0	40	47	43	40
La	16	14	24	6	21	32	22	20

# APPENDIX 3.4 - APPINITE (YARR 1991)

Sample	M10	Y25518	Y25511	Y453	Y1851	¥1	Y1452	Y4	Y2557	76C	Y2657	AP2
SiO2	52.80	56.10	56.30	54.90	52.00	48.90	56.90	48.10	46.00	44.70	43.00	42.60
TIO2	0.48	0.30	0.74	0.32	0.50	1.65	0.88	2.41	3.85	1.61	1.82	1.56
AI203	19.73	12.79	11.30	13.36	15.17	15.51	18.91	13.35	12.37	10.87	12 30	16 60
Fe(tot)	4.87	5.48	8.64	6.51	4.60	9.18	8.00	13.83	17 50	11 32	12 01	11 01
MnO	0.07	0.12	0.15	0.14	0.09	0.13	0.09	0.24	0.28	0.15	0.15	0.11
MnO	5.91	8.51	8 77	9 90	7 63	9.10	2 78	7 22	5 36	12 58	11 30	10.34
CaO	8 04	8.38	8.82	9.31	15.38	9.96	5 45	11.86	9.69	11 49	11 41	12 41
Na2O	4 80	2.80	2 10	3 10	2 60	2 60	3.60	2 10	2 10	2 20	2 50	1 70
K20	1 50	1 53	1 40	1 25	0.62	1 20	3.09	0.23	0.64	1 21	1 04	0.97
P205	0.15	0.07	0.12	0.04	0.13	0.37	0.25	0.27	0.47	0.06	0 10	0.02
1.01	1.80	3.80	1.00	1.20	1.20	2.20	0.60	0.00	1.00	3.80	3.60	2.40
Total	100.16	100.35	99.52	100.40	100.10	100.10	100.80	99.69	99 44	100.03	99.37	99 72
Nb	0	4	6	1	0	4	11	3	15	4	3	2
Zr	54	26	79	59	26	76	123	96	262	65	52	73
Y	9	15	33	12	14	30	23	29	44	33	30	31
Sr	1420	651	359	831	820	813	772	217	244	236	305	735
Rb	76	72	54	48	14	37	50	0	11	31	18	20
Th	2	10	5	6	· 1	· 1	4	14	3	2	8	11 <b>1</b> 1 - 1
Pb	9	14	19	11	15	. 0	12	21	6	9	11	106
Zn	41	60	93	62	40	69	83	109	155	82	92	82
Cu	0	31	35	46	6	0	28	165	162	0	118	n.d
NI	56	104	123	145	18	95	63	65	43	67	42	55
Cr	0	276	341	341	5	0	99	177	50	0	385	n.d
V	89	103	175	96	139	271	183	517	705	408	455	355
Ba	0 🕤	321	120	15	167	336	584	72	174	0	217	n.d
Hf	0	2	2	3	2	3	3	2	3	1 1 C	1	n.d
Ce	50	28	28	14	14	9	50	0	44	42	19	60
La	16	13	12	12	96	27	n.d.	5	n.d	n.d.	9	n.d
. *											1994 - 1994 -	
Samole	API	Y2652	¥27517	Y30517	¥77	Y55	Y80	¥71	¥31515	V26523	Y31512	V31511
Qampio					- 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975					120020		101011
SIO2	41.50	48.70	56.60	47.00	50.70	62.60	53.40	55.10	48.80	55.10	50.20	52.60
TIO2	1.96	0.85	0.91	0.58	0.67	0.70	1.14	1.03	0.90	1.02	1.00	0.71
A12O3	12.43	8.69	16.27	15.52	7.37	17.68	16.98	17.05	19.43	17.41	14.30	10.63
Fe(tot)	11.23	8.27	9.09	5.38	10.77	6.12	7.05	7.78	7.42	7.51	7.70	6.78
MnO	0.12	0.15	0.09	0.08	0.18	0.07	0.10	0.10	0.08	0.14	0.10	0.14
MaO	11.31	9.68	4.20	4.52	13.82	4.52	5.79	3.90	5.14	4.64	7.90	8.72
CaO	10.53	15.77	6.51	15.50	11.88	0.63	8.01	6.78	9.23	6.12	11.80	13.59
Na2O	2.00	1.70	3.50	1.80	1.30	1.20	3.10	3.50	3.10	3.70	2.80	2.20
K20	1.20	0.39	2.51	0.79	0.56	3.20	1.80	3.04	2.42	2.00	1.00	1.33
P205	0.05	0.08	0.29	0.11	0.05	0.13	0.22	0.00	0.54	0.19	0.30	0.11
LOI	2.40	4.60	1.40	8.00	2.00	3.40	1.80	0.60	1.80	1.60	2.40	3.60
Total	94.71	98.90	101.42	99.39	99.32	100.49	99.43	99.10	98.84	99.56	100.50	100.58
	19 A.			i -								
Nb	2	n.d	4	6	2	20	5	11	2	8	4	7
Zr	73	n.d	98	54	58	265	82	188	144	126	62	48
Y	31	nid	21	16	19	65	22	31	44	25	18	19
Sr .	735	nd	328	606	116	152	864	497	861	521	415	316
Rb	20	n.d	72	19	7	144	70	100	130	83	31	46
Th	1	n d	Ř	4	1.8	25	3	16	7	- A	4	- A
Ph	108	n d	11	10		25	ġ -	20	1.6	14	11	12
7n	80	n d	nd	4.4	81	115	62	138	- 64	79	75	AA
0	0 K .	n d	nd	21	122	25	nd	62	04 · n d	17	- 10 -	94
NI	11.U g.e.	n.u n.d	n d	2	4.4	.g1	40	62	10	20	35	20
0	00 nd	nu nd	nd	64	370	174	nd.	50	01 6 A A	27	nd	163
V	9.55	nd	285	267	249	126	101	160	100	222	220	100
Re	ooo h d	nd	450	170	89	505	nd	808	nd	677	n d	200
Hf	n.u n.d	nd	3	2	2	555	n.d	500	n d	3	n d	1
. Ca	60	n.d	25	32	12	107	60	84	88	50	45	29
la -	n.d	n.d	21	17	7	55	140	27	n.d	20	94	11
La .												

# APPENDIX 3.4 - CONTINUED - APPINITE

Sample	9 Y2554	Y2554	Y1854	Y2552	Y458	Y2556	Y1856	Y2159	M14	M11	Y2559	M5	
SiO2	52.70	53.00	52.20	52.30	52.80	47.10	50.90	53.70	50.00	53.40	46.95	48 65	
TiO2	0.71	0.73	0.49	1.44	1.19	3.40	1.00	1.16	2.10	0.53	1 60	1 58	
AI203	13.24	12.89	12.33	16.34	8.69	17.39	13 36	15 58	17.37	16.20	13 79	14 66	
Fe203	1.90	4.21	2.49	2 20	0.70	5 36	5 34	4 4 1	1 60	0.50	0 47	2 06	
FeO	5 80	3 73	4 52	5 73	6.00	6.00	2 55	5.00	6 98	5.04	0.70	7 00	
MnO	0.00	0.70	0.14	0.15	0.00	0.00	0.15	0.12	0.00	0.11	0.15	7.00	
MaO	10.16	0.14	11 00	6 77	11 74	1 60	10.10	7 94	7 54	0.11	44 96	0.13	
	10.10	10 21	0.05	0.77	19.07	9.09	10.20	6 70	7.04	0.21	0 64	9.50	
Nego	2 1	2 20	0.00	2.04	0.00	4.00	0.20	0.70	0.07	9.10	9.01	9.07	
Kao	1.01	1 00	1 16	0.00	1 25	4.00	1 20	2.40	1 00	1 02	2.00	3.04	
D2OF	1.01	0.00	0.10	0.00	0.00	1.27	1.20	2.31	1.92	1.93	1.77	1.37	
F205	1 40	1 40	4 80	1 0.15	0.20	1.60	1.00	1.00	0.14	0.20	0.32	0.11	
LOI	1.40	1.40	00.40	00.14	2.00	1.00	1.00	100 47	0.00	2.20	0.80	3.00	
rotar	100.00	89.30	99.42	99.14	101.20	99.00	99.01	100.17	88.88	100.57	99.28	100.78	
							1						
Nb	4	4	3	· 4	8	30	4	8	5	0	18	0	
7r	3.8	3.8	24	19	81	151	58	113	107	108	128	0.9	
2.1 V	23	22	14	10	21	28	10	24	27	100	10		
Cr	621	601	041	073	206	075	696	702	1057	1054	526	940	
OI Dh	40	1021	63	- 25	A 1	39	. 42 .	81	82	70	230	040	
Th	40	40		20		0	42	 	4	6	0	 	
Ph	10	10		7	6	7	0	16	4.4	45	. 0	7	
70	67	67	64	77	E 7	0.1	E A	50		49	70	· · · · ·	
. 20	07	25	20	11	10	01	40	. 59	00	43	. 70		
	35	30	100	20	10	4.0	44	21		0	44		
NI	01	470	130	51	119	18	100	44	41	. 97	197	140	
. Or	173	173	305	107	535	0	211	143		0	642	0	
v	154	154	137	135	218	367	201	112	296	114	219	264	
Ba	250	251	220	250	411	0	321	/14	. 0		192	0	
HI	1	2.:	2	2	2	0	. 2	4	0	0	3	0	
Ce	23	21	6	14	39	60	25	30	0	0	10	53	
La	16	18	9	4	16	152	12	15	0	. <b>0</b> '	10	19	
											1990 - 1999 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 -		
											1997 - 1997 1997 - 1997		
Sample	V19	VIOSO	V1050	V22150	V1751	V1751/					a ta ta ta ta		
Sample	110	11009	11000	122100	11/51	117517	A. A.						
SiO2	53.46	52.92	51.48	48.59	50.54	49.34							
T102	0.73	0.72	1.10	1.04	1.50	1.49				- 			
AI2O3	14.10	14.57	16.81	14.01	18.26	17.47							
Fe2O3	1.40	0.01	2.90	2.87	3.08	7.76					S		
FeO	5.30	7.34	4.95	6.14	4.70	n.d.						e se k	
MnO	0.14	0.13	0.14	0.15	0.11	0.10							
MgO	9.25	9.30	7.69	7.80	6.56	6.21						1.1.1.1.1	
CaO	8.98	9.38	9.84	12.26	10,10	10.17					1. S. S. S.	۰. کې د	
Na2O	2.86	2.57	3.27	2.83	3.07	3.49							
K2O	1.47	1.25	1.28	0.96	1.42	1.36			·				
P2O5	0.12	0.13	0.23	0.33	0.23	0.22							
LOI	1.60	1.60	0.40	1.80	1.60	2.20							
Total	99.59	99.93	100.24	99.31	101.93	99.81							
											$(x_1, x_2, x_3)$	aga ar ei	
												1997 - 1997 -	
Nb	4	5	1	16	12	13					1.11		
Zr	110	55	70	95	96	91							
Y.	34	16	20	16	16	17							
Sr	634	797	414	664	49	813					e		
Rb ·	60	44	46	33	49	49							
Th	18	2	9	5	1	8 <b>1</b> 5 4		4 . ·	a ar i ji	ant <sub>an</sub> ta		$2 \times 10^{10}$	
Pb	9	7	9	4	49	8				1999 - 1998 - 1999 -	1111-11-16-18-18- 1		
Zn	76	61	65	71	52	52							
Cu	58	38	45	25	0	0	and the second		1			5 G.	
Ni	140	98	207	23	50	52							
Cr	0	119	267	61	0	0							
V	264	162	191	436	188	198					$(1,1) \in [\delta(0)]$		ł
Ba	0	292	157	236	0	0					1.1.1.1.1.1	$\{x_i\} \in \{x_i\}_{i \in I}$	
Hf	ň	3	2	3	0		1. A. A.				1	s de la composition d	
Ca	53	34	A	16	0	55	с. Т. т.					i i ter	
	10	0	4	0	19	0					2000 - 1990 - 1990 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 -		
		-		-		-						1 A A A A A A A A A A A A A A A A A A A	

## APPENDIX 3.5 : BARNESMORE PLUTON (DEMPSEY 1987).

Sample No Unit	1 G1	2 G1	3 G1	4 G1	5 G1	6 G1	7 G1	8 G1	9 G1	10 G1	11 G1	1 2 G1	
SiO2	73.51	72.33	72.82	73.23	75.79	74.03	73.19	73.32	71.96	73.97	73.21	73.63	
TIO2	0.20	0.24	0.22	0.18	0.16	0.17	0.20	0.20	0.28	0.18	0.18	0.19	
A1203	14.52	14.79	14.50	14.24	13.44	14.22	14.36	14.31	14.59	14.22	14.51	14.41	
Fe(101)	1.38	1.67	1,50	1.30	0.88	0.94	1.47	1.44	1.80	0.00	1.34	1.39	
Fe2U3	0.59	0.59	0.07	0.62	0.20	0.29	0,00	0.00	1.00	0.62	0,03	0.66	
FBU	0.71	0.97	0.80	0.01	0.54	0.59	0.71	0.71	1.06	0.62	0.64	0.66	
MnO	0.04	0.07	0.05	0.03	0.03	0.04	0.03	0.05	0.05	0.05	0.04	0.04	
MgU .	1 30	1 40	1 18	1.45	0.50	0.30	1 00	1 47	1 27	1.40	1 26	0.55	
Ne2O	4 40	4 20	4 20	4.06	4 40	4 43	4 21	4 4 8	4.05	4 38	1.30	4 34	
K2O	3.51	4.02	4 01	4 20	4.05	4 28	4 02	3.53	4.52	4 06	4 18	4.34	
P205	0.06	0.08	0.08	0.06	0.06	0.05	0.06	0.06	0.08	0.04	0.05	0.06	
Total	99.45	99.34	99.12	98.75	99.56	99.21	99.09	99.28	99.32	99.68	99.43	99.57	
Rb	198	245	235	237	209	231	206	161	185	241	195	225	
Sr	187	259	185	185	103	122	193	211	2/8	162	200	172	
7	136	130	129	- 111	100	102	116	121	103	101	100	401	
Y .	21	23	26	21	18	16	16	18	19	18	16	16	
Nb	22	19	18	14	20	18	17	16	16	16	12	14	
Th	15	12	13	14	20	21	20	28	11	21	18	20	
U	11	b.d.l	4	4 .	21	5	4	· 4	b.d.l	8	4	b.d.l	
Zn	23	37	31	25	33	20	31	31	37	30	33	33	
Ni	bdi	b.d.l	b.d.l	b.d.l	b.d.l	b.d.l	b.d.l	b.d.i	3	b.d.l	b.d.l	b.d.l	
Pb	33	33	34	36	21	28	28	31	30	32	.38	36	
			-						e g				
Sample No	13	14	15	16	17	18	19	20	21	22	23	24	
Unit	Gļ	G1	G1	G1	G1	G1	G1	G1	Gt	G1	G1	G2BF	
SiO2	73 99	72 73	74 08	72 88	72 R4	72.52	74 95	72.95	73 94	73 50	73 64	73 08	
TIO2	0.17	0.23	0 17	0.22	0.22	0.22	0.15	0.24	0.20	0.18	0.18	0.19	
AI203	14.34	14.71	14.18	14.72	14.76	14.78	13.92	14.85	14.47	14.37	14.36	13.71	
Fe(tot)	1.16	1.68	1.12	1.60	1.82	1.60	1.05	1.58	1.46	1.39	1.31	1.35	
Fe2O3	0.47	0.99	0.48	0.71	0.93	0.72	0.45	0.61	0.67	0.67	0.62	0.59	
FeO	0.62	0.84	0.58	0.80	0.80	0.80	0.52	0.87	0.71	0.65	0.62	0.68	
MnO	0.04	0.04	0.04	0.04	0.06	0.04	0.03	0.04	0.05	0.05	0.05	0.04	Ì
MgO	0.44	0.58	0.38	0.64	0.66	0.73	0.39	0.65	0.47	0.45	0.41	0.43	
CaO	0.73	1.30	0.87	1.12	1.15	1.17	0.73	0.98	1.34	1.21	1.14	0.75	
Na2O	4.30	9.41	4.27	4.35	4.27	4.19	4.23	4.26	4.30	4.25	4.28	3.97	
P205	4.30	0.04	9.00	0.07	0.08	0.07	4.33	0.07	3.09	4.08	4.20	4,00	
Total	99.52	99.53	99.42	99.36	99.41	99.13	99.78	99.25	99.50	99.47	99.60	99.19	
							2.01			00.41	00.00		
					405								
Rb	257	159	227	1/2	185	183	227	163	211	219	217	224	
Sr Be	132	£10 500	300	472	569	(97 684	288	100	180	374	100	132	
7r	103	131	101	135	122	123	96	127	121	107	103	103	
Ŷ	20	21	14	17	15	18	16	16	16	16	24	20	
Nb	20	15	14	14	14	15	15	13	17	17	20	18	
Th	24	21	21	21	16	13	20	14	22	21	18	24	
ັບ	b.d.l	3	5	2	b.d.l	2	8	2	b.d.i	b.d.l	b.d.l	b.d.l	
Zn	32	35	27	33	39	35	25	32	33	31	131	22	
NI	b.d.l	b.d.l	b.d.l	b.d.i	26	b.d.l	b.d.l	b.d.l	b.d.l	b.d.l	b.d.l	b.d.1	
Pb	32	28	33	31	21	25	31	17	30	37	31	32	
			5										
Sample No	25	26	27	28	29	30	31.	32	33	34	35	36	
Onit	GEO!"	Gabr	GEOF	GEDF	Gabr	GEOF	Gabr	GZDF	Geor	Gzor	Gapr	GZDr	
SIO2	75.28	73.45	74.13	74.26	72.90	74.05	72.69	74.88	72.23	72.86	76.12	75.13	
T102	0.17	0.23	0.16	0.12	0.24	0.22	0.20	0.20	0.27	0.22	0.14	0,16	
AI203	13.37	14.07	14.24	14.55	14.55	13.87	14.72	13.82	14.75	14.68	13.60	13.76	
Fe(tot)	1.20	1.53	1.14	0.92	1.52	1.57	1.31	1.33	1,85	1.45	0.97	1.14	
Fe2O3	0,53	0.60	0.52	0.51	0.55	0.68	0.50	0.53	0.72	0.56	0.46	0.53	
F9U .	0.60	0.84	0.50	0.37	0.04	0.00	0,73	0.72	1.02	0.80	0.40	0.55	
MaO	0.04	0.08	0.40	0.92	0.64	0.05	0.48	0.03	0.00	0.00	0.03	0.04	
CaO	0.80	0.87	0.79	0.56	0.82	1.05	1.12	0.88	1.08	1.01	0.62	0.75	
Na2O	4.06	4,11	4.11	4.52	4.01	4.15	4.25	4.11	4.16	4.03	3.92	3.97	
K20	4.39	4.51	4.82	4.47	4.74	4.22	4.66	4.54	4.45	4.89	4.58	4.74	
P2O5	0.04	0.06	0.04	0.03	0.06	0.06	0.05	0.05	0.08	0.06	0.03	0.04	
Total	99.71	99.34	99.80	99.73	99.46	99.69	99.44	100.19	99.42	99.67	100.28	99.96	
						S., 1							
Rb	210	317	216	179	187	172	178	194	178	174	194	213	
Sr	128	190	139	145	199	168	207	121	205	230	122	145	
Ba	269	344	242	246	564	237	396	186	384	475	191	259	
Zr	99	125	92	62	97	110	89	91	112	93	78	90	
Y Nb	20	27	11	11	16	17	17.	19	20	17	13	13	
Th	20	17	99	91	24	5 21	10	10	10	10	22	97	
нн Ц	b.d.l	b.d.l	e∉ b.d.l∵	b.d.f	28	i.b.d.∶	acos b.d.í	b.d.l	b.d.l	b.d.i	6.d.1	b.d.	
Zn	21	26	27	18	30	32	27	28	35	30	23	23	
NI	b.d.i	b,d.i	b.d.l	b,d.1	26	b.d.l	b.d.l	b.d.l	b.d.l	b.d.l	b.d.i	b.d.l	
	~~		~ ~							10 <b></b>	-	1 2 2 1	

	Sample No Unit	37 G2	38 G2	39 G2	40 G2	41 G2	42 G2	43 G2	44 G2	45 G2	4 8 G2	47 G2	48 G2
	SiO2	75.25	75.45	75.97	75.95	76.52	75.51	76.23	74.26	75.50	75.24	76.20	75.76
	TiO2	0.11	0.13	0.13	0.11	0.12	0.14	0.11	0.12	0.12	0.14	0.12	0.13
,	AI2O3	13.80	13.60	13.07	13.28	13.20	13.31	13.26	13.82	13.65	13.65	13.28	13.56
	Fe(tot)	0.83	1.03	0.99	0.88	0.86	0.97	0.74	0.81	0.91	1.04	0,96	0.93
	Fe2O3	0.44	0.55	0.53	0.49	0.43	0.44	0.25	0.38	0.40	0.44	0.53	0.45
	FeO	0.35	0.43	0.41	0.35	0.39	0.48	0.44	0.39	0.46	0.54	0.39	0.43
	MnO	0.03	0.04	0.03	0.04	0.04	0.03	0.03	0.04	0.03	0.04	0.04	0.03
	mgo CeÓ	0.20	0.24	0.34	0.24	0.56	0.20	0.58	0.23	0.23	0.20	0.23	0.72
	Na2O	4.32	4.30	3.84	3.86	3.91	3.98	4.18	4.44	4.07	4.27	4.15	4 25
	K20	4.71	4.54	4.81	4.97	4.70	4.64	4.50	4.22	4.86	4.55	4.55	4.54
	P2O5	0.02	0.03	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.03	0.03	0.03
	Total	99.87	99.63	99.63	99.88	100.16	99,42	99.84	99.64	100.00	99.85	100.11	100.12
	Rb ,	236	277	192	205	201	228	237	185	251	238	246	233
	Sr	74	73	78	79	81	87	58	110	78	82	55	72
	Ba	83	122	99	79	87	173	14	21	105	169	74	101
	Zr	80	96	. 93	19	82	100	81	72	77	89	93	. 96
	Nb	18	25	13	13	15	22	15	13	13	18	18	10
	Th	22	27	24	42	25	29	25	23	21	22	25	27
	U	b.d.i	7	7	7	b.d.l	b.d.l	2	b.d.l	b.d.i	b.d.1	3	b.d.i
	Zn	14	18	17	16	16	19	13	19	16	17	17 1	15
	Ni	b.d.l	b.d.l	b.d.l	b.d.i	26	b.d.i	b.d.l	b.d.l	b.d.l	b.d.l	b.d.i	b.d.i
	20	29	49	20	39	24	58	34	43	39	30	35	32
	Sample No	49	50	51	52	53	54	55	56	57	58	59	60
	Unit	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2
	SIO2	75.59	75.51	75.14	75.61	75.76	75,40	75.66	76.48	75.73	76.46	74.87	76.52
	TIO2	0.13	0.12	0.12	0.12	0.13	0.13	0.14	0.13	0.12	0.13	0.11	0.12
	AI2O3	13.54	13.61	13,42	13.45	13.50	13.72	13.40	13.16	13.51	13.21	14.13	13.34
	Fe(tot)	0.98	0.89	0.95	0.82	1.00	0.86	1.00	0.87	0.94	0.93	0.91	0.88
	Fe2O3	0.50	0.46	0.52	0.39	0.60	0.38	0.47	0.41	0.48	0.44	0.54	0.46
	Mac	0.43	0.39	0.39	0.39	0.30	0.43	0.48	0.42	0.41	0.44	0.34	0.38
	MaQ	0.25	0.21	0.27	0.02	0.22	0.24	0.03	0.25	0.03	0.03	0.04	0.02
	CaO	0.75	0.62	0.57	0.53	0.66	0.64	0.68	0.60	0.54	0.50	0.66	0.60
	Na2O	4.06	4.34	4.24	4.19	4.19	4.17	4.05	4.09	4.16	4.04	4.48	4.15
	K2O	4.65	4.59	4.74	4.73	4.75	4.70	4.74	4.62	4.79	4.57	4.61	4.66
	P2O5	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	Total	99.96	99.90	99.48	99.69	100.23	99.86	99.60	100.22	100.03	100.13	100.01	100.50
	<b>Fib</b>	273	273	275	252	250	241	252	242	274	250	258	245
	Sr	70	66	65	69	81	73	70	69	71	63	83	58
	58	129	80	89	113	115	122	110	62	95	67	89	83
	~	25	23	24	22	21	24	25	23	22	14	16	16
	Nb	25	23	19	19	21	20	21	18	27	23	20	22
	Th	27	27	30	27	27	22	26	32	28	28	23	25
	U .	b.d.l	b.d.l	b.d.l	214	b.d.i	5	b.d.l	3	b.d.l	2	b.d.1	b.d.l
	Zn	17	14	18	15	20	15	14	24	24	22	23	17
	NI	b.d.1	0.0.1	D.d.)	b.d.i	28	b.d.i	b.d.i	b.d.l	b.d.l	b.d.i	b.d.i	b.d.i
	20	. 35	33	39	33	33	35	35	38	33	28	40	31
	Sample No	61	62	63	64	85	88	67	68	89	70	71	72
	Unit		04		(346	34	Ch2	CM2	Cad	Ge .	34	GE	GX
	SIO2	76.06	76.07	75.55	75.88	75.90	75.16	76.25	75.76	75.78	76.80	78.72	75.96
	T102	0.14	0.12	0.12	0.10	0.10	0.17	0.13	0.12	0.14	0.13	0.12	0.13
	AIZOS	13.35	13.63	13.71	13.67	13.44	13.58	13.24	13.87	13.40	12.98	13.03	13.42
	F0(101)	0.95	0.67	0.67	0.60	0.00	1.10	0.81	0.66	0.40	0.90	0.47	0.95
	FeD	0.47	0.38	0.38	0.30	0.32	0.60	0.44	0.38	0.48	0.42	0.41	0.42
	MnO	0.02	0.02	0.03	0.03	0.05	0.03	0.02	0.02	0.03	0.03	0.03	0.03
	MgO	0.25	0.21	0.23	0.18	0.20	0.41	0.28	0.25	0.32	0.27	0.21	0.32
	CaO	0.65	0.65	0.60	0.62	0.72	0.59	0.80	0.50	0.54	0.47	0.66	0.50
	Na2O	4,16	4.19	4.21	4.21	4.13	4.05	3,98	4.35	3.67	3.89	3.89	3.90
	K20	4.50	4.75	4.77	4.77	4.70	4.67	4.78	4.63	5.17	4.67	4.68	4.91
	rzU5 Total	0.03	100.49	100.07	100.25	100.09	0.05 99.74	100.19	100.17	100.09	100.11	100.20	100.10
										144198			199119
	Fib	217	245	264	247	238	224	231	224	187	223	181	207
	Sr	69	69	64	60	65	81	84	58	91	64	72	127
	Ba	107	124	85	70	49	147	81 -	52	92	96	80	116
	Zr	87	84	83	82	78	103	90	92	108	78.	84	76
	Y	15	13	14	15	13	18	13	15	13	15	13	13
	NO	20	17	20	25	13	22	14	23	9	15	11	11
	19 11	∡⊽ h.d F	er/ b.d.l	2	13	28	6/ ·	eo hdi	6.01	∡ə b.di	i ∠o h.di	66 b.d.)	er hdi
	Zn	15	20	21	20	22	24	19	20	18	21	21	21
	NI	b.d.l	b.d.i	b.d.l	b.d.l	26	b.d.i	b.d.l	b.d.l	b.d.l	b.d.I	b.d.1	b.d.l
	10h	20	30	26	97	40	20		0.0	30			04

Sample No Unit	73 G2	74 G2	75 G2	76 G2	77 G2	78 G2	79 G2	80 G2	81 G2	82 G2	83 G2	84 G2
SiO2 TiO2 Al2O3 Fe(tot) Fe2O3	75.48 0.10 13.74 0.67 0.34	75.75 0.11 13.46 0.77 0.37	75.83 0.12 13.29 0.77 0.36	75.88 0.13 13.64 0.83 0.37	76.52 0.13 13.23 0.95 0.48	76.34 0.14 13.19 0.95 0.40	75.76 0.13 13.60 0.95 0.46	76.59 0.12 13.38 0.83 0.41	75.55 0.13 13.55 0.98 0.49	75.98 0.13 13.55 0.98 0.50	76.43 0.12 13.26 0.91 0.46	75.84 0.12 13.61 0.90 0.45
HeO MnO	0.02	0.36	0.37	0.42	0.42	0.50	0.44	0.02	0.44	0.44	0.41	0.41
MgO CaO	0.15	0.21	0.17	0.23	0.22	0.31	0.24	0.21	0.26	0.30	0.29	0.23
Na2O	4.22	4.17	4.06	4.15	4.12	4.04	4.03	4.37	4.01	3.95	3.85	4.06
K2O P2O5	4.98 0.02	4.85 0.03	4.78 0.03	4.80 0.03	4.82	4.72	4.97 0.03	4.79	4.78 0.03	4.79 0.03	4.81 0.03	4.57
Total	99.89	99.89	99.61	100.23	100.48	100.02	100.17	100.50	100.07	100.39	100.25	100.14
Rb	234	215	246	247	242	203	220	196	205	180	192	182
Ba	63	100	63	110	43	131	123	83	112	134	79	77
Zr Y	69 11	81	86	80 11	81 17	84	76	13	. 86 14	82 13	75 15	87 13
Nb Th	10	14	22 25	24 24	28 32	18 29	14 31	14	14	10 27	11 26	13
U C	b.d.I	b.d.i	5	2	b.d.I	b.d.i	b.d.i	b.d.l	b.d.l	b.d.l	b.d.l	b.d.l
Zn Ni	16 b.d.i	15 b.d.l	18 b.d.i	19 b.d.l	20 26	22 b.d.i	23 b.d.l	21 b.d.i	29 b.d.l	19 b.d.l	19 b.d,l	24 b.d.l
рь	25	32	32	27	29	18	32	22	34	38	36	39
Sample No	85	86	87	88	89	90	91	92	93	94	95	96
Unit	G2											
SIO2 TIO2	75.65 0.11	75.91	76.22 0.11	75.73 0.13	75.85 0.11	75.91 0.12	76.28	75.93 0.13	76.09	76.47	75.95	75.70
AI2O3 Fe(tot)	13.85	13.62	13.45	13.66	13.57	13.51	13.45	13.53 0.96	13.42	13.22	13.31	13.62
Fe2O3	0.53	0.48	0.47	0.50	0.43	0.47	0.37	0.50	0.45	0.45	0.50	0.46
FeO MnO	0.34 0.03	0.40 0.04	0.34 0.04	0,44 0.05	0.34 0.06	0.38 0.04	0.44 0.03	0.42	0.38	0.38	0.52	0.51
MgO	0.19	0.23	0.23	0.28	0.20	0.23	0.24	0.25	0.28	0.20	0.29	0.24
Na2O	4.30	4.17	4.08	4.07	4.35	3.98	3.96	4.14	4.19	4.15	4.01	4.08
K2O P2O5	4.58 0.03	4.68 0.02	4.67	4.77	4.60 0.02	4.87 0.03	4.85	4.68	4.67 0.03	4.58 0.03	4.82	4.78 0.03
Total	100.34	100.26	100.19	100.25	100.24	100.10	100.35	100.20	100.20	100.25	100.15	100.25
Rb	200	243	238	233	265	223	221	236	259	246	247	247
Ba	59	58	86	96	61	95	97	66	64	79	134	142
Zr Y	78 13	91 15	75 14	94 15	85	91	84 13	91 14	90 14	83	101	94 14
Nb	14	20	16	19	22	11	13	21	18	19	16	16
U	b.d.l	b.d.l	b.d.i	b.d.l	2	b.d.l	b.d.l	5	b.d.i	b.d.1	b.d.i	4
Zn Ni	22 b.d.i	22 b.d.i	26 b.d.l	27 b.d.l	25 26	23 b.d.i	26 b.d.l	26 b.d.l	28 b.d.l	24. b.d.i	25 b.d.l	25 b.d.l
Pb	33	39	39	- <b>41</b>	. 47 .	- <b>41</b> .	3.0	39	41	37	35	34
Sample No	97	98	99	100	101	102	103	104	105	106	107	108
Unit	G2	G2	G2	G2	G2	GZ	G2	G2	Gž	G2	Ģ2	G2
SIO2 TIO2	76.20	76.22	76.39 0.14	76.16 0.13	75.79 0.13	75.81 0.12	0.12	76.87	75.29	0.14	75.58 0.13	75.95
A1203	13.27	13.16	13.28	13.50	13.50	13.49	13.66	13.12	13.38	13.48	13.63	13.50
Fe2O3	0.42	0.44	0.34	0.50	0.48	0.38	0.42	0.38	0.48	0.37	0.45	0.43
FeO	0.48	0.51	0.44	0.42	0.42	0.38	0.40	0.48	0.36	0.48	0.44	0.40
MgO	0.28	0.30	0.26	0.26	0.32	0.45	0.32	0.35	0.15	0.18	0.22	0.21
CaO Na2O	0.46 4.12	0.51 4.05	0.51 4.15	0.57 4.21	0.50	0.31	0.39	0.53	4.01	4.04	4.10	0.59
K20	4.70	4.81	4.55	4.64	4.77	4.62	4.15	4.45	4.87	4.67	4.85	4.87
Total	100.13	100.20	100.11	100.44	100.11	99.87	100.15	100.37	100.40	100.14	100.07	100.16
Rb	238	249	218	229	255	240	201	180	243	229	248	255
Sr Ba	54 126	70	65 79	70 98	60 93	61 - 88	91 229	81	66 100	75	123	93
Zr	93 1 F	96	86	89	93	90	71	88	84	91	92	85
ND ND	22	21	17	17	22	15	12	15	18	17	18	20
Th	30 b.d.i	28 b.d.i	28 b.d.l	31 b.d.l	. 28	33	32 b.d.l	32 b.d.i	31. b.d.i	29 b.d.l	34 b.d.i	29
Zn	21	25	20	24	21	24	21	21	23	23	24	24
NI	b.d.) 31	b.d.) 43	b.d.i 29	5.d.l 33	26	b.d.) 23	b.d.i 28	0.d.l 31	b.d.l 38	5.d.l	5.d.i 34	0.d.1

Sample No Unit	109 G2	110 G2	111 G2	112 G2	113 G2	114 G2	115 G2	116 G2	117 G2	118 G2	119 G2	120 G2PF
8100	70 40	75 76	78 85	78 60	75 01	75.04	75.04	75 64	75 50	75.04	75.00	70.00
SIC2	/0.43	/5./5	/5.00	/0.02	/5.61	/5.94	/5.94	/3.08	75.52	/5.64	75.92	76.23
102	12 20	12 52	13 26	13 46	12 50	13 61	13.94	19 71	10 80	13 83	12 46	0.125
Ea(tot)	07	0 02	0.03	0.82	0.01	0.85	0.76	0.04	0.04	0.84	0.040	0.02
Fe2O3	0.26	0.47	0.43	0.33	0.53	0.43	0.36	0.47	0.54	0.31	0.00	0.08
FeO	0.4	0.4	0.45	0.44	0.34	0.38	0.36	0.42	0.36	0.48	0.46	0.41
MnO	0.02	0.037	0.031	0.017	0.031	0.025	0.018	0.031	0.036	0.023	0.042	0.032
MgO	0.19	0.22	0.2	0.16	0.2	0.18	0.2	0.22	0.26	0.22	0.27	0.25
CaO	0.44	0.58	0.68	0.74	0.68	0.56	0.64	0.61	0.75	0.58	0.65	0.56
Na2O	4.24	4.03	4.11	4.13	4.11	4.12	4.13	4.14	3.97	4.04	3.93	3.87
K2O	4.75	4.81	0.66	4.55	4.66	4.77	4.83	4.91	4.94	5	4.89	4.85
P205	0.027	0.03	0.034	100 6	0.034	0.025	0.022	0.025	0.03	0.029	0.029	0.028
IOLAI	100.20	33.801	88.720	100.0	88.720	100.10	100.42	100.34	100.15	100.29	100.23	100.11
Fib	274	228	237	241	237	212	205	219	214	186	213	215
Sr	48	84	74	67	71.	61	69	70	80	77	84	75
- Ca 7r	106	76	05	88	83	80	10	80 99	119	137	70	102
Ŷ	14	14	15	15	14	12	14	14	14	14	16	14
Nb	22	12	15	19	19	19	14	15	10	11	14	14
Th	28	25	26	36	33	31	25	33	36	33	29	41
U	5	b.d.I	b.d.!	b.d.l	3	b.d.l	b.d.l	b.d.l	b.d.l	b.d.l	l.b.d	b.d.l
Zn	23	24	23	22	22	19	20	19	22	21	25	22
NI Ph	D.O.( 9.1	D.Q.I 3.4	3.6	D.O.I 38	20	0.0.I 32	0.0.I 29	D.Q.I 35	D.C.I	0.0.I 30	0.0.I 35	D.d.i
									- <b></b> -			34
0			400			100	407		400	400		
Unit	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF
SiO2	78.22	76.04	73.89	74.28	76.18	75.57	75.89	75.98	75.83	75.78	76.43	76.10
TiO2	0.12	0.14	0.16	0.15	0.15	0.15	0.13	0.13	0.13	0.12	0.12	0.12
AI203	13.60	13.42	14.70	14.36	13.30	14.36	13.69	13.53	13.71	13.60	13.30	13.39
Fe(tot)	0.85	1.01	1.12	0.98	0.99	0.98	1.01	0.97	0.88	0.85	0.73	0.89
Fe2O3	0.44	0.47	0.50	0.41	0.41	0.41	0.52	0.48	0.41	0.40	0.31	0.44
FeO	0.38	0.48	0.56	0.52	0.52	0.52	0.44	0.44	0.42	0.41	0.38	0.40
MnO	0.05	0.03	0.03	0.03	0.04	0.03	0.04	0.03	0.03	0.03	0.02	0.04
CaO	0.68	0.74	0.64	0.74	0.61	0.74	0.60	0.67	0.47	0.68	0.62	0.20
Na2O	4.17	3.98	4.12	4.31	4.22	4.31	4.12	4.13	4.29	4.16	4.10	3.88
K2O	4.72	4.51	4.99	4.60	4.40	4.60	4.67	4.61	4.73	4.74	4.54	4.76
P2O5	0.02	0.04	0.03	0.04	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.02
Total	100.62	100.18	100.00	99.79	100.09	99.79	100.40	100.27	100.29	100.15	100.04	100.00
Rb	241	178	171	181	229	230	199	218	237	235	243	192
Sr	75	96	155	84	73	68	103	74	70	67	69	77
Ba	67	132	346	74	105	71	109	105	102	75	142	82
Zr	71	86	108	81	99	85	91	91	90	89	81	80
Y	14	10	10	10	14	12	14	15	. 12 .	13	13	16
Th	25	28	10	35	33	34	38	32	30	33	28	39
U ·	b.d.l	b.d.I	b.d.l	b.d.l	b.d.l	3	3	2	b.d.i	4	b.d.I	b.d.l
Zn	23	22	25	23	25	25	24	20	24	25	21	25
Ni	b.d.l	b.d.l	b.d.i	b.d.l	26	b.d.l	b.d.l	b.d.l	b.d.l	b.d.l	b.d.l	b.d.i
Pb	40	34	30	22	32	30	34	35	29	36	32	35
Sample No	133 G2PF	134 G2PF	135 G2PF	136 G2PF	137 G2PF	138 G2PF	139 G2PF	140 G2PE	141 G2PF	142 G2PF	143 G2PF	144 G9PF
6102	76 99	78 AE	78 29	78 97	78 94	78.44	78 04	78 40	78.86	78 50	78.07	78.49
TIO2	0.15	0.14	0.13	0.15	0,10	0.09	0.07	0.12	0.13	0.13	0.10	0.13
A1203	13.35	12.98	13.17	13.09	12.98	13.34	13.29	13.13	13.13	13.19	13.51	13.27
Fe(tot)	0.99	1.01	0.96	1.07	0.79	0.85	0.53	0.87	0.94	0.90	0.80	0.98
Fe2O3	0.48	0.48	0.48	0.47	0.39	0.65	0.29	0.38	0.46	0.42	0.46	0.50
FeO	0.46	0.48	0.48	0,54	0.36	0.27	0.22	0.44	0.43	0.43	0.31	0.43
MnO	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.02	0.03	0.03	0.02	0.04
CaC	0.64	0.22	0.23	0.55	0.48	0.20	0.05	0.20	0.22	0.22	0.17	0.23
Na2O	4.16	4,10	4.03	3.96	4.11	4.39	4.56	4.06	4.11	4.12	4.15	4.07
K20	4.65	4.76	4.72	4.77	4.70	4.47	4,51	4.83	4.60	4.75	4.66	4.66
P2O5	0.03	0.02	0.02	0.03	0.02	0.02	0.01	0.03	0.03	0.03	0.02	0.03
Total	100.02	100.16	100.19	100.25	99.58	100.36	100.29	100.22	100.39	100.28	100.16	100.14
Rb	219	246	256	248	236	242	359	241	237	250	245	265
Sr	69	64	62	66	44	37	17	53	69	55	56	75
Ba	139	121	112	150	19	b.d.)	b.d.)	96	112	108	51	136
Zr	99	107	99	98	80	44	90	80	88	99	84	92
T Nb	20	22	20	20	21	10	29	17	22	14	20	21
Th	26	27	26	28	27	25	27	29	25	31	27	26
U	b.d.l	b.d.l	2	b.d.1	4	b.d.I	4	b.d.l	2	2	b.d.1	4
Zn	16	16	14	15	13	10	6	11	17	14	10	1.9
Ni	b.d.l	b.d.l	b.d.l	b.d.l	26	b.d.i	b.d.l	b.d.i	b.d.l	b.d.l	b.d.1	b.d.1
Pb	36	33	36	34	42	43	28	40	39	39	32	42

Sample No												
Compionto	145	146	147	148	149	150	151	152	153	154	155	156
Unit	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF
SiO2	76.67	76.02	76.22	76.22	75.88	76.22	76.71	76.08	75.80	75.90	76.06	76.71
TIO2	0.13	0.15	0.13	0.12	0.15	0.14	0.15	0.12	0.14	0.13	0.16	0.15
AI2O3	12.99	13.39	13.30	13.18	13.24	13.15	12.90	13.31	13.39	13.32	13.37	13.17
Fe(tot)	1.00	1.03	0.98	0.94	1.08	1.04	1.02	0.91	1.03	1.00	1.02	1.03
Fe2O3	0.52	0.45	0.50	0.54	0.50	0.51	0.64	0.48	0.50	0.52	0.42	0.45
FeO	0.43	0.52	0.43	0.36	0.52	0.48	0.34	0.39	0.48	0.43	0.54	0.52
MnO	0.03	0.03	0.04	0.03	0.04	0.04	0.02	0.02	0.03	0.03	0.02	0.03
MgO	0.21	0.25	0.22	0.20	0.26	0.21	0.24	0.25	0.27	0.25	0.26	0.27
CaO	0.51	0.69	0.57	0.57	0.62	0.59	0.44	0.50	0.69	0.54	0.50	0.49
Na2O	3.89	4.03	4.15	4.03	4.13	4.13	3.97	4.33	4.11	4.15	4.03	4.05
K2O	4.86	4.75	4.66	4.77	4.69	4.63	4.75	4.55	4.66	4.71	4.89	4.75
P2O5	0.03	0.04	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Total	100.27	100.32	100.25	100.05	100.06	100.12	100.20	100.06	100.11	100.01	100.26	100.62
-												
Ho	261	265	274	248	246	247	255	280	264	261	217	223
Sr	58		65	63	12	67	61	47	68	65	67	60
C8. 7.	111	151	104	89	0.0	123	100		139	105	100	143
Zr	105		. 82	00	99	80	102		100	00	101	102
¥ .	24	24	24	1.0	23	23	20	21	20	24	10	10
ND Th	22	20	20	10	21	20	24	20	20	20	18	20
	35	. 28	~ 0	20 6.41	31	289 1. al 1	20	الت المطا	للعما	46.7- b.alt	53	50
U 7-	1.0.0.1	~	17	1.0.1	20	1.0.1	15	1.0	1.0.0	0.0.1	0.0.1	0.0.1
20	12	2 ( b.d.)	17 bdl	10	20	bdi	10	12 6 d i	10 6 el 1	11 ball	24 5 d l	66 b.dl
Dis	4.5	4.4	42	97	20	37	27	9.0.1	35	33	97	30
FU			44	31	37	37	2/	36	30		37	30
										1. T		
Sample No	157	158	159	160	161	162	163	164	165	166	167	168
Unit	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF	G2PF
SIO2	76.27	76.15	76.21	75.56	75.80	75.93	75.32	76.21	76.94	76.89	76.23	75.66
TIO2	0.17	0.15	0.14	0.14	0.16	0.17	0.13	0.17	0.13	0.12	0.13	0.17
AI203	13.08	13.38	13.39	13.72	13.49	13.36	12.70	13.31	13.09	13.24	13.37	13.60
Fe(tot)	1.12	1.06	0.99	1.06	1.07	1.18	0.86	1.04	0.87	0.88	0.97	1.15
Fe2O3	0.46	0.48	0.45	0.52	0.47	0.49	0.37	0.39	0.40	0.42	0.48	0.49
FeO	0.60	0.52	0.49	0.49	0.54	0.62	0.44	0.59	0.42	0.41	0.45	0.60
MnO	0.02	0.05	0.03	0.04	0.03	0.04	0.02	0.05	0.03	0.03	0.04	0.03
MgO	0.33	0.24	0.26	0.30	0.26	0.29	0.27	0.22	0.22	0.17	0.19	0.30
CãO	0.37	0.74	0.64	0.74	0.62	0.68	0.49	0.66	0.36	0.53	0.64	0.58
Na2O	4.31	4.24	4.10	4.24	4.18	4.09	4.09	4.17	4.09	3.97	4.11	4.19
K2O	4.53	4.37	4.60	4.53	4.66	4.50	4.43	4.34	4.79	4.86	4.72	4.69
P205	0.04	0.03	0.03	0.03	0.04	0.04	0.03	0.04	0.03	0.03	0.04	0.05
Total	100.17	100.35	100.33	100.30	100.33	100.20	98.28	100.14	100.50	100.67	100.40	100.35
							5 C					
Rb	240	241	233	225	241	253	247	244	253	253	245	262
Rb Sr	240 62	241 78	233 70	225 78	241 69	253 81	247 47	244 78	253 48	253 52	245 68	262 68
Ro Sr Ba	240 62 139	241 78 130	233 70 110	225 78 63	241 69 109	253 81 125	247 47 31	244 76 99	253 48 114	253 52 96	245 68 114	262 68 142
Rb Sr Ba Zr	240 62 139 106	241 76 130 105	233 70 110 90	225 78 63 86	241 69 109 103	253 81 125 110	247 47 31 104	244 76 99 99	253 48 114 90	253 52 96 90	245 68 114 85	262 68 142 113
Rb Sr Ba Zr Y	240 62 139 106 18	241 76 130 105 18	233 70 110 90 15	225 78 63 86 13	241 69 109 103 16	253 81 125 110 15	247 47 31 104 13	244 76 99 99	253 48 114 90 18	253 52 96 90 19	245 68 114 85 16	262 68 142 113 19
RD Sr Ba Zr Y ND	240 62 139 106 18 22	241 76 130 105 18 26	233 70 110 90 15 19	225 78 63 86 13 20	241 69 109 103 16 19	253 81 125 110 15 21	247 47 31 104 13 22	244 76 99 99 19 30	253 48 114 90 18 24	253 52 96 90 19 20	245 68 114 85 16 20	262 68 142 113 19 25
Ro Sr Ba Zr Y Nb Th	240 62 139 106 18 22 27	241 76 130 105 18 26 28	233 70 110 90 15 19 24	225 78 63 86 13 20 24	241 69 109 103 16 19 27	253 81 125 110 15 21 29	247 47 31 104 13 22 31	244 76 99 19 30 32	253 48 114 90 18 24 29	253 52 96 90 19 20 32	245 68 114 85 16 20 32	262 68 142 113 19 25 32
Rb Sr Ba Zr Y Nb Th U	240 62 139 106 18 22 27 5.d.1	241 78 130 105 18 26 28 4	233 70 110 80 15 19 24 10	225 78 63 86 13 20 24 3	241 69 109 103 16 19 27 2	253 81 125 110 15 21 29 b.d.l	247 47 31 104 13 22 31 2	244 76 99 19 30 32 b.d.1	253 48 114 90 18 24 29 2	253 52 96 90 19 20 32 3	245 68 114 85 18 20 32 2	262 68 142 113 19 25 32 4
Rb Sr Ba Zr Y Nb Th U Zn	240 62 139 106 18 22 27 5.d.1 23	241 76 130 105 18 26 28 4 26	233 70 110 80 15 19 24 10 24	225 78 63 86 13 20 24 3 27	241 69 109 103 16 19 27 2 28	253 81 125 110 15 21 29 b.d.l 29	247 47 31 104 13 22 31 2 21	244 76 99 19 30 32 b.d.1 26	253 48 114 90 18 24 29 2 18	253 52 96 90 19 20 32 3 17	245 68 114 85 16 20 32 2 25	262 68 142 113 19 25 32 4 29
Rb Sr Ba Zr Y Nb Th U Zn Ni	240 62 139 106 18 22 27 5.d.1 23 5.d.1	241 76 130 105 18 26 28 4 26 5.d.l	233 70 110 80 15 19 24 10 24 b.d.l	225 78 63 86 13 20 24 3 27 5.d.1	241 69 109 103 16 19 27 2 26 26 26	253 81 125 110 15 21 29 b.d.l 29 b.d.l	247 47 31 104 13 22 31 2 21 b.d.l	244 76 99 19 30 32 5.d.1 26 5.d.1	253 48 114 90 18 24 29 2 18 b.d.l	253 52 96 90 19 20 32 3 17 b.d.l	245 68 114 85 16 20 32 2 25 5.d.l	262 68 142 113 19 25 32 4 29 b.d.l
Ro Sr Ba Zr Y No Th U Zn Ni Po	240 62 139 106 18 22 27 5.d.1 23 5.d.1 26	241 76 130 105 18 26 28 4 26 5.d.l 41	233 70 110 80 15 19 24 10 24 5.d.1 33	225 78 63 86 13 20 24 3 27 5.d.1 39	241 69 109 103 16 19 27 2 26 26 40	253 81 125 110 15 21 29 b.d.l 29 b.d.l 33	247 47 31 104 13 22 31 2 21 b.d.1 34	244 76 99 19 30 32 5.d.1 26 5.d.1 36	253 48 114 90 18 24 29 2 18 b.d.i 40	253 52 96 90 19 20 32 3 17 b.d.1 42	245 68 114 85 16 20 32 2 25 5.d.i 35	262 68 142 113 19 25 32 4 29 b.d.1 38
Po Sr Ba Zr Y Nb Th U Zn Ni Po	240 62 139 106 18 22 27 5.d.1 23 5.d.1 26	241 76 130 105 18 26 28 4 26 5.d.1 41	233 70 110 90 15 19 24 10 24 5.d.1 33	225 78 63 86 13 20 24 3 27 5.d.1 39	241 89 109 103 16 19 27 2 26 26 40	253 81 125 110 15 21 29 5.d.I 29 5.d.I 33	247 47 31 104 13 22 31 2 21 b.d.1 34	244 76 99 19 30 32 5.d.1 26 5.d.1 36	253 48 114 90 18 24 29 2 18 b.d.i 40	253 52 96 90 19 20 32 3 17 b.d.1 42	245 68 114 85 16 20 32 2 2 25 5.d.l 35	262 68 142 113 19 25 32 4 29 b.d.1 38
Rb Sr Ba Zr Y Nb Th U Zn Ni Pb	240 62 139 106 18 22 27 b.d.l 23 b.d.l 26	241 78 130 105 18 26 28 4 26 5.d.l 41	233 70 110 90 15 19 24 10 24 b.d.I 33	225 78 63 86 13 20 24 3 27 5.d.1 39	241 69 109 103 16 19 27 2 8 26 26 40	253 81 125 110 15 21 29 b.d.l 29 b.d.l 33	247 47 31 104 13 22 31 2 21 b.d.l 34	244 76 99 19 30 32 5.d.1 26 5.d.1 36	253 48 114 90 18 24 29 2 18 b.d.l 40	253 52 96 90 19 20 32 3 17 b.d.1 42	245 68 114 85 16 20 32 2 25 25 5.d.l 35	262 68 142 113 19 25 32 4 29 b.d.l 38
Rb Sr Ba Zr Y Nb Th U Zn Ni Pb	240 62 139 106 18 22 27 5.d.l 23 5.d.l 26	241 78 130 105 18 26 28 4 26 5.d.l 41	233 70 110 90 15 19 24 10 24 b.d.I 33	225 78 63 86 13 20 24 3 27 b.d.1 39	241 69 109 103 16 19 27 2 26 26 40	253 81 125 110 15 21 29 b.d.l 29 b.d.l 33	247 47 31 104 13 22 31 2 21 b.d.l 34	244 76 99 19 30 32 b.d.1 26 b.d.1 36	253 48 114 90 18 24 29 2 18 b.d.l 40	253 52 96 90 19 20 32 3 17 b.d.l 42	245 68 114 85 16 20 32 2 2 5 5.d.l 35	262 68 142 113 19 25 32 4 29 b.d.1 38
Pb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample No	240 62 139 106 18 22 27 5.d.l 23 5.d.l 26	241 76 130 105 18 26 28 4 26 5.d.l 41 170	233 70 110 90 15 19 24 10 24 b.d.l 33	225 78 63 86 13 20 24 3 27 b.d.l 39	241 69 109 103 16 19 27 2 26 26 26 40	253 81 125 110 15 21 29 b.d.l 29 b.d.l 33	247 47 31 104 13 22 31 2 21 b.d.l 34	244 76 99 19 30 32 b.d.1 26 b.d.1 36	253 48 114 90 18 24 29 2 18 b.d.i 40 177	253 52 96 90 19 20 32 3 17 b.d.1 42	245 68 114 85 16 20 32 25 5.d.l 35	262 68 142 113 19 25 32 4 29 b.d.l 38 180
Pb Sr Ba Zr Y Nb Th U Zn Ni Zn Ni Pb Sample No Unit	240 62 139 106 18 22 27 b.d.l 23 b.d.l 26 169 G2PF	241 76 130 105 18 26 28 4 26 5.d.l 41 170 G2PF	233 70 110 90 15 19 24 10 24 b.d.I 33 171 G2PF	225 78 63 86 13 20 24 3 27 b.d.l 39 172 G2PF	241 69 109 103 16 19 27 2 6 26 26 40 173 G2PF	253 81 125 110 15 21 29 b.d.l 29 b.d.l 33 174 G2PF	247 47 31 104 13 22 31 2 21 b.d.l 34 175 G3	244 76 99 19 30 32 b.d.1 26 b.d.1 36	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3	253 52 96 90 19 20 32 3 17 b.d.1 42 178 33	245 68 114 85 16 20 32 25 b.d.l 35 179 G3	262 68 142 113 19 25 32 4 29 b.d.1 38 180 G3
Rb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample No Unit	240 62 139 106 18 22 27 b.d.l 23 b.d.l 26 169 G2PF	241 76 130 105 26 28 4 26 5.d.l 41 170 G2PF	233 70 110 90 15 19 24 10 24 b.d.I 33 171 62PF	225 78 63 86 13 20 24 3 27 5.d.1 39 172 G2PF	241 69 109 103 16 19 27 26 26 26 40	253 81 125 110 15 21 29 b.d.l 33 174 G2PF	247 47 31 104 13 22 31 2 21 b.d.l 34 175 G3	244 76 99 19 30 32 b.d.1 26 b.d.1 36 176 G3	253 48 114 90 18 24 29 2 18 b.d.l 40 1777 G3	253 52 96 90 19 20 32 3 17 b.d.l 42 178 G3	245 68 114 85 18 20 32 25 5.d.l 35 179 Q3	262 68 142 113 19 25 32 4 29 b.d.1 38 180 G3
Pb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample No Unit SiO2	240 62 139 106 18 22 27 5.d.l 23 5.d.l 26 169 G2PF 76.46 0.12	241 78 130 105 18 26 28 4 26 5.d.l 41 170 62PF 77.73 0.11	233 70 110 90 15 19 24 10 24 b.d.l 33 171 G2PF 79.75 0.07	225 78 63 13 20 24 3 27 b.d.l 39 172 G2PF 78,44	241 69 109 103 16 19 27 2 26 26 40 173 G2PF 75.62 0 13	253 81 125 110 15 21 29 b.d.l 29 b.d.l 33 174 G2PF 65.33 0,16	247 47 31 104 13 22 31 2 21 b.d.l 34 175 G3 76.54	244 76 99 19 30 52 b.d.1 26 b.d.1 36 176 G3 76.91	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3 78.59 0.08	253 52 96 90 19 20 32 3 17 b.d.l 42 178 G3 76.92	245 68 114 85 18 20 32 2 2 5 5.d.i 35 179 G3 77.27 0.07	262 68 142 113 19 25 32 4 29 b.d.1 38 180 G3 76.88 0.08
Pb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample No Unit SiO2 TiO2	240 62 139 106 18 22 27 b.d.l 23 b.d.l 26 169 G2PF 76.46 0.12	241 78 130 105 28 4 26 b.d.l 41 170 G2PF 77.73 0.11 13 65	233 70 110 90 15 19 24 0.d.i 33 171 C2PF 79.75 0.07	225 78 63 86 13 20 24 3 27 b.d.l 39 172 G2PF 78.44 0.11	241 69 103 16 19 27 26 26 40 173 G2PF 75.62 0.13 13.56	253 81 125 110 15 21 29 b.d.l 29 b.d.l 33 174 G2PF 65.33 0.16	247 47 31 104 13 22 31 2 21 b.d.1 34 175 G3 76.54 0.08	244 76 99 19 30 32 b.d.l 26 b.d.l 36 176 G3 76.91 0.07	253 48 114 90 18 24 2 2 18 b.d.l 40 1777 G3 76.59 0.08	253 52 96 90 19 20 32 3 17 b.d.1 42 178 G3 76.92 0.07	245 68 114 85 18 20 32 2 25 5.d.i 35 77.27 0.07 13.28	262 68 142 113 19 25 32 4 29 b.d.l 38 180 G3 76.88 0.08
Pb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample No Unit SiO2 TiO2 Al2C3 Ep((to))	240 62 139 106 22 27 b.d.l 23 b.d.l 26 169 G2PF 76.46 0.12 13.96 0.82	241 78 130 105 28 4 26 b.d.l 41 170 G2PF 77.73 0.11 13.65 0.82	233 70 110 90 15 19 24 0.4 b.d.l 33 171 G2PF 79.75 0.07 11.64	225 78 63 86 13 20 24 3 27 b.d.1 39 172 G2PF 78.44 0.11 12.33 0.70	241 69 103 16 19 27 26 26 26 40 173 G2PF 75.62 0.13 13.56 0.64	263 81 125 110 15 21 29 b.d.l 29 b.d.l 33 174 G2PF 65.33 0.16 18.99 1.00	247 47 31 104 13 22 31 2 21 b.d.l 34 175 G3 76.54 0.08 13.11 0.85	244 76 99 19 30 32 b.d.l 36 176 G3 76.91 0.07 13.29	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3 78.59 0.08 13.27 0.68	253 52 96 90 19 20 32 3 17 b.d.1 42 178 3 76.92 0.07 13.34 0.65	245 68 114 85 16 20 32 2 25 5.d.l 35 77.27 0.07 13.28 0.47	262 68 142 113 19 26 32 4 29 b.d.! 38 180 G3 76.88 0.08 13.23 0.58
Pb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample No Unit SiO2 TiO2 AI2O3 Fe(tot) Fe2O3	240 62 139 106 18 22 27 b.d.l 23 b.d.l 26 5 6 9 6 28 7 6.46 0.12 13.98 0.88 0.89	241 76 130 105 28 4 26 5.d.l 41 170 G2PF 77.73 0.11 13.65 0.62	233 70 110 90 15 19 24 10 24 b.d.l 33 171 G2PF 79.75 0.07 11.64 0.24	225 78 63 86 13 20 24 3 27 b.d.1 39 172 G2PF 78.44 0.11 12.33 0.70 0.33	241 69 109 103 16 19 27 26 26 26 40 173 G2PF 75.62 0.13 13.56 0.98	253 81 125 110 15 29 b.d.l 29 b.d.l 29 b.d.l 33 3 174 G2PF 65.33 0.16 18.99 1.00 0.37	247 47 31 104 13 22 31 2 21 b.d.l 34 175 G3 76.54 0.08 13.11 0.65 0.39	244 76 99 19 30 52 b.d.1 26 b.d.1 36 176 G3 76.91 0.07 13.29 0.55	253 48 114 90 18 24 2 2 18 b.d.l 40 177 G3 76.59 0.08 13.27 0.68	253 52 96 90 19 20 32 3 17 b.d.1 42 178 G3 76.92 0.07 13.34 0.66	245 68 114 85 18 20 32 2 25 b.d.l 35 179 G3 77.27 0.07 13.28 0.47 0.37	262 68 142 113 19 25 32 4 29 b.d.1 38 180 G3 76.88 0.08 13.23 0.58 0.38
Rb           Sr         Ba           Zr         Y           Nb         Th           U         Zn           Ni         Pb           Sample No         Unit           SiO2         TiO2           Al2C3         Fe(tot)           Fe2O3         Fe(tot)	240 62 139 106 18 22 27 b.d.l 23 b.d.l 26 30 62PF 76.46 0.12 13.96 0.88 0.39 0.44	241 76 130 105 18 26 28 4 26 5.d.l 41 170 G2PF 77.73 0.11 13.65 0.62 0.25	233 70 110 80 15 19 24 b.d.1 33 171 G2PF 79.75 0.07 11.64 0.44 0.24	225 78 63 13 20 24 3 27 b.d.l 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34	241 69 103 16 19 27 28 26 26 40 173 G2PF 75.62 0.13 13.56 0.96 0.44	253 81 125 110 15 29 b.d.l 29 b.d.l 29 b.d.l 33 174 62PF 65.33 0.16 18.99 1.00 0.37	247 47 31 104 13 22 21 b.d.l 34 175 G3 76.54 0.08 13.11 0.65 0.39 9 23	244 76 99 19 30 32 b.d.l 26 b.d.l 36 176 G3 76.91 0.55 0.34	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3 78.59 0.08 13.27 0.64 0.38 9 23	253 52 96 90 19 20 32 3 17 b.d.1 42 178 G3 76.92 0.07 13.34 0.66 0.47 0.17	245 68 114 85 18 20 32 2 2 5 5.d.i 35 77.27 0.07 13.28 0.47 0.37	262 68 142 113 19 25 32 4 29 b.d.1 38 4 29 b.d.1 38 76.88 0.08 13.23 0.58 0.32
Pb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample No Unit SiO2 TiO2 AI2O3 Fe(tot) Fe2O3 Fe0	240 62 139 106 22 27 b.d.l 23 b.d.l 26 169 G2PF 76.46 0.12 13.98 0.88 0.39 0.44 0.03	241 76 130 105 28 4 26 b.d.l 41 170 G2PF 77.73 0.11 13.65 0.62 0.25 0.34	233 70 110 90 15 19 24 b.d.i 33 171 G2PF 79.75 0.07 11.64 0.44 0.24 0.24 0.18 0.02	225 78 63 86 13 20 24 3 27 b.d.l 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34	241 69 103 16 19 27 28 26 40 173 G2PF 75.62 0.13 13.56 0.96 0.48 0.48 0.44	253 81 125 110 15 29 b.d.l 29 b.d.l 33 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.57	247 47 31 104 13 22 21 b.d.1 34 175 G3 76.54 0.08 13.11 0.65 0.39 0.22	244 76 99 19 30 32 b.d.1 26 b.d.1 36 176 G3 76.91 0.07 13.29 0.55 0.34 0.19	253 48 114 90 18 24 29 2 18 b.d.l 40 1777 G3 76.59 0.08 13.27 0.64 0.38 0.23 0.01	253 52 96 90 19 20 32 3 17 b.d.l 42 178 G3 76.92 0.07 13.34 0.66 0.47 0.17 0.17	245 68 114 85 18 20 32 2 25 5.d.1 35 77.27 0.07 13.28 0.47 0.39 0.07 0.07	262 68 142 113 19 25 32 4 29 b.d.l 38 4 29 b.d.l 38 78.88 0.08 13.23 0.58 0.32 0.58
Rb           Sr         Ba           Zr         Y           Nb         Th           U         Zn           Ni         Pb           Sample No         Unit           SiO2         TiO2           Al2O3         Fe(tot)           Fe2O3         FeO           MrO         MrO	240 62 139 106 22 27 b.d.l 23 b.d.l 26 3 6 9 6 9 7 6.46 0.12 13.98 0.88 0.39 0.44 0.03 0.23	241 78 130 105 28 4 26 b.d.l 41 170 G2PF 77.73 0.11 13.65 0.25 0.34 0.02 0.22	233 70 110 90 15 19 24 b.d.i 33 171 G2PF 79.75 0.07 11.64 0.44 0.24 0.18 0.02	225 78 63 86 13 20 24 3 27 b.d.1 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34 0.04 0.21	241 69 103 16 19 27 28 26 40 173 G2PF 75.62 0.13 13.56 0.96 0.48 0.44 0.24	253 81 125 110 15 21 29 b.d.l 29 b.d.l 33 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.57 0.31	247 47 31 104 13 22 21 b.d.l 34 175 G3 76.54 0.08 13.11 0.65 0.39 0.23 0.02 0.18	244 76 99 19 30 32 b.d.l 26 b.d.l 36 76.91 0.07 13.29 0.55 0.34 0.19 0.02	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3 76.59 0.08 13.27 0.68 13.27 0.68 13.27 0.68	253 52 96 90 19 20 32 3 17 b.d.1 42 178 G3 76.92 0.07 13.34 0.68 0.47 0.17 0.01	245 68 114 85 18 20 32 25 5.d.i 35 77.27 0.07 13.28 0.47 0.39 0.07 0.02 0.10	262 68 142 113 19 25 32 4 29 b.d.1 38 29 b.d.1 38 78.88 0.08 13.23 0.58 0.32 0.23 0.03 0.03
Pb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample No Unit SiO2 TiO2 AI2O3 Fe(tot) Fe2O3 Fe0 MnO MgO CeO	240 62 139 106 22 27 b.d.l 23 b.d.l 26 76.46 0.12 13.96 0.89 0.44 0.03 0.23	241 76 130 105 28 4 26 b.d.l 41 170 G2PF 77.73 0.11 13.65 0.62 0.25 0.34 0.02 0.25 0.34	233 70 110 90 15 19 24 b.d.1 33 171 G2PF 79.75 0.07 11.64 0.24 0.18 0.02 0.09 0.42	225 78 63 86 13 20 24 3 27 b.d.1 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34 0.04 0.22	241 69 103 16 19 27 26 26 26 40 173 G2PF 75.62 0.13 13.56 0.46 0.44 0.44 0.42	253 81 125 110 15 29 b.d.l 29 b.d.l 29 b.d.l 33 33 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.57 0.03 0.31 0.10	247 47 31 104 13 22 31 2 21 b.d.l 34 175 G3 76.54 0.08 13.11 0.65 0.39 0.23 0.02 0.16	244 76 99 19 30 32 b.d.1 26 b.d.1 36 36 176 G3 76.91 0.07 13.29 0.55 0.34 0.19 0.02 0.49	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3 76.59 0.08 13.27 0.64 0.38 0.23 0.01 0.15	253 52 96 90 19 20 32 3 17 b.d.1 42 178 G3 76.92 0.07 13.34 0.66 0.47 0.17 0.01 0.04	245 68 114 85 16 20 32 2 25 b.d.l 35 77.27 0.07 13.28 0.47 0.07 0.07 0.07 0.02 0.10 0.38	262 68 142 113 19 26 32 4 29 b.d.! 38
Rb           Sr         Ba           Zr         Y           Nb         Th           U         Zn           NI         Pb           Sample No         Unit           SiO2         TiO2           Al2O3         Fe(tot)           Fe2O3         Fe0           MirO         MgO           CaO         Na2O	240 62 139 106 18 22 27 5.d.l 23 5.d.l 26 76.46 0.12 13.96 0.88 0.39 0.44 0.03 0.23 0.23 0.23	241 76 130 105 18 26 28 4 26 5.d.l 41 170 G2PF 77.73 0.11 13.65 0.62 0.25 0.34 0.02 0.22 0.16 4.15	233 70 110 80 15 19 24 b.d.1 33 171 G2PF 79.75 0.07 11.64 0.44 0.24 0.44 0.24 0.02 0.09 0.42	225 78 63 20 24 3 27 b.d.l 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34 0.04 0.21 0.21 0.22	241 69 103 16 19 27 28 26 26 40 173 G2PF 75.62 0.13 13.56 0.96 0.48 0.44 0.24 0.24 0.24	253 81 125 110 15 29 b.d.l 29 b.d.l 29 b.d.l 33 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.31 0.31 0.31 0.597	247 47 31 104 13 22 21 b.d.l 34 175 G3 76.54 0.08 13.11 0.65 0.39 0.323 0.02 0.16 0.51 4.42	244 76 99 19 30 52 b.d.1 26 b.d.1 36 176 G3 76.91 0.07 13.29 0.55 0.34 0.19 0.02 0.09 0.455	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3 78.59 0.08 13.27 0.64 0.28 0.01 0.11 0.54 4.42	253 52 96 90 19 20 32 3 17 b.d.l 42 178 G3 76.92 0.07 13.34 0.86 0.47 0.17 0.01 0.08 0.42 4.48	245 68 114 85 18 20 2 2 25 b.d.l 35 2 2 2 5 b.d.l 35 35 77.27 0.07 13.28 0.47 0.39 0.07 0.02 0.10 0.38 4.58	262 68 142 113 19 25 32 4 29 b.d.1 38 38 76.88 0.08 13.23 0.58 0.32 0.23 0.03 0.09 0.40
Rb Sr Ba Zr Zr Y Nb Th U Zn Ni Pb Sample No Unit SiO2 TiO2 Ai2O3 Fe(tot) Fe2O3 Fe0 MrO MgO CaO Na2O K2O	240 62 139 106 22 27 b.d.l 23 b.d.l 26 32PF 76.46 0.12 13.96 0.88 0.39 0.44 0.03 0.23 0.29 4.13 0.29	241 76 130 105 18 26 28 4 26 b.d.l 41 170 G2PF 77.73 0.11 13.65 0.25 0.25 0.25 0.22 0.16 4.15	233 70 110 90 15 19 24 b.d.i 33 171 G2PF 79.75 0.07 11.64 0.24 0.24 0.24 0.02 0.09 0.42 4.75 3.45	225 78 63 13 20 24 3 27 b.d.1 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34 0.04 0.21 0.22 3.97	241 69 103 16 19 27 26 26 26 40 173 G2PF 75.62 0.13 13.56 0.96 0.48 0.48 0.44 0.24 0.42 4.04 4.88	253 81 125 110 15 29 b.d.l 29 b.d.l 33 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.37 0.31 0.10 5.97 7.32	247 47 31 104 13 22 21 b.d.l 34 175 G3 76.54 0.08 13.11 0.65 0.39 0.23 0.051 4.42	244 76 99 19 30 22 b.d.1 26 b.d.1 36 176 G3 76.91 0.07 13.29 0.55 0.34 0.19 0.55 0.34 0.19 0.49 4.59	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3 76.59 0.08 13.27 0.54 0.38 0.23 0.01 0.11 0.56 4.42 4.51	253 52 96 90 19 20 32 3 17 b.d.l 42 178 G3 76.92 0.07 13.34 0.66 0.47 0.17 0.01 0.08 0.42 4.48	245 68 114 85 18 20 32 2 2 5 5.d.1 35 77.27 0.07 13.28 0.47 0.39 0.07 0.38 4.56 4.38	262 68 142 113 19 25 32 4 29 b.d.1 38 76.88 0.03 13.23 0.58 0.32 0.58 0.32 0.23 0.09 0.40 4.45
Rb           Sr           Ba           Zr           Y           Nb           Th           U           Zn           Ni           Pb           Sample No           Unit           SiO2           TiO2           Al2O3           Fe(tot)           Fe2O3           FeO           Mr0           MgO           CaO           Na2O           K2O           P2O5	240 62 139 106 22 27 b.d.l 23 b.d.l 26 30 62 PF 76.46 0.12 13.98 0.88 0.39 0.44 0.03 0.29 4.13 4.68	241 78 130 105 28 4 26 b.d.l 41 170 G2PF 77.73 0.11 13.65 0.25 0.25 0.25 0.22 0.22 0.22 0.16 4.15 4.74	233 70 110 90 15 19 24 b.d.i 33 171 C2PF 79.75 0.07 11.64 0.24 0.24 0.24 0.24 0.24 0.24 0.42 0.09 0.42 4.75 3.45 0.02	225 78 63 86 13 20 24 3 27 b.d.1 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34 0.21 0.22 3.97 4.50	241 69 103 16 19 27 26 26 26 40 173 G2PF 75.62 0.13 13.56 0.96 0.48 0.44 0.24 0.42 4.04 4.83 0.03	253 81 125 110 15 21 29 b.d.l 29 b.d.l 29 b.d.l 33 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.57 0.31 0.10 5.97 7.32 0.03	247 47 31 104 13 22 21 b.d.1 34 175 G3 76.54 0.08 13.11 0.65 0.39 0.23 0.16 0.51 4.42 4.40 0.01	244 76 99 19 30 32 b.d.l 26 b.d.l 36 176 G3 76.91 0.07 13.29 0.55 0.34 0.19 0.55 0.34 0.19 0.49 4.59 4.59	253 48 114 90 18 24 29 2 18 b.d.l 40 1777 G3 76.59 0.08 13.27 0.64 0.38 0.23 0.011 0.11 0.56 4.42 4.511 0.02	253 52 96 90 19 20 32 3 17 b.d.l 42 178 G3 76.92 0.07 13.34 0.66 0.47 0.17 0.08 0.42 4.48 4.39 0.01	245 68 114 85 18 20 32 2 25 5.d.i 35 77.27 0.07 0.39 0.07 0.028 0.47 0.39 0.07 0.028 0.47 0.38 4.58 4.58 4.58	262 68 142 113 19 25 32 4 29 b.d.l 38 76.88 0.08 13.23 0.58 0.32 0.23 0.09 0.40 4.45 4.45 4.45 4.01
Pb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample No Unit SiO2 TiO2 Al2O3 Fe(tot) Fe2O3 Fe0 MnO MgO CaO Na2O K2O P2O5 Total	240 62 139 106 22 27 b.d.l 23 b.d.l 26	241 78 130 105 28 4 26 b.d.l 41 77.73 0.11 13.65 0.62 77.73 0.11 13.65 0.25 0.25 0.25 0.34 0.02 0.25 0.34 0.02 0.16 4.15 4.74 0.039	233 70 110 90 15 19 24 0.24 b.d.l 33 171 G2PF 79.75 0.07 11.64 0.24 0.02 0.02 0.42 4.75 3.45 0.062	225 78 63 86 13 20 24 3 27 b.d.1 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34 0.04 0.22 3.97 4.50 0.02	241 69 103 16 19 27 26 26 40 173 G2PF 75.62 0.13 13.56 0.48 0.44 0.44 0.44 0.44 4.04 4.88 0.04 99.87	253 81 125 110 15 29 b.d.l 29 b.d.l 29 b.d.l 33 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.57 0.03 0.37 0.57 0.03 0.10 5.97 7.32 0.03 99.16	247 47 31 104 13 22 31 2 21 b.d.l 34 175 G3 76.54 0.08 13.11 0.65 0.39 0.65 0.39 0.62 0.65 0.51 4.42 4.40 0.01 99.87	244 76 99 19 30 32 b.d.1 26 b.d.1 36 36 176 G3 76.91 0.07 13.29 0.55 0.34 0.19 0.02 0.49 4.59 4.34 0.01	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3 76.59 0.08 13.27 0.64 0.38 0.01 0.16 4.42 4.51 0.028 100.18	253 52 96 90 19 20 32 3 17 b.d.1 42 178 G3 76.92 0.07 13.34 0.66 0.47 0.17 0.17 0.01 0.04 2 4.48 4.39 0.01 100.37	245 68 114 85 16 20 32 2 25 b.d.l 35 77.27 0.07 13.28 0.47 0.39 0.07 0.02 0.107 0.02 0.107 0.38 4.56 4.38 0.01 100.54	262 68 142 113 19 25 32 4 29 b.d.1 38 78.88 0.08 13.23 0.58 0.32 0.23 0.03 0.09 0.40 4.45 4.42 0.01
Rb           Sr           Ba           Zr           Y           Nb           Th           U           Zn           NI           Pb           Sample No           Unit           SiO2           TiO2           Al2O3           Fe(tot)           Fe2O3           FeO           MnO           MgO           CaO           Na2O           K2O           P2O5           Total	240 62 139 106 18 22 27 5.d.l 23 5.d.l 26 76.46 0.12 13.96 0.88 0.39 0.44 0.03 0.23 0.23 0.23 0.23 9.78	241 76 130 105 18 26 28 4 26 5.d.l 41 170 G2PF 77.73 0.11 13.65 0.62 0.25 0.32 0.25 0.22 0.15 4.74 0.02 100.39	233 70 110 80 15 19 24 b.d.1 33 171 G2PF 79.75 0.07 11.64 0.44 0.44 0.44 0.218 0.02 0.09 0.42 4.75 3.45 0.02 100.62	225 78 63 13 20 24 3 27 b.d.l 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.70 0.33 0.04 0.21 0.22 3.97 0.02 100.50	241 69 103 16 19 27 2 26 26 40 173 G2PF 75.62 0.13 13.56 0.96 0.44 0.24 0.24 0.24 0.24 0.03 99.87	253 81 125 110 15 29 b.d.l 29 b.d.l 29 b.d.l 29 b.d.l 33 3 3 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.31 0.10 5.97 7.32 0.03 99.16	247 47 31 104 13 22 21 b.d.l 34 22 21 b.d.l 34 175 G3 76.54 0.08 13.11 0.65 0.323 0.02 0.16 0.51 4.42 4.40 0.01 99.87	244 76 99 19 30 52 b.d.l 26 b.d.l 36 176 G3 76.91 0.07 13.29 0.55 0.34 0.19 0.02 0.09 0.459 4.59 4.34 0.01	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3 78.59 0.08 13.27 0.64 0.38 0.23 0.01 0.11 0.58 4.42 4.51 0.02 100.18	253 52 96 90 19 20 32 3 17 b.d.1 42 178 G3 76.92 0.07 13.34 0.88 0.47 0.17 0.01 0.08 0.42 4.48 4.39 0.01 100.37	245 68 114 85 18 20 22 25 b.d.l 35 77.27 0.07 13.28 0.47 0.39 0.07 0.02 0.10 0.38 4.56 4.38 0.01 100.54	262 68 142 113 19 25 32 4 29 b.d.1 38 76.88 0.08 13.23 0.58 0.32 0.03 0.09 0.40 4.45 4.42 0.01 100.14
Pb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample No Unit SiO2 TiO2 Ai2O3 Fe(tot) Fe2O3 Fe(tot) Fe2O3 Fe0 MnO MgO CaO Na2O K2O P2O5 Total	240 62 139 106 18 22 27 b.d.1 23 b.d.1 26 30 5 4.13 0.29 4.13 4.68 0.03 0.29 4.13 4.68	241 76 130 105 18 26 28 4 26 b.d.l 41 170 G2PF 77.73 0.11 13.65 0.25 0.25 0.25 0.22 0.16 4.15 4.74 0.02 100.39	233 70 110 90 15 19 24 b.d.i 33 171 G2PF 79.75 0.07 11.64 0.24 0.24 0.24 0.24 0.42 0.09 0.42 4.75 3.45 0.02 100.62	225 78 63 13 20 24 3 27 b.d.1 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34 0.04 0.21 0.22 3.97 4.50 0.02 100.50	241 69 103 16 19 27 26 26 26 40 173 G2PF 75.62 0.48 0.48 0.48 0.44 0.42 4.04 0.42 4.04 0.42 4.04 0.24 0.03 99.87	253 81 125 110 15 29 b.d.l 29 b.d.l 33 174 62PF 65.33 0.16 18.99 1.00 0.37 0.37 0.31 0.03 0.31 0.10 5.97 7.32 0.03 99.16	247 47 31 104 13 22 21 b.d.l 34 175 G3 76.54 0.08 13.11 0.65 0.39 0.23 0.051 4.42 0.01 99.87	244 76 99 19 30 52 b.d.1 26 b.d.1 36 36 176 63 76.91 0.07 13.29 0.55 0.34 0.13 0.02 0.09 0.49 4.59 0.02 0.09	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3 78.59 0.08 13.27 0.64 0.38 0.23 0.01 0.11 0.56 4.42 4.51 0.02 100.18	253 52 96 90 19 20 32 3 17 b.d.l 42 178 G3 76.92 0.07 13.34 0.66 0.47 0.17 0.08 0.42 4.48 4.39 0.01 100.37	245 68 114 85 18 20 32 2 2 5 5 d.l 35 77.27 0.07 13.28 0.47 0.39 0.07 13.28 0.47 0.39 0.02 0.10 0.38 4.58 0.01 100.54	262 68 142 113 19 25 32 4 29 b.d.1 38 76.88 0.08 0.32 0.58 0.32 0.58 0.32 0.58 0.32 0.40 4.45 4.42 0.01 100.14
Pb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample No Unit SiO2 TiO2 Ai2O3 Fe(tot) Fe2O3 Fe0 Mr0 Mr0 Mr0 CaO Na2O K2O P2O5 Total	240 62 139 106 27 b.d.l 23 b.d.l 26 169 G2PF 76.46 0.12 13.96 0.88 0.39 0.44 0.03 0.23 0.29 4.13 4.63 0.29 7.8	241 76 130 105 28 4 26 5.d.i 41 170 G2PF 77.73 0.11 13.65 0.25 0.25 0.25 0.22 0.22 0.22 0.16 4.15 4.15 4.002 100.39	233 70 110 90 15 19 24 b.d.i 33 171 24 b.d.i 33 171 33 79.75 0.07 11.64 0.24 0.24 0.24 0.24 0.44 0.44 0.44 0.24 0.09 0.42 4.75 3.45 0.02 100.62	225 78 63 86 13 20 24 3 27 b.d.1 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34 0.21 0.22 3.97 4.50 0.02 100.50	241 69 103 16 19 27 28 26 26 40 173 G2PF 75.62 0.13 13.56 0.96 0.48 0.44 0.24 0.42 4.04 4.83 99.87 195	253 81 125 110 15 21 29 b.d.l 29 b.d.l 33 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.31 0.10 5.97 7.32 0.03 99.16	247 47 31 104 13 22 21 b.d.l 34 221 b.d.l 34 76.54 6.33 76.54 6.39 6.23 6.23 6.23 6.51 4.42 4.40 0.01 99.87	244 76 99 19 30 32 b.d.1 26 b.d.1 36 36 76.91 0.07 13.29 0.55 0.34 0.19 0.25 0.09 0.49 4.59 4.59 4.59	253 48 114 90 18 24 29 2 18 b.d.l 40 1777 G3 76.59 0.08 13.27 0.64 0.38 0.23 0.01 0.11 0.56 4.42 4.51 0.02 100.18	253 52 96 90 19 20 32 3 17 b.d.l 42 178 G3 76.92 0.07 13,34 0.66 0.47 0.17 0.01 10.08 0.42 4.48 4.39 0.01 100.37	245 68 114 85 18 20 32 2 25 5.d.l 35 20 2 2 5 5.d.l 35 77.27 0.07 0.39 0.07 0.38 0.47 0.39 0.07 0.02 0.10 0.38 4.56 4.38 0.01 100.54	262 68 142 113 19 25 32 4 29 b.d.l 38 38 78.88 0.08 13.23 0.58 0.32 0.58 0.32 0.58 0.32 0.40 4.45 4.45 4.45 0.01 100.14
Pb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample No Unit SiO2 TiO2 Al2O3 Fe(tot) Fe2O3 Fe0 MnO MgO CaO Na2O K2O P2O5 Total Pb Sr	240 62 139 106 22 27 b.d.l 23 b.d.l 26 30 62PF 76.46 0.12 13.98 0.89 0.44 0.03 0.23 0.29 4.13 4.68 0.03 99.78	241 78 130 105 28 4 26 b.d.l 41 26 b.d.l 41 77.73 0.11 13.65 0.62 0.25 0.34 0.02 0.25 0.34 0.02 0.16 4.15 4.74 0.02 100.39	233 70 110 90 24 15 19 24 b.d.i 33 171 G2PF 79.75 0.07 11.64 0.44 0.24 0.42 0.02 0.42 4.75 3.45 0.02 100.62	225 78 63 86 13 20 24 3 7 5.d.1 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34 0.22 3.97 4.50 0.021 0.22 10.50	241 69 103 16 19 27 26 26 26 40 173 G2PF 75.62 0.13 13.56 0.48 0.44 0.24 0.42 4.04 4.88 0.03 99.87 195 89	253 81 125 110 15 21 29 b.d.l 29 b.d.l 29 b.d.l 33 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.57 0.03 0.37 0.57 0.03 9.16 257 85	247 47 31 104 13 22 1 b.d.l 34 2 175 G3 76.54 0.08 13.11 0.65 0.39 0.65 0.39 0.62 0.65 1.442 4.40 0.01 99.87	244 76 99 19 30 32 b.d.1 26 b.d.1 36 36 176 G3 76.91 0.07 13.29 0.55 0.34 0.19 0.02 0.99 4.59 4.34 0.01 100.34	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3 76.59 0.08 13.27 0.64 0.38 0.01 0.15 0.02 100.18 310 30	253 52 96 90 19 20 32 3 17 b.d.1 42 178 G3 76.92 0.07 13.34 0.66 0.47 0.17 0.01 0.04 2.48 4.39 0.01 100.37	245 68 114 85 16 20 32 2 25 b.d.l 35 20 77.27 0.07 13.28 0.47 0.37 0.07 0.02 0.10 0.38 4.56 4.38 0.01 100.54 358 20	262 68 142 113 19 25 32 4 29 b.d.1 38 76.88 0.08 13.23 0.58 0.32 0.23 0.03 0.40 0.40 4.45 4.42 0.01 100.14
Rb           Sr           Ba           Zr           Y           Nb           Th           U           Zn           NI           Pb           Sample No           Unit           SiO2           TiO2           Al2O3           Fe(tot)           Fe2O3           Fe0           MnO           MgO           CeO           Na2O           K2O           P2O5           Total           Fb           Sr           Ba	240 62 139 106 18 22 27 5.d.l 23 5.d.l 26 76.46 0.12 13.96 0.88 0.39 0.44 0.03 0.23 0.23 0.23 0.23 0.23 99.78	241 76 130 105 18 26 28 4 26 5.d.l 41 170 G2PF 77.73 0.11 13.65 0.62 0.25 0.32 0.25 0.32 0.15 4.74 0.02 100.39 198 72 88	233 70 110 80 15 19 24 b.d.1 33 171 G2PF 79.75 0.07 11.64 0.24 0.24 0.44 0.24 0.44 0.24 0.24 0.02 0.02	225 78 63 20 24 3 27 b.d.l 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34 0.04 0.21 0.22 3.97 0.02 100.50 180 56 28	241 69 103 16 19 27 26 26 26 40 173 G2PF 75.62 0.13 13.56 0.96 0.48 0.44 0.24 0.24 0.24 0.03 99.87 195 89 103	253 81 125 110 15 29 b.d.l 29 b.d.l 29 b.d.l 29 b.d.l 33 3 3 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.31 0.10 5.97 7.32 0.03 99.16 257 85 285	247 47 31 104 13 22 21 b.d.l 34 22 21 b.d.l 34 175 G3 76.54 0.08 13.11 0.65 0.39 0.323 0.02 0.16 0.51 4.40 0.01 99.87 177 27 b.d.l	244 76 99 19 30 32 b.d.1 26 b.d.1 36 176 G3 76.91 0.07 13.29 0.55 0.34 0.19 0.02 0.09 0.459 4.59 4.34 0.01 100.34	253 48 114 90 18 24 92 2 18 b.d.l 40 177 G3 78.59 0.08 13.27 0.64 0.38 0.23 0.01 0.11 0.56 4.42 4.51 0.02 100.18 310 30 b.d.l	253 52 96 90 19 20 32 3 17 b.d.1 42 178 G3 76.92 0.07 13.34 0.88 0.47 0.17 0.01 0.08 0.42 4.48 4.39 0.01 100.37 331 24 6	245 68 114 85 18 20 2 2 25 b.d.l 35 2 2 2 5 b.d.l 35 77.27 0.07 13.28 0.47 0.39 0.07 0.02 0.10 0.38 4.56 4.38 0.01 100.54 358 20 b.d.l	262 68 142 113 19 25 32 4 29 b.d.1 38 76.88 0.08 13.23 0.58 0.32 0.23 0.03 0.09 0.40 4.45 4.42 0.01 100.14 343 19 b.d.1
Rb           Sr           Ba           Zr           Y           Nb           Th           U           Zn           Ni           Pb           Sample No           Unit           SiO2           TiO2           Al2O3           Fe(tot)           Fe2O3           FeO           MnO           MgO           CaO           Na2O           K2O           P2O5           Total           Fb           Sr           Ba           Zr	240 62 139 106 22 27 b.d.l 23 b.d.l 26 30 69 62 76.46 0.12 13.96 0.88 0.39 0.44 0.03 0.29 4.13 4.68 0.03 99.76	241 76 130 105 18 26 28 4 26 b.d.l 41 170 G2PF 77.73 0.11 13.65 0.25 0.25 0.25 0.22 0.16 4.15 4.74 0.02 100.39 198 72 86 78	233 70 110 90 15 19 24 b.d.i 33 171 G2PF 79.75 0.07 11.64 0.24 0.24 0.24 0.24 0.02 0.42 4.75 3.45 0.02 100.62	225 78 63 13 20 24 3 27 b.d.l 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34 0.21 0.22 3.97 4.50 0.02 100.50 180 56 28 73	241 69 103 16 19 27 26 26 26 40 173 G2PF 75.62 0.13 13.56 0.48 0.48 0.44 0.24 0.42 4.04 0.42 4.04 0.24 0.24 0.24 0.03 99.87 195 89 105 89 105 89 105 86 195 105 105 105 105 105 105 105 10	253 81 125 110 15 21 29 b.d.l 29 b.d.l 29 b.d.l 33 174 62PF 65.33 0.16 18.99 1.00 0.37 0.37 0.31 0.03 0.31 0.10 5.97 7.32 0.03 99.16	247 47 31 104 13 22 21 b.d.l 34 22 1 b.d.l 34 76.54 0.08 13.11 0.65 0.39 0.23 0.02 0.16 0.51 4.42 0.01 99.87 177 27 b.d.l 37 27 5 5	244 76 99 99 19 30 22 b.d.l 26 b.d.l 36 36 176 91 36 9 76.91 0.07 13.29 0.55 0.34 0.13 0.02 0.09 0.49 4.54 0.01 100.34 344 25 5.6.1 171	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3 78.59 0.08 13.27 0.64 0.38 0.23 0.01 0.11 0.56 4.42 4.51 0.02 100.18 310 30 b.d.l 76	253 52 96 90 19 20 32 3 17 b.d.l 42 178 G3 76.92 0.07 13.34 0.66 0.47 0.17 0.08 0.42 4.48 0.042 4.48 0.01 100.37 331 24 6 75	245 68 114 85 18 20 32 2 2 5 5 d.l 35 22 25 5 d.l 35 35 77.27 0.07 13.28 0.47 0.39 0.07 13.28 0.47 0.39 0.02 0.10 0.38 4.56 4.38 0.01 100.54 358 20 0.54 135 135 20 0.54 14 20 22 22 25 26 26 26 20 20 22 26 26 20 20 22 26 26 20 20 20 20 20 20 20 20 20 20 20 20 20	262 68 142 113 19 25 32 4 29 b.d.1 38 76.88 0.08 13.23 0.58 0.32 0.58 0.32 0.58 0.32 0.23 0.09 0.40 4.45 4.42 0.01 100.14 343 19 b.d.1 19 25 32 34 343 19 25 32 343 19 26 343 19 26 343 19 26 343 19 26 34 343 19 26 35 32 32 32 32 32 32 32 32 32 32 32 32 32
Rb           Sr           Ba           Zr           Y           Nb           Th           U           Zn           Ni           Pb           Sample No           Unit           SiO2           TiO2           Al2O3           Fe(tot)           Fe2O3           FeO           MgO           CaO           Na2O           R2O           P2O5           Total           Fb           Sr           Ba           Zr           Y	240 62 139 106 22 27 b.d.l 23 b.d.l 26 169 G2PF 76.46 0.12 13.96 0.88 0.39 0.44 0.03 0.29 4.13 4.63 0.29 4.13 4.63 99.76	241 76 130 105 28 4 26 5.d.i 41 170 G2PF 77.73 0.11 13.65 0.62 0.25 0.25 0.25 0.22 0.25 0.22 0.16 4.15 4.15 4.00 2100.39 198 72 88 78 78 78	233 70 110 90 24 b.d.i 33 171 G2PF 79.75 0.07 11.64 0.44 0.24 0.24 0.24 0.44 0.44 0.44 0.4	225 78 63 86 13 20 24 3 27 b.d.1 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34 0.21 0.22 3.97 4.50 0.02 100.50 180 56 28 73 12	241 69 103 16 19 27 28 26 26 40 173 G2PF 75.62 0.13 13.56 0.96 0.48 0.44 0.24 0.42 4.04 0.42 4.04 0.24 0.42 4.04 0.42 195 89 103 105 105 105 105 105 105 105 105	253 81 125 110 15 21 29 b.d.l 29 b.d.l 33 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.57 0.31 0.10 5.97 7.32 0.03 0.31 0.10 5.97 7.32 99.16	247 47 31 104 13 22 21 b.d.l 34 22 175 63 76.54 0.08 13.11 0.65 0.39 0.23 0.16 0.51 4.42 4.40 0.01 99.87 177 27 b.d.l 75 28	244 76 99 19 30 32 b.d.1 26 b.d.1 36 36 176 G3 76.91 0.07 13.29 0.55 0.34 0.19 0.55 0.34 0.19 0.49 4.59 4.54 0.01 100.34 344 25 b.d.1 25	253 48 114 90 18 24 29 2 18 b.d.1 40 177 G3 76.59 0.08 13.27 0.54 0.38 0.01 0.11 0.56 4.42 4.51 0.02 100.18 310 30 b.d.1 76 28	253 52 96 90 19 20 32 3 17 b.d.l 42 178 G3 76.92 0.07 13.34 0.66 0.47 0.17 0.01 0.08 0.42 4.48 4.39 0.01 100.37 331 24 6 75 28	245 68 114 85 18 20 32 25 5.d.1 35 25 5.d.1 35 77.27 0.07 0.39 0.47 0.39 0.47 0.39 0.47 0.39 0.47 0.38 4.58 0.41 100.54 358 20 5.d.1 80 31	262 68 142 113 19 25 32 4 29 b.d.1 38 38 76.88 0.08 13.23 0.58 0.32 0.58 0.32 0.58 0.32 0.40 4.45 2.01 100.14 343 19 b.d.1 92,53
Rb           Sr           Ba           Zr           Y           Nb           Th           U           Zn           Ni           Pb           Sample No           Unit           SiO2           TIO2           Al2O3           Fe(tot)           Fe2O3           Fe0           MnO           MgO           CaO           Na2O           K2O           P2O5           Total           Pb           Sr           Ba           Zr           Y           Nb	240 62 139 106 27 b.d.1 23 b.d.1 26 30 62 97 76.46 0.12 13.98 0.44 0.03 0.29 4.13 4.68 0.29 4.13 4.68 0.29 99.78	241 78 130 105 28 4 26 b.d.l 41 770 G2PF 77.73 0.11 13.65 0.62 0.25 0.34 0.02 0.25 0.34 0.02 0.16 4.15 4.74 0.02 100.39 198 72 86 78 14	233 70 110 90 24 5.d.1 33 171 G2PF 79.75 0.07 11.64 0.24 0.44 0.24 0.44 0.24 0.24 0.42 0.02 0.42 4.75 3.45 0.02 100.62	225 78 63 86 13 20 24 3 27 b.d.1 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.74 0.21 0.22 3.97 4.50 0.021 0.22 3.97 4.50 0.50	241 89 103 16 19 27 2 28 28 28 40 173 G2PF 75.82 0.13 13.56 0.98 0.44 0.24 0.44 0.24 0.44 0.24 0.04 0.24 0.03 99.87 195 89 103 86 13 195 103 105 105 105 105 105 105 105 105	253 81 125 110 15 29 b.d.l 29 b.d.l 29 b.d.l 33 3 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.57 0.03 0.37 0.57 0.03 9.16 257 85 285 108 15 21	247 47 31 104 13 22 21 b.d.l 34 22 21 b.d.l 34 175 G3 76.54 0.08 13.11 0.65 0.39 0.62 0.62 0.62 0.62 0.61 0.51 99.87 177 27 b.d.l 75 63	244 76 99 99 19 30 52 b.d.1 26 b.d.1 36 36 176 G3 76.91 0.07 13.29 0.55 0.34 0.19 0.02 0.99 4.59 4.34 0.01 100.34	253 48 114 90 18 24 29 2 18 b.d.1 40 177 G3 76.59 0.08 13.27 0.64 0.23 0.01 0.15 6.42 4.51 0.02 100.18 310 30 b.d.1 76 26 30	253 52 96 90 19 20 32 3 17 b.d.1 42 178 G3 76.92 0.07 13.34 0.86 0.47 0.17 0.01 0.08 0.42 4.48 4.39 0.01 100.37 331 24 6 75 26	245 68 114 85 16 20 32 2 25 b.d.l 35 77.27 0.07 13.28 0.47 0.39 77.27 0.07 13.28 0.47 0.30 0.07 0.02 0.107 0.38 4.56 4.38 0.01 100.54 358 20 b.d.l 80 31 29	262 68 142 113 19 25 32 4 29 b.d.1 38 76.88 0.08 13.23 0.58 0.32 0.23 0.03 0.40 13.23 0.58 0.32 0.40 13.23 0.03 0.40 145 4.42 0.01 100.14 343 19 b.d.1 9 b.d.1 9 5 25 27
Rb           Sr           Ba           Zr           Y           Nb           Th           U           Zn           NI           Pb           Sample No           Unit           SiO2           TiO2           Al2O3           Fe(tot)           Fe2O3           Fe(tot)           Fe2O3           Fe0           MnO           MgO           CaO           Na2O           K2O           P2O5           Total           Fb           Sr           Ba           Zr           Y           Nb           Th	240 62 139 106 18 22 27 b.d.l 23 b.d.l 26 76.46 0.12 13.96 0.88 0.39 0.44 13.96 0.88 0.39 0.43 0.23 0.23 0.23 0.23 0.23 0.23 0.23 0.2	241 76 130 105 18 26 28 4 26 5.d.l 41 170 G2PF 77.73 0.11 13.65 0.62 0.25 0.25 0.25 0.22 0.15 4.74 0.02 100.39 198 72 88 78 14 15 27	233 70 110 80 15 19 24 b.d.1 33 171 G2PF 79.75 0.07 11.64 0.24 0.24 0.24 0.24 0.24 0.24 0.24 0.2	225 78 63 13 20 24 3 27 b.d.l 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.70 0.33 0.70 0.21 0.22 3.97 10.50 180 56 28 73 12 13 34	241 69 103 16 19 27 28 26 26 40 173 G2PF 75.62 0.13 13.56 0.96 0.48 0.44 0.24 0.24 0.24 0.03 99.87 195 89 103 86 18 13 35	253 81 125 110 15 29 b.d.l 29 b.d.l 29 b.d.l 29 b.d.l 33 3 3 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.31 0.10 5.97 7.32 0.03 99.16 257 85 285 108 15 21 38	247 47 31 104 13 22 21 b.d.l 34 22 175 G3 76.54 0.08 13.11 0.65 0.39 0.23 0.02 0.16 0.51 4.40 0.01 99.87 177 27 b.d.l 75 26 33 24	244 76 99 99 19 30 26 b.d.1 26 b.d.1 36 36 76.91 0.07 13.29 0.55 0.34 0.19 0.02 0.09 0.459 4.34 0.01 100.34 344 25 b.d.1 100.34	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3 78.59 0.08 13.27 0.64 0.38 0.28 0.01 0.11 0.52 100.18 310 30 b.d.l 76 26	253 52 96 90 19 20 32 3 17 b.d.1 42 178 G3 76.92 0.07 13.34 0.88 0.47 0.17 0.01 0.08 0.42 4.48 4.39 0.01 100.37 331 24 6 75 26 26 28	245 68 114 85 18 20 2 2 25 b.d.l 35 2 2 2 5 b.d.l 35 35 77.27 0.07 13.28 0.47 0.39 0.07 0.39 0.07 0.02 0.10 0.38 4.56 4.38 0.01 100.54 358 20 b.d.l 80 31 29 28	262 68 142 113 19 25 32 4 29 b.d.1 38 76.88 0.08 13.23 0.58 0.32 0.58 0.32 0.23 0.03 0.45 4.42 0.01 100.14 343 19 b.d.1 92 25 27 27
Pb           Sr           Ba           Zr           Y           Nb           Th           U           Zn           Ni           Pb           Sample No           Unit           SiO2           TiO2           Al2C33           Fe(tot)           Fe2C3           Fe0           MrO           MrQO           CaO           Na2O           K2O           P2O5           Total           Fb           Sr           Ba           Zr           Y           Nb           Th           U	240 62 139 106 2 27 b.d.l 23 b.d.l 26 30 69 62 7 6.46 0.12 13.96 0.88 0.39 0.44 0.03 0.29 4.13 4.69 0.23 0.29 4.13 4.63 99.76	241 76 130 105 18 26 28 4 26 b.d.l 41 170 G2PF 77.73 0.11 13.65 0.25 0.25 0.25 0.22 0.16 4.15 4.74 0.02 100.39 198 72 86 78 14 15 27 8,14 15 2,78 100,105 18 2,62 198 72 8,021 198 72 8,021 198 72 8,021 198 72 8,021 198 72 8,021 198 72 8,021 198 72 8,021 198 72 8,021 198 72 8,021 198 72 198 78 78 78 78 78 78 78 78 78 78 78 78 78	233 70 110 90 15 19 24 b.d.i 33 171 G2PF 79.75 0.07 11.64 0.24 0.24 0.24 0.24 0.24 0.24 0.24 0.2	225 78 63 66 13 20 24 3 27 b.d.l 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34 0.21 0.22 3.97 4.50 0.02 100.50 180 56 28 73 12 13 34 b.d.l	241 69 103 16 19 27 26 26 26 40 173 G2PF 75.62 0.13 13.56 0.48 0.48 0.44 0.24 0.42 4.04 0.42 4.04 0.24 0.24 0.24 0.03 99.87 195 89 105 195 89 105 195 89 105 105 105 105 105 105 105 105	253 81 125 110 15 29 b.d.l 29 b.d.l 33 174 62PF 65.33 0.16 18.99 1.00 0.37 0.31 0.10 5.97 7.32 0.03 99.16 257 85 285 108 15 21 36 b.d.l	247 47 31 104 13 22 21 b.d.l 34 175 G3 76.54 0.08 13.11 0.65 0.39 0.23 0.02 0.16 0.51 4.42 0.01 99.87 177 27 b.d.l 175 26 33 24 28	244 76 99 99 19 30 2 b.d.l 26 b.d.l 36 36 76.91 0.07 13.29 0.55 0.34 0.19 0.55 0.34 0.02 0.09 0.49 4.59 0.02 0.09 0.49 4.34 0.01 100.34 344 25 b.d.l 125 27 7 7	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3 78.59 0.08 13.27 0.64 0.38 0.21 0.011 0.56 4.42 4.51 0.02 100.18 310 30 b.d.l 76 26 30 26 56	253 52 96 90 19 20 32 3 17 b.d.1 42 178 G3 76.92 0.07 13.34 0.66 0.47 0.17 0.08 0.42 4.48 0.047 0.01 100.37 331 24 6 75 26 26 26 26 26 26 26 26	245 68 114 85 18 20 32 2 2 5 5 d.l 35 77.27 0.07 13.28 0.47 0.39 0.07 13.28 0.47 0.39 0.07 13.28 0.47 0.39 0.02 0.10 0.38 4.56 4.38 0.01 100.54 358 20 b.d.l 35 20 28 28 18	262 68 142 113 19 25 32 4 29 b.d.1 38 76.88 0.08 13.23 0.58 0.32 0.58 0.32 0.58 0.32 0.58 0.32 0.40 4.45 0.09 0.40 4.42 0.01 100.14 343 19 b.d.1 19 25 27 27 5
Pb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample No Unit SiO2 TiO2 Ai2O3 Fe(tot) Fe2O3 Fe(tot) Fe2O3 FeO Mr0 Mr0 Mr0 CaO Na2O Na2O Na2O Na2O Sr Sr Ba Zr Y Nb Th U Zn Nb Th U Zn Ni Ni Pb	240 62 139 106 22 27 b.d.l 23 b.d.l 26 76.46 0.12 13.96 0.88 0.39 0.44 0.03 0.29 4.13 4.68 0.23 0.29 4.13 4.63 99.76	241 76 130 105 28 4 26 b.d.l 41 170 G2PF 77.73 0.11 13.65 0.25 0.25 0.25 0.25 0.25 0.22 0.25 0.22 0.22	233 70 110 90 24 b.d.i 33 171 G2PF 79.75 0.07 11.64 0.44 0.24 0.24 0.24 0.24 0.44 0.44 0.24 0.44 0.4	225 78 83 86 13 20 24 3 27 b.d.1 39 172 G2PF 78.44 0.13 39 0.33 0.34 0.21 0.22 3.97 4.50 0.02 100.50 180 56 28 73 34 b.d.1 13 34 b.d.1 13 34 12 28 27 27 28 27 28 27 27 28 28 27 28 28 27 28 28 27 28 29 28 29 28 29 29 29 20 29 20 29 20 29 20 20 20 20 20 20 20 20 20 20 20 20 20	241 89 109 103 16 19 27 28 26 26 40 173 G2PF 75.62 0.13 13.56 0.96 0.48 0.44 0.44 0.44 0.42 4.04 0.42 4.04 0.42 4.03 99.87 195 89 103 105 105 105 105 105 105 105 105	253 81 125 110 15 21 29 b.d.l 29 b.d.l 33 3 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.57 0.37 0.57 0.03 0.37 0.57 0.03 0.37 0.10 5.97 7.32 0.03 99.16 257 85 285 108 15 21 25	247 47 31 104 13 22 21 b.d.l 34 22 175 G3 76.54 0.08 13.11 0.65 0.39 0.23 0.16 0.51 4.42 4.40 0.01 99.87 177 27 b.d.l 75 5.26 33 24 25 12	244 76 99 19 30 32 b.d.1 26 b.d.1 36 36 76.91 0.07 13.29 0.55 0.34 0.19 0.55 0.34 0.19 0.49 4.59 0.49 4.59 0.49 4.54 0.01 100.34 344 25 27 27 7 7	253 48 114 90 18 24 29 2 18 b.d.1 40 177 G3 76.59 0.08 13.27 0.64 0.38 0.01 0.11 0.56 4.42 4.51 0.02 100.18 310 30 b.d.1 76 59 0.08 9	253 52 96 90 19 20 32 3 17 b.d.l 42 178 G3 76.92 0.07 13.34 0.86 0.47 0.17 0.01 0.08 0.42 4.48 4.39 0.01 100.37 331 24 6 75 28 26 28 26 28 b.d.l 11	245 68 114 85 18 20 32 2 25 5.d.1 35 20 35 77.27 0.07 0.39 0.47 0.39 0.47 0.39 0.47 0.39 0.47 0.39 0.47 0.38 4.56 4.38 0.01 100.54 358 20 5.d.1 29 28 8 18	262 68 142 113 19 25 32 4 29 b.d.1 38 76.88 0.08 13.23 0.58 0.32 0.58 0.32 0.58 0.32 0.58 0.32 0.40 4.45 2.03 0.09 0.40 4.45 2.01 100.14 343 19 b.d.1 9 2.5 2.7 2.7 2.7 2.7 2.5 1.3
Pb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample No Unit SiO2 TiO2 Al2O3 Fe(tot) Fe2O3 Fe(tot) Fe2O3 Fe0 MnO MgO CaO Na2O K2O P2O5 Total Pb Sr Ba Zr Y Nb Th U U Ni Pb Ni Ni Pb Ni Ni Pb Ni Pb Ni Ni Ni Pb Ni Ni Pb Ni Ni Ni Ni Pb Ni Ni Ni Pb Ni Ni Ni Ni Ni Pb Ni Ni Ni Ni Pb Ni Ni Ni Ni Pb Ni Ni Ni Pb Ni Ni Ni Ni Ni Ni Ni Ni Ni Ni Ni Ni Ni	240 62 139 106 27 b.d.l 23 b.d.l 26 76.46 0.12 13.98 0.88 0.39 0.44 0.03 0.29 4.13 4.68 0.03 99.78 193 80 106 85 18 15 26 b.d.l 15 26 b.d.l 15 26	241 78 130 105 28 4 26 b.d.l 41 770 G2PF 77.73 0.11 13.65 0.62 0.25 0.25 0.25 0.25 0.25 0.22 0.22 0.2	233 70 110 80 15 19 24 b.d.I 33 171 62PF 79.75 0.07 11.64 0.44 0.44 0.28 0.02 0.09 0.42 4.75 3.45 0.02 100.62 130 52 34 59 14 13 31 b.d.I 8 b.d.I	225 78 63 86 13 20 24 3 27 b.d.1 39 172 G2PF 78.44 0.11 12.33 0.70 0.33 0.34 0.21 0.22 3.97 4.50 0.021 0.22 3.97 4.50 0.021 100.50 180 56 28 73 12 13 34 b.d.1 19 10 10 10 10 10 10 10 10 10 10 10 10 10	241 89 103 16 19 27 2 28 26 40 173 G2PF 75.62 0.13 13.56 0.96 0.44 0.24 0.24 0.04 0.24 0.04 0.24 0.03 99.87 195 89 103 86 13 35 b.(1) 29 28	253 81 125 110 15 29 b.d.l 29 b.d.l 29 b.d.l 33 3 174 G2PF 65.33 0.16 18.99 1.00 0.37 0.57 0.03 0.37 0.57 0.03 9.16 257 85 285 108 15 21 36 b.d.l 25 26 521 521 521 521 521 521 521 521 521 521	247 47 31 104 13 22 31 2 21 b.d.l 34 175 G3 76.54 0.08 13.11 0.65 0.39 0.65 0.39 0.62 0.62 0.62 0.62 0.62 0.61 99.87 177 27 b.d.l 75 26 33 24 25 24 25 24 25 24 25 24 25 26 26 26 27 27 27 27 27 27 27 27 27 27 27 27 27	244 76 99 99 19 30 52 b.d.1 26 b.d.1 36 36 76.91 0.07 13.29 0.55 0.34 0.07 13.29 0.55 0.34 0.02 0.09 0.49 4.59 4.59 4.59 4.34 0.01 100.34	253 48 114 90 18 24 29 2 18 b.d.l 40 177 G3 78.59 0.08 13.27 0.64 0.23 0.01 0.11 0.56 4.42 4.51 0.02 100.18 310 30 b.d.l 76 26 6 9 b.d.l	253 52 96 90 19 20 32 3 17 b.d.1 42 178 G3 76.92 0.07 13.34 0.86 0.47 0.17 0.01 0.08 0.42 4.48 4.39 0.01 100.37 331 24 6 75 26 26 26 26 26 26 26 26 26 26 26 26 26	245 68 114 85 16 20 32 2 25 b.d.l 35 77.27 0.07 13.28 0.47 0.39 77.27 0.07 13.28 0.47 0.39 0.47 0.30 0.07 0.02 0.10 0.38 4.56 4.38 0.01 100.54 358 20 b.d.l 80 31 29 28 18 29 28 18 20 29 28 18 20 29 28 18 20 20 20 20 20 20 20 20 20 20 20 20 20	262 68 142 113 19 25 32 4 29 b.d.1 38 76.88 0.08 13.23 0.58 0.32 0.23 0.03 0.49 0.40 13.23 0.03 0.49 0.40 1.45 4.42 0.01 100.14 343 19 b.d.1 92 25 27 27 5 13 b.d.1

Sample N	0 181	182	183	184	185	186	187	188	189	100	101	102
Unit	G3	G3	G3	G3	G3	G3	G3	G3	G3	G3	G3	G3
SiO2	76.36	76.30	76.28	76.68	75.10	76.67	76.89	76.83	76.63	76.88	76.55	76.73
TIO2	0.07	0.10	0.07	0.06	0.07	0.06	0.07	0.07	0.07	0.07	0.07	0.08
AI203	13.50	13.20	13.54	13.19	14.17	13.34	13.23	13.30	13.22	13.21	13.28	13.25
Fe(tot)	0.69	0.84	0.58	0.58	0.57	0.57	0.56	0.70	0.63	0.46	0.66	0.66
Fe2O3	0.48	0.50	0.45	0.40	0.36	0.39	0.35	0.40	0.42	0.25	0.47	0.40
FeO	0.19	0.31	0.12	0.16	0.19	0.16	0.19	0.27	0.19	0.19	0.17	0.23
MnO	0.03	0.03	0.03	0.02	0.02	0.03	0.04	0.02	0.03	0.01	0.01	0.02
MgO	0.12	0.22	0.11	0.07	0.11	0.12	0.14	0.14	0.09	0.08	0.10	0.12
CaO	0.47	0.50	0.42	0,39	0.56	0.38	0.42	0.39	0.38	0.27	0.34	0.38
Na2O	4.68	4.45	4.66	4.81	4.42	4.66	4.61	4.50	4.56	4.67	4.52	4.49
K20	4.39	4.42	4.53	4.30	4.98	4,45	4.37	4.58	4.49	4.37	4.49	4.42
P205	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
10(8)	100.31	100.31	100.22	100.10	99.99	100.29	100.31	100.52	100.09	100.01	100.02	100.13
Bh	359	306	366	- 416 C	338	392	351	374	370	342	360	338
Sr	24	27	23	9	60	17	21	19	18	19	23	24
Ba	b.d.l	b.d.1	b.d.i	b.d.l	62	b.d.l	b.d.i	b.d.l	b.d.l	b.d.I	h.d.l	h.d.i
Zr	75	75	79	86	77	68	69	77	73	70	72	70
Y I	27	25	28	32	27	29	29	30	28	27	27	27
Nb	27	25	30	35	26	20	29	28	27	28	29	32
Th	23	20	24	26	24	23	29	30	28	23	23	23
U	° 8 ° ·	11	15	7	8	7 -	14	7	4	4	5	3
Zn	14	18	14	11	13	12	15	12	14	10	20	11 .
Ni	b.d.l	b.d.l	b.d.l	b.d.l	26	b.d.i	b.d.i	b.d.l	b.d.l	b.d.l	b.d.l	b.d.l
Pb	37	41	29	36	40	43	40	36	39	18	22	33
										- *2		
Ce		404	105	100	107	100	100	000	001		0.45	
Sample N	0 193	194	195	190	197	198	. 198 .	200	201	202	203	204
Unit	63	63	63	63	63	63	63	63	63	63	63	
SICO	78 05	76 00	78 55	77 10	77 10	78.01	78 67	76 63	76 07	77 00	77 70	77 04
3102	0.80	0.00	10.55	0.07	0.07	10.91	/0.0/	/0.03	10.21	0.00	0.07	11.24
AI2O3	13 30	19.55	13.40	13 44	13.27	19.00	13 46	13 42	13.67	19 20	12 17	13 33
Ee(tot)	0.51	0.63	0.65	0 43	0.62	0.62	0.70	0.70	0.65	0.62	0.60	0.63
Fe203	0.00	0.39	0.38	0.40	0.02	0.38	0.41	0.41	0.32	0.33	0.00	0.00
FeO	0.22	0.22	0.24	0.18	0.19	0.22	0.28	0.26	0.30	0.14	0.18	0.10
MnO	0.02	0.01	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.01	0.02	0.02
MaQ	0.12	0.10	0.11	0.07	0.09	0.11	0.13	0.15	0.15	0.10	0.09	0.11
00	0.00	0.90	0 48	0.49		0.40	0.53	0.81	0.63	0.40	0.48	0.33
	0.30	0.30		V V	0.4/	0.43			0.03			
Na2O	4,49	4.56	4.66	4.77	4.53	4.55	4.11	4.36	4.62	4.29	4.35	4.62
Na2O K2O	4,49	4.56 4.41	4.66 4.44	4.77	0.47 4.53 4.58	4.55 4.48	4.11 4.91	4.36 4.44	4.62 4.27	4.29 4.72	4.35 4.51	4.62 4.45
Na2O K2O P2O5	4.49 4.42 0.01	4.56 4.41 0.02	4.66 4.44 0.02	4.77 4.29 0.02	0.47 4.53 4.58 0.02	0.43 4.55 4.48 0.01	4.11 4.91 0.02	4.36 4.44 0.02	4.62 4.27 0.02	4.29 4.72 0.01	4.35 4.51 0.01	4.62 4.45 0.02
Na2O K2O P2O5 Total	0.38 4,49 4,42 0.01 100.13	4.56 4.41 0.02 100.60	4.66 4.44 0.02 100.48	4.77 4.29 0.02 100.66	4.53 4.58 0.02 100.75	0.43 4.55 4.48 0.01 100.60	4.11 4.91 0.02 100.50	4.36 4.44 0.02 100.41	4.62 4.27 0.02 100.36	4.29 4.72 0.01 100.97	4.35 4.51 0.01 100.97	4.62 4.45 0.02 100.58
Na2O K2O P2O5 Total	4.49 4.42 0.01 100.13	4.56 4.41 0.02 100.60	4.66 4.44 0.02 100.48	4.77 4.29 0.02 100.66	4.53 4.58 0.02 100.75	0.43 4.55 4.48 0.01 100.60	4.11 4.91 0.02 100.50	4.36 4.44 0.02 100.41	4.62 4.27 0.02 100.36	4.29 4.72 0.01 100.97	4.35 4.51 0.01 100.97	4.62 4.45 0.02 100.58
Na2O K2O P2O5 Total	4,49 4,42 0.01 100.13	4.56 4.41 0.02 100.60	4.66 4.44 0.02 100.48	4.77 4.29 0.02 100.66	4.53 4.58 0.02 100.75	0.43 4.55 4.48 0.01 100.60	4.11 4.91 0.02 100.50	4.36 4.44 0.02 100.41	4.62 4.27 0.02 100.36	4.29 4.72 0.01 100.97	4.35 4.51 0.01 100.97	4.62 4.45 0.02 100.58
Na2O K2O P2O5 Total	4.49 4.42 0.01 100.13	0.38 4.56 4.41 0.02 100.60	4.66 4.44 0.02 100.48 374	4.77 4.29 0.02 100.66	0.47 4.53 4.58 0.02 100.75 342	0.43 4.55 4.48 0.01 100.60 339	4.11 4.91 0.02 100.50 233	4.36 4.44 0.02 100.41 265	4.62 4.27 0.02 100.36	4.29 4.72 0.01 100.97 321	4.35 4.51 0.01 100.97 296	4.62 4.45 0.02 100.58 319
Na2O K2O P2O5 Total Fb Sr	0.38 4.49 4.42 0.01 100.13 331 21	0.38 4.56 4.41 0.02 100.60 297 25	4.66 4.44 0.02 100.48 374 22	4.77 4.29 0.02 100.66 327 25	0.47 4.53 4.58 0.02 100.75 342 20	0.43 4.55 4.48 0.01 100.60 339 25	4.11 4.91 0.02 100.50 233 56	4.36 4.44 0.02 100.41 265 66	4.62 4.27 0.02 100.36 269 60	4.29 4.72 0.01 100.97 321 20	4.35 4.51 0.01 100.97 296 24	4.62 4.45 0.02 100.58 319 22
Na2O K2O P2O5 Total Rb Sr Ba	0.38 4.49 4.42 0.01 100.13 331 21 b.d.l	4.56 4.41 0.02 100.60 297 25 b.d.I	4.66 4.44 0.02 100.48 374 22 b.d.l	4.77 4.29 0.02 100.66 327 25 b.d.!	0.47 4.53 4.58 0.02 100.75 342 20 b.d.l	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1	4.11 4.91 0.02 100.50 233 56 b.d.l	4.36 4.44 0.02 100.41 265 66 12	4.62 4.27 0.02 100.36 269 60 25	4.29 4.72 0.01 100.97 321 20 b.d.l	4.35 4.51 0.01 100.97 295 24 b.d.l	4.62 4.45 0.02 100.58 319 22 b.d.l
Ra2O K2O P2O5 Total Rb Sr Ba Zr Ba	0.38 4.49 4.42 0.01 100.13 331 21 b.d.l 90	4.56 4.41 0.02 100.60 297 25 b.d.I 80	4.66 4.44 0.02 100.48 374 22 b.d.l 81	4.77 4.29 0.02 100.66 327 25 b.d.! 71	0.47 4.53 4.58 0.02 100.75 342 20 b.d.l 74 16	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14	4.36 4.44 0.02 100.41 265 66 12 53	4.62 4.27 0.02 100.36 269 60 25 68	4.29 4.72 0.01 100.97 321 20 b.d.l 67	4.35 4.51 0.01 100.97 296 24 b.d.l 60	4.62 4.45 0.02 100.58 319 22 b.d.1 70
Na2O K2O P2O5 Total Rb Sr Ba Zr Y	0.38 4.49 4.42 0.01 100.13 331 21 b.d.l 90 13 24	0.38 4.56 4.41 0.02 100.60 297 25 b.d.I 80 14 26	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32	4.77 4.29 0.02 100.66 327 25 b.d.! 71 13 21	0.47 4.53 4.58 0.02 100.75 342 20 b.d.l 74 16 29	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20	4.11 4.91 0.02 100.50 233 56 b.d.I 55 14	4.36 4.44 0.02 100.41 265 66 12 55 12 12	4.62 4.27 0.02 100.36 269 60 25 68 13 20	4.29 4.72 0.01 100.97 321 20 b.d.l 67 12 18	4.35 4.51 0.01 100.97 296 24 b.d.l 60 12 22	4.62 4.45 0.02 100.58 319 22 b.d.l 70 13 24
Na2O K2O P2O5 Total Rb Sr Ba Zr Y Nb	0.38 4.49 4.42 0.01 100.13 331 21 b.d.l 90 13 24 32	0.38 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 24	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31	4.77 4.29 0.02 100.66 327 25 b.d.l 71 13 21 25	0.47 4.53 4.58 0.02 100.75 342 20 b.d.l 74 16 29 29	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28	4.62 4.27 0.02 100.36 269 60 25 68 13 20 26	4.29 4.72 0.01 100.97 321 20 b.d.l 67 12 18 29	4.35 4.51 0.01 100.97 296 24 b.d.i 60 12 22	4.62 4.45 0.02 100.58 319 22 b.d.l 70 13 24 28
Na2O K2O P2OS Total Rb Sr Ba Zr Y Nb Th U	0.38 4.49 4.42 0.01 100.13 331 21 b.d.i 90 13 24 32 7	4.56 4.41 0.02 100.60 297 25 b.d.l 80 14 26 24 5	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7	0.47 4.53 4.58 0.02 100.75 342 20 b.d.I 74 16 29 29 5	0.43 4.55 0.01 100.60 339 25 b.d.1 73 15 20 31 4	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10	4.63 4.27 0.02 100.36 269 60 25 68 13 20 26 6	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1	4.35 4.51 0.01 100.97 296 24 b.d.i 80 12 22 20 7	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12
Na2O K2O P2O5 Total Fb Sr Ba Zr Y Nb Th U Zn	0.38 4,49 4,42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17	0.38 4.58 4.41 0.02 100.60 297 25 b.d.l 80 14 26 24 5 18	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13	0.47 4.53 0.02 100.75 342 20 b.d.l 74 16 29 5 16	0.43 4.65 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l 18	4.36 4.44 0.02 100.41 265 66 12 55 12 55 12 19 28 10 19	4.62 4.27 0.02 100.36 60 25 68 13 20 26 6 6 22	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16	4,35 4,51 0,01 100.97 296 24 b.d.l 60 12 22 20 7 18	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 17
Na2O K2O P2O5 Total Rb Sr Ba Zr Y Nb Th U Zn Nb Th U Zn Ni	0.50 4.49 4.42 0.01 100.13 331 21 b.d.i 90 13 24 32 7 17 7 b.d.i	4.56 4.41 0.02 100.60 297 25 b.d.l 80 14 26 24 5 18 b.d.l	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l	4.77 4.29 0.02 100.66 327 25 b.d.1 13 21 25 7 13 b.d.1	0.47 4.53 0.02 100.75 342 20 b.d.l 74 16 29 29 5 16 26	0.43 4.65 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 b.d.1	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l 18 b.d.l	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 b.d.l	4.62 4.27 0.02 100.36 60 25 68 13 20 28 6 22 5 68	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 b.d.1	4,35 4,51 0,01 100,97 296 24 b.d.l 60 12 22 20 7 18 b.d.l	4.62 4.45 0.02 100.58 319 22 b.d.i 70 13 24 26 12 17 b.d.i
Na2O K2O P2O5 Total Rb Sr Ba Zr Y Nb Th U Zn Ni Pb	0.38 4.49 4.42 0.01 100.13 331 b.d.1 90 13 24 90 13 24 7 7 17 b.d.1 34	0.56 4.56 4.41 0.02 100.60 297 25 b.d.l 80 14 26 24 5 18 b.d.l 24	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 29 5 16 26 43	4.65 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 b.d.1 33	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l 18 b.d.l 34	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 5.d.l 34	4.62 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.l 36	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 b.d.1 35	4,35 4,51 0,01 100.97 295 24 b.d.l 60 12 22 20 7 18 b.d.l 38	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 17 b.d.1 27
Na2O K2O P2O5 Total Rb Sr Ba Zr Y Nb Ba Zr Y Nb U Zn Ni Pb	0.38 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17 b.d.1 34	0.36 4.56 4.41 0.02 100.60 297 25 b.d.i 80 14 26 5 18 b.d.i 24 5	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53	4.77 4.29 0.02 100.66 327 25 b.d.l 71 13 21 25 7 13 b.d.l 39	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 29 5 16 26 43	4.65 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 b.d.1 33	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l 18 b.d.l 34	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 b.d.l 34	4.62 4.27 0.02 100.36 60 25 68 13 20 26 6 22 b.d.l 36	4.29 4.72 0.01 100.97 321 20 b.d.l 67 12 18 29 b.d.l 16 b.d.l 35	4,35 4,51 0,01 100,97 296 24 b.d.l 60 12 22 20 7 18 b.d.l 38	4.62 4.45 0.02 100.58 319 22 b.d.i 70 13 24 26 12 17 b.d.i 27
Na2O K2O P2OS Total Rb Sr Ba Zr Y Nb Th U Zn Ni Pb	0.36 4.49 4.42 0.01 100.13 331 21 b.0 13 24 32 7 17 b.d.i 34	0.35 4.56 4.41 0.02 100.60 297 25 b.d.l 80 14 26 24 5 18 b.d.l 24	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53	4.77 4.29 0.02 100.66 327 25 b.d.! 71 13 21 25 7 13 b.d.! 39	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 5 16 26 43	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 b.d.1 33	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l 18 b.d.l 34	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 5.d.l 34	4.62 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.i 36	4.29 4.72 0.01 100.97 321 20 b.d.l 67 12 18 29 b.d.l 16 b.d.l 35	4,35 4,51 0,01 100,97 296 24 b,d,i 60 12 22 20 7 18 b,d,i 38	4.62 4.45 0.02 100.58 319 22 b.d.i 70 13 24 26 12 17 b.d.i 27
Na2O K2O P2OS Total Rb Sr Ba Zr Y Nb Th U Zn Ni Pb	0.50 4.49 4.42 0.01 100.13 331 21 b.d.i 90 13 24 32 7 17 b.d.i 34	0.35 4.56 4.41 0.02 100.60 297 25 b.d.l 80 14 26 24 5 18 b.d.l 24	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 5 16 26 43	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 b.d.1 33	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l 18 b.d.l 34	4.36 4.44 0.02 100.41 265 66 12 55 52 19 28 10 19 28 10 19 b.d.l 34	4.62 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.i 36	4.29 4.72 0.01 100.97 321 20 b.d.i 67 12 18 29 b.d.i 16 b.d.i 35	4,35 4,51 0,01 100,97 296 24 b,d,i 60 12 22 20 7 18 b,d,i 38	4.62 4.45 0.02 100.58 319 22 b.d.l 70 13 24 26 12 17 b.d.l 27
Na2O K2O F2O5 Total Rb Sr Ba Zr Y Nb Th U Zn Ni Pb	0.50 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17 b.d.1 34	0.56 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 24 5 18 b.d.1 24 208	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 29 5 16 26 43	0.45 4.45 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 b.d.1 33 210	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l 18 b.d.l 34	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 28 10 19 5.d.l 34	4.62 4.27 0.02 100.36 269 60 25 68 13 20 26 68 13 20 28 6 6 22 b.d.l 36	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 5.d.1 35	4,35 4,51 0,01 100.97 296 24 b.d.l 60 12 22 20 7 18 b.d.l 38 215	4.62 4.45 0.02 100.58 319 22 b.d.l 70 13 24 26 12 17 b.d.l 27 216
Na2O K2O P2O5 Total Sr Ba Zr Y Nb Th U Zn Ni Pb Sample Ne Unit	0.36 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 52 7 17 b.d.1 34 0 205 G3	0.35 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 5 18 b.d.1 24 24 5 18 b.d.1 24	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 5 16 29 5 16 26 43	0.45 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 31 4 20 5. b.d.1 33	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l 18 b.d.l 34 211 G3	4.36 4.44 0.02 100.41 265 66 12 55 12 28 10 19 28 10 19 b.d.l 34 212 G3	4.62 4.27 0.02 100.36 60 25 68 13 20 26 6 22 b.d.l 36 213 G3	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 b.d.1 35 214 G3	4,35 4,51 0,01 100.97 298 24 b.d.l 60 12 22 20 7 18 b.d.l 38 b.d.l 38 215 G3	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 17 b.d.1 27 218 G3
Na2O Na2O K2O P2O5 Total Sr Ba Zr Y Nb Th U Zn Ni Pb Sample Nr Unit	0.36 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17 b.d.1 34 0 205 G3 70	0.35 4.56 4.41 0.02 100.60 297 25 b.d.l 80 14 26 5 18 b.d.l 24 5 18 b.d.l 24 5 18 b.d.l 24 5	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3	0.47 4.53 4.58 0.02 100.75 342 20 b.d.l 74 16 29 5 16 26 43 209 G3	0.45 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 b.d.1 33 4 20 b.d.1 33 210 G3	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l 18 b.d.l 34 211 G3	4.36 4.44 0.02 100.41 265 66 12 55 12 55 12 28 10 19 28 10 19 28 10 19 9 b.d.l 34 212 G3	4.62 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.l 36 213 G3	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 b.d.1 35 214 G3	4,35 4,51 0,01 100.97 296 24 b.d.l 60 12 22 20 7 18 b.d.l 38 215 G3	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 17 b.d.1 27 216 G3
Na2O K2O F2O5 Total Rb Sr Ba Zr Y Nb Th Th U Zn Ni Pb Sample Ne Unit SiO2	0.50 4.49 4.42 0.01 100.13 331 21 b.d.1 32 7 17 b.d.1 34 205 G3 76.70	0.38 4.56 4.41 0.02 100.60 297 25 b.d.i 80 14 26 5 18 b.d.i 24 5 18 b.d.i 24 5 7.01 0.7	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3 76.94	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 5 16 26 43 209 G3 76.33	0.45 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 b.d.1 33 210 G3 77.27 0.00	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 50 b.d.l 18 b.d.l 30 b.d.l 18 b.d.l 34 211 G3 76.94	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 b.d.l 34 212 G3 77.02	4.62 4.27 0.02 100.36 60 25 68 13 20 26 6 22 b.d.l 36 6 213 G3 76.62	4.29 4.72 0.01 100.97 321 20 b.d.l 67 12 18 29 b.d.l 16 b.d.l 35 214 G3 79.10	4,35 4,51 0,01 100,97 296 24 b.d.l 80 12 22 20 7 18 b.d.l 38 215 G3 76,78	4.62 4.45 0.02 100.58 319 22 b.d.i 70 13 24 26 12 17 b.d.i 27 216 G3 76.74
Na2O Na2O K2O P2OS Total Sr Ba Zr Y Nb Th U Zn Ni Pb Sample Ni Unit SiO2 TiO2	0.50 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17 b.d.1 34 0 205 G3 7 6.70 0.07	0.56 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 24 5 18 b.d.1 24 208 G3 77.01 0.07	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3 76.94 0.07	4.77 4.29 0.02 100.66 327 25 b.d.! 71 13 21 25 7 13 b.d.! 39 208 G3 76.76 0.07	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 5 16 26 43 209 G3 76.33 0.10	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 b.d.1 31 4 20 b.d.1 33 4 20 b.d.1 33 77.27 0.06	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l 15 30 b.d.l 18 b.d.l 34 211 G3 76.94 0.07	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 b.d.l 34 212 G3 77.02 0.08	4.62 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.i 36 213 G3 76.62 0.07	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 5.d.1 35 214 G3 79.10 0.06	4,35 4,51 0,01 100.97 296 24 b.d.1 80 12 22 20 7 18 b.d.1 38 215 G3 76.78 0.07	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 24 26 12 17 b.d.1 27 216 G3 76.74 0.07
Na2O Na2O K2O P2O5 Total Sr Ba Zr Y Nb Th U Zn Ni Pb Sample Ni Unit SiO2 TiO2 Al2O3 E c (cc)	0.05 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 521 b.d.1 32 7 17 b.d.1 34 205 G3 76.70 0.07 13.27 0.07	0.38 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 24 5 18 b.d.1 24 208 33 77.01 0.07 13.35 0.52	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3 76.94 0.07 13.35	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0 e	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 10 7 5 10 7 5	0.45 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 31 4 20 5. d.1 33 77.27 0.06 13.29 0.44	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l 18 b.d.l 34 211 G3 76.94 0.07 13.46 0 = 6	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 28 10 19 28 10 19 5.d.l 34 212 G3 77.02 0.08 13.33 0	4.62 4.27 0.02 100.36 60 25 68 13 20 26 6 22 5 68 13 20 28 6 22 b.d.i 38 36 76.62 0.07 13.41 0 0	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 b.d.1 35 214 G3 79.10 0.06 12.33 0.4	4.35 4.51 0.01 100.97 295 24 b.d.l 80 12 22 20 7 18 b.d.l 38 215 G3 76.78 0.07 13.38 0.07	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 24 26 12 17 b.d.1 27 216 G3 76.74 0.07 13.37 0 c c
Na2O Na2O K2O P2O5 Total Rb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample Ni U Ni Fb SiO2 TiO2 Ai2O3 Fe(tot) Fe2O5	0.36 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 7 17 b.d.1 34 0 205 G3 76.70 0.07 13.27 0.62 0.41	0.38 4.56 4.41 0.02 100.60 297 25 b.d.l 80 14 26 5 18 b.d.l 24 5 18 b.d.l 24 5 77.01 0.07 13.35 0.63 0.93	4.66 4.44 0.02 100.48 374 22 b.d.  81 17 32 31 4 19 b.d.  53 207 G3 76.94 0.07 13.35 0.48 0.22	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.42	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 10 74 10 75	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 b.d.1 33 210 G3 77.27 0.06 13.29 0.44 0.22	4.11 4.91 0.02 100.50 233 56 b.d.1 55 14 15 30 b.d.1 18 b.d.1 18 b.d.1 34 211 G3 76.94 0.07 13.46 0.59 0.92	4.36 4.44 0.02 100.41 265 66 12 55 12 28 10 19 28 10 19 28 10 19 28 34 212 G3 77.02 0.08 13.33 0.65 0.45	4.62 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.l 36 213 G3 76.62 0.07 13.41 0.61	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 b.d.1 35 214 G3 79.10 0.06 12.33 0.45 0 92	4,35 4,51 0,01 100.97 298 24 b.d.i 60 12 22 20 7 18 b.d.i 38 215 G3 76.78 0,07 13.38 0,59 0,97	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 28 12 17 b.d.1 27 218 G3 76.74 0.07 13.37 0.65
Na2O Na2O K2O P2O5 Total Rb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample N Unit SiO2 TiO2 Al2O3 Fe(tot) Fe2O3	0.50 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17 b.d.1 34 205 G3 76.70 0.07 13.27 0.62 0.41 0.12	0.35 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 24 5 18 b.d.1 24 5 18 b.d.1 24 5 77.01 0.07 13.35 0.53 0.38 0.18	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3 76.94 0.07 13.35 0.48 0.28	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.43	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 29 5 16 26 43 209 G3 78.33 0.10 13.68 0.81 0.47 23	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 b.d.1 33 210 G3 77.27 0.06 13.29 0.44 0.29	4.11 4.91 0.02 100.50 233 56 b.d.1 55 14 15 50 b.d.1 18 b.d.1 30 b.d.1 18 b.d.1 34 211 G3 76.94 0.07 13.46 0.59 0.38	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 b.d.l 34 212 G3 77.02 0.08 13.33 0.65 0.41	4.62 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.l 36 213 G3 76.62 0.07 13.41 0.61 0.61	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 b.d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.12	4,35 4,35 1,001 100.97 296 24 b.d.1 60 12 22 7 18 b.d.1 38 215 G3 76.78 0.07 13.38 0.59 0.37	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 17 b.d.1 27 216 G3 76.74 0.07 13.37 0.65 0.43 2.90
Na2O Na2O K2O P2O5 Total Rb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample Ne Unit SiO2 TiO2 Ai2O3 Fe(tot) Fe2O3 FeO MnO	0.50 4.49 4.42 0.01 100.13 331 21 b.d.1 32 7 17 b.d.1 34 7 7 17 b.d.1 34 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	0.35 4.56 4.41 0.02 100.60 297 25 b.d.i 80 14 26 24 5 18 b.d.i 24 5 5 18 b.d.i 24 5 5 3 77.01 0.07 13.35 0.53 0.33 0.18 0.02	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3 76.94 0.07 13.35 0.48 0.28 0.01	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.43 0.20 0.03	0.47 4.53 4.58 0.02 100.75 342 20 b.d.l 74 16 29 29 5 16 26 43 76.33 0.10 13.68 0.81 0.47 0.03	0.43 4.55 4.48 0.01 100.60 339 25 5. 5. 6. 17 20 31 4 20 5. 6. 15 20 31 4 20 5. 6. 15 20 5. 6. 15 20 5. 6. 15 20 5. 6. 15 20 5. 6. 17 31 4 20 5. 6. 17 31 73 15 20 5. 6. 17 31 73 15 20 5. 73 10 70 20 10 70 20 10 70 10 70 10 70 10 70 10 70 10 70 10 70 10 70 10 70 10 70 10 70 10 70 10 70 10 70 10 10 10 10 10 10 10 10 10 10 10 10 10	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 50 b.d.l 18 b.d.l 30 b.d.l 18 b.d.l 34 211 G3 76.94 0.07 13.46 0.59 0.38 0.19 0.03	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 b.d.l 34 212 G3 77.02 0.08 13.33 0.65 0.41 0.22 0.02	4.62 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.l 36 213 G3 76.62 0.07 13.41 0.61 0.39 0.20 0 0 0	4.29 4.72 0.01 100.97 321 20 b.d.l 67 12 18 29 b.d.l 16 b.d.l 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.12 0.01	4,35 4,35 1,001 100.97 296 24 b.d.l 60 12 22 20 7 18 b.d.l 38 215 G3 76.78 0.07 13.38 0.59 0.37 0.20 0 0.03	4.62 4.45 0.02 100.58 319 22 b.d.i 70 13 24 6 12 17 b.d.i 27 216 G3 76.74 0.07 13.37 0.65 0.43 0.20 0.09
Na2O Na2O K2O P2O5 Total Rb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample Ne Unit SiO2 TiO2 Al2O3 Fe(tot) Fe2O3 FeO MnO MoO	0.36 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17 b.d.1 34 26 33 76.70 0.07 13.27 0.62 0.41 0.19 0.03 0.10	0.35 4.56 4.41 0.02 100.60 297 25 b.d.1 26 24 208 63 77.01 0.07 13.35 0.53 0.33 0.18 0.02	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 76.94 0.07 13.35 0.28 0.28 0.16 0.08	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.43 0.20 0.03 0.13	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 5 16 26 43 76.33 0.10 13.68 0.81 0.47 0.30 0.03 0.16	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 b.d.1 73 15 20 b.d.1 33 4 20 b.d.1 33 77.27 0.06 13.29 0.44 0.29 0.13 0.01	4.11 4.91 0.02 100.50 233 56 b.d.1 55 14 15 30 b.d.1 18 b.d.1 34 211 G3 76.94 0.07 13.46 0.38 0.38 0.19 0.03 0.09	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 28 10 19 28 10 19 5.d.1 34 212 G3 77.02 0.08 13.33 0.65 0.41 0.22 0.041	4.62 4.27 0.02 100.36 60 25 68 13 20 26 6 22 5 68 13 20 28 6 22 5 .d.I 36 76.62 0.07 13.41 0.39 0.20 0.02 0.02	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 5.d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.12 0.05	4,35 4,35 4,51 0,01 100.97 298 24 b.d.l 60 12 22 20 7 18 b.d.l 38 215 G3 76,78 0.07 13,38 0.57 0.20 0.037 0.13	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 24 26 12 17 b.d.1 27 216 G3 76.74 0.07 13.37 0.65 0.43 0.20 0.02
Na2O Na2O K2O P2O5 Total Sr Ba Zr Y Nb Th U Zn Ni Pb Sample N U Zn Ni Pb Sample N U SiO2 TiO2 Ai2O3 Fe(tot) Fe2O3 Fe0 MnO MgO CaO	0.38 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 5 7 17 b.d.1 34 5 205 G3 76.70 0.07 13.27 0.62 0.41 0.19 0.03 0.10	0.38 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 5 18 b.d.1 24 208 G3 77.01 0.07 13.35 0.53 0.33 0.18 0.02 0.09 0.31	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3 76.94 0.07 13.35 0.48 0.07 13.35 0.28 0.18 0.01 0.08	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.43 0.20 0.03 0.13 0.42	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 33 78.33 0.10 13.68 0.81 0.47 0.30 0.03 0.03 0.05	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 31 4 20 0.31 4 20 31 4 20 31 4 20 31 4 20 5 b.d.1 33 77.27 0.06 13.29 0.44 0.29 0.13 0.01	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l 18 b.d.l 34 211 G3 76.94 0.07 13.46 0.59 0.38 0.19 0.03 0.09 0.44	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 34 77.02 0.08 13.33 0.65 0.41 10.22 0.04 10.44 10 40 40 40 40 40 40 40 40 40 40 40 40 40	4.62 4.27 0.02 100.36 269 60 25 68 13 20 28 6 22 b.d.l 36 213 G3 76.62 0.07 13.41 0.39 0.20 0.02 0.02 0.45	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 5.d.1 35 214 G3 79.10 0.08 12.33 0.45 0.32 0.12 0.01 0.05	4.35 4.51 0.01 100.97 295 24 b.d.i 60 12 22 20 7 18 b.d.i 38 215 G3 76.78 0.07 13.98 0.57 0.37 0.20 0.03 0.37	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 17 b.d.1 27 216 G3 76.74 0.07 13.37 0.65 0.43
Na2O Na2O K2O P2O5 Total Rb Sr Ba Zr Y Nb Th U Zn Ni Fb Sample Nt Unit SiO2 TiO2 A12O3 Fe(tot) Fe2O3 Fe(tot) Fe2O3 Fe0 MnO MgO CaO Na2O	0.38 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17 b.d.1 34 205 G3 76.70 0.07 13.27 0.62 0.41 0.19 0.03 0.10 0.470	0.38 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 5 18 b.d.1 24 5 18 b.d.1 24 5 18 b.d.1 24 5 18 b.d.1 24 5 13.35 0.53 0.33 0.18 0.02 0.09 0.31 4.72	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3 76.94 0.07 13.35 0.48 0.07 13.35 0.48 0.01 0.08 0.34 8	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.43 0.20 0.03 0.13 0.42 4.57	0.47 4.53 4.58 0.02 100.75 342 20 b.d.  74 16 29 5 16 26 43 76.33 0.10 13.68 0.81 0.47 0.30 0.03 0.16 0.51 4.48	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 b.d.1 33 4 20 b.d.1 33 210 G3 77.27 0.06 13.29 0.44 0.29 0.13 0.01 0.04 0.04 0.45	4.11 4.91 0.02 100.50 233 56 b.d.1 55 14 15 30 b.d.1 18 b.d.1 34 211 G3 76.94 0.07 13.46 0.59 0.38 0.19 0.03 0.09 0.44 4.60	4.36 4.44 0.02 100.41 265 66 12 55 12 28 10 19 28 10 19 28 10 19 28 34 212 G3 77.02 0.08 13.33 0.65 0.41 0.22 0.02 0.14 0.42	4.63 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.l 36 213 G3 76.62 0.07 13.41 0.61 0.39 0.20 0.02 0.02 0.02 0.02	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 b.d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.12 0.01 0.05 0.43 4.15	4.35 4.35 0.01 100.97 296 24 b.d.1 60 12 22 20 7 18 b.d.1 38 215 G3 76.78 0.07 13.38 0.59 0.37 0.20 0.03 0.13 0.37	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 28 12 17 b.d.1 27 216 G3 76.74 0.07 13.37 0.65 0.43 0.02 0.02 0.09 0.43 4.34
Na2O Na2O K2O F2O5 Total Rb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample N Unit SiO2 TiO2 A12O3 Fe(tot) Fe2O3 Fe0 MnO MgO CaO Na2O K2O	0.36 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17 b.d.1 34 205 G3 76.70 0.07 13.27 0.62 0.41 0.19 0.03 0.10 0.40 4.28	0.36 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 24 5 18 b.d.1 24 5 18 b.d.1 24 5 5 18 b.d.1 24 5 18 b.d.1 24 5 13.35 0.53 0.33 0.13 5 0.63 0.33 0.13 2.55 0.53 0.33 0.13 0.22 0.09 0.31 4.72 4.41	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3 76.94 0.07 13.35 0.48 0.28 0.48 0.28 0.01 0.08 0.34 4.43	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.43 0.03 0.13 0.42 4.57 4.49	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 29 5 16 26 43 209 G3 78.33 0.10 13.68 0.81 0.47 0.30 0.03 0.16 0.51 4.46	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 b.d.1 33 4 20 b.d.1 33 210 G3 77.27 0.06 13.29 0.44 0.29 0.44 0.29 0.44 0.24 5 0.01	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 5 14 15 5 14 15 5 14 15 5 14 15 30 b.d.l 18 b.d.l 34 211 G3 76.94 0.07 13.46 0.59 0.38 0.09 0.03 0.09 0.44 4.46	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 b.d.1 34 212 G3 77.02 0.08 13.33 0.65 0.41 1.02 0.02 0.14 0.45 4.19	4.62 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.1 36 213 G3 76.62 0.07 13.41 0.61 0.39 0.20 0.02 0.02 0.02 0.45 4.23	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 b.d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.45 0.32 0.01 0.05 0.43 4.40	4,35 4,35 4,51 0,01 100.97 296 24 b.d.1 60 12 22 20 7 18 b.d.1 38 215 G3 76.78 0.07 13.38 0.59 0.37 0.20 0.03 0.13 0.37 4.48	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 17 b.d.1 27 216 G3 76.74 0.07 13.37 0.65 0.43 0.02 0.02 0.09 0.43 4.34 4.73
Na2O           Na2O           K2O           F2O5           Total           Rb           Sr           Ba           Zr           Y           Nb           Th           U           Zn           Ni           Pb           SiO2           TiO2           Al2O3           Fe(tot)           FeQO           MnO           MgO           CaO           Na2O           K2O3	0.50 4.49 4.42 0.01 100.13 331 21 b.d.1 324 32 7 17 b.d.1 34 7 7 17 b.d.1 34 7 6.70 0.07 13.27 0.62 0.41 0.19 0.37 0.62 0.41 0.19 0.40 4.70 4.70 4.70 4.70	0.35 4.56 4.41 0.02 100.60 297 25 b.d.i 80 14 26 24 5 18 b.d.i 24 5 5 18 b.d.i 24 5 5 18 b.d.i 24 5 5 18 b.d.i 24 5 5 13 5 5 0.33 0.33 0.33 0.33 0.33 0.48 0.09 0.31 4.72 4.71 0.09	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 76.94 0.07 13.35 0.48 0.28 0.18 0.03 4.48 0.034 4.48 0.01	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 206 G3 76.76 0.07 13.45 0.65 0.43 0.20 0.03 0.13 0.42 4.57 4.49 0.02	0.47 4.53 4.58 0.02 100.75 342 20 b.d.l 74 16 29 5 16 26 43 76.33 0.16 209 G3 76.33 0.16 0.81 0.47 0.30 0.36 0.51 4.46 0.04	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 b.d.1 33 4 210 G3 77.27 0.06 13.29 0.44 0.29 0.13 0.04 0.45 4.70 4.39 0.01	4.11 4.91 0.02 100.50 233 56 b.d.1 55 14 15 30 b.d.1 18 b.d.1 34 211 G3 76.94 0.07 13.46 0.59 0.38 0.19 0.03 0.09 0.44 4.60 4.44 0.01	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 9 b.d.l 34 212 G3 77.02 0.08 13.33 0.65 0.41 0.22 0.04 10.46 4.75 0.02	4.62 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.1 36 213 G3 76.62 0.07 13.41 0.61 0.39 0.20 0.09 0.45 4.79 0.01	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 5.d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.12 0.01 0.05 0.43 4.16 4.40 0.01	4.35 4.35 4.51 0.01 100.97 296 24 b.d.1 80 12 22 20 7 18 b.d.1 38 215 G3 76.78 0.07 13.38 0.59 0.37 0.20 0.03 0.13 0.37 4.48 10.02	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 24 26 12 24 26 12 24 26 12 24 26 12 70,74 0.07 13.37 0.65 0.43 0.20 0.09 0.43 4.34 4.73 0.02
Na2O Na2O K2O P2O5 Total Rb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample Ne Unit SiO2 TiO2 Al2O3 Fe(tot) Fe2O3 FeO MnO MgO CaO Na2O K2O F2O5 Total	0.38 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 521 b.d.1 32 7 17 b.d.1 34 205 G3 76.70 0.07 13.27 0.62 0.41 0.19 0.03 0.10 4.20 0.40 4.70 4.70 4.70 4.70 4.70 4.70 4.7	0.38 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 24 5 18 b.d.1 24 208 33 77.01 0.07 13.35 0.53 0.33 0.18 0.02 0.031 4.72 4.41 0.01 100.49	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 76.94 0.07 13.35 0.48 0.07 13.35 0.28 0.18 0.01 0.01 0.034 4.48 4.43 0.01 100.17	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.66 0.43 0.20 0.03 0.13 0.42 4.57 4.49 0.02 0.03	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 5 16 5 16 5 10 7 10 7	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 31 4 20 b.d.1 33 77.27 0.06 13.29 0.44 0.29 0.13 0.01 0.045 4.70 4.39 0.01	4.11 4.91 0.02 100.50 233 56 b.d.1 55 14 15 30 b.d.1 18 b.d.1 34 211 G3 76.94 0.07 13.46 0.58 0.38 0.19 0.03 0.03 0.04 4.60 4.44 0.01 100.64	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 212 34 77.02 0.08 13.33 0.65 0.41 10.41 10 20 20 20 20 20 20 20 20 20 20 20 20 20	4.62 4.27 0.02 100.36 60 25 68 13 20 26 6 22 5.68 6 22 5.68 6 22 5.68 6 22 5.68 6 22 5.68 6 22 5.68 7.68 20 26 9.00 28 6 6 22 5.68 7.00 20 20 28 6 7.00 20 28 6 7.00 20 20 28 6 7.00 20 20 28 6 7.00 20 20 28 6 7.00 20 20 28 6 7.00 20 20 28 6 7.00 20 20 28 6 7.00 20 20 28 6 7.00 20 20 28 6 7.00 20 20 28 6 7.00 20 20 20 20 20 20 20 20 20 20 20 20 2	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 5.d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.12 0.01 0.05 12.01 0.05 12.03 0.45 0.32 0.12 0.01 10.97	4.35 4.35 0.01 100.97 295 24 b.d.l 60 12 22 20 7 18 b.d.l 38 b.d.l 38 215 G3 76.78 0.07 13.38 0.57 0.20 0.03 0.37 4.48 4.51 0.02 100.33	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 24 26 12 17 b.d.1 27 216 G3 76.74 0.07 13.37 0.65 0.43 0.20 0.02 0.02 0.02 0.43 4.34 4.73 0.02
Na2O Na2O K2O P2O5 Total Rb Sr Ba Zr Y Nb Th U Zr Nb Th U Zr Y Nb Th U Zr Y Nb Th U Zr Y Nb Th U Zr Y Nb Th U Zr S Sample Nc Sample Nc Sample Sc Sample Sc S	0.38 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 7 7 17 b.d.1 34 7 6.70 0.07 13.27 0.62 0.41 0.19 0.03 0.10 0.428 0.02 100.16	0.38 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 5 18 b.d.1 80 14 26 63 77.01 0.07 13.35 0.53 0.33 0.18 0.02 0.09 0.31 4.72 4.41 0.01 100.49	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3 76.94 0.07 13.35 0.28 0.18 0.01 0.08 0.34 4.43 0.01 100.17	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.07 13.45 0.65 0.03 0.13 0.22 0.03 0.42 4.57 4.49 0.02 100.56	0.47 4.53 4.58 0.02 100.75 342 20 b.d.l 74 16 29 29 5 16 29 5 16 29 29 5 16 29 29 5 16 29 29 5 16 29 29 5 16 29 29 5 16 29 29 5 16 26 43 7 6.33 0.10 13.68 0.81 0.03 0.03 0.03 0.03 0.03 0.04 10.05	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 b.d.1 33 4 20 b.d.1 33 77.27 0.06 13.29 0.44 0.29 0.13 0.01 0.45 4.70 4.39 0.01 100.65	4.11 4.91 0.02 100.50 233 56 b.d.1 55 14 15 30 b.d.1 18 b.d.1 18 b.d.1 34 211 G3 76.94 0.07 13.46 0.59 0.38 0.19 0.03 0.09 0.44 4.60 4.44 0.01 100.64	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 28 10 19 b.d.l 34 212 G3 77.02 0.08 13.33 0.65 0.41 0.22 0.02 0.46 4.75 4.19 0.02 100.64	4.63 4.63 4.27 0.02 100.36 60 25 68 13 20 26 6 22 b.d.l 36 22 b.d.l 36 213 G3 76.62 0.07 13.41 0.39 0.20 0.02 0.02 0.02 0.02 0.02 0.02 0.0	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 5.d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.12 0.01 0.05 0.45 0.32 0.12 0.01 10.98	4,35 4,35 4,51 0,01 100.97 298 24 b.d.l 60 12 22 20 7 18 b.d.l 38 215 G3 76.78 0,07 13.98 0,59 0,37 0,20 0,03 0,137 4,48 4,51 0,02 100.33	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 17 b.d.1 27 216 G3 76.74 0.07 13.97 0.65 0.43 0.20 0.02 0.02 0.43 4.34 4.73 0.02 100.44
Na2O Na2O K2O P2O5 Total Rb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample Ni U Ni Pb Sample Ni U Ni Pb Sample Ni U Ni Pb Sample Ni U Ni Pb Sample Ni U Ni Po Sample Ni U Ni Po Sample Ni U Ni Pb Sample Ni U Ni Pb Sample Ni U Ni Pb Sample Ni V U Ni Pb Sample Ni V U Ni Pb Sample Ni V U Ni Pb Sample Ni V U Ni Pb Sample Ni V U Ni Pb Sample Ni V U Ni Pb Sample Ni V U Ni Pb Sample Ni V U Ni Pb Sample Ni V V Ni Pb Sample Ni V V Ni Pb Sample Ni V V Ni Pb Sample Ni V V Ni Pb Sample Ni V V Ni Pb Sample Ni V V V Ni Pb Sample Ni V V V Ni Pb Sample Ni V V V Ni Pb Sample Ni V V V Ni Pb Sa Sa Sa Sa Sa Sa Sa Sa Sa Sa Sa Sa Sa	0.38 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17 b.d.1 34 7 0.07 13.27 0.62 0.41 0.03 0.10 0.40 4.70 4.28 0.02 100.16	0.35 4.56 4.41 0.02 100.60 297 25 b.d.l 80 14 26 5 18 b.d.l 24 5 18 b.d.l 24 5 18 b.d.l 24 5 18 b.d.l 24 5 13 35 0.53 0.33 0.18 0.02 0.09 0.31 4.72 4.41 0.02	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3 76.94 0.07 13.35 0.48 0.28 0.18 0.01 0.08 0.34 0.01 100.17	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.43 0.20 0.03 0.13 0.42 0.02 100.55	0.47 4.53 4.58 0.02 100.75 342 20 b.d.l 74 16 29 5 16 26 43 76.33 0.10 13.68 0.81 0.47 0.30 0.03 0.16 0.04 100.68	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 b.d.1 33 4 20 b.d.1 33 210 G3 77.27 0.06 13.29 0.44 0.29 0.13 0.01 0.04 0.01 100.65	4.11 4.91 0.02 100.50 233 56 b.d.1 55 14 15 30 b.d.1 18 b.d.1 34 211 G3 76.94 0.07 13.46 0.59 0.38 0.19 0.03 0.09 0.44 4.60 4.44 0.01 100.64	4.36 4.44 0.02 100.41 265 66 12 55 12 28 10 19 28 10 19 28 10 19 28 34 212 G3 77.02 0.08 13.33 0.65 0.41 0.22 0.02 0.14 0.45 4.19 0.02 100.64	4.63 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.l 36 213 G3 76.62 0.07 13.41 0.61 0.39 0.20 0.02 0.02 0.02 0.02 0.02 0.02 0.0	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 b.d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.12 0.01 0.05 0.43 4.15 4.40 0.01 100.98	4,35 4,35 4,51 0,01 100.97 296 24 b.d.1 60 12 22 20 7 18 b.d.1 38 215 G3 76.78 0,07 13.38 0,59 0,37 13.38 0,59 0,37 0,20 0,03 0,13 0,22 0,02 0,03 0,13 0,02 100.33	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 28 12 17 b.d.1 27 216 G3 76.74 0.07 13.37 0.65 0.43 0.02 0.02 0.09 0.43 4.34 4.73 0.02
Na2O Na2O K2O P2O5 Totai Rb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample N U Ni Pb Sample N U Ni Pb Sample N U Ni Pb Sample N U Ni Fb Sample N Q Zn Ni Fb Sample N Q Zn Sample N Sample N Sample N Zn Sample N Q Zn Sample N Sample N Q Zn Sample N Q Zn Sample N Q Zn Sample N Zn Sample N Sample N Samble N	0.36 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17 b.d.1 34 205 G3 76.70 0.07 13.27 0.62 0.41 0.19 0.03 0.10 0.40 4.28 0.02 100.16	0.38 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 24 5 18 b.d.1 24 5 18 b.d.1 24 5 5 18 b.d.1 24 5 18 b.d.1 24 5 18 b.d.1 24 5 13.35 0.53 0.33 0.13 5 0.53 0.33 0.13 5 0.53 0.20 0.09 0.31 4.72 4.41 0.02 100.60 297 25 5 b.d.1 80 14 26 26 27 25 5 16 24 5 5 18 24 5 5 18 24 25 5 18 24 25 5 18 24 25 5 18 24 25 5 18 24 25 5 18 24 25 5 18 24 24 5 18 24 25 25 25 25 25 25 25 25 25 25 25 25 25	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 76.94 0.07 13.35 0.48 0.28 0.07 13.35 0.48 0.28 0.01 0.08 0.34 4.43 0.01 100.17 385	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.43 0.20 13.45 0.65 0.43 0.21 13.45 0.65 0.43 0.22 100.56	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 29 5 16 26 43 74.33 0.10 13.68 0.81 0.47 0.33 0.10 13.68 0.81 0.47 0.33 0.16 13.68 0.03 0.03 0.16 0.51 4.56 0.03 0.03 0.04 100.68	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 b.d.1 33 4 20 b.d.1 33 210 G3 77.27 0.06 13.29 0.44 0.29 0.44 0.29 0.44 0.29 0.44 0.29 0.44 0.29 0.01 100.65 337	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l 18 b.d.l 34 211 G3 76.94 0.07 13.46 0.59 0.38 0.19 0.03 0.09 0.44 4.60 4.44 0.01 100.64	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 b.d.l 34 77.02 0.08 13.33 0.65 0.41 0.22 0.14 0.46 4.75 4.19 0.02 100.64	4.62 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.l 36 213 G3 76.62 0.07 13.41 0.61 0.39 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.0	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 b.d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.45 0.32 0.41 6.43 4.40 0.01 100.98	4,35 4,35 4,51 0,01 100.97 296 24 b.d.1 60 12 22 7 18 b.d.1 38 215 G3 76.78 0,07 13.38 0,59 0,37 0,20 0,03 0,13 0,37 4,48 4,51 0,02 100.33	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 17 b.d.1 27 216 G3 76.74 0.07 13.37 0.65 0.43 0.02 0.09 0.43 4.34 4.73 0.02 100.44 320
Na2O Na2O K2O P2O5 Totai Fb Sr Ba Zr Y Nb Th U Zn Ni Fb Sample No Unit SiO2 TiO2 Al2O3 FeO MgO CaO Na2O K2O FeO MgO CaO Na2O K2O FeO Sr Ba Zr TiO2 Al2O3 FeO Sr Ba Zr TiO2 Al2O3 FeO Sr Ba Zr TiO2 Al2O3 FeO Sr Ba Zr TiO2 Al2O3 FeO Sr Ba Zr Sr Ba Zr Sr Ba Zr Sr Ba Zr Sr Ba Zr Sr Ba Zr Sr Ba Zr Sr Ba Zr Sr Ba Zr Sr Ba Zr Sr Ba Zr Sr Ba Zr Sr Ba Zr Sr Ba Zr Sr Sr Ba Zr Sr Sr Ba Zr Sr Sr Ba Zr Sr Sr Ba Zr Sr Sr Sr Ba Zr Sr Sr Sr Sr Sr Sr Sr Sr Sr Sr Sr Sr Sr	0.36 4.49 4.42 0.01 100.13 331 21 b.d.1 32 7 7 17 b.d.1 34 7 7 17 b.d.1 34 7 7 7 7 1.7 b.d.1 34 7 7 7 7 1.7 b.d.1 34 7 7 1.7 b.d.1 34 7 7 1.7 b.d.1 34 7 7 1.7 b.d.1 34 7 7 1.7 b.d.1 34 7 7 1.7 b.d.1 34 7 7 1.7 b.d.1 34 7 7 1.7 b.d.1 34 7 7 1.7 b.d.1 34 7 7 1.7 b.d.1 34 7 7 1.7 b.d.1 34 7 7 7 1.7 b.d.1 34 7 7 1.7 0.0 205 6 205 1.3 27 0.0 205 1.3 27 0.0 205 1.3 27 0.0 205 1.3 27 0.0 205 1.3 27 0.0 205 1.3 27 1.0 2.0 5 1.3 27 1.0 2.0 5 1.3 27 1.0 2.0 5 1.0 2.0 5 1.3 2.7 1.0 2.0 5 1.0 2.0 5 1.1 2.7 1.0 2.7 1.0 2.7 1.2 7 1.0 2.0 5 1.0 2.0 5 1.1 2.7 7 1.0 2.0 5 1.1 2.7 7 1.2 7 1.0 2.0 5 1.1 2.7 7 1.1 2.7 7 1.5 7 1.1 2.7 7 7 1.1 2.7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	0.36 4.56 4.41 0.02 100.60 297 25 b.d.i 80 14 26 24 5 18 b.d.i 24 5 5 18 b.d.i 24 5 5 18 b.d.i 24 5 5 18 b.d.i 24 5 5 18 b.d.i 24 5 5 13 5 0.53 0.53 0.33 0.53 0.53 0.53 0.53 0	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 76.94 0.07 13.35 0.48 0.28 0.16 0.07 13.35 0.48 0.28 0.16 0.034 4.48 4.43 0.01 100.17	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.43 0.20 0.03 0.13 0.42 4.57 4.49 0.02 100.55	0.47 4.53 4.58 0.02 100.75 342 20 b.d.l 74 16 29 29 5 16 26 43 76.33 0.10 13.68 0.81 0.47 0.30 0.03 13.68 0.81 0.47 0.30 0.05 14.46 4.60 0.04 100.66 300 40 0.02	0.43 4.55 4.48 0.01 100.60 339 25 5.d.1 73 15 20 31 4 20 5.d.1 33 77.27 0.06 13.29 0.44 0.29 0.44 0.29 0.44 0.29 0.45 4.70 4.39 0.01 100.65	4.11 4.91 0.02 100.50 233 56 b.d.1 55 14 15 30 b.d.1 34 211 G3 76.94 0.07 13.46 0.59 0.38 0.19 0.38 0.19 0.38 0.19 0.34 0.01 100.64 345 20	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 9 b.d.l 34 212 G3 77.02 0.08 13.33 0.65 0.41 0.22 0.04 0.46 4.75 0.02 100.64	4.62 4.27 0.02 100.36 60 25 68 13 20 26 6 22 5.68 13 20 26 6 22 5.68 13 36 213 36 213 36 76.62 0.07 13.41 0.39 0.20 0.02 0.02 0.02 0.02 0.02 10.39 5.20 10.39 5.20 10.39 5.20 10.30 5.20 2.25 5.20 2.20 2	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 5 d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.12 0.01 0.05 0.43 4.15 4.40 0.01 100.98	4,35 4,35 4,51 0,01 100.97 296 24 b.d.i 80 12 22 20 7 18 b.d.i 38 215 G3 76,78 0,07 13,38 0,59 0,37 0,20 0,03 0,13 0,37 4,48 4,51 0,02 100,33	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 24 26 12 24 26 12 24 26 12 24 26 12 27 70,71 3,37 0.65 0.43 0.20 0.02 100.44 4.73 0.02
Na2O Na2O K2O P2O5 Total Fb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample Ne Unit SiO2 TiO2 Ai2O3 Fe(tot) Fe2O3 Fe0 MnO Mg0 CaO Na2O K2O Fe0 St Total Sr Ba Sr Sr Ba Sr Sr Ba Sr Sr Ba Sr Sr Ba Sr Sr Ba Sr Sr Sr Ba Sr Sr Sr Ba Sr Sr Sr Sr Sr Sr Sr Sr Sr Sr Sr Sr Sr	0.38 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17 b.d.1 34 205 G3 76.70 0.07 13.27 0.62 0.41 0.19 0.03 0.10 4.70 4.28 0.02 100.18	0.38 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 24 5 18 b.d.1 24 208 33 77.01 0.07 13.35 0.53 0.33 0.18 0.02 0.31 4.72 4.41 0.01 100.49 389 17 b.d.1	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3 76.94 0.07 13.35 0.48 0.07 13.35 0.48 0.07 13.35 0.48 0.01 0.01 0.01 0.01 7 0.48 0.18 0.01 10.	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.07 13.45 0.65 0.03 0.13 0.42 100.56	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 16 29 5 10.75	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 31 4 20 0.31 4 20 0.31 4 20 0.0 1.33 77.27 0.06 13.29 0.44 0.29 0.13 0.01 10.65 337 10 b.d.1 10.65	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l 18 b.d.l 34 211 G3 76.94 0.07 13.46 0.59 0.38 0.19 0.03 0.03 0.03 0.03 0.04 4.460 4.44 0.01 100.64	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 212 63 77.02 0.08 13.33 0.65 0.41 10.22 0.02 0.04 10.05 10 10 10 10 10 10 10 10 10 10 10 10 10	4.62 4.27 0.02 100.36 269 60 25 68 13 20 28 6 22 b.d.i 36 36 22 b.d.i 36 37 6.62 0.07 13.41 0.39 0.20 0.02 0.02 0.02 0.45 4.79 4.23 0.01 10.38	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 5.d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.12 0.01 0.05 8 20,12 0.01 10.97	4.35 4.35 0.01 100.97 295 24 b.d.1 80 12 22 20 7 18 b.d.1 38 215 G3 76.78 0.07 13.38 0.59 0.37 0.20 0.03 0.37 4.48 4.51 0.02 100.33	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 24 26 12 17 b.d.1 27 216 G3 76.74 0.07 13.37 0.65 0.43 4.34 4.73 0.02 100.44 320 20 b.d.1
Na2O Na2O K2O P2O5 Total Rb Sr Ba Zr Y Nb Th U Zn Ni Fb Sample Ni U Zn Ni Pb Sample Ni U Ni Fb Sample Ni V Ni Fb Sample Ni U SiO2 TiO2 Ai2O3 Fe (tot) Fe (to	0.36 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 7 7 17 b.d.1 34 205 G3 76.70 0.07 13.27 0.62 0.41 0.19 0.03 0.10 0.420 4.28 0.02 100.16	0.35 4.56 4.41 0.02 100.60 297 25 b.d.l 80 14 26 5 18 b.d.l 24 5 18 b.d.l 24 208 G3 77.01 0.07 13.35 0.53 0.33 0.18 0.02 0.09 0.31 1.472 4.41 0.02 100.60	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3 76.94 0.07 13.35 0.48 0.28 0.18 0.01 0.08 0.34 0.01 100.17 3855 17 b.d.l 179 9	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.07 13.45 0.65 0.03 0.13 0.22 100.56 345 24 b.d.1 81	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 29 5 16 26 43 76.33 0.10 13.68 0.81 0.43 0.03 0.03 0.18 0.03 0.04 100.68 300 40 26 85	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 b.d.1 33 210 G3 77.27 0.06 13.29 0.14 0.04 0.04 0.04 0.04 0.01 100.65 337 10 b.d.1 64	4.11 4.91 0.02 100.50 233 56 b.d.1 55 14 15 30 b.d.1 18 b.d.1 18 b.d.1 18 b.d.1 18 b.d.1 18 b.d.1 18 b.d.1 13 34 76.94 0.07 13.46 0.59 0.38 0.19 0.03 0.09 0.44 4.60 4.44 0.01 100.64	4.36 4.44 0.02 100.41 265 66 12 55 12 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 20 41 12 12 28 10 40 41 12 12 28 10 40 41 12 12 28 10 41 12 28 10 41 12 28 10 41 12 28 10 41 12 28 10 41 12 28 10 41 12 28 10 41 12 28 10 41 12 28 10 41 12 28 10 41 12 28 10 12 28 10 12 28 10 12 28 10 12 28 10 12 28 10 12 28 10 12 28 10 12 28 10 12 28 10 12 28 10 12 28 10 12 28 10 12 20 20 10 12 20 20 10 10 10 10 10 10 10 10 10 10 10 10 10	4.63 4.63 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.l 36 213 G3 76.62 0.07 13.41 0.81 0.20 0.02 0.02 0.02 0.02 0.02 0.02 0.0	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 8 29 b.d.1 16 5 d.1 35 214 G3 79.10 0.06 12.33 0.45 0.35 0.45 0.45 0.45 0.45 0.45 0.45 0.45 0.4	4,35 4,35 4,51 0,01 100.97 298 24 b.d.l 60 12 22 20 7 18 b.d.l 38 215 G3 76,78 0,07 13,38 0,07 13,38 0,07 13,38 0,07 13,38 0,07 13,38 0,07 13,38 0,07 13,38 0,07 13,38 0,07 13,38 0,07 13,38 0,07 14,48 4,51 0,01 12 22 20 7 7 8 8 8 9 18 19 19 10 19 10 19 10 10 10 10 10 10 10 10 10 10 10 10 10	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 28 12 17 b.d.1 27 218 G3 78.74 0.07 13.37 0.65 0.43 4.34 4.73 0.02 100.44 320 20 b.d.1 63
Na2O Na2O K2O P2O5 Totai Rb Sr Ba Zr Y Nb Th U Zn Ni Fb Sample Nt Unit SiO2 TiO2 Al2O3 Fe(tot) Fe2O3 Fe(tot) Fe2O3 Fe(tot) Fe2O3 Fe(tot) Fe2O5 Totai Sr Ba Zr Y Nb	0.36 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17 b.d.1 34 205 G3 78.70 0.07 13.27 0.62 0.41 0.03 0.10 0.40 4.28 0.02 100.16 360 17 b.d.1 76 15	0.38 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 24 5 18 b.d.1 24 5 18 b.d.1 24 208 G3 77.01 0.07 13.35 0.53 0.33 0.13 0.02 0.09 0.31 4.72 4.41 0.01 100.49 389 17 b.d.1 73 14	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3 76.94 0.07 13.35 0.48 0.07 13.35 0.48 0.07 13.35 0.48 0.01 0.08 0.01 0.08 0.01 79 15 5 20 7 5 20 7 5 20 7 5 20 7 5 3 7 5 20 7 5 3 7 5 20 7 5 3 7 5 20 7 5 3 7 5 20 7 5 3 7 5 20 7 5 3 7 5 20 7 5 3 7 5 20 7 5 3 7 5 20 7 5 3 7 5 20 7 5 3 7 5 20 7 5 3 7 5 20 7 5 3 7 5 20 7 5 3 7 5 20 7 5 3 7 5 20 7 5 5 20 7 5 20 7 5 20 7 5 20 7 5 20 7 5 20 7 5 20 7 5 5 20 7 20 7	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.42 0.03 0.13 0.42 4.57 4.49 0.02 100.56	0.47 4.53 4.58 0.02 100.75 342 20 b.d.l 74 16 29 5 16 26 43 209 G3 76.33 0.10 13.68 0.81 0.47 0.33 0.10 13.68 0.03 0.16 0.04 100.68 300 40 6 5 10.68 10.64 10.68 1	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 b.d.1 33 210 G3 77.27 0.06 13.29 0.44 0.29 0.44 0.29 0.44 0.29 0.01 100.65 337 10 0.04 13.29 0.01 100.65	4.11 4.91 0.02 100.50 233 56 b.d.l 55 14 15 30 b.d.l 18 b.d.l 34 211 G3 76.94 0.07 13.46 0.59 0.38 0.19 0.03 0.09 0.44 4.60 4.44 0.01 100.64 345 20 50 50 50 50 50 50 50 50 50 50 50 50 50	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 b.d.l 34 212 G3 77.02 0.08 13.33 0.65 0.41 0.22 0.14 0.46 4.75 4.19 0.02 100.64 240 31 b.d.l 240 31 b.d.l	4.63 4.63 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.l 36 213 G3 76.82 0.07 13.41 0.61 0.39 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.0	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 b.d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.12 0.01 0.05 0.43 4.40 0.01 100.98 298 21 b.d.1 4.20 5.20 298 21 b.d.1 29 5.21 20 20 5.21 20 20 5.21 20 20 20 20 20 20 20 20 20 20 20 20 20	4,35 4,35 4,51 0,01 100.97 296 24 b.d.i 60 12 22 20 7 18 b.d.i 38 215 G3 76.78 0,07 13.38 0,59 0,37 13.38 0,59 0,37 0,20 0,03 0,13 0,59 0,13 0,07 13,38 0,59 0,13 0,07 13,38 0,59 0,13 0,07 13,38 0,59 0,13 0,07 13,38 0,59 0,13 0,07 13,38 0,59 0,13 0,07 13,38 0,59 0,13 0,07 13,38 0,59 0,13 0,07 13,38 0,59 0,13 0,07 13,38 0,59 0,13 0,07 13,38 0,59 0,13 0,07 13,38 0,59 0,13 0,07 13,38 0,59 0,13 0,07 13,38 0,59 0,13 0,07 13,38 0,59 0,13 0,07 13,38 0,59 0,13 0,07 13,38 0,59 0,07 13,38 0,59 0,07 13,38 0,59 0,07 13,38 0,59 0,07 13,38 0,59 0,07 13,38 0,59 0,07 13,38 0,59 0,07 13,38 0,59 0,07 13,38 0,07 13,38 0,07 13,38 0,07 13,07 0,07 13,38 0,07 13,38 0,07 13,38 0,07 13,38 0,07 13,38 0,07 13,38 0,07 13,020 0,12 10,07 13,38 0,07 13,38 0,07 13,38 0,07 13,38 0,07 13,38 0,07 13,020 10,020 10,020 10,07 10,00	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 28 12 17 b.d.1 27 216 G3 76.74 0.07 13.37 0.65 0.43 0.02 0.09 0.43 4.73 0.02 100.44 320 20 b.d.1 63 12
Na2O Na2O K2O P2O5 Total Rb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample Ne Unit SiO2 TiO2 Al2O3 Fe(0t) Fe2O3 Fe0 Mn0 Mg0 CaO Na2O K2O Fe0 Sr Ba Zr Total Fe0 Sr Ba Zr TiO2 Al2O3 Fe0 Sr Ba Zr TiO2 Al2O3 Fe0 Sr Ba Zr TiO2 Al2O3 Fe0 Sr Ba Zr TiO2 Al2O3 Fe0 Sr Ba Zr Y Nb Th Sr Ba Zr Sr Ba Zr Sr Ba Zr Sr Ba Zr Sr Ba Zr Sr Ba Sr Ba Zr Sr Ba Sr Ba Zr Sr Sr Ba Sr Ba Zr Sr Sr Ba Sr Ba Zr Sr Sr Ba Sr Ba Zr Sr Sr Ba Sr Sr Ba Sr Sr Sr Sr Sr Sr Sr Sr Sr Sr Sr Sr Sr	0.36 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17 b.d.1 34 7 7 17 b.d.1 34 7 6 205 G3 7 6.70 0.07 13.27 0.62 0.41 0.19 0.03 0.10 0.40 4.28 0.02 100.16	0.35 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 24 5 18 b.d.1 24 5 18 b.d.1 24 5 18 b.d.1 24 5 18 b.d.1 24 5 18 b.d.1 24 5 18 b.d.1 24 5 13.35 0.53 0.33 0.18 0.02 0.07 0.7 13.35 0.53 0.33 0.18 0.02 10.60 14 26 24 5 18 b.d.1 24 5 18 b.d.1 24 5 13.35 0.53 0.33 0.18 0.02 10.60 14 25 5 18 0.07 25 5 18 0.07 25 5 18 0.07 25 5 18 0.07 25 5 18 0.07 25 5 18 0.07 25 5 18 0.07 25 5 18 0.07 25 5 18 0.07 25 5 18 0.07 25 5 18 0.07 25 5 18 0.07 25 5 18 0.07 25 5 18 0.07 25 5 18 0.07 25 5 18 0.07 25 5 18 0.07 13.35 0.03 0.02 0.03 1 4.25 0.03 1 4.25 0.07 13.35 0.02 0.07 13.35 0.02 0.07 13.35 0.02 0.07 13.35 0.02 17 10.07 13.35 0.02 0.07 13.35 0.02 0.07 14 25 0.07 13.35 0.02 0.07 11.35 0.02 0.07 11.35 0.02 0.07 11.35 0.02 0.07 11.35 0.02 0.07 17 1.35 0.02 0.02 0.07 1.35 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.0	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 76.94 0.07 13.35 0.48 0.28 0.18 0.07 13.35 0.48 0.28 0.18 0.034 4.48 4.43 0.01 100.17 3855 17 b.d.l 100.17	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 206 G3 76.76 0.07 13.45 0.65 0.43 0.20 0.03 0.13 0.42 4.57 4.49 0.02 100.56	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 29 5 16 26 43 74.33 0.10 78.33 0.10 13.68 0.81 0.47 0.33 0.16 0.51 4.46 0.03 0.04 100.68 300 40 26 85 13 21 25	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 b.d.1 33 210 G3 77.27 0.06 13.29 0.44 0.29 0.44 0.29 0.44 0.29 0.44 0.29 0.45 4.70 4.33 0.01 100.65 337 10 b.d.1 100.65	4.11 4.91 0.02 100.50 233 56 b.d.1 55 14 15 30 b.d.1 18 b.d.1 34 211 G3 76.94 0.07 13.46 0.59 0.38 0.19 0.03 0.04 4.60 4.44 0.01 100.64 345 20 b.d.1 50 50 50 50 50 50 50 50 50 50 50 50 50	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 b.d.l 34 212 G3 77.02 0.08 13.33 0.65 0.41 0.22 0.04 10.22 0.04 10.22 0.02 100.64 240 31 b.d.l 240 31 b.d.2 17 16 22 20	4.63 4.63 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.1 36 213 63 76.62 0.07 13.41 0.61 0.39 0.20 0.02 0.09 0.45 4.79 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.0	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 67 12 18 29 b.d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.12 0.01 100.98 298 21 b.d.1 5.03 208 21 208 21 20 b.d.1 67 12 208 21 20 b.d.1 67 12 20 b.d.1 67 12 20 b.d.1 67 12 20 b.d.1 67 12 20 b.d.1 67 12 20 b.d.1 67 12 20 b.d.1 67 12 20 b.d.1 67 12 20 b.d.1 67 12 20 b.d.1 67 12 20 b.d.1 67 12 20 b.d.1 67 12 20 b.d.1 67 12 20 b.d.1 67 12 20 b.d.1 67 12 20 b.d.1 67 12 20 5 21 20 5 21 20 5 21 20 20 21 20 5 21 20 20 20 20 20 21 20 20 20 20 20 20 20 20 20 20 20 20 20	4.35 4.35 4.51 0.01 100.97 296 24 b.d.1 80 12 22 20 7 18 b.d.1 38 215 G3 76.78 0.07 13.38 0.59 0.37 0.20 0.03 0.13 0.37 4.48 4.51 0.02 100.33 343 20 b.d.1 82 22 20 7 7 8 8 8 8 9 8 9 8 9 8 9 8 9 8 9 9 9 9	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 24 26 12 24 26 12 70,74 0.07 13.37 0.65 0.43 0.20 0.09 0.43 4.34 4.73 0.02 100.44 320 20 b.d.1 63 12 18 320
Na2O Na2O K2O P2O5 Total Fb Sr Ba Zr Y Nb Th U Zn Ni Pb Sample Ne Unit SiO2 TiO2 Ai2O3 Fe(tot) Fe2O3 Fe0 MnO Mg0 CaO Na2O K2O Fe0 Sr DZ Sr Sr Ba Zr Y Nb Th Si Si Si Si Si Si Si Si Si Si Si Si Si	0.36 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17 b.d.1 34 205 G3 7 6.70 0.07 13.27 0.62 0.41 0.19 0.03 0.10 4.70 4.28 0.02 100.18	0.35 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 33 77.01 0.07 13.35 0.53 0.33 0.18 0.02 0.31 4.72 4.41 0.01 100.49 389 17 b.d.1 73 4.26 26	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 76.94 0.07 13.35 0.48 0.07 13.35 0.48 0.07 13.35 0.48 0.01 0.07 13.35 0.48 0.01 0.01 8 0.18 0.01 0.01 7 9 15 26 28 4	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.43 0.07 13.45 0.43 0.02 100.56	0.47 4.53 4.58 0.02 100.75 342 20 b.d.l 74 16 29 5 16 26 43 76.33 0.10 13.68 0.81 0.47 0.30 0.03 0.16 0.04 10.05 8 300 40 26 85 13 21 25 13 21 25 13 21 25 14 29 29 5 16 29 29 5 16 29 29 5 16 29 29 5 16 29 29 5 16 29 29 5 16 29 29 5 16 29 29 5 16 26 43 7 43 7 43 0.00 13.68 0.03 0.04 10.05 1	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 31 4 20 31 4 20 31 4 20 5 b.d.1 73 15 20 31 4 20 5 b.d.1 73 15 20 31 4 20 5 b.d.1 73 15 20 31 4 20 5 b.d.1 73 15 20 31 4 20 5 b.d.1 73 15 20 31 4 20 5 b.d.1 73 15 20 31 4 20 5 5 b.d.1 73 15 20 25 5 b.d.1 73 15 20 20 5 5 b.d.1 73 15 20 20 5 5 b.d.1 73 15 20 20 5 5 b.d.1 73 15 20 20 5 5 b.d.1 73 15 20 20 5 5 b.d.1 73 15 20 20 25 5 b.d.1 73 15 20 20 21 0 0.06 13 29 0 0.06 13 29 0 0.06 13 29 0 0.06 13 29 0 0.06 13 29 0 0.06 13 29 0 0.06 13 29 0 0.06 13 29 0 0.06 13 29 0 0.06 13 29 0 0.06 13 29 0 0.06 13 29 0 0.06 13 29 0 0.06 13 29 0 0.06 13 29 0 0.06 13 29 0.06 13 29 0.06 13 29 0.06 13 29 0.06 13 29 0.01 10 0.06 13 29 0.01 10 0.05 5 10 0.01 10 29 0.01 10 0.05 10 0.01 10 0.05 10 10 29 0.01 10 29 0.01 10 29 0.01 10 29 0.01 10 29 0.01 10 29 0.01 10 29 0.01 10 29 0.01 10 29 0.01 10 29 0.01 10 29 0.01 10 29 0.01 10 29 0.01 10 29 10 20 10 20 10 20 10 20 10 20 10 20 20 10 20 10 20 10 20 20 10 20 20 20 10 20 20 20 20 20 20 20 20 20 20 20 20 20	4.11 4.91 0.02 100.50 233 56 b.d.1 55 14 15 30 b.d.1 18 b.d.1 34 211 G3 76.94 0.07 13.46 0.59 0.38 0.19 0.38 0.19 0.38 0.19 0.38 0.19 0.44 4.60 4.44 0.07 13.46 0.54 100.64	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 20 40 41 12 12 12 12 28 10 40 41 12 12 28 10 41 12 12 28 10 41 12 12 28 10 41 12 12 28 10 41 12 12 28 10 41 12 12 28 10 10 41 12 12 28 10 12 12 28 10 12 12 28 10 12 12 28 10 12 12 28 10 12 12 28 10 10 12 28 10 12 28 10 10 12 28 10 10 12 20 20 10 10 12 12 28 10 10 10 10 10 10 10 10 10 10 10 10 10	4.63 4.63 4.27 0.02 100.36 269 60 25 68 13 20 28 6 22 b.d.i 36 37 6.62 0.07 13.41 0.61 0.20 0.02 0.02 0.02 0.45 4.79 4.23 0.01 17 b.d.i 84 220 28 0.25 5.65 22 5.65 22 5.65 22 5.65 6.62 20 25 5.65 22 5.65 6.62 20 25 5.65 6.62 20 25 5.65 6.62 20 25 5.65 6.62 20 25 5.65 6.62 20 25 5.65 6.62 20 25 5.65 6.62 20 25 5.65 6.62 20 25 5.65 6.62 20 25 5.65 6.62 20 25 5.65 7.00 21 5.65 7.00 25 6.62 20 25 6.62 20 25 6.62 20 26 9.60 25 6.62 20 25 6.62 20 26 8.62 20 26 8.62 20 26 8.62 20 27 8.62 0.07 13.41 0.03 20 26 8.63 20 26 8.62 20 27 8.62 0.07 13.41 0.03 2.00 2.5 6.62 2.00 2.5 6.62 0.07 13.41 0.03 2.00 2.5 6.62 0.07 13.41 0.03 2.00 2.5 6.62 0.07 13.41 0.03 2.00 2.5 6.62 0.07 13.41 0.03 2.00 2.5 6.20 0.07 13.41 1.03 2.00 2.5 0.02 0.02 0.02 0.02 0.02 0.02	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 5 d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.12 0.01 0.06 12.33 0.45 0.32 0.12 0.01 10.97	4.35 4.35 0.01 100.97 295 24 b.d.i 60 12 22 20 7 18 b.d.i 38 215 G3 76.78 0.07 13.38 0.59 0.37 0.20 0.03 0.37 4.48 4.51 0.02 100.33 343 20 b.d.i 82 12 24 20 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 17 b.d.1 27 216 G3 76.74 0.07 13.37 0.65 0.43 0.20 0.02 0.02 0.43 4.34 4.73 0.02 100.44 320 20 b.d.1 63 22 b.d.1 70 13.37 0.20 10.58
Na2O Na2O K2O P2O5 Total Rb Sr Ba Zr Y Nb Th U Zn Ni Fb Sample Ni U Zn Ni Pb Sample Ni U Zn Ni Pb Sample Ni U Ni Fb Sample Ni U SiO2 TiO2 Ai2O3 Fe(tot) Fe2O3 Fe(tot) Fe2O3 Fe(tot) Fe2O3 Fe(tot) Fe2O3 Fe(tot) Fe2O3 Fe(tot) Fe2O3 Fe(tot) Fe2O3 Fe2O	0.30 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 7 7 17 b.d.1 34 7 6 205 G3 7 6.70 0.07 13.27 0.62 0.41 0.19 0.03 0.10 0.428 0.02 100.16	0.35 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 5 18 b.d.1 24 5 18 b.d.1 24 5 18 b.d.1 24 5 18 b.d.1 24 5 18 b.d.1 24 5 18 0.07 13.35 0.53 0.07 13.35 0.53 0.07 13.35 0.53 0.02 0.09 0.31 14 26 26 26 2 25 24 25 24 25 24 25 24 25 24 25 24 25 24 25 24 25 24 25 24 25 24 25 24 25 24 25 24 25 24 25 24 25 24 25 24 24 24 24 24 24 24 24 24 24 24 24 24	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3 76.94 0.07 13.35 0.48 0.28 0.18 0.01 0.08 0.34 4.48 4.43 0.01 100.17 3855 17 b.d.l 79 15 26 28 4	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.07 13.45 0.65 0.03 0.13 0.02 100.56 345 24 b.d.1 14 29 b.d.1 11 14 14 14 14 14 14 14 14 14 14 14 14	0.47 4.53 4.58 0.02 100.75 342 20 b.d.1 74 16 29 29 5 16 26 43 76.33 0.10 13.68 0.81 0.47 0.03 0.03 0.16 0.04 100.68 300 40 26 85 13 13 21 25 b.d.1 21 25 b.d.1 21 25 b.d.1 21 25 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 31 4 20 b.d.1 33 77.27 0.06 13.29 0.13 0.01 0.04 0.45 4.70 4.39 0.01 100.65 337 10 b.d.1 64 13 21 23 b.d.1 123 b.d.1	4.11 4.91 0.02 100.50 233 56 b.d.1 55 14 15 30 b.d.1 18 b.d.1 34 211 G3 76.94 0.07 13.46 0.07 13.46 0.07 13.46 0.03 0.09 0.44 4.60 4.44 0.01 100.64 345 20 b.d.1 77 13 23 25 4	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 19 28 10 20 20 20 20 20 20 20 20 20 20 20 20 20	4.62 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.l 36 22 b.d.l 36 213 G3 76.62 0.07 13.41 0.61 0.20 0.02 0.02 0.02 0.02 0.02 0.02 0.0	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 5 d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.12 0.01 0.05 0.45 0.32 0.12 0.01 208 21 b.d.1 72 14 0.05 72 14 30 20 5 5	4,35 4,35 4,51 0,01 100.97 298 24 b.d.l 60 12 22 20 7 18 b.d.l 38 215 G3 76,78 0,07 13,38 0,59 0,37 4,48 4,51 0,02 100,33 4,48 4,51 0,02 100,33 2,45 0,37 4,48 4,51 0,01 2,22 2,0 7 18 b.d.l 38 2,15 G3 3,20 0,37 13,38 0,59 0,37 13,38 0,59 0,37 13,38 0,59 0,37 13,38 0,59 0,37 13,38 0,59 0,37 14,51 0,01 12 2,22 2,0 7 18 5 5 6 3 3 76,78 0,07 13,38 0,59 13,38 0,59 0,59 14 15 15 15 15 15 15 15 15 15 12 22 20 7 18 18 15 15 15 15 15 15 15 12 22 20 7 18 18 15 15 15 15 15 15 12 22 20 7 18 18 15 15 15 15 15 15 15 15 15 15 15 15 15	4.62 4.45 0.02 100.58 319 22 b.d.1 70 13 24 26 12 17 b.d.1 27 216 G3 76.74 0.07 13.97 0.65 0.43 4.34 4.73 0.02 100.44 320 20 b.d.1 63 12 18 29 b.d.1 70 13.97 20 20 20 20 20 20 20 20 20 20 20 20 20
Na2O           Na2O           K2O           F2O5           Total           Fb           Sr           Ba           Zr           Y           Nb           Th           U           Zn           Ni           Pb           Sample Nd           Unit           SiO2           TiO2           Al2O3           Fe(tot)           FeQO3           Fe(tot)           FeQO3           FeQO3           FeQO4           MnO           MgO           CaO           Na2O           K2O           P2O5           Total           Sr           Ba           Zr           Y           Nb           Th           U           Zn           Ni	0.36 4.49 4.42 0.01 100.13 331 21 b.d.1 90 13 24 32 7 17 b.d.1 34 205 G3 76.70 0.07 13.27 0.62 0.41 0.19 0.03 0.10 0.40 4.70 10.18 360 17 b.d.1 76 15 28 360 17 b.d.1 76 15 28 27 7 20 5 0 20 7 0 0 20 7 0 0 20 5 0 20 7 0 0 20 5 0 0 2 0 20 5 0 20 5 0 20 5 0 20 5 0 20 5 0 20 5 0 20 5 0 20 5 0 20 5 0 20 5 0 20 5 0 20 5 0 20 5 0 20 5 0 20 5 0 20 5 0 2 2 7 0 2 2 7 0 2 7 0 2 7 0 2 7 0 2 7 0 2 7 0 2 7 0 2 7 0 2 7 0 2 7 0 2 7 0 2 7 0 0 2 7 0 0 2 7 0 0 2 7 0 2 7 0 0 2 7 0 2 7 0 2 7 0 2 7 0 0 2 7 0 2 7 0 0 2 7 0 2 7 0 2 7 0 2 2 7 0 2 2 7 0 0 2 2 7 0 2 2 2 2	0.35 4.56 4.41 0.02 100.60 297 25 b.d.1 80 14 26 3 5 18 b.d.1 24 5 18 b.d.1 24 5 18 b.d.1 24 5 18 b.d.1 24 5 18 b.d.1 24 5 13.35 0.53 0.33 0.13 0.02 0.09 0.31 4.72 4.41 0.07 13.35 0.53 0.33 0.13 14 26 26 21 14 26 21 14 26 21 26 21 25 25 25 25 25 25 25 25 25 25 25 25 25	4.66 4.44 0.02 100.48 374 22 b.d.l 81 17 32 31 4 19 b.d.l 53 207 G3 76.94 0.07 13.35 0.48 0.07 13.35 0.48 0.07 13.35 0.48 0.01 0.08 0.34 4.43 0.01 100.17 3855 17 b.d.l 1526 28 4 1522 28 4	4.77 4.29 0.02 100.66 327 25 b.d.1 71 13 21 25 7 13 b.d.1 39 208 G3 76.76 0.07 13.45 0.65 0.43 0.22 100.56 0.3 0.13 0.02 100.56 345 24 b.d.1 14 34 5 24 b.d.1 14 34 5 24 b.d.1 14 34 5 24 b.d.1 14 34 5 24 25 5 26 20 5 20 5 20 20 20 20 5 20 20 20 20 20 20 20 20 20 20	0.47 4.53 4.58 0.02 100.75 342 20 b.d.l 74 16 29 5 16 26 43 209 G3 76.33 0.10 13.68 0.81 0.47 0.30 0.18 0.03 0.16 0.04 100.68 300 4.60 0.04 100.68 300 4.5 1.5 b.d.l 2.5 5 5 5 5 5 5 5 5 5 5 5 5 5	0.43 4.55 4.48 0.01 100.60 339 25 b.d.1 73 15 20 b.d.1 33 210 G3 77.27 0.06 13.29 0.44 0.29 0.44 0.29 0.13 0.01 0.04 0.45 4.39 0.01 100.65 337 10 0.04 0.45 4.39 0.01 100.65	4.11 4.91 0.02 100.50 233 56 b.d.1 55 14 15 30 b.d.1 18 b.d.1 18 b.d.1 18 b.d.1 34 211 G3 76.94 0.07 13.46 0.59 0.38 0.19 0.03 0.09 0.44 4.60 4.44 0.01 100.64 345 20 b.d.1 77 13 23 25 4 19	4.36 4.44 0.02 100.41 265 66 12 55 12 19 28 10 19 b.d.l 34 212 G3 77.02 0.08 13.33 0.65 0.41 0.22 0.14 0.46 4.75 4.19 0.02 100.64 240 31 b.d.l 240 31 b.d.l 240 31 b.d.l 25 55 66 12 12 19 28 10 19 20 10 19 20 10 19 20 10 19 20 10 19 20 10 20 10 19 10 20 10 20 10 19 10 20 10 10 10 10 10 20 10 10 10 10 10 10 10 10 10 10 10 10 10	4.63 4.63 4.27 0.02 100.36 269 60 25 68 13 20 26 6 22 b.d.l 36 213 G3 76.62 0.07 13.41 0.61 0.20 0.02 0.02 0.02 0.02 0.02 0.02 0.0	4.29 4.72 0.01 100.97 321 20 b.d.1 67 12 18 29 b.d.1 16 b.d.1 35 214 G3 79.10 0.06 12.33 0.45 0.32 0.12 0.01 0.05 0.43 4.16 0.01 100.98 298 21 b.d.1 0.05 0.41 0.05 0.41 0.05 0.41 0.05 0.45 0.01 100.97	4.35 4.35 4.51 0.01 100.97 296 24 b.d.1 60 12 22 20 7 18 b.d.1 38 215 G3 76.78 0.07 13.38 0.59 0.37 13.38 0.59 0.37 13.38 0.59 0.03 0.13 0.02 100.33 343 20 5 5 18 215 5 18 24 5 18 24 20 7 7 18 215 20 7 7 18 215 215 20 7 7 18 215 215 215 215 215 215 215 215 215 215	4.62 4.45 0.02 100.58 319 22 b.d.i 70 13 24 28 12 17 b.d.i 27 216 G3 76.74 0.07 13.37 0.65 0.43 0.02 0.02 0.09 0.43 4.34 4.73 0.02 100.44 320 20 b.d.i 63 12 18 53 12 100.44

Sample No         217         218         219         220         221         222         223         224         225         226         23           Unit         G3         G3 <th></th>														
Unit         G3         G	Sam	nnle No	217	218	219	220	221	222	223	224	225	226	227	228
Since         Car         Car </td <td>Unit</td> <td>)  </td> <td>. 63</td> <td>63</td> <td>63</td> <td>G3</td> <td>63</td> <td>G3</td> <td>G3</td> <td>G3</td> <td>63</td> <td>63</td> <td>6.9</td> <td>60</td>	Unit	) 	. 63	63	63	G3	63	G3	G3	G3	63	63	6.9	60
SIG2         76.30         77.02         76.95         77.03         76.74         77.37         77.82         77.17         76.89         7           TIC2         0.08         0.07         0.08         0.08         0.06         0.05         0.07         0.07         0.07         0.08         0.08           AI203         13.31         13.27         13.28         13.41         13.41         13.61         13.31         13.22         13.28         13.29         13.28         13.29         13.28         13.29         13.28         13.29         13.28         13.29         13.28         13.29         13.28         13.29         1	0.00	•			40		00	00			00			00
Total         O.08         O.07         O.08         O.06         O.04         O.07         O.08         O.06         O.04         O.07         O.08         O.07         O.08         O.06         O.04         O.07         O.08         O.06         O.04         O.04         O.04         O.04         O.03         O.04         O.04         O.04         O.04         O.04         O.03         O.04 <tho.03< th="">         O.04         O.03         <th< td=""><td>SIC</td><td>2</td><td>76 90</td><td>77 02</td><td>76 05</td><td>77 03</td><td>76 74</td><td>77 37</td><td>77 82</td><td>77 62</td><td>77 17</td><td>78 50</td><td>77 45</td><td>79 10</td></th<></tho.03<>	SIC	2	76 90	77 02	76 05	77 03	76 74	77 37	77 82	77 62	77 17	78 50	77 45	79 10
Al2D3       13.31       13.27       13.22       13.47       13.61       13.31       13.02       13.22       13.29       14.29       14.29 <th14.29< th=""> <th14.29< th=""> <th14< td=""><td>TIO</td><td>2</td><td>0.00</td><td>0.07</td><td>0.00</td><td>0.08</td><td>0.06</td><td>0.08</td><td>0.05</td><td>0.07</td><td>0.07</td><td>0.39</td><td>0.00</td><td>0.10</td></th14<></th14.29<></th14.29<>	TIO	2	0.00	0.07	0.00	0.08	0.06	0.08	0.05	0.07	0.07	0.39	0.00	0.10
Pet(ta)         O.67         O.66         D.67         O.66         D.63         O.63         O.63         O.64         O.32         O.66         O.65         O.65         O.65         O.65         O.61         O.48         O.32         O.10         O.40         O.41         O.40         O.41         D.41         D.41         D.41         D.41	A10/	<u>^</u>	13 31	19.07	13 32	12 47	12 61	13 31	12 02	+2 07	19.07	12 20	10.00	10.00
Fe(10)       0.00	Ea/	tot)	0.67	0.66	0.60	0.65	0.60	0.61	0.49	0.27	0.20	0.00	12.07	12.40
PseUs         0.44         0.44         0.44         0.44         0.45         0.45         0.45         0.10         0.20         0.10         0.20         0.10         0.20         0.10         0.20         0.10         0.20         0.10         0.20         0.10         0.20         0.10         0.10         0.20         0.10         0.20         0.10         0.01         0.01         0.03         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.02         0.01         0.01         0.02         0.01         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.01         0.01         0.01         0.01         0.01 <th0.01< th="">         0.01         0.01         <th< td=""><td>F 8(</td><td></td><td>0.07</td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.50</td><td>0.01</td><td>0.40</td><td>0.32</td><td>0.01</td><td>0.00</td><td>0.68</td><td>0.52</td></th<></th0.01<>	F 8(		0.07	0.00	0.00	0.00	0.50	0.01	0.40	0.32	0.01	0.00	0.68	0.52
Peol         0.24         0.22         0.22         0.14         0.10         0.20         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.01         0.02         0.02         0.02         0.02         0.02         0.02         0.02         0.02         0.02         0.02         0.02         0.02         0.02         0.02         0.02 <th< td=""><td>Fe2</td><td>U3</td><td>0.40</td><td>0.44</td><td>0.44</td><td>0.41</td><td>0.33</td><td>0.38</td><td>0.37</td><td>0.10</td><td>0.40</td><td>0.40</td><td>0.36</td><td>0.34</td></th<>	Fe2	U3	0.40	0.44	0.44	0.41	0.33	0.38	0.37	0.10	0.40	0.40	0.36	0.34
MRC         0.02         0.02         0.02         0.02         0.01         0.02         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.02         0.01 <th0< td=""><td>FeO</td><td></td><td>0.24</td><td>0.20</td><td>0.22</td><td>0.22</td><td>0.16</td><td>0.21</td><td>0.10</td><td>0.20</td><td>0.19</td><td>0.23</td><td>0.29</td><td>0.16</td></th0<>	FeO		0.24	0.20	0.22	0.22	0.16	0.21	0.10	0.20	0.19	0.23	0.29	0.16
MgO         0.14         0.09         0.11         0.13         0.07         0.09         0.06         0.04         0.08         0.14         1.16 <th1< td=""><td>MnC</td><td>)</td><td>0.02</td><td>0.02</td><td>0.02</td><td>0.02</td><td>0.02</td><td>0.02</td><td>0.01</td><td>0.01</td><td>0.04</td><td>0.03</td><td>0.03</td><td>0.02</td></th1<>	MnC	)	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.04	0.03	0.03	0.02
CaO       0.43       0.44       0.50       0.47       0.56       0.41       0.46       0.42       0.71	MgC	כ	0.14	0.09	0.11	0.13	0.07	0.09	0.06	0.04	0.08	0.14	0.14	0.12
Na2O         4.41         4.42         4.47         4.42         4.47         4.64         4.66         4.62         4.63         4.64         4.83         4.64         4.85         4.64         4.85         4.64         4.85         4.64         4.85         4.64         4.85         4.66         4.62         4.66         4.85         4.66         4.85         4.66         4.62         4.66         4.85         4.66         4.85         4.66         4.85         4.66         100.79         100.79         100.55         100.11         100.55         100.11         100.55         100.11         100.55         100.11         100.55         100.11         100.55         100.11         100.55         100.11         100.55         100.11         100.55         100.11         100.55         100.11         100.55         100.11         100.55         100.11         100.57         100.57         100.57         100.57         100.57         100.57         100.57         100.57         100.57         100.57         100.55         100.11         100.51         100.51         100.51         100.51         100.51         100.51         100.51         100.51         100.51         100.51         100.51         100.51         100.51 <td>CaO</td> <td>)</td> <td>0.43</td> <td>0.44</td> <td>0.50</td> <td>0.47</td> <td>0.56</td> <td>0.41</td> <td>0.46</td> <td>0.44</td> <td>0.42</td> <td>0.71</td> <td>0.50</td> <td>0.50</td>	CaO	)	0.43	0.44	0.50	0.47	0.56	0.41	0.46	0.44	0.42	0.71	0.50	0.50
K20       4.47       4.42       4.47       4.61       4.56       4.42       4.36       4.46       4.38       4.35       4         P205       0.02       0.02       0.02       0.01       0.02       0.01       0.02       0.01       0.02       0.01       0.02       0.01       0.02       0.01       0.02       0.01       0.02       0.01       0.02       0.01       0.02       0.01       0.02       0.01       0.02       0.01       0.01       0.02       0.01       0.01       0.02       0.01       0.01       0.02       0.01       0.01       0.02       0.01       0.01       0.02       0.01       0.01       0.02       0.01       0.01       0.02       0.01       0.01       0.02       0.01       0.01       0.02       0.01       0.02       0.02       0.02       0.02       0.02       0.02       0.02       0.02       0.02	Na2	0	4.41	4.48	4.42	4.41	4.54	4.60	4.52	4.58	4.51	4.28	3.92	3.62
P205       0.02       0.02       0.01       0.02       0.01       0.02       0.01       0.02       0.01       100.25       100.11       100.15       100.11       100.15       100.11       100.15       100.11       100.11       100.11       100.11       100.11       100.11       100.11       100.11       100.11       100.11       100.11       100.11	K2C	)	4.47	4.42	4.47	4.61	4.56	4.42	4.36	4.46	4.38	4.35	4.84	4.97
Total       100.43       100.47       100.53       100.87       100.66       100.90       100.79       100.55       100.11       100         Fb       270       307       248       283       256       317       316       347       366       185       2         Ba       b.d.i	P2C	5	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01
Pb       270       307       248       283       256       317       316       347       366       185       2         Sr       41       22       36       33       28       25       15       22       25       39         Ba       b.d.l       b.d	Tota	al .	100.43	100.47	100.53	100.87	100.66	100.90	100.79	100.79	100.55	100.11	100.49	100.37
Pb       270       307       248       283       256       317       316       347       366       185       2         Sr       41       22       36       33       28       25       15       22       25       39         Ba       b.d.l       b.d											•			
Fb       270       307       248       283       256       317       316       347       366       185       2         Sr       4.1       2.2       36       33       2.8       25       15       2.2       25       39         Ba       b.d.l       b.d.l <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>														
Sr       41       22       36       33       28       25       15       22       25       39         Ba       b.d.l	Rb		270	307	248	283	256	317	316	347	366	185	228	213
Ba         b.d.i         b.	Sr		41	22	36	33	28	25	: 15	22	25	39	33	37
Zr       77       74       71       72       42       76       39       72       73       57         Y       13       13       14       12       9       12       11       15       12       16         Nb       18       24       17       17       15       25       18       28       26       31         U       b.d.l	Ba		b.d.l	b.d.l	b.d.l	b.d.l	b.d.l	b.d.l	b.d.i	b.d.l	b.d.i	b.d.l	b.d.l	b.d.i
Y       13       13       14       12       9       12       11       15       12       17       15       25       21       27       27       13         Th       34       32       31       27       23       25       18       28       26       31         U       b.d.l       b.d.l <td>Zr</td> <td></td> <td>77</td> <td>74</td> <td>71</td> <td>72</td> <td>42</td> <td>76</td> <td>39</td> <td>. 72</td> <td>73</td> <td>57</td> <td>62</td> <td>33</td>	Zr		77	74	71	72	42	76	39	. 72	73	57	62	33
Nb         18         24         17         17         15         25         21         27         27         13           Th         34         32         31         27         23         25         18         28         26         31           U         b.d.l         b.d.l <td>Y</td> <td></td> <td>13</td> <td>13</td> <td>14</td> <td>12</td> <td>9</td> <td>12</td> <td>11</td> <td>15</td> <td>12</td> <td>16</td> <td>18</td> <td>15</td>	Y		13	13	14	12	9	12	11	15	12	16	18	15
Th       34       32       31       27       23       25       18       28       26       31         U       b.d.l	Nb		18	24	17	17	15	25	21	27	27	13	16	15
U       b.d.i       b.d.i <thb.d.i< th="">       b.d.i       b.d.</thb.d.i<>	Th		34	32	31	27	23	25	18	28	26	31	32	14
Zn       21       17       17       20       14       17       11       10       21       14         Ni       b.d.i	U		b.d.t	b.d.l	b.d.l	b.d.I	b.d.l	b.d.l	b.d.i	10	8	6	b.d.(	b.d.l
Ni         b.d.l         b.	Zn		21	17	17	20	14	17	11	10	21	14	14	4
Pb     31     34     40     30     35     31     36     39     33     34       Sample No     229     230     231     232     233       Unit     G3     G3     G3     G3     G3       SiO2     76.77     76.72     76.40     77.52     76.68       TiO2     0.10     0.09     0.09     0.12     0.09       Al2O3     13.18     13.38     13.80     12.72     13.97       Fe(tot)     0.64     0.71     0.74     0.89     0.67       Fe2O3     0.50     0.44     0.43     0.47     0.39       FeO     0.30     0.24     0.28     0.38     0.26       MnO     0.01     0.02     0.02     0.03     0.03       MgO     0.13     0.16     0.67     19       CaO     0.47     0.64     0.49     0.52     0.52       Na2O     4.22     4.12     4.39     4.55       P2O5     0.02     0.02     0.02     0.02       Total     100.38     100.55     100.50     100.52       Y     17     13     12     14     11       Nb     29     12     20     18 <td>Ni</td> <td></td> <td>b.d.l</td> <td>b.d.l</td> <td>b.d.l</td> <td>b.d.l</td> <td>b.d.1</td> <td>b.d.l</td> <td>b.d.i</td> <td>b.d.l</td> <td>b.d.l</td> <td>b.d.f</td> <td>b.d.l</td> <td>b.d.i</td>	Ni		b.d.l	b.d.l	b.d.l	b.d.l	b.d.1	b.d.l	b.d.i	b.d.l	b.d.l	b.d.f	b.d.l	b.d.i
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Pb		31	34	40	30	35	31	36	39	33	34	35	31
Sample No     229     230     231     232     233       Unit     G3     G3     G3     G3     G3       SIO2     76.77     76.72     76.40     77.52     76.68       TiO2     0.10     0.09     0.12     0.09       Al2O3     13.18     13.38     13.60     12.72     13.37       Fe(tot)     0.64     0.71     0.74     0.89     0.67       Fe2O3     0.50     0.44     0.43     0.47     0.39       FeO     0.30     0.24     0.28     0.38     0.26       MnO     0.01     0.02     0.02     0.03     0.03       MgO     0.13     0.16     0.16     0.27     0.19       CaO     0.47     0.64     0.49     0.52     0.52       Na2O4     4.22     4.12     4.39     4.10     4.30       K2O     4.69     4.72     4.64     4.38     4.55       P2O5     0.02     0.02     0.02     0.02     100.38       Fb     237     217     287     232     254       Sr     28     56     45     53     44       Ba     b.d.i     b.d.i     16     15									1 - A - A - A - A - A - A - A - A - A -					
Sample No         229         230         231         232         233           Unit         G3         G3         G3         G3         G3         G3           SiO2         76.77         76.72         76.40         77.52         76.68           TiO2         0.10         0.09         0.09         0.12         0.09           Al2O3         13.18         13.38         13.60         12.72         13.37           Fe(tot)         0.64         0.71         0.74         0.89         0.67           Fe2O3         0.50         0.44         0.43         0.47         0.39           Fe0         0.30         0.24         0.28         0.38         0.26           MnO         0.13         0.16         0.16         0.27         0.19           CaO         0.47         0.64         0.49         0.52         0.52           Na2O         4.22         4.12         4.39         4.10         4.30           K2O         4.62         0.55         100.52         100.38           P2O5         0.02         0.02         0.02         0.02           Total         100.38         100.55         100.52 </th <th></th>														
Sample No         229         230         231         232         233           Unit         G3         G3         G3         G3         G3         G3           SIO2         76.77         76.72         76.40         77.52         76.68           TIO2         0.10         0.09         0.09         0.12         0.09           Al2O3         13.18         13.38         13.60         12.72         13.37           Fe(tot)         0.84         0.71         0.74         0.89         0.67           Fe2O3         0.50         0.44         0.43         0.47         0.39           FeO         0.30         0.24         0.28         0.38         0.26           MnO         0.01         0.02         0.02         0.03         0.03           MgO         0.13         0.16         0.16         0.27         0.19           CaO         0.47         0.64         4.39         4.10         4.30           K2O         4.69         4.72         4.64         4.38         4.55           P2O5         0.02         0.02         0.02         100.38           V         17         13         1														
UnitG3G3G3G3G3G3SiO276.7776.7276.4077.5276.68TiO20.100.090.090.120.09Al2O313.1813.3813.6012.7213.37Fe(tot)0.840.710.740.890.67Fe2O30.500.440.430.470.39FeO0.300.240.280.380.26MnO0.010.020.020.030.03MgO0.130.160.160.270.19CaO0.470.640.490.520.52Na2O4.224.124.394.104.30K2O4.694.724.644.384.55P2O50.020.020.020.020.02Total100.38100.55100.50100.52100.38Fb237217287232254Sr2856455344Bab.d.lb.d.l1616Sr2861818872Y1713121411Nb2912201817Th3626283327U3b.d.lb.d.l2b.d.lPb2334343231	Sam	nple No	229	230	231	232	233							
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Unit	ť	G3 .	G3	G3	G3	G3							
SiO2       76.77       76.72       76.40       77.52       76.68         TiO2       0.10       0.09       0.09       0.12       0.09         Al2O3       13.18       13.33       13.80       12.72       13.37         Fe(tot)       0.84       0.71       0.74       0.89       0.67         Fe2O3       0.50       0.44       0.43       0.47       0.39         FeO       0.30       0.24       0.28       0.38       0.26         MnO       0.01       0.02       0.02       0.03       0.03         MgO       0.13       0.16       0.127       0.19         CaO       0.47       0.64       0.49       0.52       0.52         Na2O       4.22       4.12       4.39       4.10       4.30         K2O       4.69       4.72       4.64       4.38       4.55         P205       0.02       0.02       0.02       0.02       100.52         Total       100.38       100.55       100.50       100.52       100.38         Pb       237       217       287       234       44         Ba       b.d.l       b.d.l       18														
TiO2       0.10       0.09       0.09       0.12       0.09         Al2O3       13.18       13.38       13.60       12.72       13.37         Fe(tot)       0.84       0.71       0.74       0.89       0.67         Fe2O3       0.50       0.44       0.43       0.47       0.39         FeO       0.30       0.24       0.28       0.38       0.26         MnO       0.01       0.02       0.02       0.03       0.03         MgO       0.13       0.16       0.17       0.19         CaO       0.47       0.64       4.30         K2O       4.69       4.72       4.64       4.30         K2O       4.69       4.72       4.64       4.30         K2O       4.69       4.72       4.64       4.38         V       10.38       100.55       100.50       100.32         Total       100.38       100.55       100.52       100.38         Fb       237       217       287       232       254         Sr       28       56       45       53       44         Ba       b.d.l       b.d.1       16       15 <td>SIO</td> <td>2</td> <td>76.77</td> <td>76.72</td> <td>76.40</td> <td>77.52</td> <td>76.68</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> <td></td>	SIO	2	76.77	76.72	76.40	77.52	76.68						1	
Al2O3       13.18       13.38       13.60       12.72       13.37         Fe(tot)       0.84       0.71       0.74       0.89       0.67         Fe2O3       0.50       0.44       0.43       0.47       0.39         FeO       0.30       0.24       0.28       0.38       0.26         MnO       0.01       0.02       0.02       0.03       0.03         MgO       0.13       0.16       0.16       0.27       0.19         CaO       0.47       0.64       0.49       0.52       0.52         Na2O       4.62       4.10       4.30         K2O       4.69       4.72       4.64       4.38         K2O       4.69       4.72       4.64       4.30         K2O       4.69       4.72       100.52       100.38         P2O5       0.02       0.02       0.02       0.02         Total       100.38       100.55       100.50       100.38         Fb       237       217       287       232       254         Sr       28       56       45       53       44         Ba       b.d.l       b.d.l       16	TIO	2	0.10	0.09	0.09	0.12	0.09							
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	A120	03	13.18	13.38	13.80	12.72	13.37							
Fe2O3       0.50       0.44       0.43       0.47       0.39         FeO       0.30       0.24       0.28       0.38       0.26         MnO       0.01       0.02       0.02       0.03       0.03         MgO       0.13       0.16       0.17       0.19         CeO       0.47       0.64       0.49       0.52       0.52         Na2O       4.22       4.12       4.39       4.10       4.30         K2O       4.69       4.72       4.64       4.38       4.55         P2O5       0.02       0.02       0.02       0.02       0.02         Total       100.38       100.55       100.50       100.52       100.38         Fb       237       217       287       232       254         Sr       28       56       45       53       44         Ba       b.d.1       b.d.1       16       15       57         Zr       89       61       81       88       72         Y       17       13       12       14       11         Nb       29       12       20       18       17         Th <td>Eel</td> <td>tot)</td> <td>0:84</td> <td>0.71</td> <td>0.74</td> <td>0.89</td> <td>0.67</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Eel	tot)	0:84	0.71	0.74	0.89	0.67							
FeO     0.30     0.24     0.28     0.38     0.26       MnO     0.01     0.02     0.02     0.03     0.03       MgO     0.13     0.16     0.16     0.27     0.19       CaO     0.47     0.64     0.49     0.52     0.52       Na2O     4.22     4.12     4.39     4.10     4.30       K2O     4.69     4.72     4.64     4.38     4.55       P2O5     0.02     0.02     0.02     0.02     0.02       Total     100.38     100.55     100.50     100.52     100.38	Fe2	03	0.50	0 44	0.43	0.47	0.39							
MinO       0.00       0.02       0.02       0.03       0.03         MgO       0.13       0.16       0.16       0.27       0.19         CaO       0.47       0.64       0.49       0.52       0.52         Na2O       4.22       4.12       4.39       4.10       4.30         K2O       4.69       4.72       4.64       4.38       4.55         P2O5       0.02       0.02       0.02       0.02       0.02         Total       100.38       100.55       100.52       100.38         Rb       237       217       287       232       254         Sr       28       56       45       53       44         Ba       b.d.l       b.d.l       16       16       15         Zr       89       61       81       88       72         Y       17       13       12       14       11         Nb       29       12       20       18       17         Th       36       26       28       32       27         U       3       b.d.l       b.d.l       b.d.l       b.d.l         Ni       b.	FeO		0.00	0.24	0.28	0.38	0.26							
MgO       0.13       0.16       0.16       0.27       0.19         CaO       0.47       0.64       0.49       0.52       0.52         Na2O       4.22       4.12       4.39       4.10       4.30         K2O       4.69       4.72       4.64       4.38       4.55         P2O5       0.02       0.02       0.02       0.02       0.02         Total       100.38       100.55       100.50       100.52       100.38         Fb       237       217       287       232       254         Sr       28       56       45       53       44         Ba       b.d.1       b.d.1       16       16       15         Zr       89       61       81       88       72         Y       17       13       12       14       11         Nb       29       12       20       18       17         Th       36       26       28       33       27         U       3       b.d.1       b.d.1       2       b.d.1         Zn       13       15       24       26       18         NI	MoC	<b>.</b> .	0.01	0.02	0.02	0.03	0.03							
Rec     0.10     0.10     0.10     0.11     0.12       CaO     0.47     0.64     0.49     0.52     0.52       Na2O     4.22     4.12     4.39     4.10     4.30       K2O     4.69     4.72     4.64     4.38     4.55       P2O5     0.02     0.02     0.02     0.02     0.02       Total     100.38     100.55     100.50     100.52     100.38       Pb     237     217     287     232     254       Sr     28     56     45     53     44       Ba     b.d.l     b.d.l     16     16     15       Zr     89     61     81     88     72       Y     17     13     12     14     11       Nb     29     12     20     18     17       Th     36     26     28     33     27       U     3     b.d.l     b.d.l     2     b.d.l       Zn     13     15     24     28     18       NI     b.d.l     b.d.l     b.d.l     b.d.l     b.d.l       Pb     23     34     34     32     31	Mar	5	0.13	0.16	0.16	0.27	0.19							
Na2O     4.12     4.13     4.10     4.30       K2O     4.69     4.72     4.64     4.38     4.55       P2O5     0.02     0.02     0.02     0.02     0.02       Total     100.38     100.55     100.50     100.52     100.38       Fb     237     217     287     232     254       Sr     28     56     45     53     44       Ba     b.d.i     b.d.i     16     16     15       Zr     B9     61     81     88     72       Y     17     13     12     14     11       Nb     29     12     20     18     17       Th     36     26     28     33     27       U     3     b.d.i     b.d.i     2     b.d.i       Pb     23     34     32     31		5	0.47	0.64	0.49	0.52	0.52							
K2O       4.69       4.72       4.64       4.38       4.55         P2O5       0.02       0.02       0.02       0.02       0.02         Total       100.38       100.55       100.50       100.52       100.38         Fb       237       217       287       232       254         Sr       28       56       45       53       44         Ba       b.d.l       b.d.l       16       15         Zr       89       61       81       88       72         Y       17       13       12       14       11         Nb       29       12       20       18       17         Th       36       26       28       33       27         U       3       b.d.l       b.d.l       2       b.d.l         Ni       b.d.l       b.d.l       b.d.l       b.d.l       b.d.l         Pb       23       34       34       32       31	Net	'n	4 22	4 12	4 30	4 10	4 30							
P2O5       0.02       0.02       0.02       0.02       0.02         Total       100.38       100.55       100.52       100.38         Fb       237       217       287       232       254         Sr       28       56       45       53       44         Ba       b.d.l       b.d.l       16       16       15         Zr       89       61       81       88       72         Y       17       13       12       14       11         Nb       29       12       20       18       17         Th       36       26       28       33       27         U       3       b.d.l       b.d.l       2       b.d.l         Zn       13       15       24       26       18         NI       b.d.l       b.d.l       b.d.l       b.d.l         Pb       23       34       34       32       31	Vac	× .	4.65	4 72	4.50 A & A	4.10	4.55					$x_1 = y_2 = 1$		
F200       0.02       0.02       0.02       0.02       0.02         Total       100.38       100.55       100.50       100.52       100.38         Fb       237       217       287       232       254         Sr       28       56       45       53       44         Ba       b.d.l       b.d.l       16       16       15         Zr       89       61       81       88       72         Y       17       13       12       14       11         Nb       29       12       20       18       17         Th       36       26       28       33       27         U       3       b.d.l       b.d.l       2       b.d.l         Zn       13       15       24       28       18         NI       b.d.l       b.d.l       b.d.l       b.d.l         Pb       23       34       34       32       31	- naC	, \c	. 4.03	9.74	0.09	0.00	0.00						41 A.	
Fb       237       217       287       232       254         Sr       28       56       45       53       44         Ba       b.d.i       b.d.i       16       16       15         Zr       B9       61       81       88       72         Y       17       13       12       14       11         Nb       29       12       20       18       17         Th       36       26       28       33       27         U       3       b.d.i       b.d.i       2       b.d.i         Zn       13       15       24       26       16         Ni       b.d.i       b.d.i       b.d.i       b.d.i       b.d.i         Pb       23       34       34       32       31	720	- O	100.02	100 55	100 50	100 80	100.02							
Fb       237       217       287       232       254         Sr       28       56       45       53       44         Ba       b.d.l       b.d.l       16       16       15         Zr       B9       61       81       88       72         Y       17       13       12       14       11         Nb       29       12       20       18       17         Th       36       26       28       33       27         U       3       b.d.l       b.d.l       2       b.d.l         Zn       13       15       24       26       18         Ni       b.d.l       b.d.l       b.d.l       b.d.l         Pb       23       34       34       32       31	rote	<b>L</b> I .	100.38	100.55	100.50	100.52	100.36							
Pb       237       217       287       232       254         Sr       28       56       45       53       44         Ba       b.d.l       b.d.l       16       16       15         Zr       89       61       61       88       72         Y       17       13       12       14       11         Nb       29       12       20       18       17         Th       36       26       28       33       27         U       3       b.d.l       b.d.l       2       b.d.l         Zn       13       15       24       26       18         Ni       b.d.l       b.d.l       b.d.l       b.d.l         Pb       23       34       34       32       31								1						
TO     237     217     267     232     254       Sr     28     56     45     53     44       Ba     b.d.l     b.d.l     16     16     15       Zr     69     61     81     88     72       Y     17     13     12     14     11       Nb     29     12     20     18     17       Th     36     26     28     33     27       U     3     b.d.l     b.d.l     2     b.d.l       Zn     13     15     24     28     18       NI     b.d.l     b.d.l     b.d.l     b.d.l       Pb     23     34     34     32     31	-		097	017	007		254							
Sr       28       56       45       53       44         Ba       b.d.i       b.d.i       16       15         Zr       69       61       81       88       72         Y       17       13       12       14       11         Nb       29       12       20       18       17         Th       36       26       28       33       27         U       3       b.d.i       b.d.i       2       b.d.i         Zn       13       15       24       28       18         Ni       b.d.i       b.d.i       b.d.i       b.d.i       b.d.i         Pb       23       34       34       32       31	-10		237	21/	28/	232	204							
base       b.d.i       bd       16       16       15         Zr       B9       61       B1       88       72         Y       17       13       12       14       11         Nb       29       12       20       18       17         Th       36       26       28       33       27         U       3       b.d.i       b.d.i       2       b.d.i         Zn       13       15       24       28       18         Ni       b.d.i       b.d.i       b.d.i       b.d.i         Pb       23       34       34       32       31	57		28	26	40	23	44							
2r       89       61       61       88       72         Y       17       13       12       14       11         Nb       29       12       20       18       17         Th       36       26       28       33       27         U       3       b.d.l       b.d.l       2       b.d.l         Zn       13       15       24       26       18         Ni       b.d.l       b.d.l       b.d.l       b.d.l         Pb       23       34       32       31	Ba		b.d.I	b.a.(	16	10	15							
Y     17     13     12     14     11       Nb     29     12     20     18     17       Th     36     26     28     33     27       U     3     b.d.l     b.d.l     2     b.d.l       Zn     13     15     24     26     16       NI     b.d.l     b.d.l     b.d.l     b.d.l       Pb     23     34     32     31	Zr		89	61	81	88	72							
Nb         29         12         20         18         17           Th         36         26         28         33         27           U         3         b.d.l         b.d.l         2         b.d.l           Zn         13         15         24         28         18           Ni         b.d.l         b.d.l         b.d.l         b.d.l           Pb         23         34         32         31	Y		17	13	12	.14	11							
Th 36 26 28 33 27 U 3 b.d.i b.d.i 2 b.d.i Zn 13 15 24 28 18 Ni b.d.i b.d.i b.d.i b.d.i Pb 23 34 34 32 31	Nb		29	12	20	18	17							
U 3 b.d.i b.d.i 2 b.d.i Zn 13 15 24 26 18 Ni b.d.i b.d.i b.d.i b.d.i Pb 23 34 34 32 31	Th		36	26	28	33	27							
Zn 13 15 24 28 18 Ni b.d.i b.d.i b.d.i b.d.i Pb 23 34 34 32 31	U		3	b.d.l	b.d.l	2	b.d.l							
Ni b.d.i b.d.i b.d.i b.d.i Pb 23 34 34 32 31	Zn		13	15	24	28	18							
Pb 23 34 34 32 31	NI		b.d.l	b.d.1	b.d.l	b.d.1	b.d.l							
	Pb		23	34	34	32	31							

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# APPENDIX 3.6 : MAIN DONEGAL GRANITE (CURTIS, IN ATKIN 1977)

Sample	2NF	5NF	6NF	- 7NF	16NF	19NF	37NF	38NF	39NF	3/4NF	17/18NF	4SF
Unit	light	light	light	light	light	light	light	light	light	light	light	light
SiO2	72.50	71.50	70.10	71.40	72.60	72.10	70.10	72.70	72.40	73.10	71.70	71.50
TiO2	0.22	0.29	0.37	0.29	0.18	0.30	0.37	0.24	0.25	0.21	0.30	0.30
AI2O3	15.60	14.70	15.50	15.50	15.40	15.00	15.30	14.80	14.60	14.50	15.10	15.40
Fe2O3	0.06	0.61	0.67	0.46	0.00	0.56	0.90	0.69	0.60	0.41	0.43	0.45
FeO	1.30	1.30	1.70	1.30	1.30	1.20	1.30	1.00	1.00	0.96	1.60	1.30
Fe(tot)	1.36	1.33	1.73	1.33	1.32	1.23	1.33	1.04	1.03	0.98	1.64	1.33
MnÒ	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.04	0.03	0.02	0.04	0.03
MaQ	0.48	0.65	0.87	0.67	0.56	0.63	0.70	0.56	0.51	0.50	0.68	0.67
CaO	1.90	2.00	2.20	2.20	1.70	1.80	1.90	1.80	1.50	1.80	2.20	2.10
Na2O	3.80	3.70	4.00	4.20	3.70	3.60	3.60	3.90	3.10	3.60	4.60	4 30
K20	4.20	4.40	3.90	3.70	4.10	4.90	4.50	3.60	4.70	4.20	3.60	3.60
P205	0.33	0.45	0.64	0.49	0.64	0.53	0.61	0.58	0.44	0.45	0.53	0.50
Total	100.42	99.05	99.34	99.81	100.22	100.12	98.44	99.26	98.56	99.36	100.39	99 73
	100114	00.00							00100		100.00	00.70
		5			- E							
Sample	8SF	11SF	12SF	21SF	15SF	20SF	13SF					
Unit	light	light	light	light	light	light	dark		· .			
	-	-		-	-	÷.,						
SiO2	71.00	71.80	70.00	74.00	73.80	71.10	69.00					
TiO2	0.30	0.26	0.37	0.27	0.23	0.43	0.41					
AI2O3	15.00	15.40	15.60	13.40	14.40	15.40	16.20			-		
Fe2O3	0.49	0.55	0.44	0.52	0.26	0.67	0.69					
FeO	1.40	1.30	1.60	1.00	0.75	1.60	2.10					
Fe(tot)	1.44	1.33	1.63	1.02	0.76	1.63	2.15					
MnÖ	0.04	0.03	0.03	0.02	0.01	0.03	0.05					
MaO	0.58	0.72	0.73	0.39	0.32	0.73	0.89					
CảO	1.90	2.40	2.50	1.50	1.40	2.30	3.30					
Na2O	3.80	3.90	4.10	3.40	3.30	3.70	4.70					
K2O	4.20	3.20	3.10	4.70	4.80	4.00	1.70					
P2O5	0.54	0.48	0.64	0.52	0.60	0.72	0.75					
Total	98.80	99.52	98.70	99.22	99.62	100.04	99.15					
# **APPENDIX 4**

# MINERAL CHEMISTRY DATA

4.1	Plagioclase (Normalised to 8 oxygen).
4.2	Alkali feldspar (Normalised to 8 oxygen).
4.3	Biotite (Normalised to 22 oxygen).
4.4	Hornblende (Normalised to 23 oxygen).
4.5	Muscovite (Normalised to 22 oxygen).
4.6	Apatite (Normalised to 12.5 oxygen ).
4.7	Epidote (Normalised to 25 oxygen).
4.8	Magnetite (Normalised to 3 oxygen ).
4.9	Garnet (Normalised to 12 oxygen).

#### APPENDIX 4.1 PLAGIOCLASE ARDARA

Sample Location	ARD4 Core/1	ARD4 Rim/1	ARD4 Haif/2	ARD4 Half/2	ARD4 Core/2	ARD4 Rim/2	ARD4 Core/3	ARD4 Core/4	ARD4 Rim/4	ARD4 Core/5	ARD4 Core/6	ARD4 Core/7
SiO2	64.73	63.73	64.69	64.72	65.57	64.15	65.42	63.78	65.18	64.11	65.03	65.21
TiO2	0.11	0.01	0.00	0.02	0.00	0.01	0.01	0.00	0.00	0.03	0.00	0.06
AI2O3	22.25	22.20	21.95	21.65	21.74	22.07	21.35	22.76	21.71	21.69	21.58	21.74
Cr203	0.00	0.12	0.00	0.11	0.00	0.07	0.00	0.08	0.08	0.00	0,16	0.05
MnO	0.05	0.00	0.00	0.08	0.05	0.00	0.00	0.00	0.00	0.14	0.00	0.05
MgO	0.00	0.02	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
CaO	3.43	1.56	3.26	2.87	1.75	3.05	2.37	3.86	2.52	2.94	2.94	2.67
NiO	0.09	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.06	0.00	0.09
Na2O	9.62	9.40	9.65	10.01	9.96	10.06	10.37	9.50	10.26	10.02	9.89	9.99
K2O	0.21	1.31	0.16	0.08	0.62	0.06	0.06	0.15	0.11	0.10	0.15	0.08
P2O5	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.00
Total	100.46	98.63	99.94	99.66	100.12	99.58	99.59	100.24	100.19	99.13	99.81	99.99
Si	2.84	2.86	2.86	2.87	2.89	2.85	2.89	2.82	2.88	2.89	2.88	2.88
Δ1 	1 15	0.00	1 15	1 1 3	1 1 3	1 16	0.00	0.00	0.00	0.00	0.00	0.00
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Fe	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca .	0.16	0.08	0.15	0.14	0.08	0.15	0.11	0.18	0.12	0.14	0.14	0.13
ini Na	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K	0.01	0.08	0.01	0.00	0.04	0.00	0.00	0.01	0.01	0.01	0.01	0.00
Ba	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a te a l											
Sample Location	ARD4 Core/8	ARD4 Core/9	ARD4 Half/9	ARD4 Rim/9	ARD10 Core/1	ARD10 Rim/1	ARD10 Core/2	ARD10 Rim/2	ARD3 Core/1	ARD3 Rim/1	ARD3 Core/2	anti 19. eo 1982
Sample Location SiO2	ARD4 Core/8 66.36	ARD4 Core/9 64.54	ARD4 Half/9 64.27	ARD4 Rim/9 65.03	ARD10 Core/1 64,44	ARD10 Rim/1 65.56	ARD10 Core/2 64.84	ARD10 Rim/2 65.93	ARD3 Core/1 62.32	ARD3 Rim/1 62.81	ARD3 Core/2 63.53	
Sample Location SiO2 TiO2	ARD4 Core/8 66.36 0.03	ARD4 Core/9 64.54 0.02	ARD4 Half/9 64.27 0.00	ARD4 Rim/9 65.03 0.00	ARD10 Core/1 64.44 0.02	ARD10 Rim/1 65.56 0.00	ARD10 Core/2 64.84 0.00	ARD10 Rim/2 65.93 0.00	ARD3 Core/1 62.32 0.05	ARD3 Rim/1 62.81 0.00	ARD3 Core/2 63.53 0.10	en en angel Se en angel Se e angel
Sample Location SiO2 TiO2 Al2O3	ARD4 Core/8 66.36 0.03 22.06	ARD4 Core/9 64.54 0.02 23.32	ARD4 Half/9 64.27 0.00 23.08	ARD4 Rim/9 65.03 0.00 22.61	ARD10 Core/1 64.44 0.02 22.36	ARD10 Rim/1 65.56 0.00 21.21	ARD10 Core/2 64.84 0.00 22.31	ARD10 Rim/2 65.93 0.00 21.79	ARD3 Core/1 62.32 0.05 23.97	ARD3 Rim/1 62.81 0.00 23.20	ARD3 Core/2 63.53 0.10 23.64	
Sample Location SiO2 TiO2 AI2O3 Cr2O3	ARD4 Core/8 66.36 0.03 22.06 0.02	ARD4 Core/9 64.54 0.02 23.32 0.06	ARD4 Half/9 64.27 0.00 23.08 0.84	ARD4 Rim/9 65.03 0.00 22.61 0.00	ARD10 Core/1 64.44 0.02 22.36 0.00	ARD10 Rim/1 65.56 0.00 21.21 0.06	ARD10 Core/2 64.84 0.00 22.31 0.02	ARD10 Rim/2 65.93 0.00 21.79 0.01	ARD3 Core/1 62.32 0.05 23.97 0.00	ARD3 Rim/1 62.81 0.00 23.20 0.00	ARD3 Core/2 63.53 0.10 23.64 0.04	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO	ARD4 Core/8 66.36 0.03 22.06 0.02 0.00	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17	ARD10 Core/2 64.84 0.00 22.31 0.02 0.17	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11	ARD3 Core/1 62.32 0.05 23.97 0.00 0.06	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.06	ARD3 Core/2 63.53 0.10 23.64 0.04 0.30	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MnO	ARD4 Core/8 66.36 0.03 22.06 0.02 0.00 0.00 0.00	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 0.00	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.12 0.00	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 0.00	ARD10 Core/2 64.84 0.00 22.31 0.02 0.17 0.00 0.00	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00	ARD3 Core/1 62.32 0.05 23.97 0.00 0.06 0.02 0.00	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.06 0.00 0.00	ARD3 Core/2 63.53 0.10 23.64 0.04 0.30 0.02 0.00	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO	ARD4 Core/8 66.36 0.03 22.06 0.02 0.00 0.00 0.00 2.63	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 0.00 3.88	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.12 0.00 3.49	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 0.00 2.43	ARD10 Core/2 64.84 0.00 22.31 0.02 0.17 0.00 0.00 3.49	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89	ARD3 Core/1 62.32 0.05 23.97 0.00 0.06 0.02 0.00 5.33	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.06 0.00 0.00 4.56	ARD3 Core/2 63.53 0.10 23.64 0.04 0.02 0.02 0.00 4.65	
Sample Location SiO2 TiO2 AI2O3 Cr2O3 FeO MnO MgO CaO NIO	ARD4 Core/8 66.36 0.03 22.06 0.02 0.00 0.00 0.00 2.63 0.00	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09 0.03	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 0.00 3.88 0.01	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.12 0.00 3.49 0.00	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 0.00 2.43 n.d	ARD10 Core/2 64.84 0.00 22.31 0.02 0.17 0.00 0.00 3.49 n.d	ARD10 Bim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d	ARD3 Core/1 62.32 0.05 23.97 0.00 0.06 0.02 0.00 5.33 0.00	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.06 0.00 0.00 4.56 0.00	ARD3 Core/2 63.53 0.10 23.64 0.04 0.30 0.02 0.00 4.65 0.09	
Sample Location SiO2 TiO2 AI2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O	ARD4 Core/8 66.36 0.03 22.06 0.02 0.00 0.00 2.63 0.00 10.27	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09 0.03 9.48	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 0.00 3.88 0.01 9.39	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.12 0.00 3.49 0.00 9.63	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d 9.60	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 0.00 2.43 n.d 10.15	ARD10 Core/2 64.84 0.00 22.31 0.02 0.17 0.00 0.00 3.49 n.d 9.95	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32	ARD3 Core/1 62.32 0.05 23.97 0.00 0.06 0.02 0.00 5.33 0.00 8.54	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.00 0.00 4.56 0.00 8.41	ARD3 Core/2 63.53 0.10 23.64 0.04 0.30 0.02 0.00 4.65 0.09 8.68	
Sample Location SiO2 TiO2 AI2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O	ARD4 Core/8 66.36 0.03 22.06 0.02 0.00 0.00 2.63 0.00 10.27 0.03	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09 0.03 9.48 0.14	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 3.88 0.01 9.39 0.16	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.12 0.00 3.49 0.00 9.63 0.21	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d 9.60 0.14	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 2.43 n.d 10.15 0.08	ARD10 Core/2 64.84 0.00 22.31 0.02 0.17 0.00 0.00 3.49 n.d 9.95 0.16	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17	ARD3 Core/1 62.32 0.05 23.97 0.00 0.06 0.02 0.00 5.33 0.00 8.54 0.14	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.06 0.00 0.00 4.56 0.00 8.41 0.30	ARD3 Core/2 63.53 0.10 23.64 0.04 0.02 0.00 4.65 0.09 8.68 0.19	
Sample Location SiO2 TiO2 AI2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O BaO BaO	ARD4 Core/8 66.36 0.03 22.06 0.00 0.00 0.00 2.63 0.00 10.27 0.03 0.00	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.06 4.09 0.03 9.48 0.14 0.02	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 3.88 0.01 9.39 0.16 0.23	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.12 0.00 3.49 0.00 9.63 0.21 0.00	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d 9.60 0.14 0.00	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 2.43 n.d 10.15 0.08 0.00 0.17	ARD10 Core/2 64.84 0.00 22.31 0.02 0.17 0.00 0.00 3.49 n.d 9.95 0.16 0.08	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17 0.04 0.22	ARD3 Core/1 62.32 0.05 23.97 0.00 0.06 0.02 0.00 5.33 0.00 8.54 0.14 0.07	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.06 0.00 4.56 0.00 8.41 0.30 0.09	ARD3 Core/2 63.53 0.10 23.64 0.04 0.02 0.00 4.65 0.09 8.68 0.19 0.06	
Sample Location SiO2 TiO2 AI2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O BaO P2O5 Total	ARD4 Core/8 66.36 0.03 22.06 0.00 0.00 0.00 2.63 0.00 10.27 0.03 0.00 0.06 101 14	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.06 4.09 0.03 9.48 0.14 0.02 0.00 101 60	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 3.88 0.01 9.39 0.16 0.23 0.00 8.30	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.00 3.49 0.00 9.63 0.21 0.00 0.00 101.05	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d 9.60 0.14 0.00 0.13 9.9 97	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 2.43 n.d 10.15 0.08 0.00 0.00 2.43	ARD10 Core/2 64.84 0.00 22.31 0.02 0.17 0.00 0.00 3.49 n.d 9.95 0.16 0.08 0.10	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17 0.04 0.32 101 42	ARD3 Core/1 62.32 0.05 23.97 0.00 0.06 0.00 5.33 0.00 8.54 0.14 0.07 0.00	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.06 0.00 4.56 0.00 8.41 0.30 0.09 0.00	ARD3 Core/2 63.53 0.10 23.64 0.04 0.30 0.00 4.65 0.09 8.68 0.19 0.06 0.03	
Sample Location SiO2 TiO2 AI2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O BaO P2O5 Total	ARD4 Core/8 66.36 0.03 22.06 0.00 0.00 2.63 0.00 10.27 0.03 0.00 0.06 101.14	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09 0.03 9.48 0.14 0.02 0.00 101.60	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 3.88 0.01 9.39 0.16 0.23 0.00 100.83	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.19 0.00 3.49 0.00 9.63 0.21 0.00 0.00 101.05	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d 9.60 0.14 0.00 0.13 99.97	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 2.43 n.d 10.15 0.08 0.00 0.17 99.43	ARD10 Core/2 64.84 0.00 22.31 0.02 0.17 0.00 0.00 0.00 3.49 n.d 9.95 0.16 0.08 0.10 100.65	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17 0.04 0.32 101.42	ARD3 Core/1 62.32 0.05 23.97 0.00 0.06 0.02 0.00 5.33 0.00 8.54 0.14 0.07 0.00 100.21	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.06 0.00 4.56 0.00 8.41 0.30 0.09 0.00 99.21	ARD3 Core/2 63.53 0.10 23.64 0.04 0.00 0.02 0.00 4.65 0.09 8.68 0.19 0.08 0.03 101.18	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NiO NiO NiO NiO NiO NiO NiO NiO NiO Ni	ARD4 Core/8 66.36 0.03 22.06 0.02 0.00 0.00 2.63 0.00 10.27 0.03 0.00 10.27 0.03 0.06 101.14	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09 0.03 9.48 0.14 0.02 0.00 101.60	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 0.00 3.88 0.01 9.39 0.16 0.23 0.00 100.83	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.12 0.00 3.49 0.00 9.63 0.21 0.00 101.05 2.84	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d 9.60 0.14 0.00 0.13 99.97	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 0.00 2.43 n.d 10.15 0.08 0.00 0.17 99.43	ARD10 Core/2 64.84 0.00 22.31 0.02 0.17 0.00 0.00 3.49 n.d 9.95 0.16 0.08 0.10 100.65	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17 0.04 0.32 101.42	ARD3 Core/1 62.32 0.05 23.97 0.00 0.06 0.02 0.00 5.33 0.00 5.54 0.14 0.07 0.00 100.21	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.00 4.56 0.00 8.41 0.30 0.09 0.00 99.21	ARD3 Core/2 63.53 0.10 23.64 0.04 0.30 0.02 0.00 4.65 0.09 8.68 0.19 0.06 0.03 101.18	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NIO Na2O K2O BaO P2O5 Total Si Ti	ARD4 Core/8 66.36 0.03 22.06 0.02 0.00 0.00 2.63 0.00 10.27 0.03 0.00 10.27 0.03 0.06 101.14	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09 0.03 9.48 0.14 0.02 0.00 101.60 2.81 0.00	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 0.00 3.88 0.01 9.39 0.16 0.23 0.00 100.83 2.82 0.00	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.12 0.00 3.49 0.00 9.63 0.21 0.00 101.05 2.84 0.00	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d 9.60 0.14 0.00 0.13 99.97 2.84 0.00	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 0.00 2.43 n.d 10.15 0.08 0.00 0.17 99.43 2.90 0.00	ARD10 Core/2 64.84 0.00 22.31 0.02 0.17 0.00 0.00 0.00 3.49 n.d 9.95 0.16 0.08 0.10 100.65	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17 0.04 0.32 101.42 2.87 0.00	ARD3 Core/1 62.32 0.05 23.97 0.00 0.08 0.02 0.00 5.33 0.00 6.54 0.14 0.07 0.00 100.21 2.76 0.00	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.00 0.00 4.56 0.00 8.41 0.30 0.09 0.00 99.21	ARD3 Core/2 63.53 0.10 23.64 0.04 0.02 0.00 4.65 0.09 8.68 0.19 0.08 0.03 101.18 2.78 0.00	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NIO Na2O K2O BaO P2O5 Total Si Ti Al	ARD4 Core/8 66.36 0.03 22.06 0.02 0.00 0.00 2.63 0.00 10.27 0.03 0.00 10.27 0.03 0.06 101.14	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09 0.03 9.48 0.14 0.02 0.00 101.60 2.81 0.00 1.20	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 0.00 3.88 0.01 9.39 0.16 0.23 0.00 100.83 2.82 0.00 1.19	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.12 0.00 3.49 0.00 9.63 0.21 0.00 101.05 2.84 0.00 1.16	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d 9.60 0.14 0.00 0.13 99.97 2.84 0.00 1.16	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 2.43 n.d 10.15 0.08 0.00 0.17 99.43 2.90 0.00 1.10	ARD10 Core/2 64.84 0.00 22.31 0.02 0.17 0.00 0.00 0.00 3.49 n.d 9.95 0.16 0.08 0.10 100.65 2.84 0.00 1.15	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17 0.04 0.32 101.42 2.87 0.00 1.12	ARD3 Core/1 62.32 0.05 23.97 0.00 0.08 0.02 0.00 5.33 0.00 6.54 0.14 0.07 0.00 100.21 2.76 0.00 1.25	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.00 0.00 4.56 0.00 8.41 0.30 0.09 0.00 99.21 2.80 0.00 1.22	ARD3 Core/2 63.53 0.10 23.64 0.04 0.02 0.00 4.65 0.09 8.68 0.19 0.08 0.03 101.18 2.78 0.00 1.22	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NIO Na2O K2O BaO P2O5 Total Si Ti Al Cr	ARD4 Core/8 66.36 0.03 22.06 0.00 0.00 2.63 0.00 10.27 0.03 0.00 10.27 0.03 0.06 101.14 2.88 0.00 1.13 0.00	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09 0.03 9.48 0.14 0.02 0.00 101.60 2.81 0.00 1.20 0.00	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 0.00 3.88 0.01 9.39 0.16 0.23 0.00 100.83 2.82 0.00 1.19 0.00	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.12 0.00 9.63 0.21 0.00 101.05 2.84 0.00 1.16 0.00	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d 9.60 0.14 0.00 0.13 99.97 2.84 0.00 1.16 0.00	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 2.43 n.d 10.15 0.08 0.00 0.17 99.43 2.90 0.00 1.10 0.00	ARD10 Core/2 64.64 0.00 22.31 0.02 0.17 0.00 0.00 0.00 3.49 n.d 9.95 0.16 0.08 0.10 100.65 2.84 0.00 1.15 0.00	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17 0.04 0.32 101.42 2.87 0.00 1.12 0.00	ARD3 Core/1 62.32 0.05 23.97 0.00 0.08 0.02 0.00 5.33 0.00 8.54 0.14 0.07 0.00 100.21 2.76 0.00 1.25 0.00	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.00 0.00 4.56 0.00 8.41 0.30 0.09 0.00 99.21 2.80 0.00 1.22 0.00	ARD3 Core/2 63.53 0.10 23.64 0.04 0.02 0.00 4.65 0.09 8.68 0.19 0.08 0.03 101.18 2.78 0.00 1.22 0.00	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NIO Na2O K2O BaO P2O5 Total Si Ti Al Cr Fe	ARD4 Core/8 66.36 0.03 22.06 0.00 0.00 2.63 0.00 10.27 0.03 0.00 10.27 0.03 0.00 10.1.14 2.88 0.00 1.13 0.00 0.00	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09 0.03 9.48 0.14 0.02 0.00 101.60 2.81 0.00 1.20 0.00 0.00	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 0.00 3.88 0.01 9.39 0.16 0.23 0.00 100.83 2.82 0.00 1.19 0.00 0.00	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.12 0.00 3.49 0.00 9.63 0.21 0.00 101.05 2.84 0.00 1.16 0.00 0.01 0.01	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d 9.60 0.14 0.00 0.13 99.97 2.84 0.00 1.16 0.00 1.16 0.00	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 0.00 2.43 n.d 10.15 0.08 0.00 0.17 99.43 2.90 0.00 1.10 0.00 0.01	ARD10 Core/2 64.64 0.00 22.31 0.02 0.17 0.00 0.00 0.00 3.49 n.d 9.95 0.16 0.08 0.10 100.65 2.84 0.00 1.15 0.00 0.01	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17 0.04 0.32 101.42 2.87 0.00 1.12 0.00 0.00 0.00 0.01 0.11 0.00 0.00 0.01 0.11 0.17 0.00 0.00 0.01 0.11 0.17 0.00 0.00 0.01 0.11 0.17 0.00 0.00 0.00 0.01 0.11 0.17 0.00 0.00 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17 0.04 0.32 1.17 0.04 0.32 1.12 0.00 0.04 0.32 0.00 0.11 0.04 0.32 0.00 0.00 0.04 0.32 0.01 0.00 0.04 0.32 0.00	ARD3 Core/1 62.32 0.05 23.97 0.00 0.08 0.02 0.00 5.33 0.00 8.54 0.14 0.07 0.00 100.21 2.76 0.00 1.25 0.00 0.00	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.00 0.00 4.56 0.00 8.41 0.30 0.09 0.00 99.21 2.80 0.00 1.22 0.00 0.00	ARD3 Core/2 63.53 0.10 23.64 0.04 0.02 0.00 4.65 0.09 8.68 0.19 0.06 0.03 101.18 2.78 0.00 1.22 0.00 0.01	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NIO Na2O K2O BaO P2O5 Total Si Ti Al Cr Fe Mn	ARD4 Core/8 66.36 0.03 22.06 0.00 0.00 2.63 0.00 10.27 0.03 0.00 10.27 0.03 0.00 10.1.14 2.88 0.00 1.13 0.00 0.00 0.00	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09 0.03 9.48 0.14 0.02 0.00 101.60 1.20 0.00 1.20 0.00 0.00 0.00 0.00	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 0.00 3.88 0.01 9.39 0.16 0.23 0.00 100.83 2.82 0.00 1.19 0.00 0.00 0.00	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.12 0.00 9.63 0.21 0.00 101.05 2.84 0.00 1.16 0.00 0.01 0.01 0.01 0.01 0.01	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d 9.60 0.14 0.00 0.13 99.97 2.84 0.00 1.16 0.00 1.16 0.00 0.01 0.00	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 0.00 2.43 n.d 10.15 0.08 0.00 0.17 99.43 2.90 0.00 1.10 0.00 1.10 0.00	ARD10 Core/2 64.64 0.00 22.31 0.02 0.17 0.00 0.00 3.49 n.d 9.95 0.16 0.08 0.10 100.65 2.84 0.00 1.15 0.00 0.01 0.00	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17 0.04 0.32 101.42 2.87 0.00 1.12 0.00 0.00 0.01 0.22 0.01 0.22 0.01 0.22 0.01 0.22 0.01 0.22 0.01 0.01 0.22 0.01 0.01 0.22 0.01 0.02 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.00 2.89 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.01 0.02 0.02 0.01 0.02 0.02 0.01 0.02 0.01 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.00 0.02 0.00 0.02 0.00 0.02 0.00 0.02 0.00 0.02 0.00 0.02 0.00 0.02 0.00 0.00 0.02 0.00 0.00 0.02 0.00 0.00 0.02 0.00 0.00 0.00 0.02 0.00 0.02 0.00 0.02 0.00 0.00 0.02 0.00	ARD3 Core/1 62.32 0.05 23.97 0.00 0.08 0.02 0.00 5.33 0.00 8.54 0.14 0.07 0.00 100.21 2.76 0.00 1.25 0.00 0.00 0.00 0.00	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.00 0.00 0.00 8.41 0.30 0.00 99.21 2.80 0.00 1.22 0.00 0.00 0.00	ARD3 Core/2 63.53 0.10 23.64 0.04 0.02 0.00 4.65 0.09 8.68 0.19 0.06 0.03 101.18 2.78 0.00 1.22 0.00 0.01 0.00	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NIO Na2O K2O BaO P2O5 Total Si Ti Al Cr Fe Mn Mg Ca	ARD4 Core/8 66.36 0.03 22.06 0.00 0.00 0.00 2.63 0.00 10.27 0.03 0.00 0.06 101.14 2.88 0.00 1.13 0.00 0.00 0.00 0.00 0.00 0.00	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09 0.03 9.48 0.14 0.02 0.00 101.60 2.81 0.00 1.20 0.00 0.00 0.00 0.00 0.00 0.0	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 0.00 3.88 0.01 9.39 0.16 0.23 0.00 100.83 2.82 0.00 1.19 0.00 0.00 0.00 0.00 0.00 0.00	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.12 0.00 9.63 0.21 0.00 101.05 2.84 0.00 1.16 0.00 0.01 0.01 0.01 0.01 0.01 0.01	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d 9.60 0.14 0.00 0.13 99.97 2.84 0.00 1.16 0.00 1.16 0.00 0.01 0.00 0.01	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 2.43 n.d 10.15 0.08 0.00 0.17 99.43 2.90 0.00 1.10 0.00 1.10 0.00 0.01 0.00 0.12	ARD10 Core/2 64.64 0.00 22.31 0.02 0.17 0.00 0.00 3.49 n.d 9.95 0.16 0.08 0.10 100.65 2.84 0.00 1.15 0.00 0.01 0.00 0.01 0.00 0.16	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17 0.04 0.32 101.42 2.87 0.00 1.12 0.00 0.01 0.00 0.14	ARD3 Core/1 62.32 0.05 23.97 0.00 0.06 0.02 0.00 5.33 0.00 8.54 0.14 0.07 0.00 100.21 2.76 0.00 1.25 0.00 0.00 0.00 0.00	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.06 0.00 0.00 0.00 8.41 0.30 0.00 99.21 2.80 0.00 1.22 0.00 0.00 0.00 0.00 0.22	ARD3 Core/2 63.53 0.10 23.64 0.04 0.02 0.00 4.65 0.09 8.68 0.19 0.06 0.03 101.18 2.78 0.00 1.22 0.00 1.22 0.00 0.01 0.00 0.01	计计算机 计计算机 化二氯化 化二氯化 化合物 化合物化合物
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NIO Na2O K2O BaO P2O5 Total Si Ti Al Cr Fe Mn Mg Ca NI	ARD4 Core/8 66.36 0.03 22.06 0.00 0.00 2.63 0.00 10.27 0.03 0.00 10.27 0.03 0.00 10.114 2.88 0.00 1.13 0.00 0.00 0.00 0.00 0.00 0.00	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09 0.03 9.48 0.14 0.02 0.00 101.60 1.20 0.00 1.20 0.00 0.00 0.00 0.00 0.0	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 0.00 0.00 3.88 0.01 9.39 0.16 0.23 0.00 100.83 2.82 0.00 1.19 0.00 0.00 0.00 0.00 0.00 0.00	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.00 9.63 0.21 0.00 101.05 2.84 0.00 1.16 0.00 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.00 0.11 0.00 0.19 0.02 0.00 0.19 0.00 0.19 0.00 0.19 0.00 0.19 0.00 0.19 0.00 0.19 0.00 0.19 0.00 0.19 0.00 0.19 0.00 0.19 0.00 0.19 0.00 0.00 0.19 0.00 0.00 0.19 0.00 0.00 0.00 0.19 0.00 0.00 0.00 0.19 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.00 0.01 0.00 0.01 0.00 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.000 0.01 0.000 0.01 0.000 0.016 0.000	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d 9.60 0.14 0.00 0.13 99.97 2.84 0.00 1.16 0.00 1.16 0.00 0.01 0.00 0.01 0.00 0.17 n.d	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 2.43 n.d 10.15 0.08 0.00 0.17 99.43 2.90 0.00 1.10 0.00 1.10 0.00 0.01 0.00 0.12 n.d	ARD10 Core/2 64.64 0.00 22.31 0.02 0.17 0.00 0.00 3.49 n.d 9.95 0.16 0.08 0.10 100.65 2.84 0.00 1.15 0.00 0.01 0.00 0.01 0.00 0.16 n.d	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17 0.04 0.32 101.42 2.87 0.00 1.12 0.00 0.01 0.00 0.14 n.d	ARD3 Core/1 62.32 0.05 23.97 0.00 0.06 0.02 5.33 0.00 8.54 0.14 0.07 0.00 100.21 2.76 0.00 1.25 0.00 0.00 0.00 0.00 0.00 0.00 0.00	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.06 0.00 4.56 0.00 8.41 0.30 0.00 99.21 2.80 0.00 1.22 0.00 0.00 0.00 0.00 0.00 0.0	ARD3 Core/2 63.53 0.10 23.64 0.04 0.02 0.00 4.65 0.09 8.68 0.19 0.06 0.03 101.18 2.78 0.00 1.22 0.00 1.22 0.00 0.01 0.00 0.22 0.00	计计算机 计计算机 化二氯化合物 化化合物 化合物 化合物化合物 化合物化合物 化合物化合物 化合物化合物 化合物化合物 化合物化合物化合物化合物化合物化合物化合物化合物化合物化合物化合物化合物化合物化
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NIO Na2O K2O BaO P2O5 Total Si Ti Al Cr Fe Mn Mg Ca Ni Na	ARD4 Core/8 66.36 0.03 22.06 0.00 0.00 2.63 0.00 10.27 0.03 0.00 10.27 0.03 0.00 10.114 2.88 0.00 1.13 0.00 0.00 0.00 0.00 0.00 0.00	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09 0.03 9.48 0.14 0.02 0.00 101.60 1.20 0.00 1.20 0.00 0.00 0.00 0.00 0.0	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 0.00 0.00 3.88 0.01 9.39 0.16 0.23 0.00 100.83 2.82 0.00 1.19 0.00 0.00 0.00 0.00 0.00 0.00	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.00 3.49 0.00 9.63 0.21 0.00 101.05 2.84 0.00 1.16 0.00 0.01 0.01 0.01 0.00 0.116 0.00 0.12	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 3.52 n.d 9.60 0.14 0.00 0.13 99.97 2.84 0.00 1.16 0.00 1.16 0.00 0.01 0.00 0.01 0.00 0.17 n.d 0.82	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 2.43 n.d 10.15 0.08 0.00 0.17 99.43 2.90 0.00 1.10 0.00 1.10 0.00 0.01 0.00 0.12 n.d 0.87	ARD10 Core/2 64.64 0.00 22.31 0.02 0.17 0.00 3.49 n.d 9.95 0.16 0.08 0.10 100.65 2.84 0.00 1.15 0.00 0.01 0.00 0.01 0.00 0.16 n.d 0.85	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17 0.04 0.32 101.42 2.87 0.00 1.12 0.00 0.01 0.00 0.11 0.04 0.32 101.42 2.87 0.00 1.12 0.00 0.01 0.04 0.32 1.12 0.00 0.01 0.32 1.17 0.04 0.32 1.17 0.00 1.17 0.04 0.32 1.17 0.00 1.17 0.04 0.32 1.17 0.00 1.17 0.04 0.32 1.17 0.00 1.17 0.04 0.32 1.17 0.00 1.17 0.04 0.32 1.12 0.00 1.12 0.00 0.01 0.01 0.32 0.11 0.32 0.17 0.04 0.32 1.12 0.00 0.01 0.01 0.01 0.32 0.01 0.32 0.01 0.32 0.01 0.04 0.00 0.01 0.02 0.01 0.32 0.01 0.04 0.00 0.00 0.00 0.04 0.00 0.00 0.01 0.04 0.00 0.00 0.01 0.00 0.01 0.04 0.00 0.00 0.00 0.01 0.00 0.02 0.00 0.00 0.01 0.00 0.01 0.02 0.00	ARD3 Core/1 62.32 0.05 23.97 0.00 0.06 0.02 5.33 0.00 8.54 0.14 0.07 0.00 100.21 2.76 0.00 1.25 0.00 0.00 0.00 0.00 0.00 0.25 0.00 0.73	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.06 0.00 4.56 0.00 8.41 0.30 0.00 99.21 2.80 0.00 1.22 0.00 0.00 0.00 0.00 1.22 0.00 0.00	ARD3 Core/2 63.53 0.10 23.64 0.04 0.02 0.00 4.65 0.09 8.68 0.19 0.06 0.03 101.18 2.78 0.00 1.22 0.00 1.22 0.00 0.01 0.00 0.02 0.00 0.74	计计算机 计计算机 化二氯化合物 化化合物合物 化合物合物合物合物合物合物合物合物合物合物合物合物合物合物
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O BaO P2O5 Total Si Ti Al Cr Fe Mn Mg Ca Ni Na Ka Ka Ka Ka Ka Ka Ka Ka Ka Ka Ka Ka Ka	ARD4 Core/8 66.36 0.03 22.06 0.00 0.00 0.00 2.63 0.00 10.27 0.03 0.00 10.27 0.03 0.00 10.114 2.88 0.00 1.13 0.00 0.00 0.00 0.00 0.00 0.00	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09 0.03 9.48 0.14 0.02 0.00 101.60 1.20 0.00 1.20 0.00 0.00 0.00 0.00 0.0	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 0.00 0.00 3.88 0.01 9.39 0.16 0.23 0.00 100.83 2.82 0.00 1.19 0.00 0.00 0.00 0.00 0.00 0.00	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.00 3.49 0.00 9.63 0.21 0.00 101.05 2.84 0.00 1.16 0.00 0.01 0.00 0.16 0.00 0.82 0.01	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d 9.60 0.14 0.00 0.13 99.97 2.84 0.00 1.16 0.00 0.11 0.00 0.01 0.00 0.01 0.00 0.01 7 n.d 0.02	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 2.43 n.d 10.15 0.08 0.00 0.17 99.43 2.90 0.00 1.10 0.00 1.10 0.00 0.01 0.00 0.12 n.d 0.87 0.01	ARD10 Core/2 64.84 0.00 22.31 0.02 0.17 0.00 3.49 n.d 9.95 0.16 0.08 0.10 100.65 2.84 0.00 1.15 0.00 0.01 0.00 0.01 0.00 0.01 0.00	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17 0.04 0.32 101.42 2.87 0.00 1.12 0.00 0.00 0.01 0.00 0.01 0.00 0.14 n.d 0.87 0.01	ARD3 Core/1 62.32 0.05 23.97 0.00 0.06 0.02 5.33 0.00 5.33 0.00 8.54 0.14 0.07 0.00 100.21 2.76 0.00 1.25 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.06 0.00 4.56 0.00 8.41 0.30 0.00 99.21 2.80 0.00 1.22 0.00 0.00 1.22 0.00 0.00 0.0	ARD3 Core/2 63.53 0.10 23.64 0.04 0.02 0.00 4.65 0.09 8.68 0.19 0.06 0.03 101.18 2.78 0.00 1.22 0.00 0.01 0.00 0.01 0.00 0.22 0.00 0.74 0.01	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O BaO P2O5 Total Si Ti Al Cr Fe Mn Mg Ca Ni Na2O K2O BaO P2O5 Total Si Ti Al Cr Si Si Cr Si Cr Si Si Cr Si Si Si Cr Si Si Si Si Si Si Si Si Si Si Si Si Si	ARD4 Core/8 66.36 0.03 22.06 0.00 0.00 2.63 0.00 10.27 0.03 0.00 10.27 0.03 0.00 10.114 2.88 0.00 1.13 0.00 0.00 0.00 0.00 0.00 0.00	ARD4 Core/9 64.54 0.02 23.32 0.06 0.12 0.00 0.06 4.09 0.03 9.48 0.14 0.02 0.00 101.60 1.20 0.00 1.20 0.00 0.00 0.00 0.00 0.0	ARD4 Half/9 64.27 0.00 23.08 0.84 0.12 0.00 0.00 3.88 0.01 9.39 0.16 0.23 0.00 100.83 2.82 0.00 1.19 0.00 0.00 0.00 0.00 0.00 0.00	ARD4 Rim/9 65.03 0.00 22.61 0.00 0.19 0.02 0.00 9.63 0.21 0.00 101.05 2.84 0.00 1.16 0.00 0.01 0.00 0.16 0.00 0.82 0.01 0.00 0.22 0.01 0.00 0.21 0.00 0.21 0.00 0.21 0.00 0.00 0.21 0.00 0.00 0.21 0.00 0.00 0.21 0.00 0.00 0.21 0.00 0.00 0.21 0.00 0.00 0.21 0.00 0.01 0.00 0.00 0.01 0.00 0.00 0.00 0.00 0.01 0.00 0.22 0.00 0	ARD10 Core/1 64.44 0.02 22.36 0.00 0.16 0.07 0.00 3.52 n.d 9.60 0.14 0.00 0.13 99.97 2.84 0.00 1.16 0.00 0.11 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01	ARD10 Rim/1 65.56 0.00 21.21 0.06 0.17 0.00 2.43 n.d 10.15 0.08 0.00 0.17 99.43 2.90 0.00 1.10 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.000000	ARD10 Core/2 64.84 0.00 22.31 0.02 0.17 0.00 3.49 n.d 9.95 0.16 0.08 0.10 100.65 2.84 0.00 1.15 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.00 0.01 0.02 0.17 0.00 0.00 0.00 0.00 0.00 0.00 0.00	ARD10 Rim/2 65.93 0.00 21.79 0.01 0.11 0.17 0.00 2.89 n.d 10.32 0.17 0.04 0.32 101.42 2.87 0.00 1.12 0.00 0.00 0.14 n.d 0.87 0.01 0.00 0.01	ARD3 Core/1 62.32 0.05 23.97 0.00 0.06 0.02 5.33 0.00 8.54 0.14 0.07 0.00 100.21 2.76 0.00 1.25 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	ARD3 Rim/1 62.81 0.00 23.20 0.00 0.06 0.00 4.56 0.00 8.41 0.30 0.09 0.00 99.21 2.80 0.00 1.22 0.00 0.00 1.22 0.00 0.00 0.0	ARD3 Core/2 63.53 0.10 23.64 0.04 0.02 0.00 4.65 0.09 8.68 0.19 0.06 0.03 101.18 2.78 0.00 1.22 0.00 0.01 0.00 0.01 0.00 0.02 0.00 0.74 0.01 0.00	计学校 化学校学校 化学校学校 化化学校学校 化化学化学 化化学化学化学 化化学化学学 化化学学学 化化学学学 化乙酰基苯基 化乙酰基乙酰基乙酰基乙酰基乙酰基乙酰基乙酰基乙酰基乙酰基乙酰基乙酰基乙酰基乙酰基乙

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#### APPENDIX 4.1 : CONTINUED PLAGIOCLASE ARDARA

#### PLAGIOCLASE FANAD

Sample Location	ARD3 Rim/2	ARD3 Core/3	ARD3 Rim/3	ARD3 Core/4	ARD3 Rim/4	ARD3 Core/5	ARD3 Rim/5		Sample Location	FAN19 Core/1	FAN19 Rim/1	FAN19 COre/2	
SiO2	62.89	60.71	61.68	60.01	61.87	62.11	63.89		SiO2	60.73	61.66	59.35	
TIO2	0.00	0.04	0.00	0.07	0.00	0.01	0.00		1102	0.00	0.00	0.00	
AI203	23.43	24.09	23.57	24.85	23.85	23.81	22.77		A1203	24.55	23.86	25.32	
Cr2O3	0.01	0.02	0.00	0.11	0.00	0.16	0.06		Cr2O3	0.00	0.03	0.02	
FeO	0.13	0.00	0.00	0.00	0.02	0.13	0.10		FeO	0.23	0.18	0.27	
MnO	0.04	0.03	0.09	0.00	0.01	0.00	0.00		MnO	0.07	0.00	0.04	
MgO	0.00	0.01	0.00	0.00	0.00	0.00	0.00		MgO	0.00	0.00	0.00	
CaO	4.78	5.66	5.18	6.55	5.29	5.05	3.82		CaO	6.41	5.59	7.30	
NIO	0.00	0.08	0.10	0.02	0.02	0.00	0.00		Na2O	7.80	8.00	7.11	
Na2O	9.07	8.22	8.49	7.84	8.55	8.63	9.55		K2O	0.41	0.35	0.27	
K2O	0.12	0.07	0.10	0.11	0.11	0.12	0.16		BaO	0.20	0.01	0.16	
BaO	0.30	0.00	0.00	0.00	0.00	0.00	0.02		P2O5	0.00	0.04	0.07	
Total	100.52	98.93	99.20	99.46	99.73	100.00	100.15		Total	100.00	99.67	99.83	
SI	2.78	2.28	2.77	2.69	2.75	2.76	2.82		Si	2.71	2.75	2.67	
TI	0.00	0.00	0.00	0.00	0.00	0.00	1.18		TI :	0.00	0.00	0.00	
Al	1.22	1.28	1.25	1.31	1.25	1.25	0.00		Al .	1.29	1.26	1.34	
Cr	0.00	0.00	0.00	0.00	0.00	0.01	1.18	···	Cr	0.00	0.00	0.00	
Fe	0.01	0.00	0.00	0.00	0.00	0.01	0.00		Fe	0.01	0.01	0.01	
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00		Mn	0.00	0.00	0.00	
Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00		Mg	0.00	0.00	0.00	
Ca	0.23	0.27	0.25	0.32	0.25	0.24	0.18		Ca	0.31	0.27	0.35	
Ni	0.00	0.00	0.00	0.00	0.00	0.00	0.00		Na	0.68	0.69	0.62	
Na	0.78	0.72	0.74	0.68	0.74	0.74	0.82		K	0.02	0.02	0.02	
ĸ	0.01	0.00	0.01	0.01	0.01	0.01	0.01		Ba	0.00	0.00	0.00	
Ba	0.01	0.00	0.00	0.00	0.00	0.00	0.00		P	0.00	0.01	0.03	

#### CONTINUED -PLAGIOCLASE FANAD

Sample Location	FAN19 Half/2	FAN19 Rim/2	FAN19 Core/3	FAN19 Rim/3	FAN19 core/4 small	FAN19 Half/5	FAN19 Core/6 small	FAN19 Core/7 smail	FAN19 Core/8	FAN23 Core/1	FAN23 Rim/1	FAN23 Core/2	FAN23 Half/2
SiO2	59.59	60.49	59.63	60.05	60.92	60.59	61.58	59.59	59.81	59.80	61.57	59.24	59.18
TiO2	0.00	0.04	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.03
AI2O3	25.05	24.60	24.45	24.97	24.87	24.54	23.70	24.83	24.77	24.70	23.53	25.22	24.95
Cr2O3	0.00	0.02	0.02	0.05	0.02	0.12	0.00	0.02	0.03	0.00	0.02	0.11	0.10
FeO	0.19	0.21	0.23	0.12	0.11	0.10	0.18	0.22	0.10	0.10	0.13	0.30	0.27
MnO	0.00	0.03	0.02	0.00	0.11	0.03	0.04	0.00	0.05	0.02	0.00	0.00	0.04
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	, 0.00	0.00	0.00
CaO	7.07	6.53	6.66	6.82	6.69	6.47	5.30	6.72	6.52	6.62	5.50	7.12	7.10
NIO	7.44	7.78	7.64	7.71	7.67	7.83	8.56	7.50	7.71	7.47	8.24	7.49	7.17
Na2O	0.36	0.32	0.30	0.22	0.16	0.33	0.20	0.29	0.17	0.34	0.35	0.25	0.27
K20	0.14	0.12	0.09	0.12	0.11	0.36	0.15	0.00	0.02	0.25	0.07	0.31	0.15
BaO	0.00	0.00	0.00	0.02	0.03	0.07	0.01	0.00	0.13	0.00	0.09	0.00	0.00
Total	99.84	100.13	99.02	99.74	100.46	100.36	99.71	99.14	99.18	99.29	99.61	100.05	99.27
			*										
SI	2.68	2.71	2.70	2.69	2.70	2.71	2.75	2.69	2.69	2.70	2.75	2.66	2.67
Ti	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Al ·····	1.33	1.30	1.30	1.32	1.30	1.29	1.25	1.32	1.31	1.32	1.24	1.34	1.33
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fe	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.01
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca	0.34	0.31	0.32	0.33	0.32	0.31	0.25	0.33	0.31	0.32	0.26	0.34	0.34
NI	0.68	0.68	0.67	0.67	0.66	0.68	0.74	0.66	0.67	0.65	0.72	0.65	0.63
Na	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.02	0.01	0.02	0.02	0.01	0.02
ĸ	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Ba		0.00	0.00	0.01	0.01	0.02	0.00	0.00	0.04	0.00	0.00	0.00	0.00

# APPENDIX 4.1 : CONTINUED PLAGIOCLASE FANAD

Sample	FAN46 Core/1	FAN 46 Bim/1	FAN46 Half/1	FAN 46 Core/2	FAN46 Bim/2	FAN 46 Core/3	FAN46 rim/3	FAN 46 Core/4	FAN46	FAN 46 Bim/4	FAN46	FAN 46	FAN46 Bim/5
200011011	0010/1			0010/2		0010/0	1111.0	001014	1164(1) -	1000 4	0016/5		1111/0
SIO2	61.07	62.03	61.17	60.45	59.25	59.62	67.60	61.44	60.48	63.27	60.90	60.10	62.29
TiO2	0.02	0.00	0.01	0.02	0.06	0.09	0.00	0.00	0.00	0.04	0.00	0.07	0.06
AI2O3	24.06	24.45	24.75	24.76	25.49	25.65	20.10	23.57	24.90	22.80	25.82	26.02	24.47
Cr2O3	0.05	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.07	0.05	0.00	0.07	0.04
FeO	0.20	0.17	0.18	0.38	0.10	0.24	0.09	0.06	0.25	0.15	0.02	0.26	0.29
MnO	0.02	0.00	0.00	0.03	0.04	0.08	0.00	0.02	0.00	0.00	0.06	0.07	0.00
MgO	0.00	0.02	0.03	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.01	0.01
CaO	5.77	5.62	6.04	6.28	7.26	7.26	4.03	5.03	6.62	4.22	6.87	7.63	5.79
NiO	0.00	0.15	0.02	0.00	0.11	0.00	0.00	0.03	0.00	0.05	0.06	0.02	0.19
Na2O	8.46	8.33	8.20	7.95	7.42	7.44	7.77	8.63	7.49	8.89	7.65	7.25	8.17
K20	0.04	0,15	0.28	0.33	0.14	0.07	0.04	0.06	0.32	0.45	0.23	0.21	0.41
BaO	0.06	0.13	0.17	0.00	0.00	0.00	0.08	0.00	0.05	0.00	0.24	0.01	0.00
Total	99.75	100.80	100.63	100.08	99.61	100.08	99.70	98.84	99.86	99.53	101.82	101.71	101.60
·					•••								
S	2.73	2.74	2.71	2.70	2.66	2.66	2.97	2.76	2.69	2.81	2.67	2.64	2.73
TI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Al	1.27	1.27	1.29	1.30	1.35	1.35	1.04	1.25	1,31	1.19	1.33	1.35	1.26
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fe	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.01	0.01
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Ca	0.28	0.40	0.29	0.30	0.35	0.35	0.19	0.24	0.32	0.20	0.32	0.36	0.27
Ni	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0,00	0.01
Na	0.73	0.71	0.70	0.69	0.64	0.64	0.33	0.75	0.65	0.77	0.65	0.62	0.69
К	0.00	0.01	0.02	0.02	0.01	0.00	0.00	0.00	0.02	0.03	0.01	0.01	0.02
Ba	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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#### APPENDIX 4.1 : CONTINUED PLAGIOCLASE ROSSES

Sample Location	G4 Core/1	G4 Rim/1	G4 Core/2	G4 Rim/2	G4 Core/3	G4 Core/4	G4 Core/4	G4 Rim/4	G3 Core/1	G3 Rim/1	G3 Core/2	G3 Rim/2
SIO2	66.57	66.79	65.74	66.02	66.40	67.14	66.14	67.74	65.12	64.74	61.64	64.16
TiO2	0.03	0.04	0.00	0.00	0.00	0.01	0.00	0.00	0.11	0.07	0.00	0.00
AI2O3	20.41	21.32	20.28	20.32	20.11	20.53	20.47	20.54	22.70	22.14	24.30	22.90
Cr2O3	0.02	0.02	0.02	0.09	0.00	0.09	0.06	0.00	0.00	0.02	0.17	0.06
FeO	0.01	0.03	0.09	0.07	0.03	0.00	0.08	0.03	0.09	0.17	0.12	0.14
MnO	0.07	0.00	0.02	0.02	0.05	0.00	0.00	0.00	0.07	0.00	0.00	0.00
MgO	0.00	4.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
NIO	0.02	0.00	0.00	0.08	0.12	0.03	0.00	0.97	0.00	0 80	8 97	9.01
Na2O	11.03	10.57	10.48	10.64	10.70	10.98	10.88	11.12	0.06	0.14	0.10	0.12
K20	0.09	0.04	0.02	0.09	0.37	0.03	0.03	0.07	0.00	0.00	0.15	0.06
BaO	0.00	0.00	0.31	0.01	0.10	0.02	0.05	0.09	0.11	0.00	0.15	0.13
Total	99.26	100.40	98.44	98.53	99.04	100.12	99.08	100.30	100.85	99.76	100.58	100.69
Si	2.95	2.91	2.94	2.94	2.95	2.94	2.94	2.96	2.84	2.86	2.73	2.82
TI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Al	1.06	1.10	1.07	1.07	1.05	1.06	1.07	1.06	1.17	1.15	1.27	1.18
Cr ·	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Mn ·	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.01
Ma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca	0.05	0.09	0.07	0.06	0.05	0.06	0.07	0.05	0.17	0.15	0.29	0.19
NI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.84	0.72	0.81
Na	0.95	0.89	0.91	0.92	0.92	0.93	0.94	0.94	0.00	0.01	0.01	0.01
ĸ	0.01	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ba	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
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Sampla	~											
Sample	Goro/2	G3 Dim/2	G3 Coro/4	G3	G3 Rim/4	Porphyry	Porphyry	Porphyry	Porphyry	Porphyry	Porphyry	Porphyry
Location	Core/3	G3 . Rim/3	G3 Core/4	G3 Half/4	G3 Rim/4	Porphyry Core/6	Porphyry Rim/6	Porphyry Core/7	Porphyry Rim/7	Porphyry Core/8	Porphyry Core/1	Porphyry Core/2
Location	G3 Core/3	G3 Rim/3 59.88	G3 Core/4 60,60	G3 Haif/4 61.70	G3 Rim/4 63.56	Porphyry Core/6 inc 63.74	Porphyry Rim/6 inc 64.19	Porphyry Core/7 inc 63.92	Porphyry Rim/7 Inc 62.88	Porphyry Core/8 pheno 63,55	Porphyry Core/1 inc 61.17	Porphyry Core/2 pheno 58.38
SiO2	Core/3 61.33 0.00	G3 Rim/3 59.88 0.00	G3 Core/4 60.60 0.02	G3 Haif/4 61.70 0.00	G3 Rim/4 63.56 0.01	Porphyry Core/6 inc 63.74 0.00	Porphyry Rim/6 inc 64.19 0.08	Porphyry Core/7 inc 63.92 0.00	Porphyry Rim/7 Inc 62.88 0.03	Porphyry Core/8 pheno 63.55 0.00	Porphyry Core/1 inc 61.17 0.00	Porphyry Core/2 pheno 58.38 0.09
SiO2 TiO2 Al2O3	G3 Core/3 61.33 0.00 24.85	G3 Rim/3 59.88 0.00 26.12	G3 Core/4 60.60 0.02 25.04	G3 Haif/4 61.70 0.00 24.72	G3 Rim/4 63.56 0.01 23.29	Porphyry Core/6 inc 63.74 0.00 23.50	Porphyry Rim/6 inc 64.19 0.08 23.15	Porphyry Core/7 inc 63.92 0.00 23.85	Porphyry Rim/7 Inc 62.88 0.03 23.95	Porphyry Core/8 pheno 63.55 0.00 23.54	Porphyry Core/1 Inc 61.17 0.00 23.83	Porphyry Core/2 pheno 58.38 0.09 26.64
SiO2 TiO2 Al2O3 Cr2O3	G3 Core/3 61.33 0.00 24.85 0.12	G3 Rim/3 59.88 0.00 26.12 0.05	G3 Core/4 60.60 0.02 25.04 0.07	G3 Haif/4 61.70 0.00 24.72 0.08	G3 Rim/4 63.56 0.01 23.29 0.02	Porphyry Core/6 inc 63.74 0.00 23.50 0.00	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12	Porphyry Core/7 inc 63.92 0.00 23.85 0.00	Porphyry Rim/7 Inc 62.88 0.03 23.95 0.03	Porphyry Core/8 pheno 63.55 0.00 23.54 0.07	Porphyry Core/1 inc 61.17 0.00 23.83 0.07	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00
SiO2 TiO2 Al2O3 Cr2O3 FeO	61,33 61,33 0.00 24,85 0.12 0.04	G3 Rim/3 59.88 0.00 26.12 0.05 0.03	G3 Core/4 60.60 0.02 25.04 0.07 0.06	G3 Haif/4 61.70 0.00 24.72 0.08 0.01	G3 Rim/4 63.56 0.01 23.29 0.02 0.04	Porphyry Corø/6 inc 63.74 0.00 23.50 0.00 0.09	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.10	Porphyry Core/7 Inc 63.92 0.00 23.85 0.00 0.26	Porphyry Rim/7 inc 62.88 0.03 23.95 0.03 0.13	Porphyry Core/8 pheno 63.55 0.00 23.54 0.07 0.03	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.19
SiO2 TiO2 Al2O3 Cr2O3 FeO MnO	G3 Core/3 61,33 0.00 24,85 0.12 0.04 0.00	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.10 0.00	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00	Porphyry Rim/7 inc 62.88 0.03 23.95 0.03 0.13 0.05	Porphyry Core/8 pheno 63.55 0.00 23.54 0.07 0.03 0.09	Porphyry Core/1 inc 61.17 0.00 23.83 0.07 0.10 0.00	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.19 0.00
SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO	G3 Core/3 61.33 0.00 24.85 0.12 0.04 0.00 0.00	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 0.00	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 0.00	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 0.00	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.10 0.00 0.00	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 0.00	Porphyry Rim/7 inc 62.88 0.03 23.95 0.03 0.13 0.05 0.00	Porphyry Core/8 pheno 63,55 0.00 23,54 0.07 0.03 0.09 0.00	Porphyry Core/1 inc 61.17 0.00 23.83 0.07 0.10 0.00 0.00	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.19 0.00 0.00
SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO	61,33 0.00 24,85 0.12 0.04 0.00 0.00 6.46	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 0.00 7.75	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 0.00 6.18	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 0.00 4.71	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.10 0.00 0.00 4.21	Porphyry Core/7 Inc 63.92 0.00 23.85 0.00 0.26 0.00 0.00 4.82	Porphyry Rim/7 Inc 62.88 0.03 23.95 0.03 0.13 0.05 0.00 5.26	Porphyry Core/8 pheno 63.55 0.00 23.54 0.07 0.03 0.09 0.00 4.68	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 0.00 5.69	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.19 0.00 0.00 8.63
Side Side Side Side Side Side Side Side	G3 Core/3 61.33 0.00 24.85 0.12 0.04 0.00 0.00 6.46 7.96	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 7.75 7.23 0.17	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 0.00 6.18 8.17 0.09	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 0.00 4.71 9.07 0.15	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47 8.99 0.15	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.10 0.00 4.21 9.41 0.30	Porphyry Core/7 Inc 63.92 0.00 23.85 0.00 0.26 0.00 0.00 4.82 8.91 0.10	Porphyry Rim/7 Inc 62.88 0.03 23.95 0.03 0.13 0.05 0.00 5.26 8.81 0.28	Porphyry Core/8 pheno 63.55 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 0.00 5.69 8.40	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.19 0.00 0.00 8.63 6.63 0.13
Sice Sice Sice Sice Sice Sice Sice Sice	G3 Core/3 61.33 0.00 24.85 0.12 0.04 0.00 0.00 6.46 7.96 0.11 0.06	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 0.00 7.75 7.23 0.17 0.15	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13 0.06	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 0.00 6.18 8.17 0.09 0.19	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 0.00 4.71 9.07 0.15 0.04	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47 8.99 0.15 0.11	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.10 0.00 4.21 9.41 0.30 0.06	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 0.26 0.00 4.82 8.91 0.19 0.11	Porphyry Rim/7 inc 62.88 0.03 23.95 0.03 0.13 0.05 0.00 5.26 8.81 0.35	Porphyry Core/8 pheno 63.55 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86 0.30	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 5.69 8.40 0.05 0.01	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.19 0.00 0.00 8.63 6.63 0.13 0.00
Sice Sice Sice Sice Sice Sice Sice Sice	Core/3 61.33 0.00 24.85 0.12 0.04 0.00 0.00 6.46 7.96 0.11 0.06	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 0.00 7.75 7.23 0.17 0.15 0.05	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13 0.01 0.10	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 0.00 6.18 8.17 0.09 0.17	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 0.00 4.71 9.07 0.15 0.04 0.18	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47 8.99 0.15 0.11 0.17	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.10 0.00 4.21 9.41 0.30 0.06 0.00	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 0.26 0.00 4.82 8.91 0.19 0.11 0.02	Porphyry Rim/7 inc 62.88 0.03 23.95 0.03 0.13 0.05 0.00 5.26 8.81 0.38 0.05 0.00	Porphyry Core/8 pheno 63.65 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86 0.30 0.00 0.00	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 5.69 8.40 0.05 0.01 0.00	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.19 0.00 0.00 8.63 6.63 0.13 0.00 0.00
Sice Location SiCe TiCe Alecos Alecos Cr2O3 FeO MnO MgO CeO NiCo Na2O K2O BaO Total	Core/3 61.33 0.00 24.85 0.12 0.04 0.00 0.00 6.46 7.96 0.11 0.06 0.18 100.68	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 0.00 7.75 7.23 0.17 0.15 0.05 101.14	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13 0.06 0.10 100.55	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 6.18 8.17 0.09 0.19 0.07 0.07	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 4.71 9.07 0.15 0.04 0.18 100.68	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47 8.99 0.15 0.11 100.92	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.00 0.00 4.21 9.41 0.30 0.00 0.00 101.40	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 0.26 0.00 4.82 8.91 0.19 0.11 0.02 101.88	Porphyry Rim/7 inc 62.88 0.03 0.13 0.05 0.00 5.26 8.81 0.38 0.05 0.00 0.144	Porphyry Core/8 pheno 63.65 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86 0.30 0.00 0.00 0.00	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 5.69 8.40 9.0.05 0.01 0.00 99.29	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.19 0.00 0.00 8.63 6.63 0.13 0.00 0.00 100.35
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O BaO Total	Core/3 61.33 0.00 24.85 0.12 0.04 0.00 6.46 7.96 0.11 0.06 0.18 100.68	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 0.00 7.75 7.23 0.17 0.15 0.05 101.14	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13 0.06 0.10 100.55	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 6.18 8.17 0.09 0.19 0.07 100.79	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 4.71 9.07 0.15 0.04 0.18 100.68	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47 8.99 0.15 0.11 0.17 100.92	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.00 0.00 4.21 9.41 0.30 0.06 0.00 101.40	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 4.82 8.91 0.19 0.11 0.02 101.88	Porphyry Rim/7 Inc 62.88 0.03 23.95 0.03 0.13 0.05 0.00 5.26 8.81 0.38 0.05 0.00 101.44	Porphyry Core/8 pheno 63.65 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86 0.30 0.00 0.00 0.00 100.71	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 5.69 8.40 0.05 0.01 0.00 99.29	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.19 0.00 0.00 8.63 6.63 0.13 0.00 0.00 100.35
Sice Location SiCe TiCe Al2C3 Cr2C3 FeC MnC MgC CaO NiCo Na2O K2CO BaO Total	Core/3 61.33 0.00 24.85 0.12 0.04 0.00 0.00 6.46 7.96 0.11 0.06 0.18 100.68	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 0.00 7.75 7.23 0.17 0.15 0.05 101.14	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13 0.06 0.10 100.55	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 6.18 8.17 0.09 0.19 0.07 100.79	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 4.71 9.07 0.15 0.04 0.18 100.68	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47 8.99 0.15 0.11 0.17 100.92	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.00 0.00 4.21 9.41 0.30 0.06 0.00 101.40	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 0.26 0.00 4.82 8.91 0.19 0.11 0.02 101.88	Porphyry Rim/7 Inc 62.88 0.03 0.13 0.05 0.00 5.26 8.81 0.38 0.05 0.00 101.44	Porphyry Core/8 pheno 63.65 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86 0.30 0.00 0.00 100.71	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 5.69 8.40 0.05 0.01 0.00 99.29	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.00 0.00 8.63 6.63 0.13 0.00 0.00 100.35
Sinple Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O BaO Total Si	Core/3 61.33 0.00 24.85 0.12 0.04 0.00 0.00 6.46 7.96 0.11 0.06 0.18 100.68	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 0.00 7.75 7.23 0.17 0.15 0.05 101.14	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13 0.06 0.10 100.55 2.68	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 6.18 8.17 0.09 0.19 0.07 100.79 2.72	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 4.71 9.07 0.15 0.04 0.18 100.68	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47 8.99 0.15 0.11 0.17 100.92 2.80	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.00 0.00 4.21 9.41 0.30 0.06 0.00 101.40 2.80	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 4.82 8.91 0.19 0.11 0.02 101.88 2.78	Porphyry Rim/7 Inc 62.88 0.03 0.13 0.05 0.00 5.26 8.81 0.38 0.05 0.00 101.44 2.76	Porphyry Core/8 pheno 63.65 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86 0.30 0.00 0.00 100.71	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 5.69 8.40 0.05 0.01 0.00 99.29 2.74	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.00 0.00 8.63 6.63 0.13 0.00 0.00 100.35
Sinple Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O BaO Total Si Ti	Core/3 61.33 0.00 24.85 0.12 0.04 0.00 6.46 7.96 0.11 0.06 0.18 100.68	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 7.75 7.23 0.17 0.15 0.05 101.14 2.64 0.00	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13 0.06 0.10 100.55 2.68 0.00	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 6.18 8.17 0.09 0.19 0.07 100.79 2.72 0.00	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 4.71 9.07 0.15 0.04 0.18 100.68 2.79 0.00	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47 8.99 0.15 0.11 0.17 100.92 2.80 0.00	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.00 0.00 4.21 9.41 0.30 0.06 0.00 101.40 2.80 0.22	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 4.82 8.91 0.19 0.11 0.02 101.88 2.78 0.00	Porphyry Rim/7 inc 62.88 0.03 0.13 0.05 0.00 5.26 8.81 0.38 0.05 0.00 101.44 2.76 0.00	Porphyry Core/8 pheno 63.65 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86 0.30 0.00 0.00 100.71	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 5.69 8.40 9.005 0.01 0.00 99.29 2.74 0.00	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.00 8.63 6.63 0.13 0.00 100.35 2.61 0.00
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O BaO Total Si Ti Al	Core/3 61,33 0.00 24,85 0.12 0.04 0.00 6.46 7.96 0.11 0.06 0.18 100.68 2.71 0.00 1.29	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 7.75 7.23 0.17 0.15 0.05 101.14 2.64 0.00 1.36	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13 0.06 0.10 100.55 2.68 0.00 1.31	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 6.18 8.17 0.09 0.19 0.07 100.79 2.72 0.00 1.21	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 4.71 9.07 0.15 0.04 0.18 100.68 2.79 0.00 1.21	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47 8.99 0.15 0.11 0.17 100.92 2.80 0.00 1.22	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.00 4.21 9.41 0.00 0.00 4.21 9.41 0.30 0.06 0.00 101.40 2.80 0.22 1.19	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 4.82 8.91 0.19 0.11 0.02 101.88 2.78 0.00 1.22	Porphyry Rim/7 Inc 62.88 0.03 0.13 0.05 0.00 5.26 8.81 0.38 0.05 0.00 101.44 2.76 0.00 1.24	Porphyry Core/8 pheno 63.65 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86 0.30 0.00 0.00 100.71 2.79 0.00 1.22	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 5.69 8.40 9.005 0.01 0.00 99.29 2.74 0.00 1.26	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.00 8.63 6.63 0.13 0.00 100.35 2.61 0.00 1.14
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O BaO Total Si Ti Al Cr	Core/3 61.33 0.00 24.85 0.12 0.04 0.00 6.46 7.96 0.11 0.06 0.18 100.68 2.71 0.00 1.29 0.00	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 7.75 7.23 0.17 0.15 0.05 101.14 2.64 0.00 1.36 0.00	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13 0.06 0.10 100.55 2.68 0.00 1.31 0.00	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 6.18 8.17 0.09 0.19 0.07 100.79 2.72 0.00 1.21 0.00	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 4.71 9.07 0.15 0.04 0.18 100.68 2.79 0.00 1.21 0.00	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47 8.99 0.15 0.11 0.17 100.92 2.80 0.00 1.22 0.00	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.00 0.00 4.21 9.41 0.30 0.06 0.00 101.40 2.80 0.22 1.19 0.00 0.22	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 4.82 8.91 0.19 0.11 0.02 101.88 2.78 0.00 1.22 0.00	Porphyry Rim/7 Inc 62.88 0.03 0.13 0.05 0.00 5.26 8.81 0.38 0.05 0.00 101.44 2.76 0.00 1.24 0.00	Porphyry Core/8 pheno 63.65 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86 0.30 0.00 0.00 100.71 2.79 0.00 1.22 0.00	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 5.69 8.40 0.05 0.01 0.00 99.29 2.74 0.00 1.26 0.00	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.00 8.63 6.63 0.13 0.00 100.35 2.61 0.00 1.14 0.00
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O BaO Total Si Ti Al Cr Fe	Core/3 61.33 0.00 24.85 0.12 0.04 0.00 6.46 7.96 0.11 0.06 0.18 100.68 2.71 0.00 1.29 0.00 0.00	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 7.75 7.23 0.17 0.15 0.05 101.14 2.64 0.00 1.36 0.00 0.00 0.00	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13 0.06 0.10 100.55 2.68 0.00 1.31 0.00 0.00	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 6.18 8.17 0.09 0.19 0.07 100.79 2.72 0.00 1.21 0.00 0.00 0.00	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 4.71 9.07 0.15 0.04 0.18 100.68 2.79 0.00 1.21 0.00 0.00	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47 8.99 0.15 0.11 0.17 100.92 2.80 0.00 1.22 0.00 0.00	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.00 0.00 4.21 9.41 0.30 0.06 0.00 101.40 2.80 0.22 1.19 0.00 0.00	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 4.82 8.91 0.19 0.11 0.02 101.88 2.78 0.00 1.22 0.00 1.22 0.00 0.01	Porphyry Rim/7 Inc 62.88 0.03 23.95 0.03 0.13 0.05 0.00 5.26 8.81 0.38 0.05 0.00 101.44 2.76 0.00 1.24 0.00 0.01	Porphyry Core/8 pheno 63.65 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86 0.30 0.00 0.00 100.71 2.79 0.00 1.22 0.00 1.22 0.00	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 5.69 8.40 0.05 0.01 0.00 99.29 2.74 0.00 1.26 0.00 0.00	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.19 0.00 0.00 8.63 6.63 0.13 0.00 0.00 100.35 2.61 0.00 1.14 0.00 0.01
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O BaO Total Si Ti Al Cr Fe Mn	Core/3 61.33 0.00 24.85 0.12 0.04 0.00 6.46 7.96 0.11 0.06 0.18 100.68 2.71 0.00 1.29 0.00 0.00 0.00 0.00	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 7.75 7.23 0.17 0.15 0.05 101.14 2.64 0.00 1.36 0.00 0.00 0.00 0.00	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13 0.06 0.10 100.55 2.68 0.00 1.31 0.00 0.00 0.00 0.00	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 6.18 8.17 0.09 0.19 0.07 100.79 2.72 0.00 1.21 0.00 0.00 0.00 0.00	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 4.71 9.07 0.15 0.04 0.18 100.68 2.79 0.00 1.21 0.00 0.00 0.00	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47 8.99 0.15 0.11 0.17 100.92 2.80 0.00 1.22 0.00 0.00 0.00 0.00	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.00 0.00 4.21 9.41 0.30 0.06 0.00 101.40 2.80 0.22 1.19 0.00 0.00 0.00 0.00 0.00	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 4.82 8.91 0.19 0.11 0.02 101.88 2.78 0.00 1.22 0.00 1.22 0.00 0.01 0.00	Porphyry Rim/7 Inc 62.88 0.03 23.95 0.03 0.13 0.05 0.00 5.26 8.81 0.38 0.05 0.00 101.44 2.76 0.00 1.24 0.00 1.24 0.00 0.01 0.00	Porphyry Core/8 pheno 63.65 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86 0.30 0.00 0.00 100.71 2.79 0.00 1.22 0.00 1.22 0.00 0.00 0.00	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 5.69 8.40 0.05 0.01 0.00 99.29 2.74 0.00 1.26 0.00 0.00 0.00 0.00	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.00 8.63 6.63 0.13 0.00 0.00 100.35 2.61 0.00 1.14 0.00 0.01 0.00
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O BaO Total Si Ti Al Cr Fe Mn Mg Ca	Core/3 61.33 0.00 24.85 0.12 0.04 0.00 6.46 7.96 0.11 0.06 0.18 100.68 2.71 0.00 1.29 0.00 0.00 0.00 0.00 0.31	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 7.75 7.23 0.17 0.15 0.05 101.14 2.64 0.00 1.36 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.37	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13 0.06 0.10 100.55 2.68 0.00 1.31 0.00 0.00 0.00 0.00 0.32	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 6.18 8.17 0.09 0.19 0.07 100.79 2.72 0.00 1.21 0.00 0.00 0.00 0.00 0.00 0.29	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 4.71 9.07 0.15 0.04 0.18 100.68 2.79 0.00 1.21 0.00 0.00 0.00 0.00 0.22	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47 8.99 0.15 0.11 0.17 100.92 2.80 0.00 1.22 0.00 0.00 0.00 0.00 0.00 0.21	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.00 0.00 4.21 9.41 0.30 0.06 0.00 101.40 2.80 0.22 1.19 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 4.82 8.91 0.19 0.11 0.02 101.88 2.78 0.00 1.22 0.00 1.22 0.00 0.01 0.00 0.23	Porphyry Rim/7 Inc 62.88 0.03 23.95 0.03 0.13 0.05 0.00 5.26 8.81 0.38 0.05 0.00 101.44 2.76 0.00 1.24 0.00 1.24 0.00 0.01 0.00 0.25	Porphyry Core/8 pheno 63.65 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86 0.30 0.00 0.00 100.71 2.79 0.00 1.22 0.00 1.22 0.00 0.00 0.00 0.00	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 5.69 8.40 0.05 0.01 0.00 99.29 2.74 0.00 1.26 0.00 1.26 0.00 0.00 0.00 0.00 0.27	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.19 0.00 0.00 8.63 6.63 0.13 0.00 0.00 100.35 2.61 0.00 1.14 0.00 0.01 0.00 0.01 0.00 0.41
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O BaO Total Si Ti Al Cr Fe Mn Mg Ca NiO NiO NiO NiO NiO NiO NiO NiO NiO NiO	Core/3 61.33 0.00 24.85 0.12 0.04 0.00 6.46 7.96 0.11 0.06 0.18 100.68 2.71 0.00 1.29 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.68	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 7.75 7.23 0.17 0.15 0.05 101.14 2.64 0.00 1.36 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.05 101.14	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13 0.06 0.10 100.55 2.68 0.00 1.31 0.00 0.00 0.00 0.00 0.02 0.67	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 6.18 8.17 0.09 0.19 0.07 100.79 2.72 0.00 1.21 0.00 0.00 0.00 0.00 0.00 0.0	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 4.71 9.07 0.15 0.04 0.18 100.68 2.79 0.00 1.21 0.00 0.00 0.00 0.00 0.00 0.22 0.77	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.03 0.00 4.47 8.99 0.15 0.11 0.17 100.92 2.80 0.00 1.22 0.00 0.00 0.00 0.00 0.00 0.0	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.00 4.21 9.41 0.30 0.06 0.00 101.40 2.80 0.22 1.19 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 4.82 8.91 0.19 0.11 0.02 101.88 2.78 0.00 1.22 0.00 1.22 0.00 0.01 0.00 0.23 5.00 0.00 2.78 0.00 2.78 0.00 2.78 0.00 2.78 0.00 2.78 0.00 2.78 0.00 2.78 0.00 2.78 0.00 2.78 0.00 2.78 0.00 0.26 0.00 0.26 0.00 2.85 0.00 0.26 0.00 0.26 0.00 2.85 0.00 0.26 0.00 2.85 0.00 0.26 0.00 0.26 0.00 0.26 0.00 0.26 0.00 0.26 0.00 0.26 0.00 0.26 0.00 0.00	Porphyry Rim/7 inc 62.88 0.03 23.95 0.03 0.13 0.05 0.00 5.26 8.81 0.38 0.05 0.00 101.44 2.76 0.00 1.24 0.00 1.24 0.00 0.05 0.05 0.00 1.24 0.00 0.25 0.75	Porphyry Core/8 pheno 63.65 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86 0.30 0.00 0.00 100.71 2.79 0.00 1.22 0.00 1.22 0.00 0.00 0.00 0.00	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 5.69 8.40 0.05 0.01 0.00 99.29 2.74 0.00 1.26 0.00 1.26 0.00 0.00 0.00 0.00 0.27 0.73	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.19 0.00 8.63 6.63 0.13 0.00 100.35 2.61 0.00 1.14 0.00 0.01 0.00 0.01 0.00 0.41 0.57
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO NiO Na2O K2O BaO Total Si Ti Al Cr Fe Mn Mg Ca NiO Na2O K2O BaO Total Ni Na NiO Na2O NiO Na2O NiO NiO NiO NiO NiO NiO NiO NiO NiO Ni	2.71 0.00 2.71 0.00 2.71 0.06 0.18 100.68 2.71 0.00 1.29 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 7.75 7.23 0.17 0.15 0.05 101.14 2.64 0.00 1.36 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.05 101.14	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13 0.06 0.10 100.55 2.68 0.00 1.31 0.00 0.00 0.00 0.00 0.00 0.00	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 6.18 8.17 0.09 0.19 0.07 100.79 2.72 0.00 1.21 0.00 0.00 0.00 0.00 0.00 0.0	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 4.71 9.07 0.15 0.04 0.18 100.68 2.79 0.00 1.21 0.00 0.00 0.00 0.00 0.00 0.00	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47 8.99 0.15 0.11 0.17 100.92 2.80 0.00 1.22 0.00 0.00 0.00 0.00 0.00 0.0	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.00 0.00 4.21 9.41 0.30 0.06 0.00 101.40 2.80 0.22 1.19 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 4.82 8.91 0.19 0.11 0.02 101.88 2.78 0.00 1.22 0.00 1.22 0.00 0.01 0.00 0.23 0.00	Porphyry Rim/7 inc 62.88 0.03 23.95 0.03 0.13 0.05 0.00 5.26 8.81 0.38 0.05 0.00 101.44 2.76 0.00 1.24 0.00 1.24 0.00 0.25 0.75 0.02	Porphyry Core/8 pheno 63.65 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86 0.30 0.00 0.00 100.71 2.79 0.00 1.22 0.00 1.22 0.00 0.00 0.00 0.00	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 5.69 8.40 0.05 0.01 0.00 99.29 2.74 0.00 1.26 0.00 1.26 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.19 0.00 8.63 6.63 0.13 0.00 100.35 2.61 0.00 1.14 0.00 0.01 0.00 0.01 0.00 0.41 0.57 0.01
Sinple Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO Na2O K2O BaO Total Si Ti Al Cr Fe Mn Mg Ca NiO Na2O K2O BaO Total Xi K	2.71 0.00 2.71 0.00 2.71 0.06 0.18 100.68 2.71 0.00 1.29 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	G3 Rim/3 59.88 0.00 26.12 0.05 0.03 0.00 7.75 7.23 0.17 0.15 0.05 101.14 2.64 0.00 1.36 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.05 101.14	G3 Core/4 60.60 0.02 25.04 0.07 0.06 0.02 0.00 6.78 7.81 0.13 0.06 0.10 100.55 2.68 0.00 1.31 0.00 0.00 0.00 0.00 0.00 0.00	G3 Half/4 61.70 0.00 24.72 0.08 0.01 0.00 6.18 8.17 0.09 0.19 0.07 100.79 2.72 0.00 1.21 0.00 1.21 0.00 0.00 0.00 0.0	G3 Rim/4 63.56 0.01 23.29 0.02 0.04 0.00 4.71 9.07 0.15 0.04 0.18 100.68 2.79 0.00 1.21 0.00 0.00 0.00 0.00 0.00 0.00	Porphyry Core/6 inc 63.74 0.00 23.50 0.00 0.09 0.03 0.00 4.47 8.99 0.15 0.11 0.17 100.92 2.80 0.00 1.22 0.00 0.00 0.00 0.00 0.00 0.0	Porphyry Rim/6 inc 64.19 0.08 23.15 0.12 0.00 0.00 4.21 9.41 0.30 0.06 0.00 101.40 2.80 0.22 1.19 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Porphyry Core/7 inc 63.92 0.00 23.85 0.00 0.26 0.00 4.82 8.91 0.19 0.11 0.02 101.88 2.78 0.00 1.22 0.00 1.22 0.00 0.01 0.00 0.23 0.76 0.01 0.00	Porphyry Rim/7 inc 62.88 0.03 23.95 0.03 0.13 0.05 0.00 5.26 8.81 0.38 0.05 0.00 101.44 2.76 0.00 1.24 0.00 1.24 0.00 0.25 0.75 0.02 0.00	Porphyry Core/8 pheno 63.65 0.00 23.54 0.07 0.03 0.09 0.00 4.68 8.86 0.30 0.00 0.00 100.71 2.79 0.00 1.22 0.00 1.22 0.00 0.00 0.00 0.00	Porphyry Core/1 Inc 61.17 0.00 23.83 0.07 0.10 0.00 5.69 8.40 0.05 0.01 0.00 99.29 2.74 0.00 1.26 0.00 1.26 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Porphyry Core/2 pheno 58.38 0.09 26.64 0.00 0.19 0.00 8.63 6.63 0.13 0.00 100.35 2.61 0.00 1.14 0.00 0.01 0.00 0.01 0.00 0.41 0.57 0.01 0.00

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#### APPENDIX 4.1 : CONTINUED PLAGIOCLASE ROSSES

Sample Location	G2 Core/2	G2 Core/3	G2 Core/4	G2 Rim/4	G2 Core/5	G2 Rím/5	G2 Core/6	G2 Rim/6	G2 Rim/6	G2 Core/7	G2 Rim/7	G2 Core/8
SiO2	63.73	64.66	64.09	64.33	63.71	64.09	64.99	64.67	68.55	65.20	64.38	62.85
TiO2	0.07	0.07	0.00	0.00	0.07	0.06	0.03	0.00	0.03	0.01	0.04	0.00
AI2O3	22.18	21.87	22.29	21.71	22.74	22.60	21.88	21.58	19.51	21.20	21.57	23.20
Cr2O3	0.08	0.08	0.10	0.07	0.04	0.00	0.00	0.00	0.07	0.00	0.02	0.02
FeO	0.00	0.01	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MnO	0.00	0.01	0.00	0.13	0.00	0.07	0.00	0.00	0.00	0.08	0.00	0.00
MgO	0.03	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00
CaO	3.44	2.82	3.48	2.89	3.59	3.55	3.03	2.59	0.10	2.25	2.84	4.50
NiO	0.04	0.14	0.08	0.17	0.18	0.04	0.00	0.00	0.00	0.00	0.00	0.00
Na2O	9.50	9.91	7.59	9.95	9.51	9,52	9.89	10.07	11.64	10.41	9.94	9.07
K2O	0.19	0.14	0.20	0.17	0.27	0.19	0.09	0.13	0.06	0.05	0.11	0.19
BaO	0.00	0.01	0.06	0.17	0.01	0.02	0.00	0.02	0.00	0.00	0.02	0.00
Iotal	99.25	99.40	99.69	88.30	99.93	100.19	99.54	99.06	99.69	99.21	98.93	99.83
									* * * #*			
Si	2.84	2.87	2.84	2.86	2.82	2.82	2.87	2.88	3.00	2.90	2.87	2.78
Ti	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Al	1.16	1.14	1.16	1.14	1.19	1.17	1.14	1.13	1.01	1.11	1.13	1.22
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mn	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca	0.16	0.13	0.17	0.14	0.17	0.17	0.14	0.12	0.01	0.11	0.14	0.31
N	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ina. V	0.82	0.05	0.82	0.00	0.82	0.01	0.85	0.87	0.99	0.90	0.86	0.78
N	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.00	0.00	0.01	0.00
Da.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
											2012 - 19 2012 - 19	
Samole	G2	G2	G2	G2	G1	G1	G1	G1	G1	Gt		
Location	Half/8	Rim/8	Core/9	Rim/9	Core/1	Half/1	Rim/1	Core/2	Rim/2	Core/3		
0:00	04.00	00.05	04.04		64 50	64.60	00 DE	64.40	07.47		月 建黄油 1 月	
5102	64.30	66.05	04.04	05.00	04.50	04.02	00.00	04.19	07.47	64.92		
102	0.00	0.10	0.00	0.00	00.00	22.00	0.01	0.01	0.00	0.00		
AI203	22.3/	21.53	22.42	6 82	0 11	ZZ.00	61.14	23.73	21.20	22.40		
E-0	0.04	0.00	0.03	0.02	0.11	0.13	0.00	0.09	0.00	0.00		
MnO	0.05	0.00	0.00	0.00	0.08	0.00	0.10	0.00	0.00	0.00		
MaQ	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
0-0	3.63	2 46	3 45	2 81	4.02	3.51	2.01	4 84	2 07	3.84		
NIO	0.00	0.00	0.08	0.22	n.d	n.d	n.d	n.d	n.d	n.d		
Na2O	9.60	10.32	9.46	10.15	9.38	9.52	10.87	9.13	10.65	9.65		
K20	0.17	0.07	0.16	0.06	0.29	0.29	0.31	0.10	0.10	0.23		
BaO	0.01	0.00	0.06	0.12	0.00	0.03	0.00	0.06	0.10	0.00		
Total	100.24	100.36	100.12	100.66	100.61	99.83	101.15	101.97	101.38	100.70	nd de s	
an ta dha Taon a bha	с. 1.98				a karata k			Na sa			1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	
	• .					1.11	i i i	1. 1.				
Si	2.84	2.89	2.85	2.87	2.83	2.86	2.91	2.79	2.92	2.85		
TI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Al	1.16	1.11	1.16	1.13	1.16	1.15	1.09	1.22	1.09	1.16		
Ur .	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Me in	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00		
ivin Mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
ivig Co	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Ni	0.17	0.06	0.10	0.15	. nd	n d	n d	กล่	o iv	0.10 'n d'	1.10	
Na	0.00	0.00	0.81	0.86	0.80	0.82	0.92	0.77	0.90	0.82		
K	0.01	0.00	0.01	0.00	0.02	0.02	0.02	0.01	0.01	0.01	n Notae i	
Ba	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
							- 1	2 A 1	<u></u>			
										1.1.1.		

### APPENDIX 4.1 : CONTINUED PLAGIOCLASE TRAWENAGH BAY

Sample Location	TRA4 Rim/1	TRA4 Core/1	TRA4 Rim/2	TRA4 Core/2	TRA4 Core/3	TRA4 Half/4	TRA4 Rim/4	TRA4 Core/4	TRA4 Half/5	TRA4 Core/6	TRA4 Rim/7	TRA4 Core/7
SiO2	68.27	67.21	67.51	67.04	67.34	67.74	67.44	67.35	67.76	68.15	67.92	68.72
TiO2	0.00	0.09	0.05	0.04	0.05	0.03	0.00	0.07	0.01	0.00	0.03	0.00
AI2O3	19.77	20.72	20.08	21.02	20.16	21.03	20.78	20.74	20.11	19.69	19.66	20.32
Cr2O3	0.03	0.00	0.00	0.03	0.00	0.02	0.05	0.07	0.00	0.00	0.00	0.00
FeO	0.00	0.04	0.06	0.03	0.13	0.00	0.00	0.00	0.00	0.03	0.07	0.20
MnO	0.00	0.00	0.02	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NiO	0.30	1.04	0.00	1.59	1.00	1.41	0.14	1.52	0.05	0.44	0.40	0.56
No2O	11 72	10.05	11 33	10.00	11 02	10.09	44 45	10.07	11 22	11 20	11 01	0.10
K2O	0.07	0.03	0.08	0.094	0.03	0.08	0.02	0.13	0.05	0.00	0.04	0.02
BaO	0.18	0.00	0.00	0.00	0.18	0.00	0.12	0.00	0.07	0.00	0.03	0.00
P2O5	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.05	0.00	0.00
Total	100.34	100.07	99.79	100.65	100.04	101.04	100.82	100.19	100.16	99.76	99.54	101.00
Si	2.99	2.94	2.97	2.92	2.96	2.94	2.93	2.94	2.98	2.99	2.99	2.97
Ti	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AL	1.02	0.01	1.04	1.08	1.05	1.07	1.07	1.07	1.04	1.09	1.02	1.04
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fe	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Ma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
My Co	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ni	0.01	0.07	0.03	0.07	0.05	0.07	0.00	0.07	0.03	0.02	0.02	0.03
Na	1.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
ĸ	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Ba	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sample	TRA4	TRA4	TRA4	TRA2	TRA2	TRA2	TRA5	TRA5	TRA5	TRA5	TRA3	
Location	Rim/8	Half/8	Core/8	Rim/1	Core/2	Rim/2	Core/1	Rim/1	Core/2	Rim/2	Rim/3	an san Baratan
SiO2	68 10	66.03	67.37	62 86	64.03	64 28	66 63	64 60	63 74	65 61	67 70	
TIO2	00.10	0.00	0.09	0.00	0.00	0.00	0.02	0.07	0.04	0.01	0.06	
AI203	20.12	20.55	20.79	24.08	23.55	23.84	22.00	22.52	22.47	21.82	20.51	
Cr2O3	0.04	0.07	0.00	0.00	0.00	0.00	0.05	0.05	0.00	0.08	0.00	
FeO	0.04	0.00	0.15	0.02	0.11	0.31	0.00	0.12	0.08	0.11	0.06	
MnO	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.06	0.00	t tanan sa t
MgO	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	
CaO	0.60	1.55	1.06	5.37	4.43	4.42	2.83	3.43	4.25	3.27	1.44	
NiO	0.12	0.06	0.07	0.04	0.00	0.23	n.d	n.d	n.d	n.đ	• <b>n.d</b> 🕓	
Na2O	11.32	10.84	11.02	8.70	9.33	9.32	10.25	9.93	9.20	10.20	10.76	
K20	0.06	0.08	0.02	0.20	0.17	0.15	0.26	0.17	0.15	0.16	0.13	
BaO	0.17	0.14	0.00	0.00	0.07	0.17	0.00	0.00	0.00	0.00	0.00	1 5 F.C.
P205	100.00	0.00	400.00	100.00	101.00	0.00	100.32	0.17	0.09	0.27	0.00	
TOTAL	100.34	99.31	100.23	100.93	101.29	102.72	102.08	100.36	99.99	101.16	100.42	
9	9 97	202	9 04	9 76		0 70	9 87	9 84	0 00	9 80	9 05	
ся T1 :	2.9/	2.83	0.00	<u>6.70</u>	0.00	0.00	0.00	£.04	2.03	¢.00	6.90	
Al	1 04	1 08	1.07	1 25	1.91	1 22	1.19	1 17	1 17	1 1 2	1 05	
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Fe	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	. 16a
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	$= \int_{\Omega} d x  d $
Mg	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	
Ca												
	0.03	0.07	0.05	0.25	0.21	0.21	0.13	0.16	0.20	0.15	0.07	
Ni	0.03	0.07 0.00	0.05 0.00	0.25 0.00	0.21	0.21 0.01	0.13 0.86	0.16 0.83	0.20	0.15 0.86	0.07 0.00	ana Angela Angela
Ni Na	0.03 0.00 0.96	0.07 0.00 0.93	0.05 0.00 0.93	0.25 0.00 0.74	0.21 0.00 0.79	0.21 0.01 0.78	0.13 0.86 0.01	0.16 0.83 0.01	0.20 0.79 0.01	0.15 0.86 0.01	0.07 0.00 0.91	
NI Na K	0.03 0.00 0.96 0.00	0.07 0.00 0.93 0.01	0.05 0.00 0.93 0.00	0.25 0.00 0.74 0.01	0.21 0.00 0.79 0.01	0.21 0.01 0.78 0.01	0.13 0.86 0.01 0.00	0.16 0.83 0.01 0.00	0.20 0.79 0.01 0.00	0.15 0.86 0.01 0.00	0.07 0.00 0.91 0.01	

#### APPENDIX 4.1 : CONTINUED PLAGIOCLASE TRAWENAGH BAY

Sample	TRA2	TRA2	TRA2	TRA2	TRA2	TRA2	TRA2	TRA2	TRA3	TRA3	TRA3	TRA3
Location	C019/3	niii/ə	0018/4		OUIE/5	run#3	0018/0	niii/u	0018/1		0010/2	F100/2
SiO2	62.49	61.86	62.78	61.19	63.93	63.21	62.80	63.07	69.14	68.80	68.23	68.32
TiO2	0.00	0.03	0.00	0.07	0.00	0.08	0.00	0.00	0.04	0.00	0.00	0.08
AI2O3	23.79	23.36	22.58	23.55	22.90	24.27	23.87	23.96	19.76	19.97	19.85	19.73
Cr2O3	0.04	0.00	0.01	0.02	0.04	0.03	0.00	0.00	0.01	0.00	0.00	0.07
FeO	0.01	0.08	0.00	0.00	0.04	0.12	0.03	0.00	0.00	0.08	0.02	0.00
MnO	0.00	0.04	0.00	0.05	0.00	0.00	0.02	0.06	0.03	0.03	0.06	0.04
MgO	0.00	0.00	0.00	0.06	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
CaO	4.93	4.94	3.99	5.03	3.91	5.12	5.16	4.92	0.26	0.42	0.82	0.71
NIO	0.00	0.11	0.00	0.04	0.00	0.03	0.17	0.00	n.d	n.d	n.d	n.d
Na2O	8.71	8.61	9.30	8.56	9.42	8.75	8.81	8.76	11.68	11.80	11.18	11.37
K2O	0.14	0.08	0.11	0.09	0.23	0.11	0.13	0.13	0.09	0.08	0.41	0.09
BaO	0.00	0.00	0.10	0.00	0.16	0.00	0.17	0.00	0.00	0.22	0.00	0.00
Total	100.11	99.11	98.87	98.66	100.28	101.47	100.90	100.41	100.84	100.90	100.32	100.15
	2			·								
Si	2.77	2.77	2.81	2.75	2.82	2.76	2.76	2.78	2.99	2.99	2.98	2.98
Ti	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Al	1.24	1.23	1.19	1.25	1.19	1.25	1.24	1.24	1.01	1.01	1.02	1.01
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca	0.23	0.24	0.19	0.24	0.19	0.24	0.24	0.23	0.01	0.02	0.04	0.03
Ni	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Na	0.75	0.75	0.81	0.75	0.81	0.74	0.75	0.75	0.98	0.99	0.95	0.96
К	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.02	0.01
Ba	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

# PLAGIOCLASE MAIN DONEGAL

Sample Location	DON4 Core/1	DON4 Rim/1	DON4 Core/2	DON4 Rim/2	DON4 Rim/2	DON4 Core/3	DON4 Core/3	267MDG Core/1	267MDG Half/1	267MDG Rim/1	267MDG Core/2	267MDG Rim/2
SIO2	61.99	62.77	63.46	63.19	62.50	62.59	62.77	62.88	62.88	63.54	62.36	64.07
TiO2	0.11	0.03	0.12	0.01	0.00	0.00	0.00	0.06	0.00	0.00	0.02	0.10
AI2O3	23.66	22.78	23.14	23.45	23.53	23.82	23.54	23.76	23.33	22.55	23.86	23.11
Cr2O3	0.04	0.00	0.00	0.02	0.00	0.06	0.00	0.10	0.08	0.02	0.15	0.14
FeO	0.05	0.03	0.00	0.09	0.01	0.04	0.07	0.00	0.00	0.09	0.05	0.01
MnO	0.07	0.00	0.06	0.06	0.00	0.00	0.00	0.11	0.00	0.01	0.00	0.00
MgO	0.00	0.00	0.00	0.00	0.00	0,00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	5.20	4.49	4.53	4.84	5.06	5.43	5.01	5.31	5.03	4.33	5.45	4.33
Na2O	8.61	9.03	8.68	8.90	8.64	8.85	8.90	7.77	8.73	9.44	8.67	9.24
K2O	0.17	0.15	0.39	0.21	0.33	0.22	0.09	0.17	0.17	0.18	0.13	0.13
BaO	0.00	0.07	0.00	0.05	0.20	0.32	0.18	0.01	0.18	0.13	0.01	0.00
P2O5	0.07	0.00	0.08	0.08	0.18	0.00	0.00	0.06	0.07	0.08	0.00	0.07
Total	99.87	99.34	100.38	100.55	100.28	101.03	100.15	100.93	100.42	100.29	100.40	100.87
S	2.76	2.81	2.81	2.79	2.78	2.76	2.78	2.76	2.79	2.82	2.76	2.81
Ti	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AI	1.24	1.20	1.21	1.22	1.23	1.24	1.23	1.23	1.22	1.18	1.24	1.19
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Fe	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca	0.25	0.22	0.21	0.23	0.24	0.26	0.24	0.25	0.24	0.21	0.26	0.20
Na	0.74	0.78	0.74	0.76	0.74	0.76	0.76	0.75	0.75	0.81	0.72	0.75
ĸ	0.01	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Ba	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
٩	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00

# APPENDIX 4.1 : CONTINUED PLAGIOCLASE MAIN DONEGAL

Sample Location	267MDG Core/3	267MDG Rim/3	267MDG Core/4	267MDG Rim/4	267MDG Core/5	267MDG Rim/5	DON16 Rim/1	DON16 Rim/2	DON16 Core/3	DON16 Rim/3	DON16 Core/4	DON16 Rim/4
SiO2	63.79	69.43	63.01	64.63	63.36	65.00	63.39	63.33	63.18	64.86	63.07	62.82
TiO2	0.00	0.08	0.07	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00
A12O3	22.76	19.73	23.07	23.39	23.75	22.58	23.16	22.98	23.21	22.81	22.83	23.13
Cr2O3	0.02	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.10	0.01	0.00	0.04
FeO	0.00	0.05	0.12	0.00	0.05	0.03	0.12	0.00	0.05	0.07	0.00	0.02
MnO	0.00	0.09	0.01	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.07	0.00
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	4.20	3.29	4.93	4.35	5.12	3.80	4.54	4.50	4.58	3.69	4.57	4.71
Na2O	9.08	8.54	8.72	9.36	9.25	9,46	9.04	8.91	8.86	9.59	9.03	8.85
K2O	0.22	0.06	0.25	0.16	0.17	0.18	0.18	0.22	0.20	0.26	0.07	0.25
BaO	0.02	0.00	0.00	0.00	0.00	0.09	0.24	0.00	0.00	0.14	0.03	0.10
P2O5	0.02	0.06	0.10	0.36	0.11	0.12	0.09	0.10	0.18	0.15	0.12	0.00
Total	99.79	100.96	100.10	102.16	101.78	100.77	100.35	99.75	100.09	101.12	99.83	99.90
Si	2.83	3.00	2.80	2.80	2.76	2.84	2.80	2.80	2.79	2.83	2.81	2.79
TI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AL	1.19	1.00	1.21	1.19	1.22	1.16	1.21	1.20	1.21	1.17	1.20	1.21
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca	0.20	0.15	0.23	0.20	0.24	0.18	0.22	0.21	0.22	0.17	0.22	0.22
Na	0.78	0.72	0,75	0.78	0.78	0.80	0.77	0.77	0.76	0.81	0.78	0.76
κ	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.00	0.01
Ba	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ρ	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00
*		an an Ar An an An Ar		ta da Antonio				12 - 1 - 1 1 - 1 - 1 1 - 1 - 1	an Arti Artic	1200	an di Simi Ang	

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#### APPENDIX 4.2. K FELDSPAR ARDARA

Sample Location	ARD4	ARD3	ARD3	ARD3	ARD3	ARD3	ARD3 Core	ARD3 Rim	ARD3	ARD3 Core	ARD3 Rim	ARD1D
SiO2	65.22	65.35	65.28	63.21	64.93	64.68	63.30	64.88	64.75	65.18	65.23	64.27
TiO2	0.00	0.00	0.00	0.02	0.00	0.00	0.08	0.10	0.02	0.04	0.06	0.00
AI2O3	18.46	18.75	18.50	18.89	18.45	18.49	18.35	18.50	18.72	18.51	18.25	18.18
Cr2O3	0.00	0.04	0.17	0.00	0.10	0.00	0.20	0.00	0.00	0.06	0.04	0.00
FeO	0.00	0.01	0.01	0.10	0.01	0.09	0.10	0.08	0.00	0.00	0.09	0.00
MmO	0.00	0.00	0.00	0.10	0.01	0.09	0.00	0.08	0.04	0.05	0.00	0.00
CaO	0.00	0.10	0.14	0.01	0.00	0.00	0.02	0.11	0.10	0.15	0.00	0.00
NIO	0.03	0.05	0.15	0.00	0.11	0.16	0.00	0.00	0.00	0.05	0.00	n.d
Na2O	0.53	0.97	0.99	0.70	0.73	0.70	0.92	0.70	0.83	0.90	0.81	0.66
K2O	15.79	15.42	15.50	15.10	15.60	15.33	15.23	15.43	15.50	15.47	15.15	15.23
BaO	0.48	0.46	0.40	0.46	0.53	0.31	0.12	0.29	0.35	0.57	0.39	0.68
P2O5	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
Total	100.49	101.25	101.04	98.44	100.34	99.87	99.32	99.96	100.28	100.91	99.90	99.16
	t s t s s									a ta		
Si	3.00	2.99	2.99	2.97	3.00	2.99	2.99	3.00	2.99	2.99	3.01	3.01
TI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A)	1.00	1.01	1.00	1.05	1.00	1.01	1.01	1.01	1.02	1.00	0.99	1.00
Cr En	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Mo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Ca	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00
NI	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	n.d
Na	0.05	0.09	0.09	0.06	0.07	0.06	0.08	0.06	0.07	0.08	0.07	0.23
к	0.93	0.90	0.91	0.91	0.92	0.91	0.91	0.91	0.91	0.91	0.89	0.91
Ba	0.01	0.01	0.01	0.01	0.01	0.91	0.00	0.01	0.01	0.01	0.01	0.01
P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Total	4.99	5.01	5.02	5.01	5.00	5.90	5.01	5.00	5.02	5.00	4.98	5.21
	n an							ing San an				
Sample	ARD1D	ARD1D	ARD1D	ARD10	ARD10	ARD4	ARD4	ABD4	ARD4	ARD4	ARD4	ARD4
Location			1.14	Core/2	Rim/2	Rim/1	Rim/1	?/2 thin strip	Core/3	Rim/3	Core/4	Rim/4
SIO2	64.84	63.09	64.04	64.89	65.01	65.04	65.04	65.33	65.11	64.88	66.33	65.50
TIO2	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.06	0.07	0.08
AI203	18.31	19.46	18.12	18.01	18.15	18.25	18.25	18.41	18.24	18.52	18.86	18.34
Cr2O3	0.00	0.06	0.06	0.00	0.00	0.05	0.05	0.00	0.00	0.04	0.02	0.06
FeO	0.00	0.05	0.10	0.00	0.03	0.11	0.11	0.01	0.02	0.07	0.00	0.16
MnO	0.12	0.00	0.02	0.03	0.11	0.05	0.05	0.00	0.06	0.01	0.00	0.06
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	* 0.00	0.01
NIO	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	. 0.07	0.00
Na2O	0.78	1.03	0.69	1.07	0.78	0.77	0.77	0.63	0.64	0.62	4.89	0.90
K20	15.18	14.77	15.26	15.20	15.70	15.74	15.74	15.79	15.46	15.88	9.57	15.38
BaO	0.55	0.58	0.65	0.28	0.51	0.24	0.24	0.56	0.88	0.46	0.69	0.56
P2O5	0.05	0.16	0.10	0.10	0.04	0.09	0.09	0.18	0.08	0.20	0.19	0.15
Total	99.92	99.22	99.00	99.58	99.94	100.10	100.10	100.59	100.15	100.58	100.32	101.07
		i i				1997 - 1997 -						
Si	3.01	2,95	3.00	3.02	3.01	3.00	3.00	3.00	3.01	2.99	2.99	3.00
ŤI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AI	1.00	1.07	1.00	0.99	0.99	0.99	0.99	1.00	0.99	1.00	1.00	0.99
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Mn	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NIG Ca	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ni	n.d	n.d	n.d	n.d	n.d	n.d.	0.00 n.d	0.00	00.00	n.d		00.0
Na	0.07	0.09	0.08	0.10	0.07	0.07	0.07	0.06	0.06	0.06	0.43	0.08
ĸ	0.90	0.88	0.91	0.90	0.93	0.93	0.93	0.93	0.91	0.93	0.55	0.90
Ba	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.02	0,01	0.01	0.01
<b>D</b>	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01

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#### APPENDIX 4.2 : CONTINUED K FELDSPAR ARDARA K FELDSPAR FANAD

Sample	ARD10 Core/1	ARD10 Bim/1	ARD10 Bim/1		FAN23 Core/1	FAN23 Bim/1	FAN23	FAN23 Bim/2	FAN23	FAN23	FAN23 Core/5	FAN23
Loodion	0010/1		11111/1		0016/1	1 (11)// 1	COLORE	· · · · · · · · · · · · · ·	Late	Late	0018/0	inan/o
SiO2	63.99	65.38	64.96	×.	62.72	65.30	61.75	64.24	65.33	65.74	62.39	63.65
TiO2	0.01	0.00	0.01		0.03	0.06	0.00	0.00	0.00	0.00	0.00	0.00
AI2O3	18.09	18.22	18.20		18.92	18.46	19.52	18.90	18.83	18.46	19.35	18.92
Cr2O3	0.02	0.02	0.07		0.11	0.00	0.00	0.12	0.00	0.04	0.03	0.00
FeO	0.11	0.12	0.09		0.11	0.04	0.21	0.07	0.19	0.16	0.15	0.21
MnO	0.00	0.11	0.03		0.00	0.05	0.00	0.08	0.00	0.01	0.00	0.00
MgO	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	0.00	0.00	0.00		0.00	0.00	0.09	0.07	0.00	0.00	0.07	0.01
Na2O	0.73	0.62	0.70		1.72	1.29	1.94	1.56	3.50	2.69	2.45	2.21
K2O -	15.27	15.91	15.73		13.01	14.73	12.34	13.62	11.43	13.10	11.41	12.23
BaO	0.78	0.15	0.16		3.11	0.49	4.27	2.59	1.07	0.45	4.74	3.30
P2O5	0.05	0.05	0.19		0.01	0.12	0.10	0.04	0.00	0.15	0.05	0.16
Total	99.05	100.25	99.86		99.73	100.39	99.98	100.94	99.94	100.56	100.31	100.11
Si	3.00	3.01	3.00		2.95	3.00	2.91	2.97	2.99	3.00	2.93	2.97
Ti	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AI	1.00	0.99	0.99		1.05	1.00	1.09	1.03	1.02	0.99	1.07	1.04
Cr	0.00	0.00	0.00		0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Fe	0.00	0.01	0.00		0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01
Mn	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mg	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca	0.00	0.00	0.00		0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Na	0.07	0.06	0.06		0.16	0.12	0.18	0.14	0.31	0.24	0.22	0.20
K	0.91	0.94	0.93		0.78	0.86	0.74	0.80	0.67	0.76	0.68	0.73
Ba	0.01	0.00	0.00		0.06	0.01	0.08	0.05	0.02	0.01	0.09	0.06
P	0.00	0.00	0.01		0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.01

# CONTINUED - K FELDSPAR FANAD

Sample	FAN7	FAN11	FAN11	F270	F270	F270	FAN7	FAN7	FAN23
Location	Rim/2	Core/1	Rim/1		a second		Rim/1	Core/1	Rim/5
SiO2	65.88	64.82	64.92	64.26	64.09	64.88	66.34	65.50	63.67
TIO2	0.00	0.00	0.00	0.09	0.14	0.00	0.05	0.09	0.00
AI203	17.82	17.94	17.71	18.95	18.54	18.31	17.88	17.46	19.15
Cr2O3	0.03	0.06	0.01	0.05	0.00	0.04	0.00	0.01	0.02
FeO	0.10	0.04	0.02	0.16	0.09	0.10	0.15	0.03	0.02
MnO	0.00	0.00	0.00	0.02	0.06	0.00	0.09	0.12	0.00
MgO	0.00	0.00	0.00	0.16	0.03	0.11	0.00	0.00	0.00
CaO	0.00	0.00	0.00	0.08	0.10	0.11	0.00	0.00	0.06
Na2O	1.61	0.63	1.45	1.19	0.77	0.76	1.63	1.71	2.14
K20	14.76	15.54	14.33	14.08	15.02	15.21	14.64	14.46	12.72
BaO	0.37	0.93	0.92	1.74	1.00	0.67	0.14	0.20	2.72
P2O5	0.38	0.37	0.22	0.00	0.00	0.00	0.33	0.48	0.06
Total	99.97	100.21	99.57	100.69	99.68	100.11	100.42	100.06	100.32
S	3.03	3.02	3.04	2.97	2.98	3.00	3.03	3.03	2.96
TI	0,00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Al	0.97	0.99	0.98	1.03	1.02	1.00	0.96	0.95	1.05
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fe	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mg	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00
Ca	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
Na	0.14	0.06	0.13	0.11	0.07	0.07	0.14	0.15	0.19
κ	0.87	0.92	0.86	0.83	0.89	0.90	0.85	0.85	0.75
<b>D</b>									
ва	0.01	0.02	0.02	0.03	0.02	0.01	0.00	0.00	0.05
P	0.01 0.02	0.02 0.02	0.02 0.01	0.03	0.02 0.00	0.01	0.00 0.01	0.00 0.02	0.05 0.00

#### APPENDIX 4.2 : CONTINUED K FELDSPAR ROSSES

Sample Location	G4	G4 core/1	G4 rim/2	G4 core/2	G4 core/2	G4 Rim/2	G4 core/3	G4 core/4	G4 rim/5	G4 core/6	G4 core/7	G4 rim/7
SiO2	65.07	64.18	64.39	64.37	64.03	64.22	64.93	64.44	64.94	64.51	64.19	64.10
TiO2	0.04	0.00	0.06	0.03	0.00	0.02	0.00	0.00	0.00	0.00	0.02	0.00
AI2O3	18.42	18.36	18.08	18.37	18.42	18.36	18.51	19.25	18.43	18.68	18.41	18.15
Cr2O3	0.00	0.01	0.00	0.13	0.00	0.00	0.07	0.02	0.42	0.00	0.00	0.00
FeO	0.00	0.00	0.00	0.01	0.07	0.07	0.00	0.09	0.10	0.16	0.03	0.00
MnÖ	0.02	0.12	0.04	0.00	0.00	0.09	0.00	0.03	0.04	0.00	0.12	0.03
MgO	0.09	0.16	0.10	0.05	0.07	0.15	0.10	0.03	0.02	0.13	0.04	0.07
CaO	0.05	0.94	0.09	0.00	0.10	0.00	0.18	0.00	0.09	0.13	0.07	0.06
NO	0.00	0.00	0.10	0.13	0.05	0.18	0.01	0.23	0.15	0.19	0.12	0.00
Nazo	. 0./1	14 00	15 50	15 17	15 97	15 47	15 64	15 47	15.96	15 45	15.60	1
R <sub>2</sub> O	0.00	0.00	0.06	0.00	0.00	0.04	0.21	0.00	0.04	0.07	0.00	0.01
P205	b.o	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
Total	100.04	98.80	99.16	98.99	98.79	99.29	99.92	100.13	100.20	99.83	99.16	98.53
Si	3.00	2.99	3.00	3.00	2.99	2.99	3.00	2.97	2.99	2,98	2.99	3.00
Ti	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AI	1.00	1.01	0.99	1.01	1.01	1.01	1.01	1.05	1.00	1.02	1.01	1.00
Cr	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Min	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
мg	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01
NI	0.00	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00
Na	0.00	0.00	0.00	0.07	0.00	0.06	0.05	0.06	0.01	0.06	0.05	0.00
K	0.00	0.89	0.92	0.90	0.92	0.92	0.92	0.91	0.90	0.91	0.93	0.92
Ba	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
Sample	G3	G3	G3	G3	G3	G3	G3	G1	G1	G1	G1	
Location	Core/1	Half/1	Rim/1	Core/2	Rim/2	Core/3	Rim/3	Core/1	Rim/1	Core/2	Rim/2	
SiO2	65.05	65.36	64.40	65.31	65.00	65.48	65.51	65,90	65.57	66.49	65.94	
TIO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.03	
A1203	18.32	18.19	18.34	18.28	18.28	18.51	18.49	18.67	18.33	18.62	18.17	
Cr2O3	0.10	0.00	0.00	0.00	0.11	0.04	0.00	0.01	0.00	0.02	0.02	
FeO	0.09	0.02	0.14	0.00	0.04	0.00	0.20	0.03	0.00	0.06	0.10	
MnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.05	0.00	
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	
CaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
NIO	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	
Na2O	0.77	0.87	0.68	0.65	0.53	0.97	1.11	0.70	0.72	3.44	0.76	
K20	15.24	15.53	15.58	15.67	15.81	14,95	15.44	15.78	15.86	11.95	15.93	
Daor	0.71	0.37	0.34	0.02	0.39	0.77	0.10	0.30	0.35	0.19	0.10	
Total	100 23	100.08	99.88	99 74	99 88	100.59	100 90	101 20	100.61	100 98	101 01	
Totar	100.20	100.00	00.00	00.14		100.00	100.00	101.20	100.01	100.00	101.01	
SI	3.00	3.01	2.99	3.01	3.01	3.00	2.99	3.00	3.01	3.00	3.01	
Tì	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Al	1.00	0.99	1.00	0.99	1.00	1.00	1.00	1.00	0.99	0.99	0.98	
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Fe	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	te printer a
Ca	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
NI	n.d	n,d	n.d	n.d	n.d	n.đ	n.d	n.d	n.d	n.d	n.d	
Na	0.07	0.08	0.06	0.06	0.05	0.09	0.10	0.06	0.08	0.30	0.07	
r. Po	0.90	0.91	0.92	0.94	0.83	0.00	0.90	0.92	0.93	0.09	0.93	
Da	0.01	0.01	0.02	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	
r	£ 0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	

#### APPENDIX 4.2 K FELDSPAR ROSSES

### K FELDSPAR TRAWENAGH BAY

Sample     G1     G1     G1     G1     G1     G1     G1     TR.       Location     Rim/2     Core/3     Core/3     Core/4     Core/5     Rim/5     Core/5       SiO2     65.94     66.17     65.65     65.85     65.47     65.       TiO2     0.03     0.00     0.00     0.01     0.00     0.0       Al2O3     18.17     18.12     18.28     18.35     18.27     18.       Cr2O3     0.02     0.00     0.03     0.00     0.00     0.0       FeO     0.10     0.00     0.04     0.09     0.07     0.0       MnO     0.00     0.15     0.05     0.01     0.00     0.0     0.0       MgO     0.00     0.00     0.00     0.00     0.00     0.0     0.0	
Location     Rim/2     Core/3     Core/4     Core/5     Rim/5     Core/5       SiO2     65.94     66.17     65.65     65.85     65.47     65.       TiO2     0.03     0.00     0.00     0.01     0.00     0.0       Al2O3     18.17     18.12     18.28     18.35     18.27     18.       Cr2O3     0.02     0.00     0.04     0.09     0.07     0.0       MnO     0.00     0.15     0.05     0.01     0.00     0.0       MgO     0.00     0.00     0.00     0.00     0.00     0.00	A3 TRA3 TRA3 TRA3 TRA4 TRA4 TRA4
SiO2     65.94     66.17     65.65     65.85     65.47     65.       TiO2     0.03     0.00     0.00     0.01     0.00     0.0       Al2O3     18.17     18.12     18.28     18.35     18.27     18.       Cr2O3     0.02     0.00     0.03     0.00     0.00     0.0       FeO     0.10     0.00     0.04     0.09     0.07     0.0       MnO     0.00     0.00     0.00     0.00     0.00     0.00     0.00       MgO     0.00     0.00     0.00     0.00     0.00     0.00     0.00	e/1 Rim/1 Core/2 Rim/2 Core/1 Core/2 Core/3
TiO2     0.03     0.00     0.00     0.01     0.00     0.01       Al2O3     18.17     18.12     18.28     18.35     18.27     18.       Cr2O3     0.02     0.00     0.03     0.00     0.00     0.0       FeO     0.10     0.00     0.04     0.09     0.07     0.0       MnO     0.00     0.15     0.05     0.01     0.00     0.0       MgO     0.00     0.00     0.00     0.00     0.00     0.00	28 65.46 65.38 65.77 65.20 64.93 64.93
Al2O3     18.17     18.12     18.28     18.35     18.27     18.       Cr2O3     0.02     0.00     0.03     0.00     0.00     0.0       FeO     0.10     0.00     0.04     0.09     0.07     0.0       MnO     0.00     0.15     0.05     0.01     0.00     0.0       MgO     0.00     0.00     0.00     0.00     0.00     0.00	04 0.00 0.03 0.00 0.07 0.02 0.00
Cr2O3     0.02     0.00     0.03     0.00     0.00     0.0       FeO     0.10     0.00     0.04     0.09     0.07     0.0       MnO     0.00     0.15     0.05     0.01     0.00     0.0       MgO     0.00     0.00     0.00     0.00     0.00     0.00       Cab     0.00     0.00     0.00     0.00     0.00     0.00	30 18.60 18.31 18.03 18.46 18.32 18.48
FeO     0.10     0.00     0.04     0.09     0.07     0.0       MnO     0.00     0.15     0.05     0.01     0.00     0.0       MgO     0.00     0.00     0.00     0.00     0.00     0.0       CaO     0.00     0.00     0.00     0.00     0.00     0.0	00 0.00 0.00 0.05 0.06 0.00 0.00
MnO     0.00     0.15     0.05     0.01     0.00     0.0       MgO     0.00<	00 0.08 0.07 0.00 0.00 0.00 0.12
MgO 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	09 0.00 0.01 0.00 0.02 0.00 0.00
CaO 0.00 0.00 0.00 0.00 0.00 0.0	00 0.00 0.00 0.00 0.04 0.07 0.09
	00 0.00 0.00 0.00 0.10 0.05 0.03
NO n.a n.a n.a n.a n.a n.a	d n.d n.d n.d 0.01 0.10 0.00
Na2O 0.76 0.50 0.64 0.65 0.92 0.7	4 0.91 0.90 1.00 0.87 0.77 0.60
K2O 15.93 16.14 16.28 15.84 15.36 15.	73 15.68 15.65 15.48 15.59 15.32 15.71
BaO 0.16 0.40 0.15 0.16 0.01 0.0	00 0.07 0.00 0.04 0.02 0.00 0.00
P2O5 0.20 0.18 0.10 0.23 0.16 0.2	28 0.19 0.20 0.31 0.00 0.00 0.05
Total 101.01 101.18 100.97 100.77 99.84 100	.03 100.74 100.28 100.30 100.30 99.56 100.02
Si 3.01 3.03 3.01 3.01 3.01 3.0	00 2.99 3.00 3.01 3.00 3.01 3.00
TI 0.00 0.00 0.00 0.00 0.00 0.00	00.0 0.00 0.00 0.00 0.00 0.00
Al 0.98 0.98 0.99 0.99 0.99 0.9	9 1.00 0.99 0.97 1.00 1.00 1.01
Cr 0.00 0.00 0.00 0.00 0.00 0.0	00.0 00.0 00.0 00.0 00.0 00.0
Fe 0.00 0.00 0.00 0.00 0.00 0.0	0 0.00 0.00 0.00 0.00 0.00 0.01
Mn 0.00 0.01 0.00 0.00 0.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00
Mg 0.00 0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.01
Ca 0.00 0.00 0.00 0.00 0.00 0.0	00 0.00 0.00 0.00 0.01 0.00 0.00
Ni a n.d. n.d. n.d. n.d. n.d. e. the n.d	d n.d. n.d n.d 0.00 0.00 0.00
Na 0.07 0.04 0.06 0.06 0.08 0.0	0.08 0.08 0.09 0.08 0.07 0.05
K 0.93 0.94 0.95 0.93 0.90 0.8	2 0.91 0.92 0.91 0.92 0.91 0.93
Ba 0.00 0.01 0.00 0.00 0.00 0.0	
P 0.01 0.01 0.00 0.01 0.01 0.0	00 0.00 0.00 0.00 0.00 0.00 0.00

#### CONTINUED - K FELDSPAR TRAWENAGH BAY

Sample	TRA4	TRA4	TRA4	TRA4	TRA4	TRA2	TRA2	TRA2	TRA2	TRA2
Location	7/4	Core/5	Rim/5	Core/6	Rim/6	Core/1	Rim/1	Core/2	Rim/2	Rim/3
SiO2	65.14	65.16	64.78	64.88	65.18	65.83	65.69	66.00	65.57	65.62
TiO2	0.08	0.00	0.00	0.00	0.03	0.04	0.00	0.00	0.09	0.15
AI2O3	18.44	18.42	18.49	18.24	18.25	18.65	18.70	18.86	18.96	18.96
Cr2O3	0.04	0.06	0.02	0.09	0.00	0.00	0.04	0.06	0.00	0.08
FeO	0.02	0.14	0.00	0.00	0.00	0.11	0.02	0.19	0.08	0.00
MnO	0.00	0.00	0.08	0.05	0.00	0.02	0.02	0.00	0.00	0.00 .,
MgO	0.18	0.09	0.12	0.09	0.03	0.07	0.08	0.14	0.06	0.07
CaO	0.08	0.06	0.07	0.05	0.13	0.50	0.00	0.14	0.11	0.02
NIO	0.05	0.00	0.10	0.00	0.02	0.16	0.05	0.07	0.02	0.16
Na2O	0.77	1.04	0.90	1.07	0.71	0.84	1.03	1.22	1.32	1.02
K2O	15.47	15.38	15.26	15.13	15.51	15.82	15.56	15.28	14.62	15.30
BaO	0.02	0.12	0.13	0.12	0.05	0.06	0.20	0.20	0.38	0.25
P2O5	0.02	0.00	0.00	0.00	0.15	0.00	0.00	0.01	0.00	0.00
Total	100.28	100.27	99.94	99.72	100.01	101.56	101.19	102.09	101.00	101.41
		~		t a sta						
Si	3.03	3.00	3.00	3.01	3.00	3.00	3.00	2.99	2.99	2.99
ŤI -	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Al	1.00	1.00	1.01	1.00	0.99	1.00	1.01	1.01	1.02	1.02
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fe	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mg	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00
Ca	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00
Ni	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
Na	0.07	0.09	0.08	0.10	0.06	0.07	0.09	0.11	0.12	0.09
K ·	0.91	0.90	0.90	0.89	0.91	0.92	0.91	0.88	0.85	0.89
Ba	0.00	0.00	0.00	0,00	0.00	0.00	0.00	0.00	0.01	0.00
Ρ.	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00

#### APPENDIX 4.2 : CONTINUED K FELDSPAR MAIN DONEGAL

Sample	MDG276	MDG276	MDG276	MDG276	MDG276	DON4	DON4	DON4	DON4	DON4	DON4	DON4
Location	Rim/1	Half/1	Core/1	Rim/1	Rim/1	Core/1	Half/1	Rim/1	Core/2	Rim/2	Core/3	Core/4
SiO2	65.52	65.32	65.98	65.66	65.72	64.95	64.26	64.87	64.89	64.98	65.42	65.17
TiO2	0.00	0.11	0.00	0.11	0.04	0.00	0.00	0.10	0.05	0.18	0.02	0.00
AI203	18.23	18.18	18.23	18.17	18.38	18.77	18.26	18.40	18.30	18.34	18.67	18.60
Cr2O3	0.05	0.07	0.07	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.08
FeO	0.13	0.00	0.01	0.10	0.00	0.00	0.08	0.00	0.00	0.14	0.02	0.15
MnO	0.00	0.00	0.02	0.00	0.02	0.07	0.00	0.41	0.02	0.05	0.00	0.00
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.03
CaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00
Na2O	0.84	0.97	0.88	1.00	0.94	2.02	0.94	1.23	1.04	1.17	0.80	0.98
K2O	15.52	15.25	15.15	15,37	15.56	13.50	15.04	14.76	14.75	15.17	15.46	15.31
BaO	0.50	0.14	0.24	0.22	0.12	0.58	0.44	0.22	0.50	0.20	0.65	0.37
P2O5	0.00	0.00	0.10	0.19	0.05	0.09	0.04	0.38	0.00	0.14	0.17	0.12
Total	100.47	100.04	100.48	100.53	100.79	99.97	99.07	99.71	99.61	100.24	101.13	100.68
SI	3.01	3.02	3.02	3.01	3.01	3.00	3.00	2.99	3.01	2.99	2.99	2.99
Ti	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
AI	0.99	0.99	0.98	0.98	0.99	1.02	1.01	1.00	1.00	1.00	1.01	1.01
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fe	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0,00
Mg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ca	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Na	0.08	0.09	0.08	0.09	0.08	0.18	0.09	0.11	0.09	0.10	0.07	0.09
к	0.91	0.90	0.88	0.90	0.91	0.79	0.90	0.87	0.87	0.89	0.90	0.90
Ba	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.01	0.01
P	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.15	0.00	0.01	0.01	0.00
Sample	DON4	DON16	DON16	DON16	DON16							

Location	Core/5	COLAN	RUDV I	nuu/ I	F100/4
SiO2	65.25	65.17	65.23	64.60	63.99
TiO2	0.04	0.00	0.12	0.00	0.00
AI2O3	18.38	18.59	18.54	18.20	18.22
Cr2O3	0.00	0.17	0.00	0.00	0.05
FeO	0.01	0.00	0.03	0.07	0.00
MnO	0.00	0.10	0.04	0.06	0.00
MgO	0.00	0.01	0.00	0.00	0.00
CaO	0.01	0.00	0.00	0.00	0.00
Na2O	1.08	1.37	1.08	0.92	0.99
K20	15.01	14.60	14.76	14.82	15.00
BaO	0.28	0.47	0.20	0.27	0.55
P2O5	0.11	0.12	0.12	0.23	0.00
Total	100.06	100.36	100.01	99.18	98.79
Si	3.01	2.99	3.00	3.01	3.00
Ti	0.00	0.00	0.00	0.00	0.00
AL	1.00	1.01	1.00	1.00	1.01
Cr	0.00	0.01	0.00	0.00	0.00
Fe	0.00	0.00	0.00	0.00	0.00
Mn	0.00	0.00	0.00	0.00	0.00
Mg	0.00	0.00	0.00	0.00	0.00
Ca	0.00	0.00	0.00	0.00	0.00
Na	0.10	0.12	0.10	0.08	0.09
κ	0.88	0.86	0.87	0.88	0.90
Ba	0.01	0.01	0.00	0.01	0.01
P	0.00	0.01	0.01	0.01	0.00

# APPENDIX 4.3 BIOTITE ROSSES

Sample Location	G2 Core/1	G2 Rim/1	G2 Core/2	G2 Core/3	G2 Rim/3	G2 Core/4	G2 Rim/4	G2 Core/5	G2 Rim/5	G2 Core/6	G2 Core/7	G2 Core/8
SiO2	35.51	35.29	34.63	35.53	36.10	35.46	35.44	35.71	35.90	35.19	35.82	35.58
TiO2	2.83	3.38	2.77	2.99	3.18	3.05	2.96	2.94	3.36	3.11	3.09	3.21
AI2O3	16.12	15.85	16.10	16.44	16.50	16.30	16.27	16.75	16.61	16.69	16.71	16.09
Cr2O3	0.05	0.01	0.01	0.03	0.00	0.15	0.12	0.05	0.01	0.05	0.04	0.02
FeO	22.00	21.47	21.15	21.87	21.43	22.31	21.91	21.43	21.39	22.07	21.69	22.26
MnO	0.54	0.49	0.46	0.59	0.52	0.40	0.50	0.52	0.55	0.65	0.52	0.52
MgO	7.71	7.98	7.65	7.46	7.77	7.97	7.74	7.83	8.05	7.97	7.93	7.71
CaO	0.10	0.16	0.73	0.08	0.17	0.06	0.04	0.14	0.08	0.14	0.01	0.01
Na2O	0.54	0.36	0.32	0.32	0.49	0.46	0.45	0.36	0.42	0.27	0.43	0.42
K20	9.38	9.18	9.22	9.51	9.54	9.60	9.42	9.37	9.36	8.74	9.59	9.46
BaOs	0.14	0.00	0.00	0.15	0.00	0.00	0.09	0.00	0.00	0.00	0.34	0.00
Total	0.01	0.00	0.45	0.00	95.87	95 76	0.00	95.01	95 74	0.04	96 17	05 28
Total	04.00	34.13	55.55	04.00	00.01	00.10	04.00	00.01	00.74	04.02		00.20
Si	5.56	5.55	5.48	5.57	5.57	5.52	5.54	5.55	5.54	5.49	5.53	5.56
TI	0.33	0.40	0.33	0.35	0.34	0.36	0.35	0.34	0.39	0.36	0.36	0.34
AI	2.98	2.94	3.00	3.04	3.00	2.99	3.00	3.07	3.02	3.07	3.04	2.96
Aliv	2.44	2.45	2.52	2.43	2.43	2.48	2.46	2.45	2.46	2.51	2.47	2.44
Alvi	0.54	0.49	0.48	0.61	0.57	0.51	0.54	0.67	0.56	0.55	0.57	0.52
Cr	0.01	0.00	0.00	0.00	0.00	0.02	0.02	0.01	0.00	0.01	0.01	0.00
Fe3+	0.32	0.31	0.31	0.32	0.30	0.32	0.32	0.31	0.30	0.32	0.31	0.32
Fe2+	2.57	2.51	2.49	2.55	2.46	2.59	2.55	2.48	2.46	2.56	2.49	2.59
Mn	0.07	0.07	0.08	80.0	0.07	0.05	0.07	0.07	0.07	0.09	0.07	0.07
Mg	1.80	1.87	1.80	1.74	1.83	1.85	1.80	1.82	1.85	1.85	1.83	1.80
Ua.	0.02	0.03	0.12	0.01	0.03	0.01	0.01	0.02	0.01	0.02	0.00	0.00
Na	1 99	4.04	1 96	1 00	0.00	0.00	4 00	0.11	4 04	0.08	0.13	0.13
Ro	0.01	0.00	0.00	0.01	1.88	1 01	0.01	0.00	0.00	0.00	1.09 -	0.00
P	0.01	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
•	0.00	0.00				0.00	0.00	0.00	0.00	0.01	0.00	0.00
Sample	G2	G2	G2	278POR	278POR	278POR	278POR	278POR	278POR	278POR	278POR	
Sample Location	G2 Rim/8	G2 Core/9	G2 Rim/9	278POR Core/1	278POR Rim/1	278POR Core/2	278POR Core/3	278POR Core/4	278POR Half/5	278POR Rim/5	278POR Core/6	
Sample Location	G2 Rim/8	G2 Core/9	G2 Rim/9	278POR Core/1 Pheno	278POR Rim/1 Pheno	278POR Core/2 G'mass	278POR Core/3 G'mass	278POR Core/4 Pheno	278POR Half/5 Pheno	278POR Rim/5 Pheno	278POR Core/6 Pheno	
Sample Location SiO2	G2 Rim/8 35.79	G2 Core/9 36.62	G2 Rim/9 35.58	278POR Core/1 Pheno 36.30	278POR Rim/1 Pheno 35,65	278POR Core/2 G'mass 35.71	278POR Core/3 G'mass 36.60	278POR Core/4 Pheno 35.43	278POR Half/5 Pheno 35.60	278POR Rim/5 Pheno 35.46	278POR Core/6 Pheno 35.87	
Sample Location SiO2 TiO2	G2 Rim/8 35.79 2.99	G2 Core/9 36.62 3.05	G2 Rim/9 35.58 3.08	278POR Core/1 Pheno 36.30 3.26	278POR Rim/1 Pheno 35,65 3,19	278POR Core/2 G'mass 35.71 2.81	278POR Core/3 G'mass 36.60 2.53	278POR Core/4 Pheno 35.43 2.55	278POR Half/5 Pheno 35.60 3.06	278POR Rim/5 Pheno 35.46 2.95	278POR Core/6 Pheno 35.87 3.07	
Sample Location SiO2 TiO2 Al2O3	G2 Rim/8 35.79 2.99 16.26	G2 Core/9 36.62 3.05 16.42	G2 Rim/9 35.58 3.08 16.48	278POR Core/1 Pheno 36.30 3.26 15.35	278POR Rim/1 Pheno 35,65 3,19 15,97	278POR Core/2 G'mass 35.71 2.81 15.92	278POR Core/3 G'mass 36.60 2.53 16.17	278POR Core/4 Pheno 35.43 2.55 17.18	278POR Half/5 Pheno 35.60 3.06 15.92	278POR Rim/5 Pheno 35.46 2.95 15.98	278POR Core/6 Pheno 35.87 3.07 15.91	
Sample Location SiO2 TiO2 AI2O3 Cr2O3	G2 Rim/8 35.79 2.99 16.26 0.00	G2 Core/9 36.62 3.05 16.42 0.00	G2 Rim/9 35.58 3.08 16.48 0.01	278POR Core/1 Pheno 36.30 3.26 15.35 0.17	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13	278POR Core/2 G'mass 35.71 2.81 15.92 0.00	278POR Core/3 G'mass 36.60 2.53 16.17 0.08	278POR Core/4 Pheno 35.43 2.55 17.18 0.05	278POR Half/5 Pheno 35.60 3.06 15.92 0.00	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02	278POR Core/6 Pheno 35.87 3.07 15.91 0.07	
Sample Location SiO2 TiO2 AI2O3 Cr2O3 FeO	G2 Rim/8 35.79 2.99 16.26 0.00 22.64	G2 Core/9 36.62 3.05 16.42 0.00 21.75	G2 Rim/9 35.58 3.08 16.48 0.01 21.72	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53	278POR Rim/1 Pheno 35,65 3,19 15.97 0,13 21.51	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31	278POR Core/3 G'mass 36.60 2.53 16.17 0.08 20.62	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20	
Sample Location SiO2 TiO2 AI2O3 Cr2O3 FeO MnO	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16	278POR Rim/1 Pheno 35,65 3,19 15,97 0,13 21,51 0,21	278POR Core/2 G'mass 35,71 2,81 15.92 0,00 21,31 0,18	278POR Core/3 G'mass 36.60 2.53 16.17 0.08 20.62 0.04	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 7.86	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68	278POR Rim/1 Pheno 35,65 3,19 15.97 0,13 21.51 0,21 8,57	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 2.00	278POR Core/3 G'mass 36.60 2.53 16.17 0.08 20.62 0.04 9.26	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 2.24	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.25	278POR Rim/1 Pheno 35,65 3,19 15.97 0,13 21.51 0,21 8.57 0,00 0,20	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21	278POR Core/3 G'mass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.08	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.04 0.26	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.28	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06 0.42	G2 Bim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.53 9.21	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21	278POR Core/3 G'mass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.08 0.29 9.57	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.04 0.36	278POR Half/5 Pheno 35.60 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06 0.42 9.28 0.00	G2 Bim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.53 9.21 0.00	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66 0.23	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95	278POR Core/3 G'mass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.08 0.29 9.57 0.00	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.04 0.36 9.17 0.20	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46 9.58 0.18	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93	
Sample Location SIO2 TIO2 AI2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 0.00	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06 0.42 9.28 0.00	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.53 9.21 0.00	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66 0.23 0.07	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95 0.07	278POR Core/3 G'mass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.08 0.29 9.57 0.00 0.16	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.04 0.36 9.17 0.20 0.03	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46 9.58 0.09	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 0.00 95.95	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06 0.42 9.28 0.00 0.00 95.12	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.53 9.21 0.00 0.00 95.06	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02 96.33	278POR Rim/1 Pheno 35,65 3,19 15.97 0,13 21.51 0,21 8.57 0,00 0,30 9.66 0,23 0,07 95,48	278POR Core/2 G'mass 35.711 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95 0.07 95.41	278POR Core/3 G'mass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.08 0.29 9.57 0.00 0.16 95.41	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.04 0.36 9.17 0.20 0.03 94.56	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06 95.85	278POR Pieno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46 9.58 0.18 0.09 95.13	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00 96.00	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 0.00 95.95	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06 0.42 9.28 0.00 0.00 95.12	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.53 9.21 0.00 0.00 95.08	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02 96.33	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66 0.23 0.07 95.48	278POR Core/2 Gimass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95 0.07 95.41	278POR Core/3 Gimass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.08 0.29 9.57 0.00 0.16 95.41	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.04 0.36 9.17 0.20 0.03 94.56	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06 95.85	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46 9.58 0.18 0.09 95.13	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00 96.00	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 0.00 95.95	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06 0.42 9.28 0.00 0.00 95.12	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.29 0.20 0.53 9.21 0.00 0.00 95.06	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02 96.33	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66 0.23 0.07 95.48	278POR Core/2 Gimass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95 0.07 95.41	278POR Core/3 Gmass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.08 0.29 9.57 0.00 0.16 95.41	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.04 0.36 9.17 0.20 0.03 94.56	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06 95.85	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.48 9.58 0.18 0.09 95.13	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00 96.00	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 0.00 95.95 5.55 0.35	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.42 9.28 0.00 0.00 95.12 5.55 0.36	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.53 9.21 0.00 0.50 9.506 5.51 0.36	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02 96.33 5.59 0.38	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66 0.23 0.07 95.48	278POR Core/2 G/mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95 0.07 95.41 5.55 0.33	278POR Core/3 G/mass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.08 0.29 9.57 0.00 0.16 95.41 5.61 0.29	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.05 9.17 0.20 0.03 94.56 5.51 0.30	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06 95.85	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 9.58 0.18 0.09 95.13 5.51 0.35	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00 96.00	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 0.00 95.95 5.55 0.35 2.97	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.42 9.28 0.00 0.00 95.12 5.55 0.36 3.01	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.53 9.21 0.00 0.00 95.06 5.51 0.36 3.01	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02 96.33 5.59 0.38 2.79	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66 0.23 0.07 95.48 5.52 0.37 2.91	278POR Core/2 G/mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95 0.07 95.41 5.55 0.33 2.92	278POR Core/3 Gmass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.08 0.29 9.57 0.00 0.16 95.41 5.61 0.29 2.92	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.05 9.17 0.20 0.03 94.56 5.51 0.30 3.15	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06 95.85 5.51 0.36 2.90	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46 9.58 0.18 0.09 95.13 5.51 0.35 2.93	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00 96.00 5.54 0.36 2.89	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 0.00 95.95 5.55 0.35 2.97 2.45	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.42 9.28 0.00 0.00 95.12 5.55 0.36 3.01 2.45	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.53 9.21 0.00 9.5.06 5.51 0.36 3.01 2.49	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02 96.33 5.59 0.38 2.79 2.41	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66 0.23 0.07 95.48 5.52 0.37 2.91 2.48	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95 0.07 95.41 5.55 0.33 2.92 2.45	278POR Core/3 G'mass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.08 0.29 9.57 0.00 0.16 95.41 5.61 0.29 2.92 2.39	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.05 9.17 0.20 0.03 9.4.56 5.51 0.30 3.15 2.50	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06 95.85 5.51 0.36 2.90 2.49	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46 9.58 0.18 0.09 95.13 5.51 0.35 2.93 2.49	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00 96.00 5.54 0.36 2.89 2.48	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alvi	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 0.00 95.95 5.55 0.35 2.97 2.45 0.53	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06 0.42 9.28 0.00 0.00 95.12 5.55 0.36 3.01 2.45 0.56	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.53 9.21 0.00 0.00 95.06 5.51 0.36 3.01 2.49 0.52	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02 96.33 5.59 0.38 2.79 2.41 0.38	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66 0.23 0.07 95.48 5.52 0.37 2.91 2.48 0.43	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95 0.07 95.41 5.55 0.33 2.92 2.45 0.46	278POR Core/3 G'mass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.04 9.26 0.29 9.57 0.00 0.16 95.41 5.61 0.29 2.92 2.39 0.53	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.05 9.17 0.20 0.03 94.56 5.51 0.30 3.15 2.50 0.65	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06 95.85 5.51 0.36 2.90 2.49 0.41	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46 9.58 0.18 0.09 95.13 5.51 0.35 2.93 2.49 0.44	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00 96.00 5.54 0.36 2.89 2.46 0.43	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv Alvi Cr	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 0.00 95.95 5.55 0.35 2.97 2.45 0.53 0.00	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06 0.42 9.28 0.00 0.00 95.12 5.55 0.36 3.01 2.45 0.56 0.00	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.53 9.21 0.00 0.00 95.06 5.51 0.36 3.01 2.49 0.52 0.00	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02 96.33 5.59 0.38 2.79 2.41 0.38 0.02	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66 0.23 0.07 95.48 5.52 0.37 2.91 2.48 0.43 0.02	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 21.31 0.21 9.47 0.95 0.07 95.41 5.55 0.33 2.92 2.45 0.46 0.00	278POR Core/3 G'mass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.04 9.26 0.29 9.57 0.00 0.16 95.41 5.61 0.29 2.92 2.39 0.53 0.01	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.05 9.17 0.20 0.03 94.56 5.51 0.30 3.15 2.50 0.65 0.01	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06 95.85 5.51 0.36 2.90 2.49 0.41 0.00	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46 9.58 0.18 0.09 95.13 5.51 0.35 2.93 2.49 0.44 0.00	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00 96.00 5.54 0.36 2.89 2.46 0.43 0.01	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv Aliv Aliv Cr Fe3+	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 0.00 95.95 5.55 0.35 2.97 2.45 0.53 0.00 0.32	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06 0.42 9.28 0.00 0.00 95.12 5.55 0.36 3.01 2.45 0.56 0.00 0.31	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.53 9.21 0.00 0.53 9.21 0.00 0.50 9.5.06 5.51 0.36 3.01 2.49 0.52 0.00 0.52 0.00 0.51 2.49	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02 96.33 5.59 0.38 2.79 2.41 0.38 0.02 0.31 0.31	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66 0.23 0.07 95.48 5.52 0.37 2.91 2.48 0.43 0.02 0.31	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95 0.07 95.41 5.55 0.33 2.92 2.45 0.46 0.00 0.31	278POR Core/3 G'mass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.04 9.26 0.29 9.57 0.00 0.16 95.41 5.61 0.29 2.92 2.39 0.53 0.01 0.29	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.05 9.17 0.20 0.03 94.56 5.51 0.30 3.15 2.50 0.65 0.01 0.30	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06 95.85 5.51 0.36 2.90 2.49 0.41 0.00 0.32	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46 9.58 0.18 0.09 95.13 5.51 0.35 2.93 2.49 0.44 0.00 0.31	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00 96.00 5.54 0.36 2.89 2.46 0.43 0.01 0.30	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv Aliv Aliv Aliv	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 95.95 5.55 0.35 2.97 2.45 0.53 0.00 0.32 2.62	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06 9.28 0.00 95.12 5.55 0.36 3.01 2.45 0.56 0.00 0.31 2.52	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.20 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.00 95.06 3.01 2.51 0.20 0.00 0.53 9.21 0.00 0.00 95.06 3.01 2.51 0.20 0.00 0.53 9.21 0.00 0.00 95.06 3.01 2.51 0.20 0.00 0.00 95.06 3.01 2.53 1.53 1.03 1.03 1.03 1.02 0.00 0.00 95.06 3.01 2.49 0.52 0.00 0.31 2.51 0.52 0.53 1.249 0.52 0.52 0.52 0.52 0.52 0.53 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.05 0.00 0.55 0.05 0.00 0.55 0.01 0.55	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02 96.33 5.59 0.38 2.79 2.41 0.38 0.02 0.31 2.47 0.20	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66 0.23 0.07 95.48 5.52 0.37 2.91 2.48 0.43 0.02 0.31 2.48 0.23	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95 0.07 95.41 5.55 0.33 2.92 2.45 0.46 0.00 0.31 2.46	278POR Core/3 Gimass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.04 9.26 0.29 9.57 0.00 0.16 95.41 5.61 0.29 2.92 2.39 0.53 0.01 0.29 2.92	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.04 0.36 9.17 0.20 0.03 94.56 5.51 0.30 3.15 2.50 0.65 0.01 0.30 2.46	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06 95.85 5.51 0.36 2.90 2.49 0.41 0.00 0.32 2.55	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46 9.58 0.18 0.09 95.13 5.51 0.35 2.93 2.49 0.44 0.00 0.31 2.50	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00 96.00 5.54 0.36 2.89 2.46 0.43 0.01 0.30 2.44	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv Aliv Aliv Cr Fe3+ Fe2+ Mn	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 95.95 5.55 0.35 2.97 2.45 0.53 0.00 0.32 2.62 0.10	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06 9.28 0.00 95.12 5.55 0.36 3.01 2.45 0.56 0.00 0.31 2.52 0.09	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.21 0.00 0.53 9.53 9.55 1.00 0.00 95.06 3.01 2.49 0.52 0.52 0.52 0.53 9.55 1.00 0.53 9.55 1.00 0.53 9.55 1.00 0.53 9.55 1.00 0.55 9.55 1.00 0.55 9.55 1.00 0.55 9.55 1.00 0.55 9.55 1.00 0.55 9.55 1.00 0.55 9.55 1.00 0.55 1.00 0.55 9.55 1.00 0.55 9.55 1.00 0.55 9.55 1.00 0.55 9.55 1.5	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02 96.33 5.59 0.38 2.79 2.41 0.38 0.02 0.31 2.47 0.22 0.31	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66 0.23 0.07 95.48 5.52 0.37 2.91 2.48 0.43 0.02 0.31 2.48 0.31 2.48 0.31 2.48 0.31 2.48 0.31 2.48 0.31 2.48 0.31 2.48 0.31 2.48 0.31 2.48 0.31 2.48 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.31 2.48 0.32 0.32 0.31 2.48 0.32 0.32 0.32 0.31 2.48 0.32	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95 0.07 95.41 5.55 0.33 2.92 2.45 0.46 0.00 0.31 2.48 0.00	278POR Core/3 Gimass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.04 9.26 0.29 9.57 0.00 0.16 95.41 5.61 0.29 2.92 2.39 0.53 0.01 0.29 2.35 0.01	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.04 0.36 9.17 0.20 0.03 94.56 5.51 0.30 3.15 2.50 0.65 0.01 0.30 2.46 0.01	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06 95.85 5.51 0.36 2.90 2.49 0.41 0.00 0.32 2.55 0.04	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46 9.58 0.18 0.09 95.13 5.51 0.35 2.93 2.49 0.44 0.00 0.31 2.50 0.22	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00 96.00 5.54 0.36 2.89 2.46 0.43 0.01 0.30 2.44 0.30	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alvi Cr Fe3+ Fe2+ Mn Mg Ca	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 95.95 5.55 0.36 2.97 2.45 0.53 0.00 0.32 2.62 0.10 1.78 0.21	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06 0.42 9.28 0.00 0.00 95.12 5.55 0.36 3.01 2.45 0.56 0.00 0.31 2.52 0.09 1.83	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.20 0.23 9.21 0.00 95.06 5.51 0.36 3.01 2.49 0.52 0.00 0.31 2.51 0.10 1.85 0.25	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02 96.33 5.59 0.38 2.79 2.41 0.38 0.02 0.31 2.47 0.02 1.99 0.00	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66 0.23 0.07 95.48 5.52 0.37 2.91 2.48 0.43 0.02 0.31 2.48 0.03 1.98 0.03 1.98 0.03 1.98 0.02 0.31 1.48 0.03 1.99 1.48 0.03 1.99 1.48 0.03 1.99 1.48 0.03 1.99 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.03 0.02 0.31 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.02 0.31 1.48 0.03 0.02 0.31 1.48 0.03 1.54 1.55 1.54	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95 0.07 95.41 5.55 0.33 2.92 2.45 0.46 0.00 0.31 2.46 0.02 2.04	278POR Core/3 Gimass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.29 9.57 0.00 0.16 95.41 5.61 0.29 2.92 2.39 0.53 0.01 0.29 2.35 0.01 2.35 0.01	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.04 0.36 9.17 0.20 0.03 94.56 5.51 0.30 3.15 2.50 0.65 0.01 0.30 2.46 0.01 1.90 0.01	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06 95.85 5.51 0.36 2.90 2.49 0.41 0.00 0.32 2.55 0.04 1.99	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46 9.58 0.18 0.09 95.13 5.51 0.35 2.93 2.49 0.44 0.00 0.31 2.50 0.02 2.01	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00 96.00 96.00 95.54 0.36 2.89 2.46 0.43 0.01 0.30 2.44 0.02 2.07	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alvi Cr Fe3+ Fe2+ Mn Mg Ca Na	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 95.95 5.55 0.35 2.97 2.45 0.53 0.00 0.32 2.62 0.10 1.78 0.09	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06 0.42 9.28 0.00 0.00 95.12 5.55 0.36 3.01 2.45 0.56 0.00 0.31 2.52 0.09 1.83 0.01 2.12	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.20 0.23 9.21 0.00 0.53 9.21 0.00 95.06 5.51 0.36 3.01 2.49 0.52 0.00 0.31 2.51 0.10 1.85 0.03 0.16 1.85 0.16 1.85 0.16 1.85 0.16 1.85 0.16 1.85 0.16 1.85 0.16 1.85 0.16 1.85 0.16 1.85 0.16 1.85 0.16 1.85 0.16 1.85 0.16 1.85 0.16 1.85 0.16 1.85 0.16 1.85 1.8	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02 96.33 5.59 0.38 2.79 2.41 0.38 0.02 0.31 2.47 0.02 1.99 0.00 0.11	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66 0.23 0.07 95.48 5.52 0.37 2.91 2.48 0.43 0.02 0.31 2.48 0.03 1.98 0.03 1.98 0.03	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95 0.07 95.41 5.55 0.33 2.92 2.45 0.46 0.00 0.31 2.46 0.02 2.04 0.00	278POR Core/3 G'mass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.29 9.57 0.00 0.16 95.41 5.61 0.29 2.92 2.39 0.53 0.01 0.29 2.35 0.01 2.12 0.01 2.12 0.01	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.04 0.36 9.17 0.20 0.03 94.56 5.51 0.30 3.15 2.50 0.65 0.01 0.30 2.46 0.01 1.90 0.01	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06 95.85 5.51 0.36 2.90 2.49 0.41 0.00 0.32 2.55 0.04 1.99 0.00	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46 9.58 0.18 0.09 95.13 5.51 0.35 2.93 2.49 0.44 0.00 0.31 2.50 0.02 2.01 0.00 0.14	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00 96.00 96.00 95.54 0.36 2.89 2.46 0.43 0.01 0.30 2.44 0.02 2.07 0.00 0.11	
Sample Location SIO2 TiO2 AI2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total SI Ti AI Aliv Alvi Cr Fe3+ Fe2+ Mn Mg Ca Na K	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 0.00 95.95 5.55 0.35 2.97 2.45 0.53 0.00 0.32 2.62 0.10 1.78 0.09 1.88	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06 0.42 9.28 0.00 0.00 95.12 5.55 0.36 3.01 2.45 0.56 0.00 0.31 2.52 0.09 1.83 0.01 3.45	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.53 9.21 0.00 0.53 9.21 0.00 95.06 5.51 0.36 3.01 2.49 0.52 0.00 0.31 2.51 0.10 1.85 0.03 0.16 1.82	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02 96.33 5.59 0.38 2.79 2.41 0.38 0.02 0.31 2.47 0.02 1.99 0.00 0.11 1.91	278POR Rim/1 Pheno 35.65 3.19 15.97 0.13 21.51 0.21 8.57 0.00 0.30 9.66 0.23 0.07 95.48 5.52 0.37 2.91 2.48 0.43 0.02 0.31 2.48 0.03 1.98 0.00 1.98 0.00 1.98	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95 0.07 95.41 5.55 0.33 2.92 2.45 0.46 0.00 0.31 2.46 0.02 2.04 0.00 0.31 2.46 0.02	278POR Core/3 G'mass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.08 0.29 9.57 0.00 0.16 95.41 5.61 0.29 2.92 2.39 0.53 0.01 0.29 2.35 0.01 2.12 0.01 2.12 0.09 1.87	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.04 0.36 9.17 0.20 0.03 94.56 5.51 0.30 3.15 2.50 0.65 0.01 0.30 2.46 0.01 1.90 0.01 1.82	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06 95.85 5.51 0.36 2.90 2.49 0.41 0.00 0.32 2.55 0.04 1.99 0.00 1.1 1.91	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46 9.58 0.18 0.09 95.13 5.51 0.35 2.93 2.49 0.44 0.00 0.31 2.50 0.02 2.01 0.00 0.14 1.90	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00 96.00 96.00 95.54 0.36 2.89 2.46 0.43 0.01 0.30 2.44 0.02 2.07 0.00 0.11 1.86	
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alvi Cr Fe3+ Fe2+ Mn Mg Ca Na K Ba	G2 Rim/8 35.79 2.99 16.26 0.00 22.64 0.73 7.70 0.05 0.28 9.51 0.00 0.00 95.95 5.55 0.35 2.97 2.45 0.53 0.00 0.32 2.62 0.10 1.78 0.01 1.78 0.00 1.78 0.01 1.78 0.01 1.78 0.00 1.78 0.01 1.78 0.00 1.78 0.01 1.78 0.00 1.78 0.01 1.78 0.01 1.78 0.00 1.88 0.00	G2 Core/9 36.62 3.05 16.42 0.00 21.75 0.66 7.86 0.06 0.42 9.28 0.00 0.00 95.12 5.55 0.36 3.01 2.45 0.56 0.00 0.31 2.52 0.09 1.83 0.01 3.13 1.84 0.00	G2 Rim/9 35.58 3.08 16.48 0.01 21.72 0.79 8.02 0.20 0.53 9.21 0.00 0.53 9.21 0.00 95.06 5.51 0.36 3.01 2.49 0.52 0.00 0.31 2.51 0.10 1.85 0.03 0.16 1.82 0.00	278POR Core/1 Pheno 36.30 3.26 15.35 0.17 21.53 0.16 8.68 0.00 0.35 9.70 0.80 0.02 96.33 5.59 0.38 2.79 2.41 0.38 0.02 0.31 2.47 0.02 1.99 0.00 0.11 1.91 0.05	278POR Rim/1 Pheno 35,65 3,19 15.97 0,13 21,51 0,21 8,57 0,00 9,66 0,23 0,07 95,48 5,52 0,37 2,91 2,48 0,03 1,98 0,02 0,31 2,48 0,03 1,98 0,00 1,91 0,01	278POR Core/2 G'mass 35.71 2.81 15.92 0.00 21.31 0.18 8.80 0.00 0.21 9.47 0.95 0.07 95.41 5.55 0.33 2.92 2.45 0.46 0.00 0.31 2.46 0.02 2.04 0.00 1.88 0.06	278POR Core/3 Gimass 36.60 2.53 16.17 0.08 20.62 0.04 9.26 0.08 0.29 9.57 0.00 0.16 95.41 5.61 0.29 2.92 2.39 0.53 0.01 0.29 2.35 0.01 2.12 0.01 2.12 0.01 2.12 0.09 1.87 0.00	278POR Core/4 Pheno 35.43 2.55 17.18 0.05 21.27 0.11 8.18 0.04 0.36 9.17 0.20 0.03 94.56 5.51 0.30 3.15 2.50 0.65 0.01 0.30 2.46 0.01 1.90 0.01 1.82 0.01	278POR Half/5 Pheno 35.60 3.06 15.92 0.00 22.17 0.26 8.64 0.00 0.38 9.65 0.11 0.06 95.85 5.51 0.36 2.90 2.49 0.41 0.00 0.32 2.55 0.04 1.99 0.00 0.11 1.91 0.01	278POR Rim/5 Pheno 35.46 2.95 15.98 0.02 21.58 0.16 8.66 0.00 0.46 9.58 0.18 0.09 95.13 5.51 0.35 2.93 2.49 0.44 0.00 0.31 2.50 0.02 2.01 0.00 0.14 1.90 0.01	278POR Core/6 Pheno 35.87 3.07 15.91 0.07 21.20 0.17 8.99 0.00 0.36 9.44 0.93 0.00 96.00 96.00 96.00 95.54 0.36 2.89 2.46 0.43 0.01 0.30 2.44 0.02 2.07 0.00 0.11 1.86 0.06	

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# APPENDIX 4.3 - CONTINUED BIOTITE ROSSES

Sample Location	G1 Core/1	G1 Rim/1	G1 Core/2	G1 Rim/2	G1 Core/3	G1 Rim/3	G1 Core/4	G1 Core/5	G1 Rim/5	G3 Core/1	G3 Rim/1	G3 Core/2
SiO2 TiO2 Al2O3	35.94 3.35 16.21	36.25 3.22 15.79	35.95 3.06 15.95	36.24 2.96 15.76	36.10 3.28 16.07	36.78 2.80 15.95	36.04 3.34 15.49	35.88 3.05 16.17	35.38 2.43 15.82	37.10 3.02 16.33	37.08 2.47 16.84	37.04 3.16 16.02
Cr2O3	0.00	0.03	0.07	0.06	0.17	0.03	0.00	0.16	0.14	0.00	0.00	0.00
FeO	20.74	21.13	21.92	22.00	21.87	22.10	21.18	21.78	22.03	20.87	19.60	20.79
MnO	0.33	0.21	0.28	0.23	0.18	0.22	0.17	0.14	0.18	0.06	0.14	0.01
MgO	8.08	8.33	8.11	8.12	7.87	8.12	8.37	8.18	8.30	8.22	8.16	8.40
CaO	0.00	0.02	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Na2O	0.37	0.35	0.55	0.41	0.29	0.40	0.21	0.22	0.35	0.24	0.36	0.32
K2O	9.25	9.51	9.48	9.62	9.37	9.74	9.49	9.53	9,03	9.74	9.33	9.67
BaO	1.04	0.51	0.78	0.71	1.08	0.09	0.09	0.92	0.24	0.30	0.29	0.44
Total	95 49	95.40	96.24	96.24	96.37	96.45	95.36	96.07	93.89	96.12	94.37	95 94
1 otal	00.40	00.40	00.24	00.24	00.07		00.00	00.07	00.00		04.07	00.04
Si	5.56	5.60	5.55	5.59	5.57	5.63	5.60	5.55	5.58	5.66	5.71	5,67
Ti	0.39	0.38	0.36	0.34	0.38	0.34	0.39	0.35	0.29	0.35	0.29	0.36
AI -	2.96	2.88	2.90	2.87	2.92	2.88	2.84	2.95	2.94	2.94	3.06	2.91
Aliv	2.44	2.40	2.45	2.41	2.44	2.37	2.40	2.46	2.42	2.34	2.29	2.33
Alvi	0.51	0.48	0.46	0.46	0.49	0.51	0.44	0.49	0.52	0.60	0.76	0.57
Cr	0.00	0.00	0.01	0.01	0.02	0.00	0.00	0.02	0.02	0.00	0.00	0.00
Fe3+	0.30	0.30	0.31	0.31	0.31	0.31	2 45	0.31	0.32	0.29	0.25	0.29
Mn	0.04	0.03	0.04	0.03	0.02	0.03	0.02	0.02	0.02	0.01	0.02	0.00
Ma	1.86	1.92	1.87	1.87	1.81	1.85	1.94	1.89	1.95	1.87	1.87	1 92
Ca	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Na	0.11	0.10	0.16	0.12	0.09	0.12	0.06	0.07	0.11	0.07	0.11	0.09
к	1.83	1.88	1.87	1.89	1.84	1.90	1.88	1.88	1.82	1.90	1.83	1.88
Ba	0.06	0.03	0.05	0.04	0.07	0.01	0.06	0.06	0.01	0.02	0.02	0.03
P ·	0.02	0.01	0.01	0.02	0.00	0.09	0.01	0.01	0.00	0.02	0.01	0.00
Sample Location	G3 Rim/2	G3 Core/3	G3 Rim/3	G3 Core/4	G3 Rim/4	G2 Core/1	G2 Rim/1	G2 Core/2	G2 Rim/2			
Sample Location SiO2	G3 Rim/2 37.21	G3 Core/3 36.32	G3 Rim/3 36.33	G3 Core/4 36.80	G3 Rim/4 36.96	G2 Core/1 36.15	G2 Rim/1 36.17	G2 Core/2 36.26	G2 Rim/2 36.52			
Sample Location SiO2 TiO2	G3 Rim/2 37.21 3.07	G3 Core/3 36.32 3.19	G3 Rim/3 36.33 3.14	G3 Core/4 36.80 3.18	G3 Rim/4 36.96 3.34	G2 Core/1 36.15 2.46	G2 Rim/1 36.17 2.65	G2 Core/2 36.26 2.60	G2 Rim/2 36.52 2.28			
Sample Location SiO2 TiO2 AI2O3	G3 Rim/2 37.21 3.07 15.65	G3 Core/3 36.32 3.19 15.98	G3 Rim/3 36.33 3.14 16.00	G3 Core/4 36.80 3.18 16.40	G3 Rim/4 36.96 3.34 16.41	G2 Core/1 36.15 2.46 17.02	G2 Rim/1 36.17 2.65 16.72	G2 Core/2 36.26 2.60 16.94	G2 Rim/2 36.52 2.28 16.41			
Sample Location SiO2 TiO2 AI2O3 Cr2O3	G3 Rim/2 37.21 3.07 15.65 0.00	G3 Core/3 36.32 3.19 15.98 0.06	G3 Rim/3 36.33 3.14 16.00 0.07	G3 Core/4 36.80 3.18 16.40 0.04	G3 Rim/4 36.96 3.34 16.41 0.06	G2 Core/1 36.15 2.46 17.02 0.14	G2 Rim/1 36.17 2.65 16.72 0.06	G2 Core/2 36.26 2.60 16.94 0.00	G2 Rim/2 36.52 2.28 16.41 0.11			
Sample Location SiO2 TiO2 AI2O3 Cr2O3 FeO	G3 Rim/2 37.21 3.07 15.65 0.00 20.27	G3 Core/3 36.32 3.19 15.98 0.06 21.11	G3 Rim/3 36.33 3.14 16.00 0.07 20.75	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09	G3 Rim/4 36.96 3.34 16.41 0.06 20.31	G2 Core/1 36.15 2.46 17.02 0.14 20.79	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77	G2 Core/2 36.26 2.60 16.94 0.00 20.44	G2 Rim/2 36.52 2.28 16.41 0.11 20.24			
Sample Location SiO2 TiO2 AI2O3 Cr2O3 FeO MnO	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89			
Sample Location SiO2 TiO2 AI2O3 Cr2O3 FeO MnO MgO CeO	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02			
Sample Location SiO2 TiO2 AI2O3 Cr2O3 FeO MrO MgO CaO Na2O	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39			
Sample Location SiO2 TiO2 AI2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21 9.66	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41	G3 Rim/4 36.96 3.34 16.41 0.08 20.31 0.00 7.92 0.00 0.39 9.50	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19			
Sample Location SiO2 TiO2 AI2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.20 0.21 9.66 0.22	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.49	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14	G2 Rim/2 38.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15			
Sample Location SiO2 TiO2 AI2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.21 9.66 0.22 0.01	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05 0.00	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83 0.00	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50 0.11	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87 0.03	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.49 0.03	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60 0.00	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14 0.02	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15 0.01			
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21 9.66 0.22 0.01 94.68	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05 0.00 95.64	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83 0.00 94.71	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50 0.11 96.20	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87 0.03 95.80	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.49 0.03 94.85	G2 Fim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60 0.00 94.71	G2 Core/2 36.26 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14 0.02 94.79	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15 0.01 93.82			
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total St	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21 9.66 0.22 0.01 94.68	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05 0.00 95.64	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83 0.00 94.71	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50 0.11 96.20 5.63	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87 0.03 95.80 5.66	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.49 0.03 94.85 5.62	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60 0.00 94.71 5.63	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14 0.02 94.79	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15 0.01 93.82 5.69			
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Totai Si Ti	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21 9.66 0.22 0.01 94.68 5.75 0.36	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05 0.00 95.64 5.62 0.37	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83 0.00 94.71	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50 0.11 96.20 5.63 0.37	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87 0.03 95.80 5.66 0.39	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.49 0.3 94.85 5.62 0.29	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60 0.00 94.71 5.63 0.31	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14 0.02 94.79 5.62 0.30	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15 0.01 93.82 5.69 0.27			
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total St Ti Al	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21 9.66 0.22 0.01 94.68 5.75 0.36 2.85	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05 0.00 95.64 5.62 0.37 2.91	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83 0.00 94.71 5.67 0.37 2.94	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50 0.11 96.20 5.63 0.37 2.96	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87 0.03 95.80 5.66 0.39 2.96	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.49 0.39 94.85 5.62 0.29 3.12	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60 0.00 94.71 5.63 0.31 3.07	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14 0.02 94.79 5.62 0.30 3.09	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15 0.01 93.82 5.69 0.27 3.02			
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21 9.66 0.22 0.01 94.68 5.75 0.36 2.85 2.25	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05 0.00 95.64 5.62 0.37 2.91 2.38 0.55	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83 0.00 94.71 5.67 0.37 2.94 2.33 0.61	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50 0.11 96.20 5.63 0.37 2.96 2.37 2.96	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87 0.03 95.80 5.66 0.39 2.96 2.34	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.49 0.03 94.85 5.62 0.29 3.12 2.38 0.7=	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60 0.00 94.71 5.63 0.31 3.07 2.37 0.72	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14 0.02 94.79 5.62 0.30 3.09 2.38 0.71	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15 0.01 93.82 5.69 0.27 3.02 2.31 2.51			
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alivi C	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21 9.66 0.22 0.01 94.68 5.75 0.36 2.85 2.25 0.60	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05 0.00 95.64 5.62 0.37 2.91 2.38 0.53 0.01	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83 0.00 94.71 5.67 0.37 2.94 2.33 0.61	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50 0.11 96.20 5.63 0.37 2.96 2.37 0.58 0.01	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87 0.03 95.80 5.66 0.39 2.96 2.34 0.62 0.01	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.49 0.03 94.85 5.62 0.29 3.12 2.38 0.75 0.02	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60 0.00 94.71 5.63 0.31 3.07 2.37 0.70 0.01	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14 0.02 94.79 5.62 0.30 3.09 2.38 0.71 0.00	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15 0.01 93.82 5.69 0.27 3.02 2.31 0.01			
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alivi Cr Fe3+	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21 9.68 0.22 0.01 94.68 5.75 0.36 2.85 2.25 0.60 0.29	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05 0.00 95.64 5.62 0.37 2.91 2.38 0.53 0.01 0.30	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83 0.00 94.71 5.67 0.37 2.94 2.33 0.61 0.32	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50 0.11 96.20 5.63 0.37 2.96 2.37 0.58 0.01 0.30	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87 0.03 95.80 5.66 0.39 2.96 2.34 0.62 0.01 0.29	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.49 0.03 94.85 5.62 0.29 3.12 2.38 0.75 0.02 0.30	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60 0.00 94.71 5.63 0.31 3.07 2.37 0.70 0.01 0.30	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14 0.02 94.79 5.62 0.30 3.09 2.38 0.71 0.00 0.29	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15 0.01 93.82 5.69 0.27 3.02 2.31 0.71 0.29			
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Si Ti Aliv Alivi Cr Fe3+ Fe2+	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21 9.68 0.22 0.01 94.68 5.75 0.36 2.85 2.25 0.60 0.29 2.04	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05 0.00 95.64 5.62 0.37 2.91 2.38 0.53 0.01 0.30 2.43	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83 0.00 94.71 5.67 0.37 2.94 2.33 0.61 0.32 2.62	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50 0.11 96.20 5.63 0.37 2.96 2.37 0.58 0.01 0.30 2.44	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87 0.03 95.80 5.66 0.39 2.96 2.34 0.62 0.01 0.29 2.32	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.49 0.03 94.85 5.62 0.29 3.12 2.38 0.75 0.02 0.30 2.41	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60 0.00 94.71 5.63 0.31 3.07 2.37 0.70 0.01 0.30 2.40	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14 0.02 94.79 5.62 0.30 3.09 2.38 0.71 0.00 0.29 2.36	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15 0.01 93.82 5.69 0.27 3.02 2.31 0.71 0.29 2.35			
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Si Ti Aliv Alivi Cr Fe3+ Fe2+ Mn	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21 9.66 0.22 0.01 94.68 5.75 0.36 2.85 2.25 0.60 0.29 2.04 0.01	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05 0.00 95.64 5.62 0.37 2.91 2.38 0.53 0.01 0.30 2.43 0.01	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83 0.00 94.71 5.67 0.37 2.94 2.33 0.61 0.32 2.62 0.02	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50 0.11 96.20 5.63 0.37 2.96 2.37 0.58 0.01 0.30 2.44 0.01	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87 0.03 95.80 5.66 0.39 2.96 2.34 0.62 0.01 0.29 2.32 0.00	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.49 0.03 94.85 5.62 0.29 3.12 2.38 0.75 0.02 0.30 2.41 0.11	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60 0.00 94.71 5.63 0.31 3.07 2.37 0.70 0.01 0.30 2.40 0.10	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14 0.02 94.79 5.62 0.30 3.09 2.38 0.71 0.00 0.29 2.36 0.10	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15 0.01 93.82 5.69 0.27 3.02 2.31 0.71 0.29 2.35 0.08			
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Si Ti Aliv Alivi Cr Fe3+ Fe2+ Mn Mg	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21 9.66 0.22 0.01 94.68 5.75 0.36 2.85 2.25 0.60 0.00 0.29 2.04 0.01 1.91	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05 0.00 95.64 5.62 0.37 2.91 2.38 0.53 0.01 0.30 2.43 0.01 1.87	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83 0.00 94.71 5.67 0.37 2.94 2.33 0.61 0.32 2.62 0.02 1.79	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50 0.11 96.20 5.63 0.37 2.96 2.37 0.58 0.01 0.30 2.44 0.01 1.81	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87 0.03 95.80 5.66 0.39 2.96 2.34 0.62 0.01 0.29 2.32 0.00 1.81	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.49 0.03 94.85 5.62 0.29 3.12 2.38 0.75 0.02 0.30 2.41 0.11 1.62	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60 0.00 94.71 5.63 0.31 3.07 2.37 0.70 0.01 0.30 2.40 0.10 1.70	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14 0.02 94.79 5.62 0.30 3.09 2.38 0.71 0.00 0.29 2.36 0.10 1.79	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15 0.01 93.82 5.69 0.27 3.02 2.31 0.71 0.29 2.35 0.08 1.63			
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv Aliv Cr Fe3+ Fe2+ Mn Mg Ca	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21 9.66 0.22 0.01 94.68 5.75 0.36 2.85 2.25 0.60 0.00 0.29 2.04 0.01 1.91 0.00	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05 0.00 95.64 5.62 0.37 2.91 2.38 0.53 0.01 0.30 2.43 0.01 1.87 0.00	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83 0.00 94.71 5.67 0.37 2.94 2.33 0.61 0.32 2.62 0.02 1.79 0.00	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50 0.11 96.20 5.63 0.37 2.96 2.37 0.58 0.01 0.30 2.44 0.01 1.81 0.00	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87 0.03 95.80 5.66 0.39 2.96 2.34 0.62 0.01 0.29 2.32 0.00 1.81 0.00	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.49 0.03 94.85 5.62 0.29 3.12 2.38 0.75 0.02 0.30 2.41 0.11 1.62 0.02	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60 0.00 94.71 5.63 0.31 3.07 2.37 0.70 0.01 0.30 2.40 0.10 1.70 0.00	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14 0.02 94.79 5.62 0.30 3.09 2.38 0.71 0.00 0.29 2.36 0.10 1.79 0.00	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15 0.01 93.82 5.69 0.27 3.02 2.31 0.71 0.01 0.29 2.35 0.08 1.63 0.00			
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv Aliv Aliv Cr Fe3+ Fe2+ Mn Mg Ca Na2 KzO KzO KzO KzO KzO KzO KzO KzO KzO KzO	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21 9.66 0.22 0.01 94.68 5.75 0.36 2.85 2.25 0.60 0.29 2.04 0.01 1.91 0.00 0.29	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05 0.00 95.64 5.62 0.37 2.91 2.38 0.53 0.01 0.30 2.43 0.01 1.87 0.00 9.09 1.87	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83 0.00 94.71 5.67 0.37 2.94 2.33 0.61 0.32 2.62 0.02 1.79 0.00 0.89	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50 0.11 96.20 5.63 0.37 2.96 2.37 0.58 0.01 0.30 2.44 0.01 1.81 0.00 0.1 8.4	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87 0.03 95.80 5.66 0.39 2.96 2.34 0.62 0.01 0.29 2.32 0.00 1.81 0.00 1.81	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.49 0.03 94.85 5.62 0.29 3.12 2.38 0.75 0.02 0.30 2.41 0.11 1.62 0.00 0.09	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60 0.00 94.71 5.63 0.31 3.07 2.37 0.70 0.01 0.30 2.40 0.10 1.70 0.00 1.70 0.01 0.30 2.40 0.10 1.70 0.01 0.30 2.40 0.10 1.70 0.01 0.30 2.40 0.10 1.70 0.01 0.30 1.70 0.01 0.30 1.77 1.32 0.00 0.38 9.32 0.60 0.00 94.71 1.55 1.55 1.57 1.57 1.55 1.57 1.	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14 0.02 94.79 5.62 0.30 3.09 2.38 0.71 0.00 0.29 2.36 0.10 1.79 0.00 1.79	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15 0.01 93.82 5.69 0.27 3.02 2.31 0.71 0.01 0.29 2.35 0.08 1.63 0.00 0.12			
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Vi Cr Fe3+ Fe2+ Mn Mg Ca Na K Ba	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21 94.68 5.75 0.36 2.85 2.25 0.60 0.00 0.29 2.04 0.01 1.91 0.00 0.29	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05 0.00 95.64 5.62 0.37 2.91 2.38 0.53 0.01 0.53 0.01 0.30 2.43 0.01 1.87 0.00 9.06	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83 0.00 94.71 5.67 0.37 2.94 2.33 0.61 0.32 2.62 0.02 1.79 0.00 0.08 1.89 0.05	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50 0.11 96.20 5.63 0.37 2.96 2.37 0.58 0.01 0.30 2.44 0.01 1.81 0.00 0.10 1.84 0.03	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87 0.03 95.80 5.66 0.39 2.96 2.34 0.62 0.01 0.29 2.32 0.00 1.81 0.00 1.81 0.00	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.49 0.03 94.85 5.62 0.29 3.12 2.38 0.75 0.02 0.30 2.41 0.11 1.62 0.00 0.09 1.91 0.03	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60 0.00 94.71 5.63 0.31 3.07 2.37 0.70 0.01 0.30 2.40 0.10 1.70 0.00 0.11 1.85 0.04	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14 0.02 94.79 5.62 0.30 3.09 2.38 0.71 0.00 0.29 2.36 0.10 1.79 0.00 1.89 0.01	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15 0.01 93.82 5.69 0.27 3.02 2.31 0.71 0.01 0.29 2.35 0.08 1.63 0.00 0.12 1.83 0.01			
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alvi Cr Fe3+ Fe2+ Mn Mg Ca Na K Ba P P	G3 Rim/2 37.21 3.07 15.65 0.00 20.27 0.10 8.27 0.00 0.21 9.66 0.22 0.01 94.68 5.75 0.36 2.85 2.25 0.60 0.00 0.29 2.04 0.01 1.91 0.00 0.06 1.90 0.01 0.00	G3 Core/3 36.32 3.19 15.98 0.06 21.11 0.05 8.10 0.00 0.31 9.48 1.05 0.00 95.64 5.62 0.37 2.91 2.38 0.53 0.01 0.30 2.43 0.01 1.87 0.00 9.06 0.09 1.87 0.06 0.00	G3 Rim/3 36.33 3.14 16.00 0.07 20.75 0.12 7.71 0.00 0.27 9.51 0.83 0.00 94.71 5.67 0.37 2.94 2.33 0.61 0.32 2.62 0.02 1.79 0.00 0.08 1.89 0.05 0.00	G3 Core/4 36.80 3.18 16.40 0.04 21.39 0.09 7.95 0.00 0.34 9.41 0.50 0.11 96.20 5.63 0.37 2.96 2.37 0.58 0.01 0.30 2.44 0.01 1.81 0.00 0.10 1.84 0.03 0.00	G3 Rim/4 36.96 3.34 16.41 0.06 20.31 0.00 7.92 0.00 0.39 9.50 0.87 0.03 95.80 5.66 0.39 2.96 2.34 0.62 0.01 0.29 2.32 0.00 1.81 0.00 1.81 0.00 0.12 1.86 0.05 0.00	G2 Core/1 36.15 2.46 17.02 0.14 20.79 0.84 6.99 0.00 0.29 9.59 0.03 94.85 5.62 0.29 3.12 2.38 0.75 0.02 0.30 2.41 0.11 1.62 0.00 0.09 1.91 0.03 0.00	G2 Rim/1 36.17 2.65 16.72 0.06 20.73 0.77 7.32 0.00 0.38 9.32 0.60 0.00 94.71 5.63 0.31 3.07 2.37 0.70 0.01 0.30 2.40 0.10 1.70 0.00 0.11 1.85 0.04 0.00	G2 Core/2 36.26 2.60 16.94 0.00 20.44 0.77 7.75 0.00 0.31 9.57 0.14 0.02 94.79 5.62 0.30 3.09 2.38 0.71 0.00 0.29 2.36 0.10 1.79 0.00 1.89 0.01 0.00	G2 Rim/2 36.52 2.28 16.41 0.11 20.24 0.61 7.89 0.02 0.39 9.19 0.15 0.01 93.82 5.69 0.27 3.02 2.31 0.71 0.01 0.29 2.35 0.08 1.83 0.00 0.12 1.83 0.01			

#### APPENDIX 4.3 : CONTINUED. BIOTITE ARDARA

Location	ARD4 Core/1	ARD4 Core/2	ARD4 Core/3	ARD4 Rim/3	ARD4 Core/11	ARD4 Core/12	ARD4 Core/13	ARD4 Core/14	ARD4 Core/15	ARD1D Core/1	ARD1D Rim/1	ARD1D Core/2
SiO2	37.32	37,19	37.21	37.01	37.27	37.49	37,30	37.28	37.22	36.81	36.71	35.98
TIO2	1.87	1.89	1.88	1.54	2.34	1.77	1.81	1.95	2.02	2.47	2.83	2.93
AI2O3	15.72	15.46	15.38	15.71	15.33	15.19	15.40	15.63	15.59	14.93	14.53	14.67
Cr2O3	0.03	0.01	0.06	0.00	0.08	0.00	0.03	0.00	0.11	0.08	0.14	0.09
FeO	17.97	18.29	18.14	18.05	19.18	19.26	18.79	18.89	18.65	20.56	20.11	20.49
MnO	0.06	0.05	0.16	0.16	0.11	0.21	0.12	0.08	0.16	0.00	0.00	0.00
MgO	11.88	11.90	11.42	12.14	11.80	11.42	11.44	11.86	11.72	10.34	10.01	10.12
CaO No2O	0.12	0.13	0.13	0.05	0.13	0.09	0.05	0.11	0.17	0.00	0.00	0.07
K2O	9.42	0.37	0.07	0.33	9.53	0.27	0.41	0.40	9.52	9.54	9.52	0.45
BaO	0.07	0.00	0.00	0.00	0.01	0 17	0.00	0.00	0.13	0.10	0.09	0.12
P2O5	0.02	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.11	0.06
Total	94.28	94.77	94.68	93.44	96.20	95.66	94.86	95.62	95.74	95.34	94.45	94.49
Si	5.70	5.70	5.71	5.69	5.64	5.72	5.71	5.66	5.66	5.66	5.70	5.60
Ti	0.22	0.22	0.22	0.18	0.27	0.20	0.21	0.22	0.23	0.29	0.33	0.34
Al	2,83	2.79	2.78	2.85	2.73	2.73	2.78	2.80	2.79	2.70	2.66	2.69
Aliv	2.30	2.30	2.29	2.31	2.36	2.29	2.29	2.34	2.35	2.34	2.30	2.40
Alvi	0.53	0.49	0.49	0.54	0.37	0.44	0.49	0.46	0.45	0.36	0.36	0.30
Cr	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.02	0.01
Fe3+	0.25	0.26	0.26	0.26	0.27	0.27	0.27	0.26	0.26	0.29	0.29	0.29
Fe2+	2.04	2.09	2.07	2.07	2.16	2,19	2.14	2.14	2.11	2.35	2,32	2.38
Min	0.01	0.01	0.02	0.02	0.01	0.27	0.02	0.01	0.02	0.00	0.00	0.00
Ng Co	2./1	0.02	2.01	2.79	2.00	0.02	0.01	2.09	2.00	0.00	2.02	2.00
Na	0.02	0.02	0.02	0.01	0.02	0.02	0.01	0.02	0.03	0.00	0.00	0.01
K	1 73	1.85	1 87	1.80	1 84	1.91	1.86	1.82	1.85	1 87	1 88	1 88
Ra	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
P	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.01	0.01
Sampel	ARD1D	ARD3A	ARD3A	ABD3A	ARD3A	ARD3A	ARD3A	ABD3A	48034		ARDSA	
Location	Rim/2	Core/1	Rim/1	Core/2	Rim/3	Core/3	Rim/3	Core/4	Rim/4	Core/5	Core/6	Rim/6
Location SiO2	Rim/2	Core/1	Rim/1	Core/2 36.57	Rim/3	Core/3	Rim/3	Core/4	Rim/4	Core/5	Core/6	Rim/6
SiO2	Rim/2 36.58 2.31	Core/1 36.63 1.91	Rim/1 36.08 2.06	Core/2 36.57 1.94	Rim/3 36.54 1.96	Core/3 36.64 1.76	Rim/3 36.93 1.96	Core/4 37.01 2.39	Bim/4 37.18 2.24	Core/5 37.19 1.71	Core/6 36.72 1.96	81m/6 37.06 1.96
SiO2 TiO2 Al2O3	Rim/2 36.58 2.31 14.74	Core/1 36.63 1.91 15.46	Rim/1 36.08 2.06 14.72	Core/2 36.57 1.94 15.13	Rim/3 36.54 1.96 15.17	Core/3 36.64 1.76 15.06	Rim/3 36.93 1.96 15.01	Core/4 37.01 2.39 15.00	Bim/4 37.18 2.24 15.01	Core/5 37.19 1.71 14.73	Core/6 36.72 1.96 14.98	81m/6 37.06 1.96 15.50
Location SIO2 TIO2 AI2O3 Cr2O3	Rim/2 36.58 2.31 14.74 0.01	Core/1 36.63 1.91 15.46 0.08	Rim/1 36.08 2.06 14.72 0.05	Core/2 36.57 1.94 15.13 0.00	Rim/3 36.54 1.96 15.17 0.02	Core/3 36.64 1.76 15.06 0.03	Rim/3 36.93 1.96 15.01 0.11	Core/4 37.01 2.39 15.00 0.00	Bim/4 37.18 2.24 15.01 0.04	Core/5 37.19 1.71 14.73 0.05	Core/6 36.72 1.96 14.98 0.11	Bim/6 37.06 1.96 15.50 0.04
SiO2 TiO2 Al2O3 Cr2O3 FeO	Rim/2 36.58 2.31 14.74 0.01 19.51	Core/1 36.63 1.91 15.46 0.08 20.97	Rim/1 36.08 2.06 14.72 0.05 20.56	Core/2 36.57 1.94 15.13 0.00 21.00	Rim/3 36.54 1.96 15.17 0.02 20.60	Core/3 36.64 1.76 15.06 0.03 21.22	Rim/3 36.93 1.96 15.01 0.11 21.48	Core/4 37.01 2.39 15.00 0.00 21.02	Rim/4 37.18 2.24 15.01 0.04 20.49	Core/5 37.19 1.71 14.73 0.05 19.99	Core/6 36.72 1.96 14.98 0.11 20.86	81m/6 37.06 1.96 15.50 0.04 20.91
Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02	Core/1 36.63 1.91 15.46 0.08 20.97 0.00	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00	Core/2 36.57 1.94 15.13 0.00 21.00 0.05	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10	Core/3 36.64 1.76 15.06 0.03 21.22 0.00	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00	Core/4 37.01 2.39 15.00 0.00 21.02 0.00	Rim/4 37.18 2.24 15.01 0.04 20.49 0.00	Core/5 37.19 1.71 14.73 0.05 19.99 0.00	Core/6 36.72 1.96 14.98 0.11 20.86 0.00	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00
SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 10.70	Rim/4 37.18 2.24 15.01 0.04 20.49 0.00 10.72	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82
SiO2 TiO2 Ai2O3 Cr2O3 FeO MnO MgO CaO	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 10.70 0.00	Rim/4 37.18 2.24 15.01 0.04 20.49 0.00 10.72 0.08	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14
SiO2 TiO2 Ai2O3 Cr2O3 FeO MnO MgO CaO Na2O	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 10.70 0.00 0.50	Rim/4 37.18 2.24 15.01 0.04 20.49 0.00 10.72 0.08 0.34	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25
Location SiO2 TiO2 Ai2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O Na2O	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 2.22	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 10.70 0.00 0.50 9.57 0.00	Rim/4 37.18 2.24 15.01 0.04 20.49 0.00 10.72 0.08 0.34 9.40	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00
Location SiO2 TIO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO Dao5	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 0.23 0.00	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00	Core/3 36.84 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 10.70 0.00 0.50 9.57 0.00	Rim/4 37.18 2.24 15.01 0.04 20.49 0.00 10.72 0.08 0.34 9.40 0.00 0.00	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00
Location SiO2 TIO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Tatal	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 0.23 0.09	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00 0.00 0.10	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00 0.06	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00 0.00	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00 0.00	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00 0.00	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00 0.00 0.00	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 10.70 0.00 0.50 9.57 0.00 0.00 0.50	Rim/4 37.18 2.24 15.01 0.04 20.49 0.00 10.72 0.08 0.34 9.40 0.00 0.04 9.5 53	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00 0.07	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04 0.04 0.04	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00 0.00 0.00
Location SiO2 TiO2 Ai2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 0.23 0.09 93.58	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00 0.10 95.74	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00 0.06 94.93	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00 0.00 95.12	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00 0.00 94.87	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00 0.00 95.39	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00 0.00 96.32	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 10.70 0.00 0.50 9.57 0.00 0.00 9.57	Rim/4 37.18 2.24 15.01 0.04 20.49 0.00 10.72 0.08 0.34 9.40 0.00 0.04 95.53	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00 0.07 95.15	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04 0.04 95.42	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00 0.00 95.68
Location SiO2 TiO2 Ai2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 0.23 0.09 93.58 5.71	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00 0.10 95.74 5.62	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00 0.06 94.93 5.70	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00 0.00 95.12 5.66	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00 0.00 94.87 5.66	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00 0.00 95.39 5.67	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00 0.00 96.32 5.66	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 10.70 0.00 0.50 9.57 0.00 0.00 95.71 5.67	Rim/4 37.18 2.24 15.01 0.04 20.49 0.00 10.72 0.08 0.34 9.40 0.00 0.04 95.53	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00 0.07 95.15	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04 0.04 95.42 5.66	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00 0.00 95.68
Location SiO2 TiO2 Ai2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 0.23 0.09 93.58 5.71 0.27	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00 0.10 95.74 5.62 0.22	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00 0.06 94.93 5.70 0.24	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00 95.12 5.66 0.23	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00 0.00 94.87 5.66 0.23	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00 0.00 95.39 5.67 0.20	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00 0.00 96.32 5.66 0.23	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 10.70 0.00 0.50 9.57 0.00 0.00 95.71 5.67 0.22	Rim/4 37.18 2.24 15.01 0.04 20.49 0.00 10.72 0.08 0.34 9.40 0.00 0.04 95.53 5.71 0.26	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00 0.07 95.15 5.72 0.20	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04 0.04 95.42 5.66 0.23	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00 0.00 95.68 5.67 0.23
Location SiO2 TiO2 Ai2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Ai	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 0.23 0.09 93.58 5.71 0.27 2.71	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00 0.10 95.74 5.62 0.22 2.80	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00 0.06 94.93 5.70 0.24 2.66	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00 0.00 95.12 5.66 0.23 2.76	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00 0.00 94.87 5.66 0.23 2.77	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00 0.00 95.39 5.67 0.20 2.75	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00 0.00 96.32 5.66 0.23 2.71	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 10.70 0.00 0.50 9.57 0.00 0.00 95.71 5.67 0.28 2.71	Rim/4 37.18 2.24 15.01 0.04 20.49 0.00 10.72 0.08 0.34 9.40 0.00 0.04 95.53 5.71 0.26 2.72	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00 0.07 95.15 5.72 0.20 2.67	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04 0.04 95.42 5.66 0.23 2.72	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00 0.00 0.00 95.68 5.67 0.23 2.80
Location SiO2 TiO2 Ai2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Ai Aliv Aliv	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 0.23 0.09 93.58 5.71 0.27 2.71 2.29	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00 0.10 95.74 5.62 0.22 2.80 2.38 0.43	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00 0.06 94.93 5.70 0.24 2.66 2.30	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00 0.00 95.12 5.66 0.23 2.76 2.34	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00 0.00 94.87 5.66 0.23 2.77 2.35 0.42	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00 0.00 95.39 5.67 0.20 2.75 2.33 0.41	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00 0.00 96.32 5.66 0.23 2.71 2.34 0.27	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 10.70 0.00 9.57 0.00 0.00 95.71 5.67 0.28 2.71 2.33 0.20	Rim/4 37.18 2.24 15.01 0.04 20.49 0.00 10.72 0.08 0.34 9.40 0.00 0.04 95.53 5.71 0.26 2.72 2.29 0.43	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00 0.07 95.15 5.72 0.20 2.67 2.28 0.20	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04 0.04 95.42 5.66 0.23 2.72 2.34	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00 0.00 95.68 5.67 0.23 2.80 2.33 0.43
Location SiO2 TIO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alivi Cr	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 0.23 0.09 93.58 5.71 0.27 2.71 2.29 0.42	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00 0.10 95.74 5.62 0.22 2.80 2.38 0.42	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00 0.06 94.93 5.70 0.24 2.66 2.30 0.36 0.01	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00 95.12 5.66 0.23 2.76 2.34 0.43 0.00	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00 0.00 94.87 5.66 0.23 2.77 2.35 0.42 0.00	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00 0.00 95.39 5.67 0.20 2.75 2.33 0.41 0.00	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00 0.00 96.32 5.66 0.23 2.71 2.34 0.37 0.01	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 10.70 0.00 0.50 9.57 0.00 0.00 95.71 5.67 0.28 2.71 2.33 0.39	Rim/4 37.18 2.24 15.01 0.04 20.49 0.00 10.72 0.08 0.34 9.40 0.00 0.04 95.53 5.71 0.26 2.72 2.29 0.42 0.01	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00 0.07 95.15 5.72 0.20 2.67 2.28 0.39 0.01	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04 0.04 95.42 5.66 0.23 2.72 2.34 0.39 0.01	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00 0.00 95.68 5.67 0.23 2.80 2.33 0.47
Location SiO2 TIO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alivi Cr Ea3+	Rim/2 36.58 2.31 14.74 0.02 10.45 0.00 0.22 9.41 0.23 0.09 93.58 5.71 0.27 2.71 2.29 0.42 0.00 0.28	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00 0.10 95.74 5.62 0.22 2.80 2.38 0.42 0.00 0.30	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00 0.06 94.93 5.70 0.24 2.66 2.30 0.36 0.036	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00 95.12 5.66 0.23 2.76 2.34 0.43 0.030	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00 0.00 94.87 5.66 0.23 2.77 2.35 0.42 0.00 0.29	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00 0.00 95.39 5.67 0.20 2.75 2.33 0.41 0.03 0.30	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00 0.00 96.32 5.66 0.23 2.71 2.34 0.37 0.30	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 10.70 0.00 0.50 9.57 0.00 0.00 9.57 0.00 0.00 9.571 5.67 0.28 2.71 2.33 0.39 0.00	Rim/4 37.18 2.24 15.01 0.04 20.49 0.00 10.72 0.08 0.34 9.40 0.00 0.04 95.53 5.71 0.26 2.72 2.29 0.42 0.01 0.29	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00 0.07 95.15 5.72 0.20 2.67 2.28 0.39 0.01 0.28	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04 0.04 95.42 5.66 0.23 2.72 2.34 0.39 0.01 0.30	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00 0.00 95.68 5.67 0.23 2.80 2.33 0.47 0.30
Location SiO2 TIO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O Na2O Na2O K2O BaO P2O5 Total Si Ti A1 Aliv Avi Cr2O3 FeO MnO MgO CaO Si Ti CaO Si Ti CaO Si Ti CaO Si Ti CaO Si Ti Ali Aliv A	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 0.23 0.09 93.58 5.71 0.27 2.71 2.29 0.42 0.00 0.28 2.26	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00 0.10 95.74 5.62 0.22 2.80 2.38 0.42 0.00 0.30 0.30	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00 0.06 94.93 5.70 0.24 2.66 2.30 0.36 0.03 0.29 2.37	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00 0.00 95.12 5.566 0.23 2.76 2.34 0.43 0.00 0.30 2.42	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00 0.00 94.87 5.66 0.23 2.77 2.35 0.42 0.00 0.29 2.37	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00 0.00 95.39 5.67 0.20 2.75 2.33 0.41 0.03 0.30 2.44	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00 0.00 96.32 5.66 0.23 2.71 2.34 0.37 0.30 2.45	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.50 9.57 1.2.33 0.39 0.00 0.30 0.30 0.30	Rim/4 37.18 2.24 15.01 0.04 20.49 0.00 10.72 0.08 0.34 9.40 0.00 0.04 95.53 5.71 0.26 2.72 2.29 0.42 0.01 0.29 2.34	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00 0.07 95.15 5.72 0.20 2.67 2.28 0.39 0.28 2.29	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04 0.04 95.42 5.66 0.23 2.72 2.34 0.39 0.01 0.30 2.40	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00 0.00 95.68 5.67 0.23 2.80 2.33 0.47 0.30 2.38
Location SiO2 TIO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O Na2O K2O BaO P2O5 Total Si Ti A1 Aliv Aivi Cr Fe3+ Fe2+ Mn	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 0.23 0.09 93.58 5.71 0.27 2.71 2.29 0.42 0.00 0.28 2.26 0.00	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00 0.10 95.74 5.62 0.22 2.80 2.38 0.42 0.00 2.40 0.00	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00 0.06 94.93 5.70 0.24 2.66 2.30 0.36 0.01 0.29 2.37 0.00	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00 95.12 5.66 0.23 2.76 2.34 0.43 0.00 2.42 0.01	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00 0.00 94.87 5.66 0.23 2.77 2.35 0.42 0.00 0.29 2.37 0.01	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00 0.00 95.39 5.67 0.20 2.75 2.33 0.41 0.00 0.34 0.00 2.44 0.00	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00 0.00 96.32 5.66 0.23 2.71 2.34 0.37 0.01 0.37 0.01 0.245 0.00	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.50 9.57 1.2.33 0.39 0.00 0.39 0.00 0.2.40 0.00	Rim/4     37.18     2.24     15.01     0.04     20.49     0.00     10.72     0.08     0.34     9.40     0.00     0.04     95.53     5.71     0.26     2.72     2.29     0.42     0.01     0.29     2.34     0.00	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00 0.07 95.15 5.72 0.20 2.67 2.28 0.39 0.01 0.28 2.29 0.00	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04 0.04 95.42 5.66 0.23 2.72 2.34 0.39 0.01 0.30 2.40 0.00	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00 95.68 5.67 0.23 2.80 2.33 0.47 0.01 0.238 0.00
Location SiO2 TIO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alvi Cr Fe3+ Fe2+ Mn Mg	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 0.23 0.09 93.58 5.71 0.27 2.71 2.29 0.42 0.00 0.28 2.00 0.243	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00 0.10 95.74 5.62 0.22 2.80 2.38 0.42 0.00 2.38 0.42 0.00 2.40 0.00 2.47	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00 0.06 94.93 5.70 0.24 2.66 2.30 0.36 0.01 0.29 2.37 0.00 2.47	Core/2 36.57 1.94 15.13 0.00 21.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00 0.00 95.12 5.66 0.23 2.76 2.34 0.43 0.00 0.30 2.42 0.01 2.46	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00 0.00 94.87 5.66 0.23 2.77 2.35 0.42 0.00 0.29 2.37 0.01 2.46	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00 0.00 95.39 5.67 0.20 2.75 2.33 0.41 0.00 2.44 0.00 2.49	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00 0.00 96.32 5.66 0.23 2.71 2.34 0.37 0.01 0.30 2.45 0.00 2.44	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.50 9.57 1.2.33 0.39 0.00 0.30 2.44	Rim/4     37.18     2.24     15.01     0.04     20.49     0.00     10.72     0.08     0.34     9.40     0.00     0.04     95.53     5.71     0.26     2.72     2.29     0.42     0.01     0.29     2.34     0.00     2.45	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00 0.07 95.15 5.72 0.20 2.67 2.28 0.39 0.01 0.28 2.29 0.00 2.64	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04 0.04 95.42 5.66 0.23 2.72 2.34 0.39 0.01 0.30 2.40 0.00 2.47	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00 95.68 5.67 0.23 2.80 2.33 0.47 0.01 0.30 2.38 0.00 2.47
Location SiO2 TIO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv Cr Fe3+ Fe2+ Mn Mg Ca	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 0.23 0.09 93.58 5.71 0.27 2.71 2.29 0.42 0.00 0.28 2.00 0.28 2.00 2.43 0.00	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00 0.10 95.74 5.62 0.22 2.80 2.38 0.42 0.00 0.30 2.40 0.30 2.47 0.04	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00 0.06 94.93 5.70 0.24 2.66 2.30 0.36 0.01 0.29 2.37 0.00 2.47 0.03	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00 0.00 95.12 5.66 0.23 2.76 2.34 0.43 0.00 0.30 2.42 0.01 2.46 0.02	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00 0.00 94.87 5.66 0.23 2.77 2.35 0.42 0.00 0.29 2.37 0.01 2.46 0.04	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00 0.00 95.39 5.67 0.20 2.75 2.33 0.41 0.00 2.44 0.00 2.49 0.01	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00 0.00 96.32 5.66 0.23 2.71 2.34 0.37 0.01 0.30 2.45 0.00 2.44 0.00	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.50 9.57 1.2.33 0.39 0.00 0.30 2.40 0.00 2.44 0.00	Rim/4     37.18     2.24     15.01     0.04     20.49     0.00     10.72     0.08     0.34     9.40     0.00     0.04     95.53     5.71     0.26     2.72     2.29     0.42     0.01     0.29     2.45     0.01	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00 0.07 95.15 5.72 0.20 2.67 2.28 0.39 0.01 0.28 2.29 0.00 2.64 0.03	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04 0.04 95.42 5.66 0.23 2.72 2.34 0.39 0.01 0.30 2.40 0.00 2.47 0.01	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00 0.00 95.68 5.67 0.23 2.80 2.33 0.47 0.01 0.30 2.38 0.00 2.47 0.02
Location SiO2 TIO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv Aliv Fe3+ Fe2+ Mn Mg Ca Na Na Na Na Na Na Na Na Na N	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 0.23 0.09 93.58 5.71 0.27 2.71 2.29 0.42 0.00 0.28 2.00 0.28 2.00 0.28 2.00 0.243 0.00 0.27	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00 0.10 95.74 5.62 0.22 2.80 2.38 0.42 0.00 0.30 2.40 0.30 2.47 0.04 0.13	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00 0.06 94.93 5.70 0.24 2.66 2.30 0.36 0.01 0.29 2.37 0.00 2.47 0.03 0.15	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00 0.00 95.12 5.66 0.23 2.76 2.34 0.43 0.00 0.30 2.48 0.02 0.01 2.46 0.02 0.10	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00 0.00 94.87 5.66 0.23 2.77 2.35 0.42 0.00 0.29 2.37 0.01 2.46 0.04 0.13	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00 0.00 95.39 5.67 0.20 2.75 2.33 0.41 0.00 0.30 2.49 0.01 0.10	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00 0.00 96.32 5.66 0.23 2.71 2.34 0.37 0.01 0.30 2.45 0.00 2.44 0.00 0.16	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.00 0.50 9.57 0.00 0.00 0.50 9.57 0.00 0.00 0.50 9.57 0.00 0.00 0.50 9.57 0.00 0.00 0.50 9.57 0.00 0.00 0.50 9.57 0.00 0.00 0.50 9.57 0.00 0.00 0.50 9.57 0.00 0.00 0.50 9.57 0.00 0.00 0.50 9.57 0.00 0.00 0.50 9.57 0.00 0.00 0.50 9.57 0.28 2.71 2.33 0.39 0.00 0.30 0.30 0.00 0.30 0.30 0.00 0.30 0.30 0.30 0.00 0.30 0	Rim/4     37.18     2.24     15.01     0.04     20.49     0.00     10.72     0.08     0.34     9.40     0.00     0.04     95.53     5.71     0.26     2.72     2.29     0.42     0.01     0.29     2.45     0.01     0.10	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00 0.07 95.15 5.72 0.20 2.67 2.28 0.39 0.01 0.28 2.29 0.00 2.64 0.03 0.11	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04 0.04 95.42 5.66 0.23 2.72 2.34 0.39 0.01 0.30 2.40 0.00 2.47 0.01 0.09	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00 0.00 95.68 5.67 0.23 2.80 2.33 0.47 0.01 0.30 2.38 0.00 2.47 0.02 0.07
Location SIO2 TIO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv Aliv Aliv Aliv Cr Fe3+ Fe2+ Mn Mg Ca Na K	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 0.23 0.09 93.58 5.71 0.27 2.71 2.29 0.42 0.00 0.28 2.26 0.00 2.43 0.00 2.43 0.00 7.1.87	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00 0.10 95.74 5.62 0.22 2.80 2.38 0.42 0.00 0.30 2.40 0.30 2.47 0.04 0.13 1.78	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00 0.06 94.93 5.70 0.24 2.66 2.30 0.36 0.01 0.29 2.37 0.00 2.47 0.03 0.15 1.82	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00 0.00 95.12 5.66 0.23 2.76 2.34 0.43 0.00 0.30 2.42 0.01 2.46 0.02 0.10 1.85	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 10.66 0.21 0.43 9.17 0.00 0.00 94.87 5.66 0.23 2.77 2.35 0.42 0.00 0.29 2.37 0.01 2.46 0.04 0.13 1.81	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00 0.00 95.39 5.67 0.20 2.75 2.33 0.41 0.00 0.30 2.44 0.00 2.49 0.01 0.10 1.87	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00 0.00 96.32 5.66 0.23 2.71 2.34 0.37 0.01 0.30 2.45 0.00 2.44 0.00 0.16 1.87	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.20 0.257 0.28 2.71 2.33 0.39 0.00 0.30 2.40 0.30 2.44 0.00 2.44	Rim/4     37.18     2.24     15.01     0.04     20.49     0.00     10.72     0.08     0.34     9.40     0.00     0.04     95.53     5.71     0.26     2.72     2.29     0.42     0.01     0.29     2.34     0.00     2.45     0.01     1.84	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00 0.07 95.15 5.72 0.20 2.67 2.28 0.39 0.01 0.28 2.29 0.00 0.264 0.03 0.11 1.83	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04 0.04 95.42 5.66 0.23 2.72 2.34 0.39 0.01 0.30 2.40 0.247 0.01 0.09 1.89	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00 0.00 95.68 5.67 0.23 2.80 2.33 0.47 0.01 0.30 2.38 0.07 1.76
Location SIO2 TIO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alvi Cr Fe3+ Fe2+ Mn Mg Ca Naa K Ba	Rim/2 36.58 2.31 14.74 0.01 19.51 0.02 10.45 0.00 0.22 9.41 0.23 0.09 93.58 5.71 0.27 2.71 2.29 0.42 0.00 0.28 2.26 0.00 2.43 0.00 0.27 1.87 0.01	Core/1 36.63 1.91 15.46 0.08 20.97 0.00 10.79 0.26 0.44 9.10 0.00 0.10 95.74 5.62 0.22 2.80 2.38 0.42 0.00 0.30 2.40 0.00 2.40 0.00 2.47 0.04 0.13 1.78 0.00	Rim/1 36.08 2.06 14.72 0.05 20.56 0.00 10.72 0.03 0.48 9.23 0.00 0.06 94.93 5.70 0.24 2.66 2.30 0.36 0.01 0.29 2.37 0.00 2.47 0.03 0.15 1.82 0.00	Core/2 36.57 1.94 15.13 0.00 21.00 0.05 10.64 0.10 0.32 9.37 0.00 0.00 95.12 5.66 0.23 2.76 2.34 0.43 0.00 0.30 2.42 0.01 2.46 0.02 0.10 1.85 0.00	Rim/3 36.54 1.96 15.17 0.02 20.60 0.10 0.66 0.21 0.43 9.17 0.00 0.00 94.87 5.66 0.23 2.77 2.35 0.42 0.00 0.29 2.37 0.42 0.00 0.29 2.37 0.01 2.46 0.04 0.29 2.37 0.01 2.46 0.04 0.29 2.37	Core/3 36.64 1.76 15.06 0.03 21.22 0.00 10.81 0.06 0.34 9.49 0.00 0.00 95.39 5.67 0.20 2.75 2.33 0.41 0.00 0.30 2.44 0.00 2.49 0.01 0.10 1.87 0.00	Rim/3 36.93 1.96 15.01 0.11 21.48 0.00 10.68 0.01 0.55 9.59 0.00 0.00 96.32 5.66 0.23 2.71 2.34 0.37 0.01 0.30 2.45 0.00 2.44 0.00 0.16 1.87 0.00	Core/4 37.01 2.39 15.00 0.00 21.02 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.50 9.57 0.00 0.00 9.57 0.00 0.00 0.20 0.00 0.50 9.57 0.00 0.00 0.00 0.00 0.50 9.57 0.00 0.00 0.00 0.50 9.57 0.00 0.00 0.00 0.50 9.57 0.00 0.00 0.00 0.50 9.57 0.00 0.00 0.00 0.50 9.57 0.00 0.00 0.00 0.00 0.50 9.57 0.00 0.00 0.00 0.50 9.57 0.00 0.00 0.00 0.50 9.57 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.50 9.57 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.50 9.57 0.00 0.30 2.40 0.00 0.15 1.87 0.00 0.00 0.00 0.30 0.40 0.00 0.15 1.87 0.00 0	Rim/4     37.18     2.24     15.01     0.04     20.49     0.00     10.72     0.08     0.34     9.40     0.00     0.04     95.53     5.71     0.26     2.72     2.29     0.42     0.01     0.29     2.34     0.00     2.45     0.01     1.84     0.00	Core/5 37.19 1.71 14.73 0.05 19.99 0.00 11.52 0.19 0.37 9.32 0.00 0.07 95.15 5.72 0.20 2.67 2.28 0.39 0.01 0.28 2.29 0.00 2.64 0.03 0.11 1.83 0.00	Core/6 36.72 1.96 14.98 0.11 20.86 0.00 10.75 0.06 0.32 9.59 0.04 0.04 95.42 5.66 0.23 2.72 2.34 0.39 0.01 0.30 2.40 0.00 2.47 0.01 0.09 1.89 0.00	Rim/6 37.06 1.96 15.50 0.04 20.91 0.00 10.82 0.14 0.25 9.00 0.00 95.68 5.67 0.23 2.80 2.33 0.47 0.01 0.30 2.38 0.00 2.47 0.02 0.07 1.76 0.00

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#### APPENDIX 4.3 - CONTINUED BIOTITE ARDARA

Sampel	ARD3A	ARD3A	ARD3A	ARD10	ARD10	ARD10	ARD10	ARD10	ARD10
Location	Core/7	Core/8	Rim/8	Core/1	Rim/1	Core/2	Rim/2	Core/3	Rim/3
SIO2	37 13	36 57	36.92	37 87	37.61	38.06	37 26	37.81	28.23
TiO2	1 88	2 41	1 82	1 90	1 01	1 77	1 73	1 76	1 80
A1203	15 10	14.87	15 11	15.87	15.89	15 64	15 43	15.63	15 35
Cr2O3	0.00	0 1 9	0.05	0 10	0.05	0.08	0.06	0.03	0.07
FaD	20.16	20.05	20.32	17 28	17 51	17 47	17 26	16 96	16 86
MnO	0.01	0.06	0.00	0 10	0.24	0.25	0.21	0.17	0.00
MaO	11 62	10 43	10.83	11 64	11 65	12 20	12 43	11 60	11 55
CoC	0 11	0 12	0.00	0.07	0.02	0.03	0.06	0.00	0.00
Na2O	0.11	0.12	0.10	0.07	0.02	0.03	0.00	0.00	0.00
Kan	0.40	0.01	0.30	0.44	0.40	0.31	0.42	0.20	0,10
R <sub>2</sub> O	5.24	0.00	0.00	0.20	0.00	0.10	0.00	0.00	9.03
DaU DaU	0.00	0.00	0.00	0.00	0.20	0.15	0.22	0.00	0.34
Total	0.00	0.00	0.03	0.09	05 26	0.10	0.09	0.00	0.10
TOTAL	90.00	93.40	94.92	95.09	95.50	90.00	94.02	94.00	94.40
Si	5.68	6.06	5.70	5.73	5.68	5.72	5.69	5.76	5.51
Ti	0.22	0.28	0.21	0.22	0.22	0.20	0.20	0.20	0.22
AI	2.72	2.71	2.75	2.83	2.83	2,77	2.78	2.81	2.75
Aliv	2.32	1.94	2,30	2.27	2.32	2.28	2.31	2.24	2.49
Alvi	0.40	0.77	0.45	0.56	0.51	0.49	0.47	0.57	0.26
Cr	0.00	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01
Fe3+	0.28	0.30	0.29	0.24	0.24	0.24	0.24	0.24	0.24
Fe2+	2.29	2.41	2.34	1.95	1.97	1.95	1.96	1.92	1.91
Mn	0.00	0.01	0.00	0.02	0.03	0.03	0.03	0.02	0.01
Ma	2.63	2.40	2.49	2.62	2.62	2.73	2.83	2.66	2.62
Ca	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.00	0.00
Na	0.13	0.15	0.17	0.13	0.13	0.09	0.12	0.07	0.05
K	1.80	1.89	1.81	1.79	1.86	1.86	1.73	1.86	1.87
Ba	0.00	0.00	0.00	0.02	0.01	0.01	0.01	0.04	0.02
P	0.00	0.00	0.00	0.01	0.03	0.02	0.01	0.01	0.02

#### APPENDIX 4.3 : CONTINUED BIOTITE FANAD

Sampel Location	FAN23 Core/1	FAN23 Rim/1	FAN23 Core/2	FAN23 Rim/2	FAN23 Core/3	FAN23 Rim/3	FAN23 Core/4	FAN23 Rim/4	FAN19 Core/1	FAN19 Half/1	FAN19 Rim/1	FAN19 Core/2
SiO2	35.83	36.22	36.43	36.50	35.70	36.52	36.61	36.56	35.17	36.40	36.33	35.37
TiO2	4.05	4.07	3.97	3.29	4.18	3.71	3.36	3.66	4.02	3.80	3.95	3.14
AI2O3	13.39	14.23	13.82	13.01	14.76	14.21	14.26	14.22	14.44	14.20	14.45	14.56
Cr2O3	0.02	0.06	0.20	0.01	0.01	0.06	0.08	0.08	0.02	0.12	0.17	0.00
HeQ MeQ	18.86	18.50	19.20	19.47	19.95	18.66	19.53	19.08	20.85	19.96	20.27	20.70
MaQ	11.00	11 35	11 43	13.17	10.00	11 90	0.03	10.02	0.00	10.17	10.00	0.00
CaO	0.07	0 11	0.00	0.01	0.00	0.20	0.00	0.09	0.00	0.10	0.10	0.00
Na2O	0.43	0.43	0.42	0.11	0.34	0.10	0.37	0.29	0.35	0.49	0.32	0.33
K20	8.93	9.10	8.80	9.17	8.98	8.47	9.43	9.30	8.62	8.92	9.23	8.33
BaO	1.37	0.87	1.95	0.61	2.22	0.66	1.00	0.75	2.35	1.76	1.17	0.85
P2O5	0.07	0.10	0.10	0.08	0.02	0.11	0.13	0.07	0.10	0.11	0.15	0.75
Total	94.26	95.04	96.32	94.44	96.87	94.61	96.06	94.98	95.81	96.03	96.48	94.51
Si	5.60	5.58	5.59	5.67	5.49	5.61	5.61	5.64	5.48	5.61	5.57	5.51
Ti	0.48	0.47	0.46	0.38	0.48	0.43	0.39	0.43	0.47	0.44	0.46	0.37
AI	2.47	2.58	2.50	2.38	2.68	2.57	2.57	2.59	2.66	2.58	2.61	2.68
Aliv	2.40	2.43	2.41	2.33	2.51	2.39	2.39	2.36	2.52	2.39	2.43	2.49
Alvi	0.07	0.16	0.09	0.05	0.17	0.18	0.18	0.22	0.14	0.20	0.18	0,19
Cr Ee2	0.00	0.01	0.02	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.02	0.00
Fe3+	0.27	0.26	0.27	0.28	0.28	0.20	0.20	0.27	0.30	0.28	0.29	0.30
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ma	2.62	2.61	2.61	2.82	2.45	2.72	2.57	2.50	2.32	2.34	2.36	2.60
Ca	0.01	0.02	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.02	0.02	0.00
Na	0.13	0.13	0.13	0.03	0.10	0.03	0.11	0.09	0.11	0.14	0.10	0.10
к	1.78	1.79	1.72	1.82	1.76	1.66	1.84	1.83	1.72	1.75	1.81	1.66
Ba	0.08	0.05	0.12	0.04	0.13	0.04	0.06	0.05	0.14	0.11	0.07	0.05
P	0.01	0.01	0.01	0.01	0.00	0.02	0.02	0.01	0.01	0.01	0.02	0.01
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Sampel Location	FAN19 Rim/2	FAN19 Core/3	FAN19 Rim/3	FAN19 Core/4	F582 Core/3	F582 Core/2	F582 Rim/2	FAN11 Core/1	FAN11 Rim/1	FAN11 Core/2	FAN11 Rim/2	FAN11 Core/3
Sampel Location	FAN19 Rim/2	FAN19 Core/3	FAN19 Rim/3	FAN19 Core/4	F582 Core/3	F582 Core/2	F582 Rim/2	FAN11 Core/1	FAN11 Rim/1	FAN11 Core/2	FAN11 Rim/2	FAN11 Core/3
Sampel Location SiO2 TiO2	FAN19 Rim/2 35.83 4.17	FAN19 Core/3 35.06 3.98	FAN19 Rim/3 36.12 3.06	FAN19 Core/4 35.79 3.74	F582 Core/3 35.83 4,46	F582 Core/2 37.31 4.38	F582 Rim/2 36.93 4.62	FAN11 Core/1 38.81 3.10	FAN11 Rim/1 38.99 2.66	FAN11 Core/2 38.49 2.70	FAN11 Rim/2 38.22 2.83	FAN11 Core/3 38.79 3.73
Sampel Location SiO2 TiO2 Al2O3	FAN19 Rim/2 35.83 4.17 14.34	FAN19 Core/3 35.06 3.98 14.52	FAN19 Rim/3 36.12 3.06 14.94	FAN19 Core/4 35.79 3.74 14.27	F582 Core/3 35.83 4.46 14.84	F582 Core/2 37.31 4.38 14.42	F582 Rim/2 36.93 4.62 14.26	FAN11 Core/1 38.81 3.10 13.85	FAN11 Rim/1 38.99 2.66 14.36	FAN11 Core/2 38.49 2.70 13.90	FAN11 Rim/2 38.22 2.83 14.07	FAN11 Core/3 38.79 3.73 13.60
Sampel Location SiO2 TiO2 AI2O3 Cr2O3	FAN19 Rim/2 35.83 4.17 14.34 0.00	FAN19 Core/3 35.06 3.98 14.52 0.11	FAN19 Rim/3 36.12 3.06 14.94 0.06	FAN19 Core/4 35.79 3.74 14.27 0.02	F582 Core/3 35.83 4.46 14.84 0.01	F582 Core/2 37.31 4.38 14.42 0.05	F582 Rim/2 36.93 4.62 14.26 0.00	FAN11 Core/1 38.81 3.10 13.85 0.09	FAN11 Rim/1 38.99 2.66 14.36 0.14	FAN11 Core/2 38.49 2.70 13.90 0.19	FAN11 Rim/2 38.22 2.83 14.07 0.04	FAN11 Core/3 38.79 3.73 13.60 0.12
Sampel Location SiO2 TiO2 AI2O3 Cr2O3 FeO	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28	F582 Core/3 35.83 4.46 14.84 0.01 19.37	F582 Core/2 37.31 4.38 14.42 0.05 19.14	F582 Rim/2 36.93 4.62 14.26 0.00 18.89	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24
Sampel Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00
Sampel Location SiO2 TiO2 AI2O3 Cr2O3 FeO MnO MgO	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13
Sampel Location SiO2 TiO2 AI2O3 Cr2O3 FeO MnO MgO CaO	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00
Sampel Location SiO2 TiO2 AI2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 0.12	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 0.45	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 2.26	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 0.00 0.58	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 0.00 8.42	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 0.00	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0,00 0.00 0.88
Sampel Location SiO2 TiO2 AI2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.38	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.24	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 0.00 9.58	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 0.00 9.42 0.77	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.24	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 0.00 9.25 1.05	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 0.00 9.88 4 20
Sampel Location SiO2 TiO2 AI2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12 1.23 0.05	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.34 0.00	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 nd	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71 0.d	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 0.00 9.58 0.95 0.26	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 0.00 9.42 0.77 0.38	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 0.00 9.25 1.05 0.37	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 12.13 0.00 9.88 1.30 0.34
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06 95.52	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10 96.56	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 96.22	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.34 0.00 95.01	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d 96.81	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 n.d 97.82	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71 n.d 97.45	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 0.00 9.58 0.26 96.14	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 0.00 9.42 0.77 0.38 96.38	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19 95.97	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 0.00 9.25 1.05 0.37 95,98	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 12.13 0.00 0.00 9.88 1.30 0.34 98.13
Sampel Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06 95.52	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10 96.56	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12 1.23 0.05 96.22	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.34 0.00 95.01	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d 96.81	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 n.d 97.82	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71 n.d 97.45	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 12.18 0.00 0.00 9.58 0.95 0.26 96.14	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 0.00 9.42 0.77 0.38 96.38	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19 95.97	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 0.00 9.25 1.05 0.37 95.98	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 12.13 0.00 9.88 1.30 0.34 98.13
Sampel Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06 95.52 5.57	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10 96.56 5.45	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12 1.23 0.05 96.22 5.55	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.34 0.00 95.01 5.59	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d 96.81 5.46	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 n.d 97.82 5.58	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71 n.d 97.45	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 12.18 0.00 0.00 9.58 0.95 0.26 96.14 5.84	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 12.84 0.00 9.42 0.77 0.38 96.38	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19 95.97 5.84	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 0.00 9.25 1.05 0.37 95.98	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 12.13 0.00 9.88 1.30 0.34 98.13
Sampel Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06 95.52 5.57 0.49	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10 96.56 5.45 0.45	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12 1.23 0.05 96.22 5.55 0.35	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.34 0.00 95.01 5.59 0.44	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d 96.81 5.46 0.51	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 n.d 97.82 5.58 0.49	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71 n.d 97.45 5.56 0.52	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 12.18 0.00 0.00 9.58 0.95 0.26 96.14 5.84 0.35	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 12.84 0.00 9.42 0.77 0.38 96.38 5.81 0.30	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19 95.97 5.84 0.31	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 0.00 9.25 1.05 0.37 95.98 5.75 0.32	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 12.13 0.00 9.88 1.30 0.34 98.13 5.77 0.42
Sampel Location SIO2 TIO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti AI	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06 95.52 5.57 0.49 2.63	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10 96.56 5.45 0.45 2.66	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12 1.23 0.05 96.22 5.55 0.35 2.71	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.34 0.00 95.01 5.59 0.44 2.63	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d 96.81 5.46 0.51 2.67	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 n.d 97.82 5.58 0.49 2.54	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71 n.d 97.45 5.56 0.52 2.53	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 0.00 9.58 0.95 0.26 96.14 5.84 0.35 2.46	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 0.00 9.42 0.77 0.38 96.38 5.81 0.30 2.52	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19 95.97 5.84 0.31 2.49	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 0.00 9.25 1.05 0.37 95.98 5.75 0.32 2.50	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 12.13 0.00 9.88 1.30 0.34 98.13 5.77 0.42 2.38
Sampel Location SIO2 TIO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06 95.52 5.57 0.49 2.63 2.43	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10 96.56 5.45 2.66 2.55	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12 1.23 0.05 96.22 5.55 0.35 2.71 2.45	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.34 0.00 95.01 5.59 0.44 2.63 2.41	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d 96.81 5.46 0.51 2.67 2.54	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 n.d 97.82 5.58 0.49 2.54 2.42	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71 n.d 97.45 5.56 0.52 2.53 2.45	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 0.00 9.58 0.95 0.26 96.14 5.84 0.35 2.46 2.16	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 0.00 9.42 0.77 0.38 96.38 5.81 0.30 2.52 2.20	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19 95.97 5.84 0.31 2.49 2.16	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 0.00 9.25 1.05 0.37 95.98 5.75 0.32 2.50 2.25	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 12.13 0.00 9.88 1.30 0.34 98.13 5.77 0.42 2.38 2.23
Sampel Location SIO2 TIO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06 95.52 5.57 0.49 2.63 2.43 0.20	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10 96.56 5.45 2.66 2.55 0.45	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12 1.23 0.05 96.22 5.55 0.35 2.71 2.45 0.26	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.34 0.00 95.01 5.59 0.44 2.63 2.41 0.22	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d 96.81 5.46 0.51 2.67 2.54 0.13	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 n.d 97.82 5.58 0.49 2.54 2.42 0.25 2.54	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71 n.d 97.45 5.56 0.52 2.53 2.45 0.08	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 0.00 9.58 0.95 0.26 96.14 5.84 0.35 2.46 2.16 0.29	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 0.00 9.42 0.77 0.38 96.38 5.81 0.30 2.52 2.20 0.33	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19 95.97 5.84 0.31 2.49 2.16 0.32	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 0.00 9.25 1.05 0.37 95.98 5.75 0.32 2.50 2.25 0.25	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 9.88 1.30 0.34 98.13 5.77 0.42 2.38 2.23 0.15
Sampel Location SIO2 TIO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alvi Cr	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06 95.52 5.57 0.49 2.63 2.43 0.20 0.00	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10 96.56 5.45 2.66 2.55 0.11 0.21	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12 1.23 0.05 96.22 5.55 0.35 2.71 2.45 0.26 0.01	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.34 0.00 95.01 5.59 0.44 2.63 2.41 0.22 0.00	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d 96.81 5.46 0.51 2.67 2.54 0.13 0.07	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 n.d 97.82 5.58 0.49 2.54 2.42 0.12 0.12	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71 n.d 97.45 5.56 0.52 2.53 2.45 0.08 0.00	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 0.00 9.58 0.26 96.14 5.84 0.35 2.46 2.16 0.29 0.01	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 12.84 0.00 9.42 0.77 0.38 96.38 5.81 0.30 2.52 2.20 0.33 0.02	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19 95.97 5.84 0.31 2.49 2.16 0.32 0.02	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.00 9.25 1.05 0.37 95.98 5.75 0.32 2.50 2.25 0.25 0.25	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 9.88 1.30 0.34 98.13 5.77 0.42 2.38 2.23 0.15 0.02
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alvi Cr Fe3+ Ea2	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06 95.52 5.57 0.49 2.63 2.43 0.20 0.00 0.29	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10 96.56 5.45 2.66 2.55 0.45 2.66 2.55 0.11 0.01 0.01 0.02	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12 1.23 0.05 96.22 5.55 0.35 2.71 2.45 0.26 0.01 0.29 2.24	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.34 0.00 95.01 5.59 0.44 2.63 2.41 0.22 0.00 0.29 2.32	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d 96.81 5.46 0.51 2.67 2.54 0.13 0.00 0.27	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 n.d 97.82 5.58 0.49 2.54 2.42 0.12 0.12 0.01 0.26 2.12	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71 n.d 97.45 5.56 0.52 2.53 2.45 0.08 0.00 0.26 2.12	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 0.00 9.58 0.26 96.14 5.84 0.35 2.46 2.16 0.29 0.01 0.24	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 0.00 9.42 0.77 0.38 96.38 5.81 0.30 2.52 2.20 0.33 0.02 0.23 1.87	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19 95.97 5.84 0.31 2.49 2.16 0.32 0.02 0.25 1.99	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 9.25 1.05 0.37 95.98 5.75 0.32 2.50 2.25 0.25 0.25 0.01 0.24	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 9.88 1.30 0.34 98.13 5.77 0.42 2.38 2.23 0.15 0.02 0.25
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alvi Cr Fe3+ Fe2+ Mn	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06 95.52 5.57 0.49 2.63 2.43 0.20 0.00 0.29 2.31	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10 96.56 5.45 0.45 2.66 2.55 0.11 0.01 0.30 2.44	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12 1.23 0.05 96.22 5.55 0.35 2.71 2.45 0.26 0.01 0.29 2.34 0.00	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.34 0.00 95.01 5.59 0.44 2.63 2.41 0.22 0.00 0.29 2.36 0.00	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d 96.81 5.46 0.51 2.67 2.54 0.13 0.00 0.27 2.20	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 n.d 97.82 5.58 0.49 2.54 2.42 0.12 0.01 0.26 2.13 0.00	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71 n.d 97.45 5.56 0.52 2.53 2.45 0.08 0.00 0.26 2.12 0.00	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 0.00 9.58 0.26 96.14 5.84 0.35 2.46 2.16 0.29 0.01 0.24 1.94	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 12.84 0.00 9.42 0.77 0.38 96.38 5.81 0.30 2.52 2.20 0.33 0.02 0.23 1.87 0.00	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19 95.97 5.84 0.31 2.49 2.16 0.32 0.02 0.25 1.98 0.00	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 9.25 1.05 0.37 95.98 5.75 0.32 2.50 2.25 0.25 0.25 0.25 0.21 0.24 1.94 0.92	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 9.88 1.30 0.34 98.13 5.77 0.42 2.38 2.23 0.15 0.02 0.25 2.02 0.00
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alvi Cr Fe3+ Fe3+ Fe2+ Mn	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06 95.52 5.57 0.49 2.63 2.43 0.20 0.00 0.29 2.31 0.00 2.33	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10 96.56 5.45 0.45 2.66 2.55 0.11 0.01 0.30 2.44 0.00 2.32	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12 1.23 0.05 96.22 5.55 0.35 2.71 2.45 0.26 0.01 0.29 2.34 0.00 2.46	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.34 0.00 95.01 5.59 0.44 2.63 2.41 0.22 0.00 0.29 2.36 0.00 2.35	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d 96.81 5.46 0.51 2.67 2.54 0.13 0.00 0.27 2.20 0.00 2.62	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 n.d 97.82 5.58 0.49 2.54 2.42 0.12 0.01 0.26 2.13 0.26	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71 n.d 97.45 5.56 0.52 2.53 2.45 0.08 0.00 0.26 2.12 0.00 2.68	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 9.58 0.95 0.26 96.14 5.84 0.35 2.46 2.16 0.29 0.01 0.24 1.94 0.00 2.73	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 9.42 0.77 0.38 96.38 5.81 0.30 2.52 2.20 0.33 0.02 0.23 1.87 0.00 2.85	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19 95.97 5.84 0.31 2.49 2.16 0.32 0.02 0.25 1.98 0.00 2.74	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 9.25 1.05 0.37 95.98 5.75 0.32 2.50 2.25 0.25 0.25 0.21 0.24 1.94 0.24 1.94 0.286	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 9.88 1.30 0.34 98.13 5.77 0.42 2.38 2.23 0.15 0.02 0.25 2.02 0.00 2.69
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alvi Cr Fe3+ Fe2+ Mn Mg Ca	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06 95.52 5.57 0.49 2.63 2.43 0.20 0.29 2.31 0.00 2.33 0.00	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10 96.56 5.45 0.45 2.66 2.55 0.11 0.01 0.30 2.44 0.00 2.32 0.00	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12 1.23 0.05 96.22 5.55 0.35 2.71 2.45 0.26 0.01 0.29 2.34 0.00 2.46 0.01	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.34 0.00 95.01 5.59 0.44 2.63 2.41 0.22 0.00 0.29 2.36 0.00 2.35 0.01	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d 96.81 5.46 0.51 2.67 2.54 0.13 0.00 0.27 2.20 0.00 2.62 0.01	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 n.d 97.82 5.58 0.49 2.54 2.42 0.12 0.01 0.26 2.13 0.00 2.68 0.02	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.00 9.44 0.71 n.d 97.45 5.56 0.52 2.53 2.45 0.08 0.00 0.26 2.12 0.00 2.68 0.01	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 9.58 0.26 96.14 5.84 0.35 2.46 2.16 0.29 0.01 0.24 1.94 0.00	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 9.42 0.77 0.38 96.38 5.81 0.30 2.52 2.20 0.33 0.02 0.23 1.87 0.00 2.85 0.00	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19 95.97 5.84 0.31 2.49 2.16 0.32 0.02 0.25 1.98 0.00 2.74 0.00	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 9.25 1.05 0.37 95.98 5.75 0.32 2.50 2.25 0.25 0.25 0.25 0.25 0.24 1.94 0.24 1.94 0.02	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 9.88 1.30 0.34 98.13 5.77 0.42 2.38 2.23 0.15 0.02 0.25 2.02 0.00
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alvi Cr Fe3+ Fe2+ Mn Mg Ca Na	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06 95.52 5.57 0.49 2.63 2.43 0.20 0.00 0.29 2.31 0.00 2.33 0.00	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10 96.56 5.45 0.45 2.66 2.55 0.11 0.01 0.30 2.44 0.00 2.32 0.00 0.16	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12 1.23 0.05 96.22 5.55 0.35 2.71 2.45 0.26 0.01 0.29 2.34 0.00 2.46 0.01 0.14	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.04 0.36 9.08 1.34 0.00 95.01 5.59 0.44 2.63 2.41 0.22 0.00 0.29 2.36 0.00 2.35 0.01 0.11	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d 96.81 5.46 0.51 2.67 2.54 0.13 0.00 0.27 2.20 0.00 2.62 0.01 0.13	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 n.d 97.82 5.58 0.49 2.54 2.42 0.12 0.01 0.26 2.13 0.00 2.68 0.02 0.16	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71 n.d 97.45 5.56 0.52 2.53 2.45 0.08 0.00 0.26 2.12 0.00 2.68 0.01 0.18	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 9.58 0.26 96.14 5.84 0.35 2.46 2.16 0.29 0.01 0.24 1.94 0.00 2.73 0.00 0.00	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 12.84 0.00 9.42 0.77 0.38 96.38 5.81 0.30 2.52 2.20 0.33 0.02 0.23 1.87 0.00 2.85 0.00 0.00	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19 95.97 5.84 0.31 2.49 2.16 0.32 0.02 0.25 1.98 0.00 2.74 0.00 2.74 0.00	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 0.00 9.25 1.05 0.37 95.98 5.75 0.32 2.50 2.25 0.25 0.25 0.25 0.25 0.24 1.94 0.02 2.86 0.00 0.00	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 9.88 1.30 0.34 98.13 5.77 0.34 98.13 5.77 0.42 2.38 2.23 0.15 0.02 0.25 2.02 0.00 0.00
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alvi Cr Fe3+ Fe2+ Mn Mg Ca Na K	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06 95.52 5.57 0.49 2.63 2.43 0.20 0.00 0.29 2.31 0.00 2.33 0.00 2.33 0.00 1.76	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10 96.56 5.45 0.45 2.66 2.55 0.11 0.01 0.30 2.44 0.00 2.32 0.00 0.16 1.73	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12 1.23 0.05 96.22 5.55 0.35 2.71 2.45 0.26 0.01 0.29 2.34 0.00 2.46 0.01 0.14 1.79	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.34 0.00 95.01 5.59 0.44 2.63 2.41 0.22 0.00 0.29 2.36 0.00 2.35 0.01 0.11 1.81	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d 96.81 5.46 0.51 2.67 2.54 0.13 0.00 0.27 2.20 0.00 2.62 0.01 0.13 1.78	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 n.d 97.82 5.58 0.49 2.54 2.42 0.12 0.01 0.26 2.13 0.00 2.68 0.02 0.16 1.77	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71 n.d 97.45 5.56 0.52 2.53 2.45 0.08 0.00 0.26 2.12 0.00 2.68 0.01 0.18 1.81	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 9.58 0.26 96.14 5.84 0.35 2.46 2.16 0.29 0.01 0.24 1.94 0.00 2.73 0.00 1.84	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 9.42 0.77 0.38 96.38 5.81 0.30 2.52 2.20 0.33 0.02 0.23 1.87 0.00 2.85 0.00 0.285 0.00 0.00 1.79	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19 95.97 5.84 0.31 2.49 2.16 0.32 0.02 0.25 1.98 0.00 2.74 0.00 1.84	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 0.00 9.25 1.05 0.37 95.98 5.75 0.32 2.50 2.25 0.25 0.25 0.25 0.25 0.24 1.94 0.02 2.86 0.00 0.00 1.77	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 9.88 1.30 0.34 98.13 5.77 0.42 2.38 2.23 0.15 0.02 0.25 2.02 0.00 2.69 0.00 0.00 1.87
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alvi Cr Fe3+ Fe2+ Mn Mg Ca Na K Ba Ra Si Ti Al Si Si Ti Si Ti Si Si Si Si Si Si Si Si Si Si Si Si Si	FAN19 Rim/2 35.83 4.17 14.34 0.00 19.96 0.00 10.05 0.00 0.29 8.85 1.98 0.06 95.52 5.57 0.49 2.63 2.43 0.20 0.00 0.29 2.31 0.00 2.33 0.00 0.29 2.31 0.00 2.33 0.00	FAN19 Core/3 35.06 3.98 14.52 0.11 21.09 0.00 10.02 0.01 0.54 8.75 2.36 0.10 96.56 2.55 0.45 2.66 2.55 0.11 0.01 0.30 2.44 0.00 2.32 0.00 0.16 1.73 0.14	FAN19 Rim/3 36.12 3.06 14.94 0.06 20.42 0.00 10.72 0.05 0.47 9.12 1.23 0.05 96.22 5.55 0.35 2.71 2.45 0.26 0.01 0.29 2.34 0.00 2.46 0.01 0.14 1.79 0.01	FAN19 Core/4 35.79 3.74 14.27 0.02 20.28 0.00 10.09 0.04 0.36 9.08 1.34 0.00 95.01 5.59 0.44 2.63 2.41 0.22 0.00 0.29 2.36 0.00 2.35 0.01 0.11 1.81 0.08	F582 Core/3 35.83 4.46 14.84 0.01 19.37 0.03 11.55 0.03 0.45 9.15 1.09 n.d 96.81 5.46 0.51 2.67 2.54 0.13 0.00 0.27 2.20 0.00 2.62 0.01 0.13 1.78 0.07	F582 Core/2 37.31 4.38 14.42 0.05 19.14 0.00 12.03 0.10 0.57 9.26 0.57 n.d 97.82 5.58 0.49 2.54 2.42 0.12 0.01 0.26 2.13 0.00 2.68 0.02 0.16 1.77 0.03	F582 Rim/2 36.93 4.62 14.26 0.00 18.89 0.00 11.94 0.05 0.00 9.44 0.71 n.d 97.45 5.56 0.52 2.53 2.45 0.08 0.00 0.26 2.12 0.00 2.68 0.01 0.18 1.81 0.04	FAN11 Core/1 38.81 3.10 13.85 0.09 17.32 0.00 12.18 0.00 9.58 0.95 0.26 96.14 5.84 0.35 2.46 2.16 0.29 0.01 0.24 1.94 0.00 2.73 0.00 0.00 1.84 0.00	FAN11 Rim/1 38.99 2.66 14.36 0.14 16.83 0.00 12.84 0.00 9.42 0.77 0.38 96.38 5.81 0.30 2.52 2.20 0.33 0.02 0.23 1.87 0.00 2.85 0.00 0.285 0.00 0.00 1.79 0.05	FAN11 Core/2 38.49 2.70 13.90 0.19 17.54 0.00 12.11 0.00 9.52 1.34 0.19 95.97 5.84 0.31 2.49 2.16 0.32 0.02 0.25 1.98 0.00 2.74 0.00 0.00 1.84 0.08	FAN11 Rim/2 38.22 2.83 14.07 0.04 17.31 0.12 12.73 0.00 9.25 1.05 0.37 95.98 5.75 0.32 2.50 2.25 0.25 0.25 0.25 0.25 0.25 0.2	FAN11 Core/3 38.79 3.73 13.60 0.12 18.24 0.00 12.13 0.00 9.88 1.30 0.34 98.13 5.77 0.42 2.38 2.23 0.15 0.02 0.25 2.02 0.00 2.69 0.00 0.00 1.87 0.08

# APPENDIX 4.3 : CONTINUED BIOTITE MAIN DONEGAL GRANITE

Sampel Location	DON4 Core/1	DON4 Rim/1	DON4 Core/2 small	DON4 Rim/2 small	DON4 Core/3	DON4 Half/3	DON4 Rim/3	DON4 Core/4 small	DON4 Core/5 inc.	DON4 Core/6	DON4 Rim/6	DON4 Core/7 small
SiO2 TiO2	35.43	35.52 2.89	35.13 3.21	34.56 2.75	35.37 3.12	35.37 3.09	35.48 2.87	35.06 2.51	35.24 3.69	35.44 2.82	37.02	35.23
AI2O3	15.90	16.10	15.93	16.11	15.94	16.13	15.93	15.81	16.25	15.96	16.02	15.77
Cr2O3	0.08	0.00	0.07	0.08	0.04	0.09	0.00	0.01	0.05	0.12	0.00	0.02
FeO	23.10	23.22	22.59	22.62	23.05	23.27	23.40	23.60	22.88	23.64	22.50	23.00
MnO	0.00	0.05	0.03	0.00	0.00	0.09	0.07	0.00	0.10	0.01	0.09	0.07
MgO CaO	7.92	0.03	0.00	0.10	0.08	0.20	0.01	7.00	0.01	0.00	7.5Z	7.93
Na2O	0.38	0.44	0.00	0.33	0.45	0.23	0.32	0.31	0.27	0.49	0.38	0.44
K20	9.69	9.58	9.39	8.77	9.47	9.04	9.61	9.54	9.63	9.64	8.93	9.46
BaO	0.31	0.18	0.00	0.14	0.34	0.00	0.26	0.26	0.35	0.28	0.16	0.26
P2O5	0.00	0.11	0.00	0.12	0.12	0.19	0.06	0.00	0.01	0.06	0.04	0.08
Iotal	95.77	96.11	94.42	93.45	95.82	95.80	95.86	95.05	95.88	96.42	95.18	95.45
· -												
SI	5.52	5.50	5.52	5.48	5.50	5.47	5.52	5.52	5.47	5.49	5.72	5.50
11 Δ1	0.35	2 94	2 95	0.33	2 9 9 2	2 94	2 92	2 04	0.43	0.33	2 9 3	2 0.38
Aliv	2.48	2.50	2.48	2.52	2.50	2.53	2.48	2.48	2.53	2.51	2.28	2.50
Alvi	0.44	0.44	0.47	0.49	0.43	0.41	0.44	0.46	0.45	0.41	0.64	0.40
Cr	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.00	0.00
Fe3+	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.34	0.33	0.34	0.32	0.33
F62+	2.68	2.68	2.64	2.67	2.67	2.68	2.67	2.77	2.65	2.73	2.59	2.67
Ma	1.84	1.85	1 01	1.86	1.81	1 90	1.82	1.85	1 72	1 84	1 73	1.85
Ca	0.00	0.00	0.00	0.02	0.01	0.01	0.00	0.02	0.00	0.00	0.01	0.00
Na	0.11	0.13	0.12	0.10	0.14	0.07	0.10	0.10	0.08	0.15	0.11	0.13
к	1.93	1.89	1.88	1.77	1.88	1.78	1.91	1.92	1.91	1.91	1.76	1.88
Ba	0.02	0.01	0.00	0.01	0.02	0.00	0.01	0.02	0.02	0.02	0.01	0.02
F .	0.00	0.01	0.00	0.02	0.02	0.02	0.02	0.00	0.00	0.01	0.01	0.01
Samoel	MDG267	MDG267	MDG267	MDG267	MDG267	MDG267	MDG267	MDG267	DON17	DON17	DON17	
Sampel Location	MDG267 Core/1	MDG267 Rim/1	MDG267 Core/2	MDG267 Rim/2	MDG267 Core/3	MDG267 Rim/3	MDG267 Core/4	MDG267 Rim/4	DON17 Rim/2	DON17 Core/3	DON17 Rim/3	
Sampel Location SiO2	MDG267 Core/1 35.28	MDG267 Rim/1 35.13	MDG267 Core/2 35.58	MDG267 Rim/2 35.53	MDG267 Core/3 35.31	MDG267 Rim/3 35.62	MDG267 Core/4 35.51	MDG267 Rim/4 35.72	DON17 Rim/2 36.01	DON17 Core/3 36.07	DON17 Rim/3 36.25	
Sampel Location SiO2 TiO2 Al2O3	MDG267 Core/1 35.28 3.06 17.17	MDG267 Rim/1 35.13 2.71 16.51	MDG267 Core/2 35.58 2.41 17.80	MDG267 Rim/2 35.53 2.33 17.54	MDG267 Core/3 35.31 2.45 17.55	MDG267 Rim/3 35.62 2.61 17.38	MDG267 Core/4 35.51 2.40 17.72	MDG267 Rim/4 35.72 2.47 17.91	DON17 Rim/2 36.01 3.08 15.84	DON17 Core/3 36.07 3.35 16.37	DON17 Rim/3 36.25 3.13 16.37	
Sampel Location SiO2 TiO2 AI2O3 Cr2O3	MDG267 Core/1 35.28 3.06 17.17 0.01	MDG267 Rim/1 35.13 2.71 16.51 0.00	MDG267 Core/2 35.58 2.41 17.80 0.10	MDG267 Rim/2 35.53 2.33 17.54 0.03	MDG267 Core/3 35.31 2.45 17.55 0.00	MDG267 Rim/3 35.62 2.61 17.38 0.02	MDG267 Core/4 35.51 2.40 17.72 0.03	MDG267 Rim/4 35.72 2.47 17.91 0.13	DON17 Rim/2 36.01 3.08 15.84 0.17	DON17 Core/3 36.07 3.35 16.37 0.00	DON17 Rim/3 36.25 3.13 16.37 0.06	
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40	DON17 Core/3 36.07 3.35 16.37 0.00 22.20	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92	
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10	
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 2.12	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.92	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42	
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.00 0.21	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 0.49	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 0.37	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.01	
Sampel Location SiO2 TiO2 Ai2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25 9.22	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.00 0.21 9.30	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 8.65 0.049 9.62	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 0.37 9.76	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.40 9.48	
Sampel Location SiO2 TiO2 Ai2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25 9.22 0.39	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.00 0.21 9.30 0.28	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43 0.33	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 0.49 9.62 0.43	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 0.37 9.76 0.08	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43	
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46 0.14	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25 9.22 0.39 0.16	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10 0.02	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.00 0.21 9.30 0.28 0.08	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43 0.33 0.03	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 0.49 9.62 0.43 0.16	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 8.41 0.00 0.37 9.76 0.08 0.09	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04	
Sampel Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46 0.14 96.07	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04 93.81	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25 9.22 0.39 0.16 95.29	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10 0.02 95.20	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03 95.11	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.00 0.21 9.30 0.28 0.08 95.06	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43 0.33 0.03 95.35	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10 96.75	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 0.49 9.62 0.43 0.16 96.84	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 0.37 9.76 0.08 0.09 96.70	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04 96.61	
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46 0.14 96.07	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04 93.81	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25 9.22 0.39 0.16 95.29	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10 0.02 95.20	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03 95.11	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.00 0.21 9.30 0.28 0.08 95.06	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.05 0.03 0.28 9.43 0.33 0.03 95.35	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10 96.75	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 0.49 9.62 0.43 0.16 96.84	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 0.37 9.76 0.08 0.09 96.70	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04 96.61	
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46 0.14 96.07 5.45	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04 93.81	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25 9.22 0.39 0.16 95.29 5.50	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10 0.02 95.20	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03 95.11	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 0.21 9.30 0.28 0.08 95.06	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43 0.33 0.03 95.35	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10 96.75	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 0.49 9.62 0.43 0.16 96.84	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 0.37 9.76 0.08 0.09 96.70	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04 96.61	
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46 0.14 96.07 5.45 0.36	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04 93.81 5.55 0.32	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25 9.22 0.39 0.16 95.29 5.50 0.28	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10 0.02 95.20 5.51 0.27	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03 95.11 5.49 0.29	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.00 0.21 9.30 0.28 0.08 95.06 5.52 0.30	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43 0.33 0.03 95.35 5.50 0.28	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10 96.75 5.45 0.28	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 0.49 9.62 0.43 0.16 96.84 5.53 0.36	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 0.37 9.76 0.08 0.09 96.70 5.51 0.39	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04 96.61	
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46 0.14 96.07 5.45 0.36 3.13	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04 93.81 5.55 0.32 3.07	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 9.22 0.39 0.16 95.29 5.50 0.28 3.24	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 7.39 0.00 0.22 9.46 0.10 0.02 95.20 5.51 0.27 3.21	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03 95.11 5.49 0.29 3.22	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.00 0.21 9.30 0.28 0.08 95.06 5.52 0.30 3.18	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43 0.33 0.03 95.35 5.50 0.28 3.23	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10 96.75 5.45 0.28 3.22	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 0.49 9.62 0.43 0.16 96.84 5.53 0.36 2.87	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 0.37 9.76 0.08 0.09 96.70 5.51 0.39 2.95	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04 96.61 5.54 0.36 2.95	
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 7.20 0.00 0.41 9.15 0.46 0.14 96.07 5.45 0.36 3.13 2.55	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04 93.81 5.55 0.32 3.07 2.45	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 0.25 9.22 0.39 0.16 95.29 5.50 0.28 3.24 2.50	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10 0.02 95.20 5.51 0.27 3.21 2.49	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03 95.11 5.49 0.29 3.22 2.51	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.00 0.21 9.30 0.28 0.08 95.06 5.52 0.30 3.18 2.48	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43 0.33 0.03 95.35 5.50 0.28 3.23 2.50	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10 96.75 5.45 0.28 3.22 2.55	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 0.49 9.62 0.43 0.16 96.84 5.53 0.36 2.87 2.47	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 0.37 9.76 0.08 0.09 96.70 5.51 0.39 2.95 2.49	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04 96.61 5.54 0.36 2.95 2.46	
Sampel Location SiO2 TiO2 Ai2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alivi CaO	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46 0.14 96.07 5.45 0.36 3.13 2.55 0.58	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04 93.81 5.55 0.32 3.07 2.45 0.62	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25 9.22 0.39 0.16 95.29 5.50 0.28 3.24 2.50 0.75	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10 0.02 95.20 5.51 0.27 3.21 2.49 0.72 0.72	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03 95.11 5.49 0.29 3.22 2.51 0.71	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.00 0.21 9.30 0.28 0.08 95.06 5.52 0.30 3.18 2.48 0.70	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43 0.33 0.03 95.35 5.50 0.28 3.23 2.50 0.73 2.50	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10 96.75 5.45 0.28 3.22 2.55 0.67	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 0.49 9.62 0.43 0.16 96.84 5.53 0.36 2.87 2.47 0.39	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 0.37 9.76 0.08 0.09 96.70 5.51 0.39 2.95 2.49 0.46 0.25	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04 96.61 5.54 0.36 2.95 2.46 0.49	
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Alivi Cr Ee3+	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46 0.14 96.07 5.45 0.36 3.13 2.55 0.58 0.00 0.33	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04 93.81 5.55 0.32 3.07 2.45 0.62 0.00 2.29	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25 9.22 0.39 0.16 95.29 5.50 0.28 3.24 2.50 0.75 0.01 0.31	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10 0.02 95.20 5.51 0.27 3.21 2.49 0.72 0.00 0.32	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03 95.11 5.49 0.29 3.22 2.51 0.71 0.03	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.66 0.10 7.40 0.00 0.21 9.30 0.28 0.08 95.06 5.52 0.30 3.18 2.48 0.70 0.00 0.32	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43 0.33 0.03 95.35 5.50 0.28 3.23 2.50 0.73 0.03	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10 96.75 5.45 0.28 3.22 2.55 0.67 0.02 0.32	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 0.49 9.62 0.43 0.16 96.84 5.53 0.36 2.87 2.47 0.39 0.32	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 0.37 9.76 0.08 0.09 96.70 5.51 0.39 2.95 2.49 0.46 0.031	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04 96.61 5.54 0.36 2.95 2.46 0.49 0.31	
Sampel Location SiO2 TiO2 Ai2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv Alivi Cr Fe3+ Fe2+	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46 0.14 96.07 5.45 0.36 3.13 2.55 0.58 0.03 2.64	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04 93.81 5.55 0.32 3.07 2.45 0.62 0.032 2.62	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25 9.22 0.39 0.16 95.29 5.50 0.28 3.24 2.50 0.75 0.01 0.31 2.53	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10 0.02 95.20 5.51 0.27 3.21 2.49 0.72 0.00 0.32 2.61	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03 95.11 5.49 0.29 3.22 2.51 0.71 0.03 2.59	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.66 0.10 7.40 0.00 0.21 9.30 0.28 0.08 95.06 5.52 0.30 3.18 2.48 0.70 0.032 2.55	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43 0.33 0.03 95.35 5.50 0.28 3.23 2.50 0.73 0.00 0.31 2.54	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10 96.75 5.45 0.28 3.22 2.55 0.67 0.02 0.32 2.59	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 0.49 9.62 0.43 0.16 96.84 5.53 0.36 2.87 2.47 0.39 0.32 2.56	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 0.37 9.76 0.08 0.09 96.70 5.51 0.39 2.95 2.49 0.46 0.03 0.31 2.53	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04 96.61 5.54 0.36 2.95 2.46 0.49 0.01 0.31 2.50	
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv Alivi Cr Fe3+ Fe2+ Mn	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46 0.14 96.07 5.45 0.36 3.13 2.55 0.58 0.00 0.33 2.64 0.03	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04 93.81 5.55 0.32 3.07 2.45 0.62 0.02 0.32 2.62 0.04	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25 9.22 0.39 0.16 95.29 5.50 0.28 3.24 2.50 0.75 0.01 0.31 2.53 0.03	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10 0.02 95.20 5.51 0.27 3.21 2.49 0.72 0.00 0.32 2.61 0.00	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03 95.11 5.49 0.29 3.22 2.51 0.71 0.032 2.59 0.02	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.00 0.21 9.30 0.28 0.08 95.06 5.52 0.30 3.18 2.48 0.70 0.032 2.55 0.01	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43 0.33 0.03 95.35 5.50 0.28 3.23 2.50 0.73 0.00 0.31 2.54 0.03	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10 96.75 5.45 0.28 3.22 2.55 0.67 0.02 0.32 2.59 0.01	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 0.49 9.62 0.43 0.16 96.84 5.53 0.36 2.87 2.47 0.39 0.32 2.56 0.00	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 0.37 9.76 0.08 0.09 96.70 5.51 0.39 2.95 2.49 0.46 0.031 2.53 0.00	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04 96.61 5.54 0.36 2.95 2.46 0.49 0.31 2.50 0.01	
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv Avi Cr Fe3+ Fe2+ Mn Mg	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46 0.14 96.07 5.45 0.36 3.13 2.55 0.58 0.03 3.2.64 0.03 1.66	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04 93.81 5.55 0.32 3.07 2.45 0.62 0.02 2.62 0.04 1.67	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25 9.22 0.39 0.16 95.29 5.50 0.28 3.24 2.50 0.75 0.01 0.31 2.53 0.03 1.67	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10 0.02 95.20 5.51 0.27 3.21 2.49 0.72 0.02 0.32 2.61 0.00 1.71	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03 95.11 5.49 0.29 3.22 2.51 0.71 0.00 0.32 2.59 0.02 1.69	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.00 0.21 9.30 0.28 0.08 95.06 5.52 0.30 3.18 2.48 0.70 0.32 2.55 0.01 1.71	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43 0.33 0.03 95.35 5.50 0.28 3.23 2.50 0.73 0.03 1.70	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10 96.75 5.45 0.28 3.22 2.55 0.67 0.02 0.32 2.59 0.01 1.77	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 0.49 9.62 0.43 0.16 96.84 5.53 0.36 2.87 2.47 0.39 0.32 2.56 0.00 1.98	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 2.20 0.00 8.41 0.00 0.37 9.76 0.08 0.09 96.70 5.51 0.39 2.95 2.49 0.46 0.031 2.53 0.00 1.92	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04 96.61 5.54 0.36 2.95 2.46 0.49 0.31 2.50 0.01 1.92	一方,有有一方,有"有","不",有"有","有","有","有","有","有","有","有","有","
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv Avi Cr Fe3+ Fe2+ Mn Mg Ca	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46 0.14 96.07 5.45 0.36 3.13 2.55 0.58 0.03 3.2.64 0.03 1.66 0.00 0.41	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04 93.81 5.55 0.32 3.07 2.45 0.62 0.04 1.67 0.02 2.62	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25 9.22 0.39 0.16 95.29 5.50 0.28 3.24 2.50 0.75 0.01 2.53 0.03 1.67 0.03	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10 0.02 95.20 5.51 0.27 3.21 2.49 0.72 0.00 0.32 2.61 0.00 1.71 0.00	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03 95.11 5.49 0.29 3.22 2.51 0.71 0.00 0.32 2.59 0.02 1.69 0.02	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.00 0.21 9.30 0.28 0.08 95.06 5.52 0.30 3.18 2.48 0.70 0.32 2.55 0.01 1.71 0.00	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43 0.33 0.03 95.35 5.50 0.28 3.23 2.50 0.73 0.03 1.254 0.03 1.70 0.03 1.254	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10 96.75 5.45 0.28 3.22 2.55 0.67 0.02 0.32 2.59 0.01 1.77 0.00	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 0.49 9.62 0.43 0.16 96.84 5.53 0.36 2.87 2.47 0.39 0.32 2.56 0.00 1.98 0.00	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 2.20 0.00 8.41 0.00 0.37 9.76 0.08 0.09 96.70 5.51 0.39 2.95 2.49 0.46 0.031 2.53 0.00 1.92 0.00	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04 96.61 5.54 0.36 2.95 2.46 0.49 0.31 2.50 0.01 1.92 0.00	一方,有有一方,有"有","不",有"有","有","有","有","有","有","有","有","有","
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv Aliv Cr Fe3+ Fe2+ Mn Mg Ca Nag Ca Si KeO Si KeO Si Si KeO Si Si Si Si Si Si Si Si Si Si Si Si Si	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46 0.14 96.07 5.45 0.36 3.13 2.55 0.36 3.13 2.55 0.33 2.64 0.03 1.66 0.00 0.12 2.64	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04 93.81 5.55 0.32 3.07 2.45 0.62 0.00 0.32 2.62 0.04 1.67 0.02 0.02 0.02	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25 9.22 0.39 0.16 95.29 5.50 0.28 3.24 2.50 0.75 0.01 0.31 2.53 0.03 1.67 0.00 1.82	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10 0.02 95.20 5.51 0.27 3.21 2.49 0.72 0.00 0.32 2.61 0.00 1.71 0.00 1.71 0.00 1.87	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03 95.11 5.49 0.29 3.22 2.51 0.71 0.00 0.32 2.59 0.02 1.69 0.00 1.87	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.00 0.21 9.30 0.28 0.08 95.06 5.52 0.30 3.18 2.48 0.70 0.00 0.32 2.55 0.01 1.71 0.00 0.32 2.55 0.01	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43 0.33 0.03 95.35 5.50 0.28 3.23 2.50 0.73 0.03 1.254 0.03 1.70 0.01 0.01 0.01 0.01 0.01 0.01 0.01	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10 96.75 5.45 0.28 3.22 2.55 0.67 0.02 0.32 2.59 0.01 1.77 0.00 0.13 1.79	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 0.49 9.62 0.43 0.16 96.84 5.53 0.36 2.87 2.47 0.39 0.02 0.32 2.56 0.00 1.98 0.00 0.18	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 0.37 9.76 0.08 0.09 96.70 5.51 0.39 2.95 2.49 0.46 0.031 2.53 0.00 1.92 0.00 1.92 0.00	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04 96.61 5.54 0.36 2.95 2.46 0.49 0.01 0.31 2.50 0.01 1.92 0.00 0.12 2.50	一方,有一方,有一方,有一方,有一方,有一方,有一方,有一方,有一方,有一方,有
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Vi Cr Fe3+ Fe2+ Mn Mg Ca Ra Si Ti Aliv Aliv Aliv Si Cr Si Ti Aliz Si Ti Aliz Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Cr Si Si Si Si Si Si Si Si Si Si Si Si Si	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46 0.14 96.07 5.45 0.36 3.13 2.55 0.36 3.13 2.55 0.36 3.13 2.55 0.00 0.33 2.64 0.03 1.66 0.00 0.180 0.03	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04 93.81 5.55 0.32 3.07 2.45 0.00 0.32 2.62 0.04 1.67 0.02 0.07 1.82 0.02	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 9.22 0.39 0.16 95.29 5.50 0.28 3.24 2.50 0.75 0.01 0.31 2.53 0.03 1.67 0.00 0.07 1.82 0.02	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10 0.02 95.20 5.51 0.27 3.21 2.49 0.72 0.00 0.32 2.61 0.00 1.71 0.00 1.71 0.00 1.71 0.00 1.71 0.00 1.87 0.01	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03 95.11 5.49 0.29 3.22 2.51 0.71 0.00 0.32 2.59 0.02 1.69 0.00 7.87 0.02	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.21 9.30 0.28 0.08 95.06 5.52 0.30 3.18 2.48 0.70 0.00 0.32 2.55 0.01 1.71 0.00 0.32 2.55 0.01 1.71 0.00 1.84 0.02	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 9.43 0.03 9.43 0.03 95.35 5.50 0.28 3.23 2.50 0.73 0.00 0.31 2.54 0.03 1.70 0.01 0.01 0.08 1.86 0.02	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10 96.75 5.45 0.28 3.22 2.55 0.67 0.02 0.32 2.59 0.01 1.77 0.00 0.13 1.79 0.01	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 0.49 9.62 0.43 0.16 96.84 5.53 0.36 2.87 2.47 0.39 0.02 0.32 2.56 0.00 1.98 0.00 0.15 1.88 0.03	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 8.41 0.03 9.76 0.08 0.09 96.70 5.51 0.39 2.95 2.49 0.46 0.00 0.31 2.53 0.00 1.92 0.00 0.11 1.90 0.01	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04 96.61 5.54 0.36 2.95 2.46 0.49 0.01 0.31 2.50 0.01 1.92 0.00 0.12 1.85 0.03	- 「「「「「」」」「「」」」」」」「「」」」「「」」」「」」」」」」」」」」
Sampel Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al Aliv Aliv Aliv Aliv Cr Fe3+ Fe2+ Mn Mg Ca Na K Ba P	MDG267 Core/1 35.28 3.06 17.17 0.01 22.93 0.25 7.20 0.00 0.41 9.15 0.46 0.14 96.07 5.45 0.36 3.13 2.55 0.36 3.13 2.55 0.38 0.00 0.33 2.64 0.03 1.66 0.00 0.12 1.80 0.03 0.02	MDG267 Rim/1 35.13 2.71 16.51 0.00 22.29 0.32 7.11 0.10 0.21 9.05 0.34 0.04 93.81 5.55 0.32 3.07 2.45 0.62 0.00 0.32 2.62 0.04 1.67 0.02 0.07 1.82 0.02 0.01	MDG267 Core/2 35.58 2.41 17.80 0.10 21.94 0.20 7.25 0.00 0.25 9.22 0.39 0.16 95.29 5.50 0.28 3.24 2.50 0.75 0.01 0.31 2.53 0.03 1.67 0.00 0.07 1.82 0.02 0.02	MDG267 Rim/2 35.53 2.33 17.54 0.03 22.57 0.02 7.39 0.00 0.22 9.46 0.10 0.02 95.20 5.51 0.27 3.21 2.49 0.72 0.00 0.32 2.61 0.00 0.32 2.61 0.00 1.71 0.00 1.71 0.00 0.32 2.61 0.00 1.71 0.00 0.32 2.61 0.00 0.32 2.61 0.00 0.32 2.61 0.00 0.32 2.61 0.00 0.32 2.61 0.00 0.32 2.61 0.00 0.32 0.00 0.32 0.00 0.32 0.00 0.32 0.00 0.02 9.46 0.00 0.02 9.46 0.00 0.02 9.50 0.00 0.02 9.46 0.00 0.02 9.50 0.00 0.02 9.46 0.00 0.02 9.46 0.00 0.02 9.50 0.00 0.02 9.46 0.00 0.02 9.50 0.00 0.02 9.50 0.00 0.02 9.46 0.00 0.02 9.50 0.00 0.02 9.50 0.00 0.02 9.50 0.00 0.00 0.00 0.02 9.46 0.00 0.02 9.50 0.00 0.02 9.50 0.00 0.00 0.00 0.02 9.46 0.00 0.02 9.50 0.00 0.02 9.50 0.00 0.02 9.50 0.00 0.02 9.50 0.00 0.02 9.50 0.00 0.02 9.50 0.00 0.02 9.50 0.00 0.02 9.50 0.00 0.02 9.50 0.00 0.02 9.50 0.00 0.02 9.50 0.00 0.00 0.02 9.50 0.00 0.00 0.00 0.00 0.00 0.00 0.00	MDG267 Core/3 35.31 2.45 17.55 0.00 22.39 0.18 7.28 0.03 0.22 9.42 0.25 0.03 95.11 5.49 0.29 3.22 2.51 0.71 0.00 0.32 2.59 0.02 1.69 0.00 0.07 1.87 0.02 0.00	MDG267 Rim/3 35.62 2.61 17.38 0.02 22.06 0.10 7.40 0.21 9.30 0.28 0.08 95.06 5.52 0.30 3.18 2.48 0.70 0.00 0.32 2.55 0.01 1.71 0.00 0.06 1.84 0.02 0.01	MDG267 Core/4 35.51 2.40 17.72 0.03 22.04 0.21 7.35 0.03 0.28 9.43 0.33 0.03 95.35 5.50 0.28 3.23 2.50 0.73 0.00 0.31 2.54 0.03 1.70 0.01 0.01 0.08 1.86 0.02 0.00	MDG267 Rim/4 35.72 2.47 17.91 0.13 22.76 0.05 7.76 0.00 0.43 9.18 0.24 0.10 96.75 5.45 0.28 3.22 2.55 0.67 0.02 0.32 2.59 0.01 1.77 0.00 0.13 1.79 0.01 0.01	DON17 Rim/2 36.01 3.08 15.84 0.17 22.40 0.00 8.65 0.00 0.49 9.62 0.43 0.16 96.84 5.53 0.36 2.87 2.47 0.39 0.02 0.32 2.56 0.00 1.98 0.00 1.5 1.88 0.03 0.02	DON17 Core/3 36.07 3.35 16.37 0.00 22.20 0.00 8.41 0.00 0.37 9.76 0.08 0.09 96.70 5.51 0.39 2.95 2.49 0.46 0.00 0.31 2.53 0.00 1.92 0.00 1.11 1.90 0.01 0.01	DON17 Rim/3 36.25 3.13 16.37 0.06 21.92 0.10 8.42 0.01 0.40 9.48 0.43 0.04 96.61 5.54 0.36 2.95 2.46 0.49 0.01 0.31 2.50 0.01 1.85 0.03 0.01	一方,有有一方,有有一方,有一方,有一方,有有一方,有一方,有一方,有一方,有一

#### APPENDIX 4.3 : CONTINUED BIOTITE MAIN DONEGAL GRANITE

Sampel	DON16	DON16	DON16	DON16	DON16	DON16	DON16	DON17	DON17	DON17
Location	Core/1	Rim/1	Core/2	Core/3	Rim/3	Core/4	Rim/4	Core/1	Rim/1	Core/2
SiO2	35.52	35.96	35.32	34.85	35.58	35.35	35.47	35.48	35.91	35.83
TiO2	3.18	3.24	3.13	2.69	2.96	3.03	3.20	2.63	3.10	3.21
A12O3	15.93	15.76	15.84	15.57	15.86	16.18	16.14	16.26	16.70	16.10
Cr2O3	0.13	0,11	0.02	0.07	0.00	0.07	0.03	0.00	0.05	0.00
FeO	22.75	22.81	22.70	23.52	22.53	22.66	22.31	20.51	21.59	22.27
MnO	0.09	0.11	0.19	0.30	0.12	0.16	0.22	0.04	0.01	0.05
MgO	7.94	7.64	7.76	8.54	7.91	7.64	7.45	10.64	8.81	8.47
CaO	0.00	0.06	0.01	0.05	0.00	0.03	0.02	0.00	0.02	0.02
Na2O	0.38	0.43	0.36	0.36	0.56	0.42	0.33	0.45	0.36	0.51
K20	9.55	9.49	9.41	8.07	9.55	9.22	9.54	8.22	9.11	9.67
BaO	0.56	0.13	0.11	0.58	0.54	0.22	0.25	0.45	0.54	0.19
P2O5	0.06	0.05	0.00	0.06	0.04	0.04	0.05	0.07	0.08	0.09
Total	96.04	95.77	94.82	94.65	95.65	95.08	94.98	94.76	96.27	96.41
Si	5.51	5.57	5.53	5.51	5.54	5.52	5.54	5.47	5.49	5.51
Ti	0.37	0.38	0.37	0.32	0.35	0.36	0.38	0.31	0.36	0.37
AI .	2.91	2.88	2.93	2.90	2.91	2.98	2.97	2.96	3.01	2.92
Aliv	2.49	2.43	2.47	2.49	2.46	2.48	2.46	2.53	2.51	2.50
Alvi	0.42	0.45	0.46	0.41	0.46	0.49	0.51	0.42	0.51	0.42
Cr	0.02	0.01	0.00	0.01	0.00	0.01	0.03	0.00	0.01	0.00
Fe3+	0.33	0.33	0,33	0.34	0.32	0.33	0.32	0.29	0.30	0.32
Fe2+	2.63	2.63	2.65	2.77	2.61	2.63	2.59	2.35	2.46	2.55
Mn	0.01	0.01	0.03	0.04	0.02	0.02	0.03	0.01	0.00	0.01
Mg	1.84	1.76	1.80	2.03	1.84	1.79	1.73	2.44	2.01	1.94
Ca	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Na	0.11	0.13	0.11	0.11	0.17	0.13	0.10	0.13	0.11	0.15
к	1.89	1.88	1.88	1.63	1.90	1.84	1.90	1.62	1.78	1.90
Ba	0.03	0.01	0.01	0.04	0.03	0.01	0.02	0.03	0.03	0.01
P	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01

#### APPENDIX 4.3 : CONTINUED BIOTITE TRAWENAGH BAY

Sampel	TRA2	TRA2	TRA2	TRA2	TRA2	TRA2	TRA2	TRA2	TRA2	TRA2	TRA2	TRA2
Location	Core/1	Rim/1	Core/2	Core/3	Rim/3	Core/4	Core/5	Rim/5	Core/6	Core/7	Rim/7	Core/8
SIO2	36.01	36.71	35.97	35.99	35.57	36.13	36.16	36.09	35.71	36.08	36.31	35.92
TiO2	3.04	3.02	3.13	3.05	2.94	3.03	3.29	3.39	3.10	3.18	- 3.05	2.62
AI2O3	16.17	16.66	16.42	16.19	16.51	16.73	16.31	16.24	16.12	16.37	16.79	16.27
Cr2O3	0.00	0.00	0.04	0.00	0.04	0.06	0.07	0.07	0.00	0.03	0.00	0.08
FeO	22.89	21.81	22.20	22.08	22.44	21.85	22.74	22.17	21.60	22.56	21.55	23.47
MnO	0.25	0.21	0.13	0.30	0.12	0.32	0.20	0.13	0.16	0.29	0.31	0.16
MqO	8.35	8.70	8.22	8.56	8.55	8.44	8.07	7.97	7.94	7.90	7,70	7.72
CaO	0.02	0.11	0.07	0.05	0.07	0.09	0.00	0.08	0.82	0.07	0.03	0.12
Na2O	0.27	0.44	0.44	0.39	0.40	0.33	0.46	0.26	0.49	0.37	0.37	0.45
K2O	9.46	9.49	9.62	9.34	8.89	9.77	9.48	9.49	9.18	9.65	9.59	9.57
BaO	0.06	0.00	0.04	0.00	0.00	0.10	0.00	0.10	0.14	0.00	0.04	0.10
P2O5	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.48	0.00	0.00	0.00
Total	96.52	97.14	96.27	95.92	95.54	96.84	96.78	96.01	95.73	96.51	95.74	96.46
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Si	5.56	5.58	5.54	5.56	5.51	5.52	5.56	5.56	5.51	5.56	5.60	5.56
Ti	0.35	0.35	0.36	0.35	0.34	0.35	0.38	0.39	0.36	0.37	0.35	0.31
AL	2.94	2.98	2.98	2.95	3.02	3.01	2.96	2.95	2.93	2.97	3.05	2.97
Aliv	2.41	2.43	2.46	2.41	2.49	2.48	2.44	2.44	2.49	2.44	2.40	2.44
Alvi	0.50	0.56	0.53	0.54	0.53	0.53	0.52	0.52	0.45	0.53	0.65	0.53
Cr	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01
Fe3+	0.33	0.31	0.32	0.31	0.32	0.31	0.32	0.31	0.31	0.32	0.31	0.34
Fe2+	2.63	2.47	2.55	2.54	2.59	2.48	2.60	2.55	2.48	2.59	2.47	2.70
Mn	0.03	0.03	0.02	0.04	0.02	0.04	0.03	0.02	0.02	0.04	0.04	0.02
Mg	1.92	1.97	1.19	1.97	1.97	1.92	1.85	1.83	1.83	1.82	1.77	1.78
Ca	0.00	0.02	0.01	0.01	0.01	0.02	0.00	0.01	0.14	0.01	0.05	0.02
Na	0.08	0.13	0.13	0.12	0.12	0.10	0.14	0.08	0.15	0.11	0.11	0.14
ĸ	1.86	1.84	1.89	1.84	1.76	1.90	1.86	1.87	1.81	1.90	1.89	1.89
Ba	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.01
Ρ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00
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#### APPENDIX 4.4 HORNBLENDE ARDARA

Sample Location	ARD3 Core/1	ARD3 Core/2	ARD3 Rim/2	ARD3 Core/3	ARD3 Rím/3	ARD3 Core/4	ARD3 Core/5	ARD3 Rim/5	ARD3 Core/6	ARD3 Core/7	ARD1D Core/1	ARD1D Rim/1
SiO2	43.53	43.77	43.54	43.56	42.08	43.52	43.43	44.04	43.32	43.18	43.16	43.34
TìO2	1.73	1.62	1.40	1.76	1.33	1.18	1.36	1.14	1.42	1.50	1.59	0.74
A12O3	9.09	9.51	9.18	8.98	9.43	9.64	9.12	9.80	9.36	9.17	8.65	9.07
Cr2O3	0.02	0.01	0.15	0.14	0.02	0.00	0.12	0.01	0.05	0.12	0.05	0.10
FeO	19,73	20.00	19.77	19.06	20.37	20.24	18.87	19.32	19.01	19.08	18.26	18.56
MnO	0.10	0.14	0.15	0.16	0.30	0.23	0.13	0.35	0.10	0.18	0.08	0.02
MgO	9.33	9.48	9.28	9.67	8.92	8.85	9.79	9.59	9.81	9.92	9.57	9.36
CaO	11.23	11.91	11.33	11.26	11.06	11.41	11.32	11.37	11.24	11.56	11.12	10.83
Na2O	1.74	1.84	1.77	2.04	1.68	1.78	2.03	1.77	2.02	1.90	1.85	1.83
K2O	1.12	1.20	1.12	1.17	1.08	1.21	1.14	1.14	1.07	1.11	1.10	1.05
BaO	0.03	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.03	0.00	0.08	0.31
P2O5	0.11	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09
Total	97.45	98.17	97.54	97.79	96.26	97.96	97.36	98.51	97.40	97.73	95.58	95.29
Si	6.64	6.63	6.65	6.65	6.57	6.65	6.65	6.67	6.64	6.61	6.69	6.75
Ti	0.20	0.18	0.16	0.20	0.16	0.14	0.16	0.13	0.16	0.17	0.19	0.09
AI ``	1.64	1.70	1.65	1.62	1.74	1.74	1.65	1.75	1.69	1.66	1.58	1.66
AIIV	1.36	1.37	1.35	1.35	1.43	1.35	1.35	1.33	1.36	1.39	1.31	1.25
AIVI	0.28	0.33	0.30	0.27	0.31	0.39	0.29	0.42	0.33	0.27	0.28	0.42
Cr	0.00	0.00	0.02	0.02	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01
Fe	2.52	2.53	2.52	2.44	2.66	2.86	2.42	2.45	2.44	2.44	2.37	2.42
Mn	0.01	0.02	0.02	0.02	0.04	0.03	0.02	0.05	0.01	0.02	0.01	0.02
Mg	2.21	2.14	2.11	2.20	2.08	2.02	2.23	2.17	2.24	2.27	2.21	2.17
Ca	1.84	1.82	1.85	1.84	1.85	1.87	1.86	1.89	1.86	1.90	1.85	1.81
Na	0.52	0.54	0.52	0.60	0.51	0.53	0.60	0.52	0.60	0.56	0.56	0.55
к	0.22	0.23	0.22	0.23	0.22	0.53	0.22	0.22	0.21	0.22	0.22	0.21
Ba	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
P .	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
										10 C		
												1.1
	•											
Sample	ARD1D	ARDID	ARD1D	ARD1D	ARD1D	ARD1D	ARD1D	ARD1D				
Sample Location	ARD1D Core/2	ARD1D Core/3	ARD1D Core/4	ARD1D Core/5	ARD1D Core/6	ARD1D Core/7	ARD1D Core/8	ARD1D Core/9				
Sample Location	ARD1D Core/2	ARD1D Core/3	ARD1D Core/4	ARD1D Core/5	ARD1D Core/6	ARD1D Core/7	ARD1D Core/8	ARD1D Core/9				بو <sup>میری</sup> م
Sample Location SiO2	ARD1D Core/2 43.51	ARD1D Core/3 43.57	ARD1D Core/4 43.15	ARD1D Core/5 43.49	ARD1D Core/6 43.51	ARD1D Core/7 42.16	ARD1D Core/8 44.15	ARD1D Core/9 43.89				
Sample Location SiO2 TiO2	ARD1D Core/2 43.51 0.98	ARD1D Core/3 43.57 1.17	ARD1D Core/4 43.15 1.33	ARD1D Core/5 43.49 1.56	ARD1D Core/6 43.51 1.56	ARD1D Core/7 42.16 0.95	ARD1D Core/8 44.15 1.39	ARD1D Core/9 43.89 1.04				
Sample Location SiO2 TiO2 Al2O3	ARD1D Core/2 43.51 0.98 8.86	ARD1D Core/3 43.57 1.17 8.77	ARD1D Core/4 43.15 1.33 8.40	ARD1D Core/5 43.49 1.56 8.51	ARD1D Core/6 43.51 1.56 8.85	ARD1D Core/7 42.16 0.95 9.61	ARD1D Core/8 44.15 1.39 8.91	ARD1D Core/9 43.89 1.04 9.18				
Sample Location SiO2 TiO2 Al2O3 Cr2O3	ARD1D Core/2 43.51 0.98 8.86 0.16	ARD1D Core/3 43.57 1.17 8.77 0.10	ARD1D Core/4 43.15 1.33 8.40 0.06	ARD1D Core/5 43.49 1.56 8.51 0.11	ARD1D Core/6 43.51 1.56 8.85 0.09	ARD1D Core/7 42.16 0.95 9.61 0.00	ARD1D Core/8 44.15 1.39 8.91 0.08	ARD1D Core/9 43.89 1.04 9.18 0.06				
Sample Location SiO2 TiO2 A12O3 Cr2O3 FeO	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92	ARD1D Core/7 42.16 0.95 9.61 0.00 19.40	ARD1D Core/8 44.15 1.39 8.91 0.08 19.29	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95				
Sample Location SiO2 TiO2 A12O3 Cr2O3 FeO MriO	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12	ARD1D Core/7 42.16 0.95 9.61 0.00 19.40 0.09	ARD1D Core/8 44.15 1.39 8.91 0.08 19.29 0.06	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09				
Sample Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17	ARD1D Core/7 42.16 0.95 9.61 0.00 19.40 0.09 9.18	ARD1D Core/8 44.15 1.39 8.91 0.08 19.29 0.06 9.68	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62				
Sample Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 10.95	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22	ARD1D Core/7 42.16 0.95 9.61 0.00 19.40 0.09 9.18 11.38	ARD1D Core/8 44.15 1.39 8.91 0.08 19.29 0.06 9.68 11.39	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67				
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 10.95 1.87	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17	ARD1D Core/7 42.16 0.95 9.61 0.00 19.40 0.09 9.18 11.38 1.46	ARD1D Core/8 44.15 1.39 8.91 0.08 19.29 0.06 9.68 11.39 1.54	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45				
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11	ARD1D Core/5 43.49 1.56 8.51 1.8.29 0.23 9.75 10.95 1.87 1.00	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14	ARD1D Core/7 42.16 0.95 9.61 19.40 0.09 9.18 11.38 1.46 1.14	ARD1D Core/8 44.15 1.39 8.91 0.08 9.68 11.39 1.54 1.12	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20				
Sample Location SiO2 TiO2 A12O3 Gr2O3 FeO MrO MrO MgO CaO Na2O K2O BaO	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 10.95 1.87 1.00 0.14	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11	ARD1D Core/7 42.16 0.95 9.61 0.09 9.18 11.38 1.46 1.14 0.00	ARD1D Core/8 44.15 1.39 8.91 0.08 9.08 9.06 9.68 11.39 1.54 1.12 0.29	ARD1D Core/9 1.04 9.18 0.06 18.06 0.09 9.62 11.67 1.45 1.20 0.00				
Sample Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 10.95 1.87 1.00 0.14 0.29	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07	ARD1D Core/7 42.16 0.95 9.61 0.00 19.40 0.09 9.18 11.38 1.46 1.14 0.00 0.16	ARD1D Core/8 44.15 1.39 8.91 0.08 9.08 9.08 9.68 11.39 1.54 1.12 0.29 0.04	ARD1D Core/9 43.89 1.04 9.18 0.06 18.06 5.0.09 9.62 11.67 1.45 1.20 0.00 0.18				
Sample Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total	ARD1D Core/2 43.51 0.98 8.86 0.16 9.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 10.95 1.87 1.00 0.14 0.29 96.19	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07 96.53	ARD1D Core/7 42.16 0.95 9.61 0.00 19.00 0.09 9.18 11.38 1.46 1.14 0.00 0.16 96.53	ARD1D Core/8 44.15 1.39 8.91 0.08 19.29 0.06 9.68 11.39 1.54 1.12 0.29 0.04 97.95	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32				
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 9.75 10.95 1.87 1.00 0.14 0.29 96.19	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07 96.53	ARD1D Core/7 42.16 0.95 9.61 0.00 19.40 0.09 9.18 11.38 1.46 1.14 0.00 0.16 96.53	ARD1D Core/8 44.15 1.39 8.91 0.08 19.29 0.06 9.68 11.39 1.54 1.12 0.29 0.04 97.95	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32				
Sample Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 10.95 1.87 1.00 0.14 0.29 96.19	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07 96.53	ARD1D Core/7 42.16 0.95 9.61 0.00 19.40 0.09 9.18 11.38 1.46 1.14 0.00 0.16 96.53	ARD1D Core/8 44.15 1.39 8.91 0.08 19.29 0.06 9.68 11.39 1.54 1.12 0.29 0.04 97.95	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32				
Sample Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64 6.71	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32 6.73	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 1.095 1.87 1.00 0.14 0.29 96.19 6.71	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07 96.53 6.67	ARD1D Core/7 42.16 0.95 9.61 0.00 19.40 0.09 9.18 11.38 1.46 1.14 0.00 0.16 96.53 6.65	ARD1D Core/8 44.15 1.39 8.91 0.08 19.29 0.06 9.68 11.39 1.54 1.12 0.29 0.04 97.95 6.70	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32 6.69				
Sample Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43 6.71 0.11	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64 6.71 0.14	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32 6.73 0.16	ARD1D Core/5 43.49 1.56 8.51 0.23 9.75 10.95 1.87 1.00 0.14 0.29 96.19 6.71 0.18	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07 96.53 6.67 0.18	ARD1D Core/7 42.16 0.95 9.61 19.40 0.09 9.18 11.38 1.46 1.14 0.00 0.16 96.53 6.65 0.11	ARD1D Core/8 44.15 1.39 8.91 0.08 19.29 0.06 9.68 11.39 1.54 1.12 0.29 0.04 97.95 6.70 0.16	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32 6.69 0.12				
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43 6.71 0.11 1.61	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64 6.71 0.14 1.59	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32 6.73 0.16 1.54	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 10.95 1.87 1.00 0.14 0.29 96.19 6.71 0.18 1.55	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07 96.53 6.67 0.18 1.60	ARD1D Core/7 42.16 0.95 9.61 10.00 19.40 0.09 9.18 11.38 1.46 1.14 0.00 0.16 96.53 6.65 0.11 1.74	ARD1D Core/8 44.15 1.39 8.91 0.06 9.68 11.39 1.54 1.12 0.29 0.04 97.95 6.70 0.16 1.60	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32 6.69 0.12 1.65				
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al AlIV	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43 6.71 0.11 1.61 1.29	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64 6.71 0.14 1.59 1.29	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32 6.73 0.16 1.54 1.25	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 10.95 1.87 1.00 0.14 0.29 96.19 6.71 0.18 1.55 1.29	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07 96.53 6.67 0.18 1.60 1.33	ARD1D Core/7 42.16 0.95 9.61 1.000 19.40 0.09 9.18 11.38 1.46 1.14 0.00 0.16 96.53 6.65 0.11 1.74 1.35	ARD1D Core/8 44.15 1.39 8.91 0.06 9.68 11.39 1.54 1.12 0.29 0.04 97.95 6.70 0.16 1.60 1.30	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32 6.69 0.12 1.65 1.31				
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al AlIV AIVI	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43 6.71 0.11 1.61 1.29 0.33	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64 6.71 0.14 1.59 1.29 0.30	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32 6.73 0.16 1.54 1.25 0.27	ARD1D Core/5 43.49 1.56 8.51 18.29 0.23 9.75 10.95 1.87 1.00 0.14 0.29 96.19 6.71 0.18 1.55 1.29 0.25	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07 96.53 6.67 0.18 1.60 1.33 0.27	ARD1D Core/7 42.16 0.95 9.61 1.000 19.40 0.09 9.18 11.38 1.46 1.14 0.00 0.16 96.53 6.65 0.11 1.74 1.35 0.39	ARD1D Core/8 44.15 1.39 8.91 0.08 9.68 11.39 1.54 1.12 0.29 0.04 97.95 6.70 0.16 1.60 1.30 0.30	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32 6.69 0.12 1.65 1.31 0.34				
Sample Location SiO2 TiO2 Al2O3 Gr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total Si TI Al AlIV AIVI Cr	ARD1D Core/2 43.51 0.98 8.86 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43 6.71 0.11 1.61 1.29 0.33 0.02	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64 6.71 0.14 1.59 1.29 0.30 0.01	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32 6.73 0.16 1.54 1.25 0.27 0.01	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 1.095 1.87 1.00 0.14 0.29 96.19 6.71 0.18 1.55 1.29 0.25 0.01	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07 96.53 6.67 0.18 1.60 1.33 0.27 0.01	ARD1D Core/7 42.16 0.95 9.61 0.00 19.40 0.09 9.18 11.38 1.46 1.14 0.00 0.16 96.53 6.65 0.11 1.74 1.35 0.39 0.00	ARD1D Core/8 44.15 1.39 8.91 0.08 9.08 9.08 11.39 1.54 1.12 0.29 0.04 97.95 6.70 0.16 1.60 1.30 0.30 0.01	ARD1D Core/9 43.89 1.04 9.18 0.06 18.06 5.0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32 6.69 0.12 1.65 1.31 0.34 0.01				
Sample Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti A1 A1IV AIVI Cr Fe	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43 6.71 0.11 1.61 1.29 0.33 0.02 2.46	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64 6.71 0.14 1.59 1.29 0.30 0.01 2.46	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32 6.73 0.16 1.54 1.25 0.27 0.01 2.45	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 10.95 1.87 1.00 0.14 0.29 96.19 6.71 0.18 1.55 1.29 0.25 0.01 2.36	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07 96.53 6.67 0.18 1.60 1.33 0.27 0.01 2.30	ARD1D Core/7 42.16 0.95 9.61 0.00 19.40 0.09 9.18 11.38 1.46 1.14 0.00 0.16 96.53 6.65 0.11 1.74 1.35 0.39 0.00 2.50	ARD1D Core/8 44.15 1.39 8.91 0.08 9.08 9.08 11.39 1.54 1.12 0.29 0.04 97.95 6.70 0.16 1.60 1.30 0.30 0.01 2.45	ARD1D Core/9 43.89 1.04 9.18 0.06 18.05 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32 6.69 0.12 1.65 1.31 0.34 0.01 2.41				
Sample Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti A1 A1IV AIVI Cr Fe Mn	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43 6.71 0.11 1.61 1.29 0.33 0.02 2.46 0.01	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64 6.71 0.14 1.59 1.29 0.30 0.01 2.46 0.02	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 6.73 0.16 95.32 6.73 0.16 1.54 1.55 0.27 0.01 2.45 0.02	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 1.095 1.87 1.00 0.14 0.29 96.19 96.19 6.71 0.18 1.55 1.25 0.25 0.01 2.36 0.03	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.17 96.53 6.67 0.18 1.60 1.33 0.27 0.01 2.30 0.02	ARD1D Core/7 42.16 0.95 9.61 1.38 1.46 1.14 0.00 0.16 96.53 6.65 0.11 1.74 1.35 0.39 0.00 2.50 0.01	ARD1D Core/8 44.15 1.39 8.91 0.08 19.29 0.06 9.68 11.39 1.54 1.12 0.29 0.04 97.95 6.70 0.16 1.60 1.30 0.30 0.01 2.45 0.01	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32 6.69 0.12 1.65 1.31 0.34 0.01 2.41 0.01				
Sample Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti A1 XI/V A1/V A1/V A1/V Cr Fe Mn Mg	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43 6.71 0.11 1.61 1.29 0.33 0.02 2.46 0.01 2.19	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64 6.71 0.14 1.59 1.29 0.30 0.01 2.46 0.02 2.16	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32 6.73 0.16 1.54 1.25 0.27 0.01 2.45 0.02 2.14	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 1.095 1.87 1.00 0.14 0.29 96.19 8.71 0.18 1.55 1.29 0.25 0.01 2.36 0.03 2.24	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07 96.53 6.67 0.18 1.60 1.33 0.27 0.01 2.30 0.02 2.32	ARD1D Core/7 42.16 0.95 9.61 1.38 1.40 0.09 9.18 1.38 1.46 1.14 0.00 0.16 96.53 6.65 0.11 1.74 1.35 0.39 0.00 2.50 0.01 2.11	ARD1D Core/8 44.15 1.39 8.91 0.08 19.29 0.06 9.68 11.39 1.54 1.12 0.29 0.04 97.95 6.70 0.16 1.60 1.30 0.01 2.45 0.01 2.19	ARD1D Core/9 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32 6.69 0.12 1.65 1.31 0.31 0.01 2.41 0.01 2.19			117、1997年に「「「「「「「「「「「」」」」「「」」「「」」」「「」」」「「」」」」「「」」」」	
Sample Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti A1 AI/V AI/V AI/V Cr Fe Mn Mg Ca	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43 6.71 0.11 1.61 1.29 0.33 0.02 2.46 0.01 2.19 1.86	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64 6.71 0.14 1.59 1.29 0.30 0.01 2.46 0.02 2.16 1.89	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32 6.73 0.16 1.54 1.25 0.27 0.01 2.45 0.02 2.14 1.90	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 1.095 1.87 1.00 0.14 0.29 96.19 96.19 96.19 96.19 0.25 0.01 2.36 0.03 2.24 1.81	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 1.22 1.17 1.14 0.11 96.53 6.67 0.18 1.60 1.33 0.27 0.01 2.30 0.02 2.32 1.84	ARD1D Core/7 42.16 0.95 9.61 10.00 19.40 0.09 9.18 11.38 1.46 1.14 0.00 0.16 96.53 6.65 0.11 1.74 1.35 0.39 0.00 2.50 0.01 2.11 1.88	ARD1D Core/8 44.15 1.39 8.91 0.08 19.29 0.06 9.68 11.39 1.54 1.12 0.29 0.04 97.95 6.70 0.16 1.60 1.30 0.30 0.30 0.30 1.245 0.01 2.45	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32 6.69 0.12 1.65 1.31 0.34 0.01 2.41 0.01 2.19 11.67				
Sample Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti A1 A1V1 Cr Fe Mn Mg Ca Na Na	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 96.43 6.71 0.11 1.61 1.29 0.33 0.02 2.46 0.01 2.19 1.86 0.47	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64 6.71 0.14 1.59 1.29 0.30 0.01 2.46 0.02 2.16 1.89 0.51	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32 6.73 0.16 1.54 1.25 0.27 0.01 2.45 0.02 2.14 1.90 0.48	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 1.095 1.87 1.00 0.14 0.29 96.19 6.71 0.18 1.55 1.29 0.25 0.01 2.36 0.03 2.24 1.81 0.56	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07 96.53 6.67 0.18 1.60 1.33 0.27 0.01 2.30 0.02 2.32 1.84 0.53	ARD1D Core/7 42.16 0.95 9.61 0.00 19.40 0.09 9.18 11.38 1.46 1.14 0.00 0.16 96.53 6.65 0.11 1.74 1.35 0.39 0.00 2.50 0.01 2.11 1.88 0.44	ARD1D Core/8 44.15 1.39 8.91 0.08 19.29 0.06 9.68 11.39 1.54 1.12 0.29 0.04 97.95 6.70 0.16 1.60 1.30 0.30 0.01 2.45 0.01 2.19 1.85 0.46	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32 6.69 0.12 1.65 1.31 0.34 0.01 2.41 0.01 2.19 11.67 0.43				
Sample Location SiO2 TiO2 A12O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti A1 AIVI Cr Fe Mn Mg Ca Na2V K2O BaO P2O5 Total	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43 6.71 0.11 1.61 1.29 0.33 0.02 2.46 0.01 2.19 1.86 0.47 0.22	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64 6.71 0.14 1.59 1.29 0.30 0.01 2.46 0.02 2.16 1.89 0.51 0.22	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32 6.73 0.16 1.54 1.25 0.27 0.01 2.45 0.02 2.14 1.90 0.48 0.22	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 10.95 1.87 1.00 0.14 0.29 96.19 6.71 0.18 1.55 1.29 0.25 0.01 2.36 0.03 2.24 1.81 0.56 0.20	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07 96.53 6.67 0.18 1.60 1.33 0.27 0.01 2.30 0.02 2.32 1.84 0.53 0.22	ARD1D Core/7 42.16 0.95 9.61 0.00 19.40 0.09 9.18 11.38 1.46 1.14 0.00 0.16 96.53 8.65 0.11 1.74 1.35 0.39 0.00 2.50 0.01 2.11 1.88 0.44 0.23	ARD1D Core/8 44.15 1.39 8.91 0.06 9.68 11.39 1.54 1.12 0.29 0.04 97.95 6.70 0.16 1.60 1.30 0.30 0.01 2.45 0.01 2.19 1.85 0.46 0.22	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32 6.69 0.12 1.65 1.31 0.34 0.01 2.41 0.01 2.19 11.67 0.43 0.23				
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MnO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al AlIV AlVI Cr Fe Mn Mg Ca Na2K K Ba	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43 6.71 0.11 1.61 1.29 0.33 0.02 2.46 0.01 2.19 1.86 0.47 0.22 0.01	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64 6.71 0.14 1.59 1.29 0.30 0.01 2.46 0.02 2.16 1.89 0.51 0.22 0.00	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32 6.73 0.16 1.54 1.25 0.27 0.01 2.45 0.02 2.14 1.90 0.48 0.22 0.00	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 10.95 1.87 1.00 0.14 0.29 96.19 6.71 0.18 1.55 1.29 0.25 0.01 2.36 0.03 2.24 1.81 0.56 0.20 0.02	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07 96.53 6.67 0.18 1.60 1.33 0.27 0.01 2.32 1.84 0.53 0.22 0.01	ARD1D Core/7 42.16 0.95 9.61 0.00 19.40 0.09 9.18 11.38 1.46 1.14 0.00 0.16 96.53 6.65 0.11 1.74 1.35 0.39 0.00 2.50 0.01 2.11 1.88 0.44 0.23 0.00	ARD1D Core/8 44.15 1.39 8.91 0.06 9.68 11.39 1.54 1.12 0.29 0.04 97.95 6.70 0.16 1.60 1.30 0.30 0.01 2.45 0.01 2.45 0.46 0.22 0.02	ARD1D Core/9 43.89 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32 6.69 0.12 1.65 1.31 0.34 0.01 2.41 1.67 0.43 0.23 0.00				
Sample Location SiO2 TiO2 Al2O3 Cr2O3 FeO MrO MgO CaO Na2O K2O BaO P2O5 Total Si Ti Al AlIV AIVI Cr Fe Mn Mg Ca Na K Ba P	ARD1D Core/2 43.51 0.98 8.86 0.16 19.08 0.10 9.53 11.23 1.56 1.14 0.24 0.05 96.43 6.71 0.11 1.61 1.29 0.33 0.02 2.46 0.01 2.19 1.86 0.47 0.22 0.01 0.01	ARD1D Core/3 43.57 1.17 8.77 0.10 19.14 0.13 9.43 11.46 1.72 1.12 0.00 0.03 96.64 6.71 0.14 1.59 1.29 0.30 0.01 2.46 0.02 2.16 1.89 0.51 0.22 0.00 0.00	ARD1D Core/4 43.15 1.33 8.40 0.06 18.76 0.18 9.22 11.35 1.57 1.11 0.02 0.16 95.32 6.73 0.16 1.54 1.25 0.27 0.01 2.45 0.22 2.14 1.90 0.48 0.22 0.00 0.02	ARD1D Core/5 43.49 1.56 8.51 0.11 18.29 0.23 9.75 10.95 1.87 1.00 0.14 0.29 96.19 6.71 0.18 1.55 1.29 0.25 0.01 2.36 0.03 2.24 1.81 0.56 0.00 2.20 0.02 0.02	ARD1D Core/6 43.51 1.56 8.85 0.09 17.92 0.12 10.17 11.22 1.17 1.14 0.11 0.07 96.53 6.67 0.18 1.60 1.33 0.27 0.01 2.30 0.02 2.32 1.84 0.53 0.22 0.01 0.01	ARD1D Core/7 42.16 0.95 9.61 0.00 19.40 0.09 9.18 11.38 1.46 1.14 0.00 0.16 96.53 6.65 0.11 1.74 1.35 0.39 0.00 2.50 0.01 2.50 0.01 1.88 0.44 0.23 0.00 0.02	ARD1D Core/8 44.15 1.39 8.91 0.06 9.68 11.39 1.54 1.12 0.29 0.04 97.95 6.70 0.16 1.60 1.30 0.30 0.01 2.45 0.01 2.19 1.85 0.46 0.22 0.02 0.01	ARD1D Core/9 1.04 9.18 0.06 18.95 0.09 9.62 11.67 1.45 1.20 0.00 0.18 97.32 6.69 0.12 1.65 1.31 0.34 0.01 2.41 0.01 2.41 0.01 2.41 0.01 2.43 0.02				

1.

#### APPENDIX 4.4 : CONTINUED HORNBLENDE - FANAD

Sample Location	FAN 46 Core/1	FAN 46 rim/1	FAN 46 core/2	FAN 46 rim2	FAN 46	FAN 46 Core/3	FAN 46 rim/3	FAN 46	FAN 46	FAN23 Core/1	FAN23 Rim/1	FAN23 Core/2
SiO2	46.71	49.04	44.86	46.39	47.46	42.72	45 59	44 38	46.95	43 22	45.93	44 35
TiO2	1.68	1.12	1.79	1.43	1.34	2.95	1.71	1.81	1.28	1.38	1.27	1.84
AI2O3	7.41	6.19	8.68	7.34	8.02	10.96	8.13	8.81	7.68	9.46	7.50	8.65
Cr2O3	0.14	0.07	0.23	0.04	0.07	0.07	0.17	0.19	0.00	0.07	0.08	0.11
FeO	16.28	15.45	17.47	16.10	16.54	15.35	16.01	16.61	17.12	17.18	16.69	17.42
MnO	0.19	0.16	0.07	0.10	0.12	0.18	0.07	0.19	0.11	0.22	0.17	0.22
MgO	12.26	13.39	11.29	12.46	12.44	11.49	12.06	10.96	11.84	11.41	11.57	10.66
CaO	11.22	12.10	11.86	11.71	11.86	11.14	11.44	12.18	11.73	10.50	11.46	11.37
Na2O	1.77	1.16	1.57	1.74	1.56	2.00	1.96	1.69	1.59	1.56	1.42	1.96
K2O	0.71	0.50	0.75	0.66	0.71	1.24	0.59	0.90	0.71	0.68	0.76	0.74
BaO	0.02	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.26	0.00	0.17
P2O5	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n d	0.14	0.09	0.07
Total	98.02	98.63	98.20	97.96	99.69	98.07	97.50	97.72	98.71	96.05	96.93	97.56
Si	6.92	7.15	6.70	6.91	6.91	6.39	6.81	6.69	6.93	6.61	6.91	6.70
TI	0.19	0.12	0.20	0.16	0.15	0.33	0.19	0.21	0.14	0.16	0.14	0.21
Al 🗄	1.30	1.06	1.53	1.29	1.38	1.93	1.43	1.57	1.34	1.70	1.33	1.54
AllV	1.08	0.85	1.30	1.09	1.09	1.61	1.19	1.31	1.07	1.39	1.09	1.30
AIVI	0.22	0.21	0.23	0.20	0.28	0.32	0.24	0.25	0.27	0.31	0.24	0.24
Cr	0.02	0.01	0.03	0.01	0.01	0.01	0.02	0.02	0.00	0.01	0.01	0.01
Fe	2.02	1.88	2.19	2.01	2.01	1.92	2.00	2.09	2.11	2.20	2.10	2.20
Mn	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.03	0.01	0.03	0.02	0.03
Mg	2.71	2.91	2.51	2.77	2.70	2.56	2.68	2.46	2.61	2.60	2.60	2.40
Ca ·	1.78	1.89	1.90	1.87	1.85	1.79	1.83	1.97	1.86	1.72	1.85	1.84
inia K	0.51	0.33	0.40	0.50	0.44	0.58	0.57	0.05	0.45	0.46	0.42	0.57
R Do	0.13	0.09	0.14	0.13	0.13	0.24	0.11	0.17	0.13	0.13	0.15	0.14
P2O5	00.00 n d	00.00 n d	0.00 n.d	0.00 n d	00.00 h n	0.00 n.d	n d	0.00 n d	0.00 h.d	0.02	0.00	0.01
1200	n.u			n,u s	11.4	1.0	1.4	11.4	n.u	0.02	0.01	0.01
Sample	FAN7	FAN7	FAN11	FAN11	FAN11	FAN11	FAN11	FAN11	FAN11	FAN19	FAN19	FAN19
Location	Core/1	Core/2	Core/3	Rim/3	Rim/1	Core/2	Rim/2	Core/3	Rim/3	Core/1	Rim/1	Core/2
SiO2	46.25	46.29	47.49	50.56	50.60	47.51	47.36	48.13	47.50	43.16	45.33	45.28
TiO2	1.15	1.26	1.07	0.33	0.15	1.30	1.17	1.08	1.20	1.64	1.57	1.39
AI2O3	7.13	7.06	6.53	4.87	4.20	6.71	6.71	6.30	6.98	9.49	8.24	7.88
Cr2O3	0.21	0.09	0.16	0.08	0.06	0.02	0.11	0.02	0.19	0.14	0.03	0.11
FeO	17.41	16.77	15.26	14.22	13.75	15.17	15.46	14.74	15.63	18.37	16.93	17.13
MnO	0.32	0.16	0.00	0.09	0.19	0.27	0.10	0.27	0.18	0.02	0.03	0.03
MgO	11.08	11.18	12.65	13.95	14.40	12.51	12.43	12.92	12.57	10.07	11.28	11.23
CaO	11.72	11.56	11.83	12.13	12.35	11.56	11.81	< <b>11.71</b>	11.48	11.69	11.65	11.57
Na2O	1.39	1.30	1.06	0.78	0.69	1.31	1.10	1.10	1.45	1.86	1.58	1.60
K20	0.97	1.08	0.83	0.48	0.33	0.88	0.81	0.78	0.92	0.89	0.83	0.77
BaO	0.58	0.44	0.25	0.00	0.32	0.09	0.11	0.47	0.36	0.35	0.08	0.22
P2O5,	0.53	0.37	0.27	0.32	0.33	0.34	0.37	0.37	0.40	0.11	0.20	0.12
Total	98.73	97.56	97.38	97.80	97.35	97.86	97.53	97.88	98.85	97.77	97.74	97.33
		· · · ·				a 21.4			an fa an far Th			
Si	6.90	6.95	7.06	7.37	7.41	7.03	7.02	7.10	6.98	6.56	6.79	6.83
TI	0.12	0.14	0.12	0.04	0.02	0.14	0.13	0.12	0.13	0.19	0.18	0.18
Al	1.25	1.25	1.14	0.84	0.73	1.17	1.17	1.10	1.21	1.70	1.45	1.40
Aliv	1.11	1.05	0.94	0.63	0.59	0.97	0.98	0.90	1.02	1.44	1.21	1.18
AIVI	0.15	0.20	0.20	0.20	0.14	0.20	0.20	0.19	0.18	0.26	0.24	0.23
Cr	0.02	0.01	0.02	0.01	0.01	0.00	0.01	0.00	0.02	0.02	0.00	0.01
Fe	2.17	2.11	1.99	1.73	1.69	1.88	1.92	1.82	1.92	2.33	2.12	2.16
Mn	0.04	0.02	0.00	0.01	0.02	0.03	0.01	0.03	0.41	0.00	0.00	0.00
Mg	2.46	2.50	2.80	3.01	3.15	2.76	2.75	2.84	2.75	2.28	2.52	2.52
Ca	1.87	1.86	1.88	1.89	1.94	1.83	1.88	1.85	1.81	1.90	1.87	1.87
Na	0.40	0.38	0.30	0.22	0.19	0.38	0.32	0.32	0.41	0.55	0.46	0.47
r. Ra	0.19	0.21	0.10	0.09	0.00	0.17	0.15	0.10	0.17	0.17	0.10	0.15
p	0.04	0.03	0.02	0.00	0.04	0.01	0.01	0.05	0.02	0.02	0.01	0.01
•	0.01	0.00	0.00	0.04	0.04	0.04	0.00	0.00	0.00	0.01	0.00	0.06

#### APPENDIX 4.4 : CONTINUED. HORNBLENDE FANAD

sample	FAN19	FAN19	FAN19	FAN19	FAN19
location	Rim/2	Core/3	Rim/3	Core/3	Rim/3
SiO2	45.81	41.49	44.15	45.52	45.36
TiO2	1.25	2.52	1.45	1.62	1.35
AI2O3	8.24	11.30	8.31	8.43	8.02
Cr2O3	0.00	0.02	0.03	0.02	0.02
FeO	17.42	14.27	17.25	15.47	16.65
MnO	0.07	0.06	0.00	0.11	0.01
MgO	11.28	11.09	11.09	11.99	11.40
CaO	11.77	11.60	11.47	11.32	11.58
Na2O	1.40	2.12	1.48	1.42	1.44
K2O	0.86	0.83	0.93	0.83	0.80
BaO	0.23	0.05	0.23	0.00	0.00
P2O5	0.00	0.11	0.14	0.10	0.05
Total	98.32	95.44	96.56	96.79	96.68
Si	6.84	6.34	6.73	6.82	6.85
TI	0.14	0.29	0.17	0.18	0.15
AI	1.45	2.04	1.49	1.49	1.43
AIIV	1.16	1.66	1.27	1.18	1.15
AIVI	0.29	0.37	0.23	0.31	0.28
Cr	0.00	0.00	0.00	0.00	0.00
Fe	2.18	1.82	2.20	1.94	2.10
Mn	0.01	0.01	0.00	0.01	0.00
Mg	2.51	2.53	2.52	2.68	2.57
Ca	1.88	1.90	1.87	1.82	1.87
Na	0.40	0.63	0.44	0.41	0.42
ĸ	0.16	0.16	0.18	0.16	0.15
Ba	0.01	0.00	0.01	0.00	0.00
Ρ	0.00	0.01	0.02	0.01	0.01

#### TOORIES HORNBLENDE

IocationCore/1Rim/1Core/2Core/2Rim/2Core/3Rim/3Core/4Rim/4SiO247.0747.3148.9746.4046.8547.6247.6346.8947.31TiO21.280.901.031.381.180.810.661.261.48Al2O37.207.375.557.397.266.606.797.476.66Cr2O30.040.140.220.060.190.210.150.140.20FeO15.7815.4914.8415.8615.5515.4315.7915.7614.86MnO0.120.000.090.000.050.240.140.110.26MgO12.7512.6613.3812.2312.3312.8412.9112.4713.08CaO11.7311.7612.1411.6411.6611.7411.9811.6111.99Na2O1.521.491.061.291.561.491.371.751.48K2O0.790.800.620.850.810.680.750.770.79BaO0.050.150.170.000.070.000.170.000.09P2O50.100.030.120.050.110.150.170.000.07Ti0.140.100.110.160.130.090.070.140.16Al/V1.061.01<	sample	тоз	тоз	тоз	TO3	TO3	TOS	TO3	TO3	TO3
SiO2   47.07   47.31   48.97   46.40   46.85   47.62   47.63   46.89   47.31     TiO2   1.28   0.90   1.03   1.38   1.18   0.81   0.66   1.26   1.48     Al2O3   7.20   7.37   5.55   7.39   7.26   6.60   6.79   7.47   6.66     Cr2O3   0.04   0.14   0.22   0.06   0.19   0.21   0.15   0.14   0.20     FeO   15.78   15.49   14.84   15.86   15.55   15.43   15.79   15.76   14.86     MnO   0.12   0.00   0.09   0.00   0.05   0.24   0.14   0.11   0.26     MgO   12.75   12.66   13.38   12.23   12.33   12.84   12.91   12.47   13.08     CaO   11.73   11.76   12.14   11.64   11.66   11.74   11.98   11.61   11.99     Na2O   1.52   1.49   1.06   1.29   1.56   1.49   1.37   1.75   1.48     K2O	location	Core/1	Rim/1	Core/2	Core/2	Rim/2	Core/3	Rim/3	Core/4	Rim/4
Side     17.07     14.86       MnO     0.12     0.00     0.09     0.00     0.05     0.24     0.14     0.11     0.26       MgO     12.75     12.66     13.38     12.23     12.33     12.84     12.91     12.47     13.08       CaO     11.73     11.76     12.14     11.64     11.66     11.74     11.98     11.81     11.19 <t< td=""><td>SiOo</td><td>47.07</td><td>47 31</td><td>48 97</td><td>46 40</td><td>48.85</td><td>47 62</td><td>17 63</td><td>46 80</td><td>47 21</td></t<>	SiOo	47.07	47 31	48 97	46 40	48.85	47 62	17 63	46 80	47 21
Al2O3   7.20   7.37   5.55   7.39   7.26   6.60   6.79   7.47   6.66     Cr2O3   0.04   0.14   0.22   0.06   0.19   0.21   0.15   0.14   0.20     FeO   15.78   15.49   14.84   15.86   15.55   15.43   15.79   15.76   14.86     MnO   0.12   0.00   0.09   0.00   0.05   0.24   0.14   0.11   0.26     MgO   12.75   12.66   13.38   12.23   12.33   12.84   12.91   12.47   13.08     CaO   11.73   11.76   12.14   11.64   11.66   11.74   11.98   11.61   11.99     Na2O   1.52   1.49   1.06   1.29   1.56   1.49   1.37   1.75   1.48     K2O   0.79   0.80   0.62   0.85   0.81   0.68   0.75   0.77   0.79     BaO   0.05   0.15   0.17   0.00   0.07   0.017   0.00   0.09     P2O5   0.10	TIO2	1 28	-77.07 n on	10.07	1 38	1 18	0.81	77.00	1 26	1 4 9
Cr2O3   0.04   0.14   0.22   0.06   0.19   0.21   0.15   0.14   0.20     FeO   15.78   15.49   14.84   15.86   15.55   15.43   15.79   15.76   14.86     MpO   0.12   0.00   0.09   0.00   0.05   0.24   0.14   0.11   0.26     MgO   12.75   12.66   13.38   12.23   12.33   12.84   12.91   12.47   13.08     CaO   11.73   11.76   12.14   11.64   11.66   11.74   11.98   11.61   11.99     Na2O   1.52   1.49   1.06   1.29   1.56   1.49   1.37   1.75   1.48     K2O   0.79   0.80   0.62   0.85   0.81   0.68   0.75   0.77   0.79     BaO   0.05   0.15   0.17   0.00   0.07   0.00   0.17   0.00   0.09     P2O5   0.10   0.03   0.12   0.05   0.11   0.15   0.07   0.15     Total   98.42	A1202	7 20	7 37	5 55	7 30	7.26	6 60	6 70	7 47	6 66
Circos     0.04     0.14     0.22     0.06     1.15     0.12     0.14     0.22     0.06     1.15     0.12     0.14     0.22     0.06     1.15     0.11     0.14     0.12     0.00     0.02     0.01     0.15     0.14     0.11     0.26       MnO     0.12     0.00     0.09     0.00     0.05     0.24     0.14     0.11     0.26       MgO     12.75     12.66     13.38     12.23     12.33     12.84     12.91     12.47     13.08       Cac     11.73     11.76     12.14     11.64     11.66     11.74     11.98     11.81     11.99       Na2O     1.52     1.49     1.06     1.29     1.56     1.49     1.37     1.75     1.48       K2O     0.79     0.80     0.62     0.85     0.81     0.68     0.75     0.77     0.79       BaO     0.05     0.15     0.17     0.00     0.07     0.00     0.07     0.16       Total	C-202	0.04	0.14	0.00	0.00	0.10	0.00	0,75	0.44	0.00
NnO     0.12     0.00     0.09     0.00     0.05     0.24     0.14     0.11     0.26       MgO     12.75     12.66     13.38     12.23     12.33     12.84     12.91     12.47     13.08       Cac     11.73     11.76     12.14     11.64     11.66     11.74     11.98     11.61     11.99       Na2O     1.52     1.49     1.06     1.29     1.56     1.49     1.37     1.75     1.48       K2O     0.79     0.80     0.62     0.85     0.81     0.68     0.75     0.77     0.79       BaO     0.05     0.15     0.17     0.00     0.07     0.00     0.17     0.00     0.09       P2O5     0.10     0.03     0.12     0.05     0.11     0.15     0.17     0.00     0.07     0.00     0.07     0.14       O10     0.03     0.12     0.05     0.11     0.15     0.07     0.15       Total     98.42     98.04     98.17 <td>5-00 ·</td> <td>15 79</td> <td>15 40</td> <td>14 84</td> <td>15 86</td> <td>15 55</td> <td>15.49</td> <td>45 70</td> <td>15 70</td> <td>14 96</td>	5-00 ·	15 79	15 40	14 84	15 86	15 55	15.49	45 70	15 70	14 96
Mino     0.12     0.00 <th< td=""><td>Ma</td><td>0 12</td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.05</td><td>0.94</td><td>0.10</td><td>0'11</td><td>14.00</td></th<>	Ma	0 12	0.00	0.00	0.00	0.05	0.94	0.10	0'11	14.00
MgO     12.73     12.00     13.36     12.23     12.33     12.34     12.91     12.44     13.06       CaO     11.73     11.76     12.14     11.64     11.64     11.74     11.98     11.61     11.99       Na2O     1.52     1.49     1.06     1.29     1.56     1.49     1.75     1.48       K2O     0.79     0.80     0.62     0.85     0.81     0.68     0.75     0.77     0.79       BaO     0.05     0.15     0.17     0.00     0.07     0.00     0.17     0.00     0.09       P2O5     0.10     0.03     0.12     0.05     0.11     0.15     0.07     0.15       Total     98.42     98.04     98.17     97.09     97.61     97.68     98.48     98.21     98.35       Si     6.94     6.99     7.19     6.94     6.96     7.05     7.02     6.93     6.97       Ti     0.14     0.10     0.11     0.16     0.13     0.0	MacO	10.12	10.00	10.00	40.00	40.00	10.04	40.04	40.47	10.20
Na2O     1.52     1.49     1.64     1.65     1.49     1.37     1.75     1.48       K2O     0.79     0.80     0.62     0.85     0.81     0.68     0.75     0.77     0.79       BaO     0.05     0.15     0.17     0.00     0.07     0.00     0.17     0.00     0.09       P2O5     0.10     0.03     0.12     0.05     0.11     0.15     0.17     0.00     0.07     0.00     0.07     0.15       Total     98.42     98.04     98.17     97.09     97.61     97.68     98.48     98.21     98.35       Si     6.94     6.99     7.19     6.94     6.96     7.05     7.02     6.93     6.97       Ti     0.14     0.10     0.11     0.16     0.13     0.09     0.07     0.14     0.16       AllV     1.06     1.01     0.81     1.06     1.04     0.95     0.98     1.07     1.03       AlVI     0.20     0.28     <		14.70	14 76	10.00	11 04	12.00	14.04	14.00	14.4/	11.00
NA2O     1.32     1.49     1.06     1.29     1.56     1.49     1.37     1.75     1.48       K2O     0.79     0.80     0.62     0.85     0.81     0.68     0.75     0.77     0.79       BaO     0.05     0.15     0.17     0.00     0.07     0.00     0.17     0.00     0.09       P2O5     0.10     0.03     0.12     0.05     0.11     0.15     0.17     0.00     0.07     0.15       Total     98.42     98.04     98.17     97.09     97.61     97.68     98.48     98.21     98.35       Si     6.94     6.99     7.19     6.94     6.96     7.05     7.02     6.93     6.97       Ti     0.14     0.10     0.11     0.16     0.13     0.09     0.07     0.14     0.16       Al     1.25     1.28     0.96     1.30     1.27     1.15     1.18     1.30     1.16       AllV     0.60     0.20     0.28 <td< td=""><td>Naco</td><td>1 60</td><td>1.70</td><td>12.14</td><td>11.04</td><td>11.00</td><td>11.74</td><td>11.80</td><td>11.01</td><td>11.99</td></td<>	Naco	1 60	1.70	12.14	11.04	11.00	11.74	11.80	11.01	11.99
K20     0.79     0.80     0.82     0.81     0.81     0.88     0.75     0.77     0.79       BaO     0.05     0.15     0.17     0.00     0.07     0.00     0.17     0.00     0.09       P2O5     0.10     0.03     0.12     0.05     0.11     0.15     0.17     0.00     0.09       P2O5     0.10     0.03     0.12     0.05     0.11     0.15     0.17     0.00     0.09       F2O5     0.10     0.03     0.12     0.05     0.11     0.15     0.17     0.00     0.09       F2O5     0.10     0.03     0.12     0.05     0.11     0.15     0.017     0.00     0.09       Factor     98.42     98.04     98.17     97.09     97.61     97.68     98.48     98.21     98.35       Si     6.94     6.99     7.19     6.94     6.96     7.05     7.02     6.93     6.97       Ti     0.14     0.10     0.11     0.16	KOO	0.70	1.49	1.00	1.29	00.1	1.49	1.37	1.75	1.40
Bad     0.03     0.15     0.17     0.00     0.07     0.00     0.17     0.00     0.09       P2O5     0.10     0.03     0.12     0.05     0.11     0.15     0.17     0.00     0.19       Total     98.42     98.04     98.17     97.09     97.61     97.68     98.48     98.21     98.35       Si     6.94     6.99     7.19     6.94     6.96     7.05     7.02     6.93     6.97       Ti     0.14     0.10     0.11     0.16     0.13     0.09     0.07     0.14     0.16       All     1.25     1.28     0.96     1.30     1.27     1.15     1.18     1.30     1.16       AllV     1.06     1.01     0.81     1.06     1.04     0.95     0.98     1.07     1.03       AlVI     0.20     0.28     0.15     0.24     0.20     0.20     0.23     0.12       Cr     0.00     0.02     0.03     0.01     0.02 <td< td=""><td>K20</td><td>0.79</td><td>0.80</td><td>0.62</td><td>0.85</td><td>0.81</td><td>0.68</td><td>0.75</td><td>0.77</td><td>0.79</td></td<>	K20	0.79	0.80	0.62	0.85	0.81	0.68	0.75	0.77	0.79
P205     0.10     0.03     0.12     0.05     0.11     0.15     0.15     0.07     0.15       Total     98.42     98.04     98.17     97.09     97.61     97.68     98.48     98.21     98.35       Si     6.94     6.99     7.19     6.94     6.96     7.05     7.02     6.93     6.97       Ti     0.14     0.10     0.11     0.16     0.13     0.09     0.07     0.14     0.16       Al     1.25     1.28     0.96     1.30     1.27     1.15     1.18     1.30     1.16       AlIV     1.06     1.01     0.81     1.06     1.04     0.95     0.98     1.07     1.03       AlVI     0.20     0.28     0.15     0.24     0.20     0.20     0.23     0.12       Cr     0.00     0.02     0.03     0.01     0.02     0.02     0.02     0.02       Fe     1.95     1.91     1.82     1.98     1.93     1.91     1	BaO	0.05	0.15	0.17	0.00	0.07	0.00	0.17	0.00	0.09
Si     6.94     6.99     7.19     6.94     6.96     7.05     7.02     6.93     6.97       Ti     0.14     0.10     0.11     0.16     0.13     0.09     0.07     0.14     0.16       Al     1.25     1.28     0.96     1.30     1.27     1.15     1.18     1.30     1.16       AlIV     1.06     1.01     0.81     1.06     1.04     0.95     0.98     1.07     1.03       AlVI     0.20     0.28     0.15     0.24     0.20     0.20     0.23     0.12       Cr     0.00     0.02     0.03     0.01     0.02     0.02     0.02     0.02       Fe     1.95     1.91     1.82     1.98     1.93     1.91     1.95     1.95     1.83       Mn     0.02     0.00     0.01     0.00     0.01     0.03     0.02     0.02     0.03	P205	0.10	0.03	0.12	0.05	0.11	0.15	0.15	0.07	0.15
Si     6.94     6.99     7.19     6.94     6.96     7.05     7.02     6.93     6.97       Ti     0.14     0.10     0.11     0.16     0.13     0.09     0.07     0.14     0.16       Al     1.25     1.28     0.96     1.30     1.27     1.15     1.18     1.30     1.16       AlV     1.06     1.01     0.81     1.06     1.04     0.95     0.98     1.07     1.03       AlVI     0.20     0.28     0.15     0.24     0.20     0.23     0.12       Cr     0.00     0.02     0.03     0.01     0.02     0.02     0.02       Fe     1.95     1.91     1.82     1.98     1.93     1.91     1.95     1.95       Mn     0.02     0.00     0.01     0.00     0.01     0.03     0.02     0.02     0.03	Total	98.42	98.04	98.17	97.09	97.61	97.68	98.48	98.21	98.35
Si     6.94     6.99     7.19     6.94     6.96     7.05     7.02     6.93     6.97       Ti     0.14     0.10     0.11     0.16     0.13     0.09     0.07     0.14     0.16       Al     1.25     1.28     0.96     1.30     1.27     1.15     1.18     1.30     1.16       AlV     1.06     1.01     0.81     1.06     1.04     0.95     0.98     1.07     1.03       AlVI     0.20     0.28     0.15     0.24     0.20     0.20     0.23     0.12       Cr     0.00     0.02     0.03     0.01     0.02     0.03     0.02     0.02     0.02       Fe     1.95     1.91     1.82     1.98     1.93     1.91     1.95     1.95     1.83       Mn     0.02     0.00     0.01     0.00     0.01     0.03     0.02     0.02     0.03		5.		S. 19						
Ti     0.14     0.10     0.11     0.16     0.13     0.09     0.07     0.14     0.16       Al     1.25     1.28     0.96     1.30     1.27     1.15     1.18     1.30     1.16       AlV     1.06     1.01     0.81     1.06     1.04     0.95     0.98     1.07     1.03       AlVI     0.20     0.28     0.15     0.24     0.24     0.20     0.23     0.12       Cr     0.00     0.02     0.03     0.01     0.02     0.03     0.02     0.02     0.28       Fe     1.95     1.91     1.82     1.98     1.93     1.91     1.95     1.95       Mn     0.02     0.00     0.01     0.00     0.01     0.03     0.02     0.02     0.03	Si	6.94	6.99	7,19	6.94	6.96	7.05	7.02	6.93	6.97
Al     1.25     1.28     0.96     1.30     1.27     1.15     1.18     1.30     1.16       AllV     1.06     1.01     0.81     1.06     1.04     0.95     0.98     1.07     1.03       AlVI     0.20     0.28     0.15     0.24     0.24     0.20     0.20     0.23     0.12       Cr     0.00     0.02     0.03     0.01     0.02     0.03     0.02     0.02     0.02       Fe     1.95     1.91     1.82     1.98     1.93     1.91     1.95     1.95     1.83       Mn     0.02     0.00     0.01     0.00     0.01     0.03     0.02     0.02     0.03	Ti	0.14	0.10	0.11	0.16	0.13	0.09	0.07	0.14	0.16
AllV     1.06     1.01     0.81     1.06     1.04     0.95     0.98     1.07     1.03       AlVI     0.20     0.28     0.15     0.24     0.24     0.20     0.20     0.23     0.12       Cr     0.00     0.02     0.03     0.01     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.02     0.03     0.02     0.02     0.03     0.02     0.02     0.03     0.02     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03 <td>AL</td> <td>1.25</td> <td>1.28</td> <td>0.96</td> <td>1.30</td> <td>1.27</td> <td>1.15</td> <td>1.18</td> <td>1.30</td> <td>1.16</td>	AL	1.25	1.28	0.96	1.30	1.27	1.15	1.18	1.30	1.16
AIVI     0.20     0.28     0.15     0.24     0.24     0.20     0.20     0.23     0.12       Cr     0.00     0.02     0.03     0.01     0.02     0.03     0.01     0.02     0.03     0.02     0.03     0.02     0.02     0.03     0.02     0.02     0.03     0.02     0.02     0.03     0.02     0.02     0.03     0.02     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.03     0.02     0.03     0.03     0.02     0.03     0.03     0.02     0.03     0.03     0.02     0.03     0.03     0.02     0.03	AIIV	1.06	1.01	0.81	1.06	1.04	0.95	0.98	1.07	1.03
Cr     0.00     0.02     0.03     0.01     0.02     0.03     0.02     0.03     0.02     0.02     0.03     0.02     0.02     0.03     0.02     0.02     0.03     0.02     0.02     0.03     0.02     0.02     0.03     0.02     0.02     0.03     0.02     0.02     0.03     0.02     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0.02     0.03     0	AIVI	0.20	0.28	0.15	0.24	0.24	0.20	0.20	0.23	0.12
Fe     1.95     1.91     1.82     1.98     1.93     1.91     1.95     1.95     1.83       Mn     0.02     0.00     0.01     0.00     0.01     0.03     0.02     0.02     0.03	Cr	0.00	0.02	0.03	0.01	0.02	0.03	0.02	0.02	0.02
Mn 0.02 0.00 0.01 0.00 0.01 0.03 0.02 0.02 0.03	Fe	1.95	1.91	1.82	1.98	1.93	1.91	1.95	1.95	1.83
	Mn	0.02	0.00	0.01	0.00	0.01	0.03	0.02	0.02	0.03
Mg 2.80 2.79 2.93 2.72 2.73 2.83 2.84 2.75 2.87	Mg	2.80	2.79	2.93	2.72	2.73	2.83	2.84	2.75	2.87
Ca 1.85 1.86 1.91 1.87 1.86 1.86 1.89 1.84 1.98	Ca	1.85	1.86	1.91	1.87	1.86	1.86	1.89	1.84	1.98
Na 0.44 0.43 0.30 0.37 0.45 0.43 0.39 0.50 0.44	Na	0.44	0.43	0.30	0.37	0.45	0.43	0.39	0.50	0.44
K 0.15 0.15 0.12 0.16 0.15 0.13 0.14 0.15 0.15	ĸ	0.15	0.15	0,12	0.16	0.15	0.13	0.14	0.15	0.15
Ba 0.00 0.01 0.01 0.00 0.00 0.00 0.01 0.00 0.01	Ba	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.01
P 0.01 0.00 0.02 0.01 0.01 0.02 0.02 0.01 0.01	P	0.01	0.00	0.02	0.01	0.01	0.02	0.02	0.01	0.01

#### APPENDIX 4.5. MUSCOVITE ROSSES

Sample Location	G2 Core/1	G2 Rim/1	G2 Core/2	G2 Rim/2	G2 Core/3	G2 Core/4	G2 Rim/4	G2 Core/5	G2 Rim/5	G2 Core / 6	G2 Core/7	G2 Core/8
SiO2	44.87	43.26	44:47	45.40	46.47	44.85	45.20	45.06	46.12	45.16	44.99	45.49
TiO2	1.34	1.42	1.03	0.75	1.85	0.85	0.72	1.40	1.92	1.28	0.80	0.88
AI2O3	29.32	29.29	29.27	28.29	29.01	30.06	30.11	30.28	27.65	29.98	29.33	30.32
Cr2O3	0.00	0.05	0.14	0.07	0.00	0.00	0.00	0.01	0.13	0.04	0.00	0.00
FeQ	4.78	5.31	5.24	5.81	5.06	5.56	5.36	5.03	5.50	4.79	5.81	4.50
MnO	0.00	0.00	0.00	0.01	0.00	0.00	0.11	0.00	0.06	0.00	0.00	0.00
MaQ	1 21	1 20	1 26	1 78	1 68	1.32	1 26	1 34	2.04	1 4 8	1 64	1 22
	0.08	0.00	0.06	0.05	0.08	0.13	0.00	0 14	0.00	0.11	0.04	0.04
Na2O	0.54	0.37	0.68	0.51	0.39	0.10	0.00	0.53	0.20	0.56	0.50	0.61
K2O	10.27	10.57	10.00	10.51	10.66	10.22	10 47	10.00	10.20	10.45	10.30	10.44
PaO	0.02	0.00	0.40	0.00	0.00	0.00	0.07	0.00	0.00	0.40	0.07	0.00
040	0.02	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00
Tatal	0.00	0.00	0.00	0.00	05 10	0.00	0.04	0.00	0.01	0.00	0.01	0.00
TOTAL	92.40	93.40	92.00	93.90	90.19	93.30	93.02	34.07	54.05	83.66	93.JZ	90.0 <b>2</b>
S	6.31	6.33	6.29	6.34	6.36	6.26	6.29	6.24	6.39	6.27	6.29	6.32
TI-	0.01	0.00	0.11	0.01	0 19	0.09	0.08	0.15	0.00	0.13	0.08	0.02
A1	4 86	4 99	4 88	4 77	4 68	A 0A	A Q A	4 95	4 51	1 01	1 93	4 06
~	4.00	4.03	4.00	4.77	0.00	0.00	0.00	0.00	0.01	- 0.01	0.00	0.00
	0.00	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00
	0.00	0.02	0.02	0.00	0.00	0.00	0.02	0.00	0.04	0.50	0.00	0.02
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Ng	0.25	0.25	0.26	0.37	0.34	0.27	0.20	0.20	0.42	0.31	0.34	0.25
Ca	0.01	0.00	0.01	0.01	0.01	0.02	0.00	0.02	0.00	0.02	0.01	0.01
Na	0.15	0.10	0.19	0.14	0.11	0.14	0.11	0.14	0.08	0.15	0.13	0.17
ĸ	1.84	1.87	1.88	1.88	1.86	1.82	1.86	1.82	1.90	1.85	1.85	1.85
Ba	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Р	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00
<b>0</b>		-							00			
Sample	Gi2	62	Gi2	- G2	G2 Corro /0	Gi2	G3 Cruc/d	Citi i	03	63	1997 - 1997 -	
Location	Colela	Core/10	Core/1	Hom/ I	Core/2	Mim/2	Core/1	FUM/1	Core/2	HIM/2		
SIO2	45.70	46.10	45.94	45.65	45.30	45.47	46.77	50.50	46.42	46.01	1 - C. A. A.	1.60
TIO2	0.81	0.24	0.28	0.69	0.89	1.21	1.31	0.43	0.86	0.70		10 J
A12O3	30.59	29.75	27.85	26.00	30.99	29.91	27.63	25.38	28.30	28.11	11.000	100
Cr2O3	0.01	0.00	0.10	0.00	0.00	0.00	0.00	0.03	0.03	0.00		
FeO	4.68	4.83	6.09	6.68	4.05	4.61	5.87	6.55	5.46	5.30		1.15
MnO	0.06	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.04	$1 \pm 1 \pm 1 \pm 1$	9 - 19 - Av
MaQ	1.44	1.68	1.89	2.38	0.97	0.97	1.85	2.27	1.90	1.69		
CảO	0.09	0.09	0.00	0.04	0.00	0.00	0.00	0.08	0.00	0.00		
Na2O	0.64	0.44	0.32	0.30	0.82	0.39	0.27	0.32	0.21	0.28	이 안전 문	14 <u>1</u> 2 2
K20	10.26	10.83	10.62	10.82	10.21	10.26	10.89	9.25	10.79	10.95	1 - 119	
BaO	0.00	0.16	0.08	0.00	0.20	0.00	0.26	0.21	0.27	0.17		
P205	0.00	0.00	0.14	0.03	0.08	0.12	0.07	0.05	0.08	0.14		tere a
Total	94.28	94.12	93.27	92.66	93.40	92.82	94.91	95.07	94.31	93.39	e e e Se e e	,
SI	6.29	6.38	6.44	6.49	6.27	6.34	6.46	6.87	6.43	6.44	가공공연	a segal
Ti	0.08	0.03	0.03	0.07	0.09	0.13	0.14	0.04	0.09	0.07		
A)	4.97	4,85	4.60	4.36	5.05	4.91	4.50	4.07	4.62	4.64		1 de la com
Cr	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.08	
Fe	0.54	0.56	0.71	0.79	0.47	0.54	0.68	0.74	0.63	0.62		
Mn	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01		(1,2,1)
Ma	0.30	0.35	0.40	0.50	0.20	0.20	0.38	0.46	0.39	0.35		1. 1. 1. 1.
Ca	0.01	0.01	0.00	0.01	0,00	0.00	0.00	0.01	0.00	0.00		
Na	0.17	0.12	0.09	0.08	0.22	0.11	0.07	0.09	0.06	0.08		12 (A. 66)
ĸ	1.80	1.91	1.90	1.96	1.80	1.82	1.92	1.61	1.91	1.95		a se pla
Ba	0.00	0.01	0.01	0.00	0.01	0.00	0.01	0.01	0.02	0.01		\$.4×
P	0.00	0.00	0.02	0.00	0.01	0.01	0.01	0.01	0.01	0.02		

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#### APPENDIX 4.5 : CONTINUED MUSCOVITE TRAWENAGH BAY

Sample Location	TRA4 Core/1	TRA4 Core/2	TRA4 Core/3	TRA4 Core/4	TRA4 Core/5	TRA4 Rim/5	TRA4 Core/6	TRA4 Rim/6	TRA4 Core/7	TRA4 Rím/7	TRA4 Rim/8	TRA4 Core/9
SiO2	45.28	45.34	45.58	45.38	45.32	45.48	45.56	45.70	44.98	44.98	44.84	45.63
TiO2	0.73	0.72	0.79	0.77	0.77	0.92	0.80	0.70	0.72	0.79	0.91	0.91
AI2O3	29.64	29.58	29.51	30.12	30.39	29.84	29.70	29.57	31.19	31.25	30.83	10.35
Cr2O3	0.10	0.00	0.01	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00
FeO	5.10	5.30	5.69	5.32	4.91	5.19	5.84	6.17	4.47	4.81	4.44	5.12
MnO	0.00	0.01	0.04	0.02	0.01	0.04	0.05	0.06	0.16	0.00	0.19	0.09
NgU C-C	1.45	0.04	1.40	0.06	1.44	1.17	1.19	1.19	1.00	1.18	0.87	1.35
Na2O	0.05	0.04	0.00	0.00	0.10	0.04	0.10	0.20	0.50	0.10	0.04	0.05
K2O	10.42	10.39	10.65	10.42	10.13	10.05	10.67	9.98	10.54	10.60	10.46	10.44
BaO	0.10	0.00	0.21	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00
P2O5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00
Total	93.28	93.15	94.40	93.64	93.54	93.01	94.24	94.10	93.65	94.13	93.10	94.41
Si	6.33	6.34	6.32	6.31	6.29	6.36	6.34	6.32	6.24	6.22	6.25	6.30
Ti	0.08	0.08	0.08	0.08	0.08	0.10	0.08	0.07	0.08	0.08	0.10	0.10
Al	4.88	4.87	4.82	4.94	4.97	4.72	4.87	4.82	5.10	5.09	5.07	4.94
Cr	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
Fe	0.60	0.62	0.66	0.62	0.57	0.61	0.68	0.71	0.52	0.56	0.52	0.59
Mn	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.02	0.00	0.02	0.01
Mg	0.30	0.27	0.29	0.25	0.30	0.24	0.25	0.24	0.21	0.24	0.18	0.28
Ca	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.04	0.01	0.02	0.01	0.01
Na	0.11	0.13	0.11	0.10	0,13	0.10	0.07	0.11	0.14	0.12	0.13	0.12
Ro.	1.00	0.40	1.89	1.85	0.00	1.79	1.09	0.00	0.00	1.87	0.00	1.64
P.	0.01	0.19	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	14.17	14.36	14.20	14.15	14.14	13.92	14.21	14.11	14.18	14.19	14.13	14.18
Sample Location	TRA2 Core/10	TRA2 Core/11	TRA2 Core/12	TRA2 Rim/12	TRA2 Core/13	TRA2 Core/14	TRA2 Rim/14	TRA2 Core/15	TRA2 Rim/15	TRA3 Core/1	TRA3 Rim/1	TRA3 Core/2
SiO2	45 78	45 60	45 82	45.81	46.89	44 36	45.00	45 68	48 00	45 50	45 03	45 38
TiO2	0.88	0.83	0.82	1.02	0.55	1.32	0.59	1.29	1.30	0.21	0.64	0.28
A1203	29.83	30.26	28.84	28.85	29.68	28.26	28.37	28.87	28.29	31.93	31.75	33.12
Cr2O3	0.00	0.11	0.05	0.00	0.02	0.04	0.02	0.00	0.07	0.04	0.00	0.00
FeO	5.24	5.14	6.40	6.47	5.90	5.23	5.41	5.53	5.88	4.62	4.39	3.68
MnO	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
MgO	1.39	1.23	1.65	1.97	1.69	1.43	1.53	1.55	1.72	0.46	0.52	0.49
CaO	0.05	0.07	0.09	0.03	0.01	0.14	0.10	0.03	0.11	0.00	0.00	0.00
Na2O	0.38	0.35	0.26	0.45	0.35	0.44	0.35	0.43	0.35	0.37	0.52	0.74
K2O ReO	0.02	0.01	10.41	10.69	0.10	10.30	10.50	0.00	10.82	10.89	10.39	10.48
P205	0.00	0.01	0.05	0.00	0.10	0.00	0.00	0.00	0.00	0.20	0.13	0.10
Total	94.17	94.30	94.38	95.51	96.10	91.60	91.93	94.22	94.63	94.21	94.19	94.29
, ota,	• • • • •								21 gas			
Si	6.35	6.30	6.37	6.32	6.38	6.33	6.40	6.35	6.39	6.26	6,29	6.20
TI	0.91	0.09	0.09	0.11	0.06	0.14	0.06	0.14	0.14	0.02	0.07	0.03
AI	4.87	4.93	4.72	4.69	4.76	4.76	4.75	4.73	4.62	5.18	5.13	5.33
Cr	0.00	0.01	0.01	0.00	0.02	0.01	0.00	0.00	0.01	0.00	0.00	0.00
Fe	0.61	0.59	0.74	0.75	0.67	0.63	0.64	0.64	0.68	0,53	0.50	0.42
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mg	0.29	0.25	0.34	0.40	0.34	0.31	0.33	0.32	0.36	0.09	0.11	0.10
ual No	0.01	0.00	0.01	0.01	0.00	0.02	0.02	0.01	0.02	0.00	0.00	0.00
K	1 88	1 88	1.84	1.92	1.92	1 80	1 02	1 02	1 01	1 01	1.89	1 8 3
1 <b>\</b>		1.00										
ыа	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01
ва Р	0.00	0.00	0.00	0.00 0.00	0.01	0.00 0.00	0.00	0.00	0.00	0.01 0.01	0.01	0.01

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#### APPENDIX 4 : CONTINUED MUSCOVITE TRAWENAGH BAY

Sample     TRA3     TRA3     TRA3     TRA5     TRA5     Core/2     DON4	TRAV	VENA	AGH B	AY				1	MAIN	DON	EGAL		
SiO2   46.18   45.94   45.83   46.19   46.06   45.85   45.72   45.45   45.51   46.01   46.14     TiO2   0.44   0.37   0.21   0.95   0.25   0.60   0.53   0.67   1.40   1.13   0.81     Al2O3   32.33   32.66   32.36   29.17   30.96   29.77   28.70   29.30   30.00   28.17   29.33     Cr2O3   0.00	Sample Location	TRA3 Rim/2	TRA3 Core/3	TRA3 Rim/3	TRA5 Core/1	TRA5 Core/2		DON4 Core/1	DON4 Rim/1	DON4 Core/2	DON4 Core/3	DON4 Core/4	DON4 Core/5
TiQ2   0.44   0.37   0.21   0.95   0.25   0.60   0.53   0.67   1.40   1.13   0.81     Al2O3   32.33   32.66   32.36   29.17   30.96   29.77   28.70   29.30   30.00   28.17   29.33     Cr2O3   0.00   0.00   0.20   0.00	SiO2	46.18	45.94	45.83	46.19	46.06	2 	45.85	45.72	45.45	45.51	46.01	46.14
A12O3   32.33   32.66   32.36   29.17   30.96   29.77   28.70   29.30   30.00   28.17   29.33     Cr2O3   0.00   0.00   0.20   0.0	TiO2	0.44	0.37	0.21	0.95	0.25		0.60	0.53	0.67	1.40	1.13	0.81
Gr2Q3   0.00   0.00   0.20   0.00   0.00   0.00   0.03   0.05   0.00   0.00     FeQ   4.21   4.10   4.00   5.64   5.07   5.11   5.28   5.85   4.98   5.60   5.54     MnO   0.01   0.00 <t< td=""><td>A12O3</td><td>32.33</td><td>32.66</td><td>32.36</td><td>29.17</td><td>30.96</td><td></td><td>29.77</td><td>28.70</td><td>29.30</td><td>30.00</td><td>28.17</td><td>29.33</td></t<>	A12O3	32.33	32.66	32.36	29.17	30.96		29.77	28.70	29.30	30.00	28.17	29.33
FeO     4.21     4.10     4.00     5.64     5.07     5.11     5.28     5.85     4.98     5.60     5.54       MnO     0.01     0.00     0.02     0.04     0.32     0.25     0.22     0.49     0.42     0.31     0.79     10.78     10.79     10.78     10.79     10.78     10.79     10.78     10.79     10.78     10.79     10.78     11     0.02     0.00     0.00     0.02     0.00     0.00     10.02     0.00     0.00	Cr2O3	0.00	0.00	0.20	0.00	0.00		0.00	0.00	0.03	0.05	0.00	0.00
MnO     0.01     0.00	FeO	4.21	4.10	4.00	5.64	5.07		5.11	5.28	5.85	4.98	5.60	5.54
MgO   0.44   0.56   0.50   1.20   0.87   1.14   1.27   1.26   1.09   1.49   1.19     CaO   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.02   0.00   0.02   0.00   0.02   0.00   0.02   0.00   0.02   0.04     Na2O   0.51   0.54   0.56   0.38   0.44   0.32   0.25   0.22   0.49   0.42   0.31     K2O   10.50   10.72   10.82   10.95   11.05   10.62   10.98   10.74   10.92   10.79   10.78     BaO   0.00   0.00   0.03   0.12   0.01   0.13   0.22   0.26   0.13   0.18   0.12     P2O5   0.24   0.02   0.00   0.09   0.01   0.02   0.09   0.02   0.00   0.03   0.02     Total   94.65   94.59   94.29   94.66   94.72   93.45   93.04   93.82   94.56   93.82   94.28     Si   6.28   6.26<	MnO	0.01	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
CaO     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.02     0.00     0.02     0.01       Na2O     0.51     0.54     0.56     0.38     0.44     0.32     0.25     0.22     0.49     0.42     0.31       K2O     10.50     10.72     10.82     10.95     11.05     10.62     10.98     10.74     10.92     10.79     10.78       BaO     0.00     0.00     0.03     0.12     0.01     0.13     0.22     0.26     0.13     0.18     0.12       P2O5     0.24     0.02     0.00     0.09     0.01     0.02     0.09     0.02     0.00     0.03     0.02       Total     94.65     94.29     94.66     94.72     93.45     93.04     93.82     94.56     93.82     94.28       Si     6.28     6.26     6.27     6.39     6.33     6.37     6.42     6.34     6.29     6.41	MaQ	0.44	0.56	0.50	1.20	0.87		1.14	1.27	1.26	1.09	1.49	1.19
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	CaO	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.02	0.00	0.02	0.04
K2010.5010.7210.8210.9511.0510.6210.9810.7410.9210.7910.78Ba00.000.000.030.120.010.130.220.260.130.180.12P2050.240.020.000.090.010.020.090.020.000.030.02Total94.6594.5994.2994.6694.7293.4593.0493.8294.5693.8294.28Si6.286.266.276.396.336.376.426.346.296.416.39Ti0.050.040.020.100.030.060.060.070.150.120.08Al5.185.245.224.795.014.884.754.824.894.634.79Cr0.000.000.000.000.000.000.000.000.000.000.00Mg0.090.120.100.250.180.240.270.260.220.310.25Ca0.000.000.000.000.000.000.000.000.000.000.000.00Mg0.990.120.100.250.180.240.270.260.220.310.25Ca0.000.000.000.000.000.000.000.000.000.000.000.00Mg0.14 <td>Na2O</td> <td>0.51</td> <td>0.54</td> <td>0.56</td> <td>0.38</td> <td>0.44</td> <td></td> <td>0.32</td> <td>0.25</td> <td>0.22</td> <td>0.49</td> <td>0.42</td> <td>0.31</td>	Na2O	0.51	0.54	0.56	0.38	0.44		0.32	0.25	0.22	0.49	0.42	0.31
BaO     0.00     0.00     0.03     0.12     0.01     0.13     0.22     0.26     0.13     0.18     0.12       P2O5     0.24     0.02     0.00     0.09     0.01     0.02     0.09     0.02     0.00     0.03     0.02       Total     94.65     94.59     94.29     94.66     94.72     93.45     93.04     93.82     94.56     93.82     94.28       Si     6.28     6.26     6.27     6.39     6.33     6.37     6.42     6.34     6.29     6.41     6.39       Ti     0.05     0.04     0.02     0.10     0.03     0.06     0.06     0.07     0.15     0.12     0.08       AI     5.18     5.24     5.22     4.79     5.01     4.88     4.75     4.82     4.89     4.63     4.79       Cr     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00	K2O	10.50	10.72	10.82	10.95	11.05		10.62	10.98	10.74	10.92	10.79	10.78
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	BaO	0.00	0.00	0.03	0.12	0.01		0.13	0.22	0.26	0.13	0.18	0.12
Total   94.65   94.59   94.29   94.66   94.72   93.45   93.04   93.82   94.56   93.82   94.28     Si   6.28   6.26   6.27   6.39   6.33   6.37   6.42   6.34   6.29   6.41   6.39     Ti   0.05   0.04   0.02   0.10   0.03   0.06   0.06   0.07   0.15   0.12   0.08     AI   5.18   5.24   5.22   4.79   5.01   4.88   4.75   4.82   4.89   4.63   4.79     Cr   0.00	P2O5	0.24	0.02	0.00	0.09	0.01	1.11	0.02	0.09	0.02	0.00	0.03	0.02
Si   6.28   6.26   6.27   6.39   6.33   6.37   6.42   6.34   6.29   6.41   6.39     Ti   0.05   0.04   0.02   0.10   0.03   0.06   0.06   0.07   0.15   0.12   0.08     AI   5.18   5.24   5.22   4.79   5.01   4.88   4.75   4.82   4.89   4.63   4.79     Cr   0.00   0.00   0.02   0.00 </td <td>Total</td> <td>94.65</td> <td>94.59</td> <td>94.29</td> <td>94.66</td> <td>94.72</td> <td></td> <td>93.45</td> <td>93.04</td> <td>93.82</td> <td>94.56</td> <td>93.82</td> <td>94.28</td>	Total	94.65	94.59	94.29	94.66	94.72		93.45	93.04	93.82	94.56	93.82	94.28
Git   0.25   0.26   0.27   0.39   0.33   0.37   0.42   0.34   0.25   0.41   0.35     Ti   0.05   0.04   0.02   0.10   0.03   0.06   0.06   0.07   0.15   0.12   0.08     AI   5.18   5.24   5.22   4.79   5.01   4.88   4.75   4.82   4.89   4.63   4.79     Cr   0.00<	<b>S</b> I	6 00	6.06	e 07	6 20	6 22		6 37	6 40	6 94	6 20	6 4 1	A 20
In   0.05   0.04   0.02   0.10   0.03   0.06   0.06   0.07   0.13   0.12   0.08     AI   5.18   5.24   5.22   4.79   5.01   4.88   4.75   4.82   4.89   4.63   4.79     Cr   0.00   0.0	Эł Т:	0.20	0.20	0.27	0.35	0.00		0.37	0.42	0.34	0.15	0.41	0.09
Al   5.16   5.24   5.22   4.79   5.01   4.65   4.73   4.62   4.63   4.63   4.63   4.75     Cr   0.00	AL 5	5 1 0	E 04	0.02 E 22	4 70	5.01		A-99	4 76	A 92	4 80	- A 63	4.70
Circl     0.00     0.00     0.02     0.00 <t< td=""><td></td><td>0.00</td><td>0.24</td><td>0.02</td><td>4.75</td><td>0.01</td><td></td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.01</td><td>0.00</td><td>0.00</td></t<>		0.00	0.24	0.02	4.75	0.01		0.00	0.00	0.00	0.01	0.00	0.00
Mn     0.00     0.01     0.00     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0	5	0.00	0.00	0.02	0.00	0.00		0.50	0.00	0.00	0.58	0.65	0.00
Min     0.00     0.01     0.00     0.01     0.00     0.01     0.00     0.01	Min	0.40	0.47	0.40	0.00	0.00		0.00	0.02	0.00	0.00	0.00	0.04
Mg     0.05     0.12     0.10     0.25     0.10     0.25     0.10     0.25     0.10     0.25     0.10     0.25     0.10     0.25     0.10     0.25     0.10     0.25     0.10     0.25     0.10     0.25     0.10     0.25     0.10     0.25     0.10     0.25     0.10     0.25     0.10     0.25     0.10     0.25     0.10     0.12     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.01     0.00     0.00     0.00     0.01     0.00     0.01     0.00     0.01     0	Ma	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Na     0.14     0.14     0.15     0.10     0.12     0.86     0.07     0.06     0.13     0.11     0.08       K     1.82     1.86     1.89     1.93     1.94     1.88     1.97     1.91     1.92     1.92     1.90       Ba     0.00     0.00     0.01     0.00     0.01	Mg Ca	0.03	0.00	0.10	0.00	0.00		0.00	0.00	0.00	0.00	0.07	0.01
K     1.82     1.86     1.89     1.93     1.94     1.88     1.97     1.91     1.92     1.92     1.90       Ba     0.00     0.00     0.01     0.00     0.01 <td>Na</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td></td> <td>0.00</td> <td>0.07</td> <td>0.00</td> <td>0.13</td> <td>0.00</td> <td>0.01</td>	Na	0.00	0.00	0.00	0.00	0.00		0.00	0.07	0.00	0.13	0.00	0.01
Ba     0.00     0.00     0.01     0.00     0.01     0	ive.	1 82	1.86	1 80	1 03	1 04		1.88	1 07	1 01	1 92	1 02	1 00
La     0.05     0.05     0.06     0.07     0.07     0.07     0.07     0.07     0.07     0.07     0.07     0.07     0.07     0.07     0.07     0.07     0.07     0.07     0.07     0.07     0.07     0.07     0.00     0	Ra	0.00	0.00	0.00	0.01	0.00		0.01	0.01	0.01	0.01	0.01	0.01
$r_{\rm res} = 0.00 - 0.$	0	0.00	0.00	0.00	0.01	0.00		0.01	0.01	0.01	0.01	0.01	0.01
	Total	14 06	14 13	14 14	14 15	14 17		14 11	14 16	14.16	14.15	14 17	14 1

MUSCOVITE

# APPENDIX 4.6 : DONEGAL GRANITES - APATITES

Sample Loaction	FAN270	FAN3	FAN23 Core	FAN23 Core	FAN23 Core	FAN19	ARD4 Core	ARD4 Core	ARD4 Core	ARD4	ARD3A	ARD3A
SiO2	0.44	0.69	0.43	0.37	0.45	0.21	0.13	0.28	0.24	0.31	0.40	0.79
TíO2	0.20	0.07	0.08	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.05
AI2O3	0.11	0.00	0.15	0.09	0.06	0.11	0.06	0.10	0.09	0.05	0.10	0.76
Cr2O3	0.00	0.00	0.01	0.00	0.04	0.00	0.00	0.09	0.00	0.00	0.00	0.00
FøO	0.03	0.03	0.00	0.00	0.17	0.13	0.08	0.08	0.00	0.19	0.18	0.10
MnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.14	0.01	0.16	0.02	0.05	0.00	0.07	0.10	0.00	0.00	0.10	0.06
CaO	55.13	54.67	54.83	54.61	54.70	54.38	55.85	54.77	54.75	55.77	54.11	54.27
NiO	0.10	n.d	n.d	n.d	n.d	n.d	n.d	0.27	0.13	0.23	0.20	0.07
Na2O	0.31	0.21	0.20	0.14	0.07	0.20	0.18	0.17	0.15	0.19	0.18	0.00
K20	0.02	0.12	0.15	0.09	0.09	0.14	0.08	0.01	0.01	0.02	0.00	0.01
BaO	0.00	0.00	0.00	0.00	0.11	0.20	0.05	0.00	0.12	0.00	0.00	0.17
P2O5	43.47	41.93	42.99	43.43	43.12	42.73	43.77	43.45	43.16	43.74	42.94	42.93
Total	99.54	97.64	98.99	98.83	98.89	98.09	100.19	99.03	98.65	100.31	98.31	99.22
									t.			
Si	0.08	0.12	0.07	0.06	0.08	0.04	0.02	0.05	0.04	0.05	0.07	0.14
Ti ·	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01
AI ·	0.02	0.00	0.03	0.02	0.07	0.02	0.01	0.02	0.02	0.01	0.02	0.15
Cr	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Fe	0.00	0.00	0.00	0.00	0.03	0.02	0.01	0.01	0.00	0.03	0.03	0.02
Mn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mg	0.04	0.00	0.04	0.01	0.01	0.00	0.02	0.03	0.00	0.00	0.03	0.02
Ca	10.04	10.25	10.09	10.05	10.08	10.13	10.16	10.05	10.12	10.13	10.02	9.95
Ni	0.01	n.d	n.d	n.d	n.d	n.d	n.d	0.04	0.02	0.03	0.03	0.01
Na	0.10	0.07	0.07	0.00	0.02	0.07	0.06	0.06	0.05	0.06	0.06	0.00
ĸ	0.00	0.03	0.03	0.02	0.02	0.03	0.02	0.00	0.01	0.00	0.00	0.00
Ba	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0,01
Р	6.26	6.21	6.25	6.31	6.28	6.29	6.29	6.30	6.30	6.28	6.28	6.22
Sample	ARD3A	ROS21	ROS21	ROS21	ROS6	ROS6	ROS6	TRA5	TRA5	DON4	DON4	
Location		Core	Rim				·	Core	Rim	Core	Rim	
SIDO	0.57	0.10	0.16	0.16	0.19	0.20	0.11	0.00	0.07	0.21	0.45	
3102 TIO2	0.07	0.19	0.10	0.10	0.19	0.29	0.00	0.00	0.07	0.21	0.15	
A1203	0.00	0.00	0.00	0.00	0.06	0.02	0.00	0.02	0.11	0.00	0.00	
Cr2O3	0.00	0.00	0.00	0.07	0.00	0.00	0.04	0.00	0.00	0.00	0,00	
FeO	0.23	0.27	0.20	0.33	0.12	0.59	0.25	0.12	0.18	0.12	0.15	
MnO	0.00	0.00	0.00	0.00	0.70	0.60	0.66	0.00	0.22	0.00	0.13	
MaQ	0.11	0.01	0.07	0.14	0.07	0.02	0.08	0.04	0.11	0.00	0.02	
CaO	54.92	55.29	55.42	55.04	53.28	52.74	53.23	55.48	54.86	54.48	54.45	
NIO	0.14	n.d	n.d	n.d	0.21	0.03	0.00	n.d	n.d	n.d	n.d	
Na2O	0.20	0.22	0.28	0.15	0.14	0.20	0.22	0.18	0.32	0.26	0.21	
K2O	0.01	0.05	0.10	0.08	0.03	0.04	0.00	0.04	0.17	0.02	0.09	
BaO	0.00	0.00	0.22	0.00	0.22	0.00	0.17	0.00	0.00	0.00	0.00	
P2O5	43.15	43.82	43.46	43.73	42.92	42.25	43.04	44.27	44.29	43.74	43.91	
Total	99.44	99.93	99.81	99.91	97.94	96.89	97.80	100.14	100.15	98.88	99.11	
									5 si .			
<b>C</b> i	0.01	0.03	0.03	0.03	0.03	0.05	0.02	0.00	0.01	0.04	0.03	
	0.01	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.01	0.04	0.03	
Δ1	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	
Cr .	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	
Fe	0.03	0.04	0.03	0.05	0.02	0.09	0.04	0.02	0.03	0.02	0.02	
Min	0.00	0.00	0.00	0.00	0.10	0.09	0.10	0.00	0.03	0.00	0.02	
Mg	0.03	0.00	0.02	0.04	0.02	0.00	0.02	0.01	0.03	0.00	0.01	
Ca	10.08	10.08	10.14	10.03	9.93	9.93	9.93	10.07	9.94	10.01	9.99	
Ni	0.02	n.d	n.d	n.d	0.03	0.00	0.00	n.d	n.d	n.d	n.d	
Na	0.07	0.07	0.09	0.05	0.05	0.07	0.07	0.06	0.10	0.09	0.07	
к	0.00	0.01	0.02	0.02	0.01	0.01	0.00	0.01	0.04	0.01	0.02	
Ba	0.00	0.00	0.01	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.00	
P	6.26	6.31	6.28	6.29	6.32	6.29	6.34	6.35	6.34	6.35	6.36	

e e construction a tan tang Kabupatèn

#### APPENDIX 4.7 EPIDOTE - DONEGAL GRANITES.

Sample Location	ARD3A Smali	ARD3A	ARD3A	ARD3A	ARD3A	TRA2	TRA2	ARD4	ARD4	ARD4	ARD4	ARD4
SiO2	37.34	37.64	37.49	37.27	37.30	38.25	37.33	39.27	37.36	37.81	37.74	37.72
TiO2	0.12	0.06	0.27	0.18	0.18	0.08	0.00	0.00	0.00	0.20	0.20	0.00
A12O3	22.08	22.54	21.70	21.72	21.60	23.16	21.91	21.86	22.84	22.25	21.87	21.87
Cr2O3	0.15	0.42	0.06	0.07	0.10	0.15	0.12	0.06	0.11	0.05	0.08	0.17
FeO	13.22	13.16	13.89	13.77	13.94	12.93	13.08	12.61	12.55	13.73	13.89	14.05
MnO	0.00	0.01	0.00	0.07	0.11	0.19	0.08	0.04	0.00	0.15	0.20	0.00
MgO	0.17	0.13	0.31	0.09	0.24	0.12	0.14	0.00	0.13	0.21	0.10	0.15
CaO	22.76	23.14	23.01	22.76	22.95	23.07	22.78	22.24	23.13	22.95	22.74	22.74
Na2O	0.12	0.11	0.14	0.08	0.21	0.08	0.14	0.08	0.15	0.13	0.23	0.08
K20	0.00	0.00	0.02	0.00	0.03	0.00	0.00	0.00	0.00	0.03	0.04	0.00
BaO	0.00	0.06	0.00	0.05	0.00	0.10	0.09	0.15	0.00	0.00	0.00	0.18
Total	95.97	97.16	96.88	96.06	96.45	98.00	95.65	96.33	96.56	97.50	97.07	96.95
Si	6.25	6.21	6.24	6.25	6.23	6.24	6.27	6.49	6.23	6.23	6.28	6.29
Ti	0.02	0.01	0.03	0.02	0.02	0.01	0.00	0.00	0.00	0.03	0.02	0.00
AL	4.35	4.39	4.26	4.30	4.26	4.45	4.33	4.26	4.49	4.32	4.29	4.30
Cr	0.02	0.06	0.01	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.02
Fe	1.85	1.82	1.93	1.93	1.95	1.76	1.85	1.74	1.75	1.89	1.93	1.96
Mn	0.00	0.00	0.00	0.01	0.02	0.03	0.01	0.01	0.00	0.02	0.03	0.00
Mg	0.04	0.03	0.08	0.02	0.06	0.03	0.03	0.00	0.03	0.05	0.03	0.04
Ca	4.08	4.09	4.10	4.09	4.11	4.03	4.10	3.94	4.13	4.05	4.05	4.06
Na	0.04	0.04	0.05	0.03	0.07	0.03	0.05	0.02	0.05	0.04	0.07	0.02
K	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00
Ba	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01
Total	16.65	16.64	16.69	16.66	16.73	16.59	16.66	16.48	18.69	16.66	16.72	16.71
%Ps	29.80%	29.90%	31.20%	30.99%	31.40%	28.38%	29.95%	29%	28%	30.46%	31.06%	31.32%

Sample Location	FAN30	FAN30	FAN30	FAN30	ARD1D	ROS21	ROS21	ROS21	ROS21
SiO2	37.33	37.33	37.50	37.77	37.46	37.34	37.94	38.41	37.45
TiO2	0.84	0.22	0.05	0.51	0.10	0.11	0.29	0.08	0.21
AI2O3	17.57	19.63	19.55	19.27	21.48	21.92	22.64	23.41	21.85
Cr2O3	0.07	0.14	0.14	0.11	0.11	0.08	0.00	0.08	0.00
FeO	18.79	17.06	17.14	17.73	14.33	13.00	12.74	11.83	13.49
MnO	0.00	0.00	0.00	0.00	0.00	0.00	0,40	0.16	0.12
MgO	0.44	0.17	0.12	0.24	0.00	0.00	0.00	0.00	0.00
CaO	22.44	20.25	22.22	22.72	22.75	22.62	22.79	23.37	22.81
Na2O	0.26	0.19	0.04	0.18	0.04	0.10	0.08	0.07	0.07
K20	0.00	0.02	0.00	0.04	0.03	0.02	0.05	0.04	0.00
BaO	0.00	0.00	0.00	0.00	0.06	0.05	0.01	0.03	0.00
Total	97.35	95.01	96.32	98.57	96.35	95.24	96.96	97.47	95.99
×									
CI	6 35	6 90	6 9 F	0.01		6 99	6 0E	6 97	A 07
ок. т: :	0.30	0,09	0.00	0.07	0.27	0.29	0.60	0.27	0.27
A1	0.11	0.00	9.00	0.01	4.04	4.05	4.40	0.01	4.01
A	0.01	0.80	0.02	0.03	4.24	4.30	4.40	4.50	4.31
5	0.01	0.02	0.02	0.02	0.02	1 80	1 70	1 0.01	4 90
re Ma	2.07	2.44	2.40	2.40	2.01	0.00	1.70	1.01	1.09
N/m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02
	4.00	0.04	4.03	4.07	4.09	4.09	4.00	4.00	4.00
Cat No.	4.09	0.00	4.03	4.07	4.00	4.00	4.02	4.09	4.09
Na	0.09	0.00	0.01	0.00	0.01	0.03	0.02	0.02	0.02
N	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00
Del Total	10.00	0.00	10.00	10.00	40.00	10.00	- U.UU -	40.00	0.00
10181	10.94	10.33	10.76	10.00	00.00	10.05	10.00	10.04	10.02
% <b>PS</b>	43.14%	30.10%	30.34%	39.30%	32.13%	29.20%	20.04%	20.39%	30.4/%

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# OPAQUE MINERAL - DONEGAL GRANITES

Sample Location	TRA5	FAN7	FAN7	FAN270 inc hbl	FAN270	ROS6 inc bio	FAN23	FAN23	FAN23
SiO2	0.64	0.41	0.40	0.39	0.31	0.30	0.43	0.48	0.41
TiO2	0.13	0.11	0.25	0.20	0.32	0.19	0.17	0.34	0.20
AI2O3	0.66	0.23	0.26	0.22	0.22	0.10	0.10	0.14	0.35
Cr2O3	0.24	0.25	0.16	0.06	0.01	0.11	0.44	0.18	0.06
FeO	92.25	91.65	92.35	90.33	91.44	92.01	90.83	90.71	91.51
MgO	0.09	0.11	0.08	0.09	0.00	0.06	0.00	0.05	0.16
CaO	0.03	0.05	0.00	0.08	0.00	0.21	0.03	0.00	0.00
Na2O	0.46	0.52	0.47	0.60	0.53	0.55	0.43	0.09	0.44
K20	0.00	0.02	0.02	0.00	0.01	0.04	0.02	0.46	0.07
P2O5	0.09	0.01	0.00	0.09	0.00	0.03	0.00	0.00	0.01
Total	94.57	93.44	93.99	92.06	92.85	93.61	92.44	92.47	93.21
Si	0.26	0.17	0.16	0.17	0.13	0.13	0.18	0.20	0.17
Ti	0.04	0.04	0.22	0.07	0.10	0.06	0.05	0.11	0.06
AI	0.31	0.11	0.12	0.11	0.11	0.05	0.05	0.07	0.17
Cr	0.75	0.08	0.05	0.02	0.00	0.04	0.15	0.06	0.02
Fe	30.90	31.41	31.43	32.10	32.44	32.13	31.63	31.51	31.50
Mg	0.05	0.07	0.05	0.06	0.00	0.04	0.00	0.03	0.10
Ca	0.02	0.05	0.00	0.04	0.00	0.09	0.01	0.00	0.00
Na	0.35	0.41	0.37	0.49	0.43	0.45	0.35	0.37	0.35
к	0.00	0.01	0.01	0.00	0.01	0.02	0.01	0.05	0.04
P	0.03	0.00	0.00	0.03	0.00	0.01	0.00	0.00	0.00

#### **APPENDIX 4.9**

#### GARNET - TRAWENAGH BAY

Sample Location	TRA3 Core/1	TRA3 Rim/1	TRA3 Core/2	TRA3 Rim/2	TRA3 Core/3	TRA3 Rim/3	TRA3 Core/4	TRA3 Rim/4
8100		20 50	36 50	36 46	96 97	38 60	26 00	26 70
5102	30.00	0.05	0.00	0.11	0.00	0.00	00.00	0.00
102	20.27	20.03	20.12	10.00	20.00	20.17	10.00	20.00
A1203	20.37	0.04	0.02	0.00	0.01	0.00	19.90	0.00
5203	29.00	22 82	0.02	21 33	23 14	22 40	0.00	0.00
Mac	20.20	10 70	20.56	20.74	10 70	20.24	20.77	20.10
Ma	0.50	077	D /0	0 54	0.71	0.00	0.49	0.55
	0.01	0.77	0.43	0.54	0.71	0.00	0.40	0.55
Nego	0.30	0.40	0.01	0.55	0.47	0.43	0.01	0.03
KOO	0.33	0.01	0.12	0.15	0.20	0.15	0.19	0.04
R20	0.02	0.04	0.00	0.00	0.00	0.00	0.08	0.00
Dau	0.08	0.04	0.00	0.04	0.00	0.00	0.23	0.00
Tatal	102.01	101 10	101 61	100.00	101 52	100 40	101 01	101 66
Iotai	102.21	101.11	101.01	100.09	101.53	100.88	101.31	101.60
Si	2.97	2.99	2.98	3.00	2.98	2.99	2.97	2.99
TI	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Al	1.95	1.95	1.94	1.94	1.94	1.94	1.93	1.93
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fe	1.57	1.56	1.59	1.47	1.57	1.53	1.64	1.58
Mn	1.39	1.36	1.42	1.45	1.86	1.40	1.40	1.40
Mg	0.74	0.09	0.06	0.07	0.09	0.10	0.06	0.07
Ca	0.03	0.04	0.05	0.05	0.04	0.04	0.05	0.03
Na	0.52	0.31	0.02	0.03	0.03	0.03	0.03	0.04
ĸ	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0,00
Ba	0.00	0.00	0,00	0.00	0.00	0.01	0.01	0.00
P	0.01	0.01	0.01	0.01	0.02	0.04	0.01	0.01

#### **APPENDIX 5**

#### WHOLE ROCK MAJOR AND TRACE ELEMENT ANALYSES

- 5.1 Thorr pluton.
- 5.2 Rosses pluton.
- 5.3 Ardara pluton.
- 5.4 Fanad pluton.
- 5.5 Main Donegal pluton.
- 5.6 Trawenagh Bay pluton.

# THORR PLUTON

Units     Hbl-free     Hbl-free     Contact     Hbl-bear     Hbl-bar	1-bear 9.33
$ \begin{array}{c ccccc} SiO2 & 76.39 & 71.75 & 64.28 & 63.39 & 62.73 & 64.45 & 64.09 & 65.24 & 42.03 & 12.12 & 14.62 & 16.97 & 16.78 & 16.84 & 16.66 & 16.28 & 15.94 & 17.02 & 0.48 & 0.86 & 0.67 & 1.31 & 1.79 & 1.62 & 1.46 & 1.21 & 1.21 & 1.20 & 0.48 & 0.88 & 1.70 & 3.56 & 4.47 & 4.44 & 3.95 & 3.88 & 3.54 & MrO & 0.01 & 0.03 & 0.04 & 0.05 & 0.05 & 0.06 & 0.06 & 0.05 & MgO & 0.42 & 1.28 & 2.15 & 2.50 & 2.58 & 2.30 & 3.20 & 2.04 & CaO & 0.66 & 1.25 & 2.61 & 2.98 & 3.40 & 2.72 & 3.02 & 2.82 & Na2O & 3.78 & 4.57 & 4.38 & 4.06 & 4.17 & 4.01 & 4.63 & 4.10 & K2O & 4.73 & 4.18 & 3.86 & 4.08 & 3.90 & 4.68 & 4.22 & 4.08 & P2OS & 0.01 & 0.08 & 0.28 & 0.19 & 0.16 & 0.21 & 0.21 & 0.20 & LOI & 0.24 & 0.49 & 0.51 & 0.61 & 0.69 & 0.57 & 0.52 & 0.57 & Total & 99.42 & 100.22 & 99.27 & 99.83 & 99.70 & 100.30 & 100.67 & 99.23 & S & Trace element (ppm) \\ \hline Trace element (ppm) \\ \hline Ba & 650 & 894 & 1467 & 1930 & 1852 & 1462 & 1948 & 1304 & Ce & b.d.1 & b.d.1 & 47 & 52 & 61 & 66 & 90 & 60 & La & 20 & 25 & 32 & 39 & 50 & 53 & 59 & 45 & Nb & n.d. & n.d. & 11 & 9 & n.d. & 9 & n.d. & Nd & b.d.1 & b.d.1 & 32 & 23 & 24 & 33 & 54 & 32 & Pb & 18 & 28 & 13 & 21 & 19 & 18 & 22 & 20 & Pb & 111 & 154 & 183 & 78 & 91 & 100 & 94 & 82 & Sc & b.d.1 & 3 & 11 & 3 & 4 & 6 & 6 & 5 & Sr & 84 & 399 & 667 & 808 & 787 & 642 & 1235 & 613 & Th & 14 & 15 & 5 & 10 & 4 & 10 & 11 & 7 & V & 8 & 21 & 55 & 65 & 64 & 59 & 68 & 63 & S7 & 7 & 12 & 37 & 13 & 9 & 17 & 20 & 15 & Zh & 21 & 41 & 80 & 70 & 64 & 52 & 60 & 59 & Zr & 85 & 101 & 221 & 304 & 310 & 289 & 232 & 259 & ZF & Z$	9.33
SIC2 76.39 71.75 64.28 63.39 62.73 64.45 64.09 65.24 1   Al2O3 12.12 14.62 16.97 16.78 16.84 16.66 16.28 15.94 1   Fe2O3 0.38 0.86 0.67 1.31 1.79 1.62 1.46 1.21   FeCO 0.49 0.68 2.60 2.84 2.39 2.10 2.18 2.10   Fetot 0.88 1.70 3.56 4.47 4.44 3.95 3.88 3.54   MrO 0.01 0.03 0.04 0.05 0.05 0.06 0.06 0.05   MgO 0.42 1.28 2.15 2.50 2.58 2.30 3.20 2.04   Cao 0.66 1.25 2.61 2.98 3.40 2.72 3.02 2.82   Na2O 3.78 4.57 4.38 4.06 4.17 4.01 4.63 4.10   K2O 4.73 4.18 3.86 4.08 3.90 4.68 4.22 4.08   P2O5 0.01 0.08 0.28 0.19 0.61 0.21 0.21 0.20   LOI 0.24 0.	9.33
IO2   0.18   0.27   0.63   0.72   0.74   0.70   0.56   0.564     Fe2O3   12.12   14.62   16.97   16.78   16.84   16.66   16.28   15.94   1     Fe2O3   0.38   0.86   0.67   1.31   1.79   1.62   1.46   1.21     FeCO   0.49   0.68   2.60   2.84   2.39   2.10   2.18   2.10     Fetot   0.88   1.70   3.56   4.47   4.44   3.95   3.88   3.54     MnO   0.01   0.03   0.04   0.05   0.06   0.06   0.05     MgO   0.42   1.28   2.15   2.50   2.58   2.30   3.20   2.04     CaO   0.66   1.25   2.61   2.98   3.40   2.72   3.02   2.82     Na2O   3.78   4.57   4.38   4.06   4.17   4.01   4.63   4.22   4.08     P205   0.01   0.68   0.28   0.19   0.16   0.21   0.21   0.20   0.57 <td< td=""><td></td></td<>	
Al203   12.12   14.62   16.97   16.78   16.84   16.66   16.28   15.94     Fe2O3   0.38   0.86   0.67   1.31   1.79   1.62   1.46   1.21     FeO   0.49   0.68   2.60   2.84   2.39   2.10   2.18   2.10     Fetot   0.88   1.70   3.56   4.47   4.44   3.95   3.88   3.54     MrO   0.01   0.03   0.04   0.05   0.05   0.06   0.05     MgO   0.42   1.28   2.15   2.50   2.58   2.30   3.20   2.82     Na2O   3.78   4.57   4.38   4.06   4.17   4.01   4.63   4.10     K2O   4.73   4.18   3.86   4.08   3.90   4.68   4.22   4.08     P2O5   0.01   0.06   0.28   0.19   0.16   0.21   0.21   0.20     LOI   0.24   0.49   0.51   0.61   0.69   0.57   0.52   0.57     Trace element (ppm)   5 <td>1.73</td>	1.73
Fe2O3   0.38   0.86   0.67   1.31   1.79   1.62   1.46   1.21     FeO   0.49   0.68   2.60   2.84   2.39   2.10   2.18   2.10     Fetot   0.88   1.70   3.56   4.47   4.44   3.95   3.88   3.54     MnO   0.01   0.03   0.04   0.05   0.05   0.06   0.06   0.05     MgO   0.42   1.28   2.15   2.50   2.58   2.30   3.20   2.04     Cao   0.66   1.25   2.61   2.98   3.40   2.72   3.02   2.82     Na2O   3.78   4.57   4.38   4.06   4.17   4.01   4.63   4.10     K2O   4.73   4.18   3.86   4.08   3.90   4.68   4.22   4.08     P2O5   0.01   0.08   0.28   0.19   0.16   0.21   0.21   0.20     LOI   0.24   0.49   0.51   0.61   0.69   557   0.52   0.57     Total   99.42 <td>9.11</td>	9.11
FeO     0.49     0.68     2.60     2.84     2.39     2.10     2.18     2.10       Fetot     0.88     1.70     3.56     4.47     4.44     3.95     3.88     3.54       MrO     0.01     0.03     0.04     0.05     0.06     0.06     0.05       MgO     0.42     1.28     2.15     2.50     2.58     2.30     3.20     2.04       CaO     0.66     1.25     2.61     2.98     3.40     2.72     3.02     2.82       Na2O     3.78     4.57     4.38     4.06     4.17     4.01     4.63     4.10       K2O     4.73     4.18     3.86     4.02     4.08     P205     0.01     0.08     0.28     0.19     0.16     0.21     0.21     0.20       LOI     0.24     0.49     0.51     0.61     0.69     0.57     0.52     0.57       Trace element (ppm)     Ea     650     894     1467     1930     1852     1462	.06
Fetot   0.88   1.70   3.56   4.47   4.44   3.95   3.88   3.54     MnO   0.01   0.03   0.04   0.05   0.05   0.06   0.06   0.05     MgO   0.42   1.28   2.15   2.50   2.53   2.30   3.20   2.04     CaO   0.66   1.25   2.61   2.98   3.40   2.72   3.02   2.82     Na2O   3.78   4.57   4.38   4.06   4.17   4.01   4.63   4.10     K2O   4.73   4.18   3.86   4.08   3.90   4.68   4.22   4.08     P2O5   0.01   0.08   0.28   0.19   0.16   0.21   0.20   0.20     LOI   0.24   0.49   0.51   0.61   0.69   0.57   0.52   0.57     Total   99.42   100.22   99.27   99.83   99.70   100.30   100.67   99.23   9     Trace element (ppm)   Ea   650   894   1467   1930   1852   1462   1948   1304 <td>.48</td>	.48
MnO   0.01   0.03   0.04   0.05   0.05   0.06   0.06   0.05     MgO   0.42   1.28   2.15   2.50   2.58   2.30   3.20   2.04     Cao   0.66   1.25   2.61   2.98   3.40   2.72   3.02   2.82     Na2O   3.78   4.57   4.38   4.06   4.17   4.01   4.63   4.10     K2O   4.73   4.18   3.86   4.08   3.90   4.68   4.22   4.08     P2O5   0.01   0.08   0.28   0.19   0.16   0.21   0.21   0.20     LOI   0.24   0.49   0.51   0.61   0.69   0.57   0.52   0.57     Total   99.42   100.22   99.27   99.83   99.70   100.30   100.67   99.23   \$     Trace element (ppm)	.93
MgO 0.42 1.28 2.15 2.50 2.58 2.30 3.20 2.04   CaO 0.66 1.25 2.61 2.98 3.40 2.72 3.02 2.82   Na2O 3.78 4.57 4.38 4.06 4.17 4.01 4.63 4.10   K2O 4.73 4.18 3.86 4.08 3.90 4.68 4.22 4.08   P2O5 0.01 0.08 0.28 0.19 0.16 0.21 0.21 0.20   LOI 0.24 0.49 0.51 0.61 0.69 0.57 0.52 0.57   Total 99.42 100.22 99.27 99.83 99.70 100.30 100.67 99.23 5   Trace element (ppm) 5 61 66 90 60   La 20 25 32 39 50 53 59 45   Nb n.d. n.d. 11 9 n.d. 9 n.d.   Nd b.d.l. b.d.l. 32 23 24 33 54 32   Pb 18 28 13 21 19 18 22 20   Rb <td>.06</td>	.06
CaO     0.66     1.25     2.61     2.98     3.40     2.72     3.02     2.82       Na2O     3.78     4.57     4.38     4.06     4.17     4.01     4.63     4.10       K2O     4.73     4.18     3.86     4.08     3.90     4.68     4.22     4.08       P2O5     0.01     0.08     0.28     0.19     0.16     0.21     0.21     0.20       LOI     0.24     0.49     0.51     0.61     0.69     0.57     0.52     0.57       Total     99.42     100.22     99.27     99.83     99.70     100.30     100.67     99.23     \$       Trace element (ppm)     Ba     650     894     1467     1930     1852     1462     1948     1304       Ce     b.d.l.     b.d.l.     47     52     61     66     90     60       La     20     25     32     39     50     53     59     45       Nb     n.d	.88
Na2O   3.78   4.57   4.38   4.06   4.17   4.01   4.63   4.10     K2O   4.73   4.18   3.86   4.08   3.90   4.68   4.22   4.08     P2O5   0.01   0.08   0.28   0.19   0.16   0.21   0.21   0.20     LOI   0.24   0.49   0.51   0.61   0.69   0.57   0.52   0.57     Total   99.42   100.22   99.27   99.83   99.70   100.30   100.67   99.23   9     Trace element (ppm)	1.73
K2O   4.73   4.18   3.86   4.08   3.90   4.68   4.22   4.08     P2O5   0.01   0.08   0.28   0.19   0.16   0.21   0.21   0.20     LOI   0.24   0.49   0.51   0.61   0.69   0.57   0.52   0.57     Total   99.42   100.22   99.27   99.83   99.70   100.30   100.67   99.23   9     Trace element (ppm)	.18
P2O5   0.01   0.08   0.28   0.19   0.16   0.21   0.21   0.21   0.20     LOI   0.24   0.49   0.51   0.61   0.69   0.57   0.52   0.57     Total   99.42   100.22   99.27   99.83   99.70   100.30   100.67   99.23   9     Trace element (ppm)     Ba   650   894   1467   1930   1852   1462   1948   1304     Ce   b.d.l.   b.d.l.   47   52   61   66   90   60     La   20   25   32   39   50   53   59   45     Nb   n.d.   n.d.   11   9   n.d.   9   n.d.     Nd   b.d.l.   32   23   24   33   54   32     Pb   18   28   13   21   19   18   22   20     Rb   111   154   183   78   91   100   94   82     Sc   b.d.l.   <	1.70
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	1.37
Total     99.42     100.22     99.27     99.83     99.70     100.30     100.67     99.23     5       Trace element (ppm)     Ea     650     894     1467     1930     1852     1462     1948     1304       Ce     b.d.l.     b.d.l.     47     52     61     66     90     60       La     20     25     32     39     50     53     59     45       Nb     n.d.     n.d.     11     9     n.d.     9     n.d.       Nd     b.d.l.     b.d.l.     32     23     24     33     54     32       Pb     18     28     13     21     19     18     22     20       Rb     111     154     183     78     91     100     94     82       Sc     b.d.l.     3     11     3     4     6     6     5       Sr     84     399     667     808     787     642<	1.62
Trace element (ppm)Ba $650$ $894$ $1467$ $1930$ $1852$ $1462$ $1948$ $1304$ Ceb.d.l.b.d.l. $47$ $52$ $61$ $66$ $90$ $60$ La $20$ $25$ $32$ $39$ $50$ $53$ $59$ $45$ Nbn.d.n.d.n.d. $111$ $9$ n.d. $9$ $n.d.$ Ndb.d.l. $b.d.l.$ $32$ $23$ $24$ $33$ $54$ $32$ Pb $18$ $28$ $13$ $21$ $19$ $18$ $22$ $20$ Rb $111$ $154$ $183$ $78$ $91$ $100$ $94$ $82$ Scb.d.l. $3$ $11$ $3$ $4$ $6$ $6$ $5$ Sr $84$ $399$ $667$ $808$ $787$ $642$ $1235$ $613$ Th $14$ $15$ $5$ $10$ $4$ $10$ $11$ $7$ V $8$ $21$ $55$ $65$ $64$ $59$ $68$ $63$ Y $7$ $12$ $37$ $13$ $9$ $17$ $20$ $15$ Zn $21$ $41$ $80$ $70$ $64$ $62$ $60$ $59$ Zr $85$ $101$ $221$ $304$ $310$ $289$ $232$ $259$ Norm $7$ $12$ $33$ $11.89$ $16.00$ $11.86$ $11.06$ $9.78$ $13.46$ Out $34.37$ $23.38$ $11.89$ <	9.64
Trace element (ppm)Ba $650$ $894$ $1467$ $1930$ $1852$ $1462$ $1948$ $1304$ Ceb.d.l.b.d.l. $47$ $52$ $61$ $66$ $90$ $60$ La $20$ $25$ $32$ $39$ $50$ $53$ $59$ $45$ Nbn.d.n.d.n.d. $111$ $9$ $n.d.$ $9$ $n.d.$ Ndb.d.l. $b.d.l.$ $32$ $23$ $24$ $33$ $54$ $32$ Pb $18$ $28$ $13$ $21$ $19$ $18$ $22$ $20$ Rb $111$ $154$ $183$ $78$ $91$ $100$ $94$ $82$ Scb.d.l. $3$ $11$ $3$ $4$ $6$ $6$ $5$ Sr $84$ $399$ $667$ $808$ $787$ $642$ $1235$ $613$ Th $14$ $15$ $5$ $10$ $4$ $10$ $11$ $7$ V $8$ $21$ $55$ $65$ $64$ $59$ $68$ $63$ Y $7$ $12$ $37$ $13$ $9$ $17$ $20$ $15$ Zn $21$ $41$ $80$ $70$ $64$ $62$ $60$ $59$ Zr $85$ $101$ $221$ $304$ $310$ $289$ $232$ $259$ Norm $7$ $12$ $3.38$ $11.89$ $16.00$ $11.86$ $11.06$ $9.78$ $13.46$ Out $3.437$ $23.38$ $11.51$ </td <td></td>	
Trace element (ppm)Ba650894146719301852146219481304Ceb.d.l.b.d.l.475261669060La2025323950535945Nbn.d.n.d.n.d.119n.d.9n.d.Ndb.d.l. $32$ 2324335432Pb1828132119182220Rb11115418378911009482Scb.d.l.31134665Sr843996678087876421235613Th1415510410117V821556564596863Y71237139172015Zn2141807064626059Zr85101221304310289232259	
Ba650894146719301852146219481304Ceb.d.l.b.d.l.475261669060La2025323950535945Nbn.d.n.d.n.d.119n.d.9n.d.Ndb.d.l.b.d.l.322324335432Pb1828132119182220Rb11115418378911009482Scb.d.l.31134665Sr843996678087876421235613Th1415510410117V821556564596863Y71237139172015Zn21418070644626059Zr85101221304310289232259NormQu34.3723.3811.8916.0011.8611.069.7813.46Cor0.000.501.510.720.000.550.000.13	
Ea     650     894     1467     1930     1652     1462     1946     1304       Ce     b.d.l.     b.d.l.     47     52     61     66     90     60       La     20     25     32     39     50     53     59     45       Nb     n.d.     n.d.     n.d.     11     9     n.d.     9     n.d.       Nd     b.d.l.     b.d.l.     32     23     24     33     54     32       Pb     18     28     13     21     19     18     22     20       Rb     111     154     183     78     91     100     94     82       Sc     b.d.l.     3     11     3     4     6     6     5       Sr     84     399     667     808     787     642     1235     613       Th     14     15     5     10     4     10     11     7	250
Ca     D.G.I.     D.G.I.     47     52     61     66     90     60       La     20     25     32     39     50     53     59     45       Nb     n.d.     n.d.     n.d.     11     9     n.d.     9     n.d.       Nd     b.d.l.     b.d.l.     32     23     24     33     54     32       Pb     18     28     13     21     19     18     22     20       Rb     111     154     183     78     91     100     94     82       Sc     b.d.l.     3     11     3     4     6     6     5       Sr     84     399     667     808     787     642     1235     613       Th     14     15     5     10     4     10     11     7       V     8     21     55     65     64     59     68     63       Y <td>338</td>	338
La   20   25   32   39   50   53   59   45     Nb   n.d.   n.d.   n.d.   11   9   n.d.   9   n.d.     Nd   b.d.l.   b.d.l.   32   23   24   33   54   32     Pb   18   28   13   21   19   18   22   20     Rb   111   154   183   78   91   100   94   82     Sc   b.d.l.   3   11   3   4   6   6   5     Sr   84   399   667   808   787   642   1235   613     Th   14   15   5   10   4   10   11   7     V   8   21   55   65   64   59   68   63     Y   7   12   37   13   9   17   20   15     Zn   21   41   80   70   64   62   60   59     Zr <td>97</td>	97
Nb     n.d.     n.d.     11     9     n.d.     9     n.d.       Nd     b.d.l.     b.d.l.     32     23     24     33     54     32       Pb     18     28     13     21     19     18     22     20       Rb     111     154     183     78     91     100     94     82       Sc     b.d.l.     3     11     3     4     6     6     5       Sr     84     399     667     808     787     642     1235     613       Th     14     15     5     10     4     10     11     7       V     8     21     55     65     64     59     68     63       Y     7     12     37     13     9     17     20     15       Zn     21     41     80     70     64     62     60     59       Zr     85     <	11
Nd   b.d.l.   b.d.l.   32   23   24   33   54   32     Pb   18   28   13   21   19   18   22   20     Rb   111   154   183   78   91   100   94   82     Sc   b.d.l.   3   11   3   4   6   6   5     Sr   84   399   667   808   787   642   1235   613     Th   14   15   5   10   4   10   11   7     V   8   21   55   65   64   59   68   63     Y   7   12   37   13   9   17   20   15     Zn   21   41   80   70   64   62   60   59     Zr   85   101   221   304   310   289   232   259     Norm   2   3.38   11.89   16.00   11.86   11.06   9.78   13.46 <t< td=""><td>n.a. '</td></t<>	n.a. '
Pb   18   28   13   21   19   18   22   20     Rb   111   154   183   78   91   100   94   82     Sc   b.d.l.   3   11   3   4   6   6   5     Sr   84   399   667   808   787   642   1235   613     Th   14   15   5   10   4   10   11   7     V   8   21   55   65   64   59   68   63     Y   7   12   37   13   9   17   20   15     Zn   21   41   80   70   64   62   60   59     Zr   85   101   221   304   310   289   232   259     Norm   2   3.38   11.89   16.00   11.86   11.06   9.78   13.46     Cor   0.00   0.50   1.51   0.72   0.00   0.55   0.00   0.13 <td>43</td>	43
Fb11115418378911009482Scb.d.l.31134665Sr843996678087876421235613Th1415510410117V821556564596863Y71237139172015Zn2141807064626059Zr85101221304310289232259NormQu34.3723.3811.8916.0011.8611.069.7813.46Cor $0.00$ $0.50$ $1.51$ $0.72$ $0.00$ $0.55$ $0.00$ $0.13$	21
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	145
Sr 84 399 667 808 787 642 1235 613   Th 14 15 5 10 4 10 11 7   V 8 21 55 65 64 59 68 63   Y 7 12 37 13 9 17 20 15   Zn 21 41 80 70 64 62 60 59   Zr 85 101 221 304 310 289 232 259   Norm Qu 34.37 23.38 11.89 16.00 11.86 11.06 9.78 13.46   Cor 0.00 0.50 1.51 0.72 0.00 0.55 0.00 0.13	1
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	337
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	8
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	85
Zn   21   41   60   70   64   62   60   59     Zr   85   101   221   304   310   289   232   259     Norm   Qu   34.37   23.38   11.89   16.00   11.86   11.06   9.78   13.46     Cor   0.00   0.50   1.51   0.72   0.00   0.55   0.00   0.13	24
Zr 85 101 221 304 310 289 232 259 Norm Qu 34.37 23.38 11.89 16.00 11.86 11.06 9.78 13.46 Cor 0.00 0.50 1.51 0.72 0.00 0.55 0.00 0.13	89
Norm Qu 34.37 23.38 11.89 16.00 11.86 11.06 9.78 13.46 Cor 0.00 0.50 1.51 0.72 0.00 0.55 0.00 0.13	196
Norm Qu 34.37 23.38 11.89 16.00 11.86 11.06 9.78 13.46 Cor 0.00 0.50 1.51 0.72 0.00 0.55 0.00 0.13	
Norm Qu 34.37 23.38 11.89 16.00 11.86 11.06 9.78 13.46 Cor 0.00 0.50 1.51 0.72 0.00 0.55 0.00 0.13	
Norm Qu 34.37 23.38 11.89 16.00 11.86 11.06 9.78 13.46 Cor 0.00 0.50 1.51 0.72 0.00 0.55 0.00 0.13	
Qu     34.37     23.38     11.89     16.00     11.86     11.06     9.78     13.46       Cor     0.00     0.50     1.51     0.72     0.00     0.55     0.00     0.13	
Cor 0.00 0.50 1.51 0.72 0.00 0.55 0.00 0.13	
	1.33
Or 27.95 24.70 22.81 24.11 23.05 27.05 24.94 24.11	1.07
AD 31.29 36.07 37.06 34.36 35.29 33.93 39.16 34.69	5.37
An 2.13 0.66 11.12 13.54 15.71 12.12 11.18 12.68	6.09
	3.17
Hy U.90 1.52 4.69 4.49 8.64 2.97 9.46 2.45	1.86
MI 0.55 1.25 0.97 1.90 2.60 2.35 2.12 1.75	.54
m	1.39
Ap 0.02 0.19 0.66 0.45 0.38 0.50 0.50 0.47	1.88

# **ROSSES PLUTON**

Sample Unit	ROS3 Porp	ROS29 Porp	ROS28 Porp	ROS2 G1	ROS4 G1	ROS11 G1	ROS12 G1	ROS4AP G1	ROS5 G2	ROS6 G2	ROS7 G2	ROS14 G2
SiO2	71.63	70.39	70.23	72.65	72.55	70.05	71.66	72.98	72.39	74.02	73.30	74.18
AI2O3	14.74	14.29	15.22	14.39	14.15	14.65	14.53	13.83	13.66	13.25	14.24	13.37
TiO2	0.20	0.27	0.29	0.13	0.18	0.31	0.21	0.20	0.25	0.16	0.19	0.16
FeO	0.81	1.13	1.07	0.59	0.64	1.41	0.96	0.78	1.17	0.71	0.75	0.63
Fe2O3	0.64	0.76	1.05	0.36	0.56	0.74	0.52	0.61	0.67	0.53	0.59	0.58
Fetot	1.54	2.02	2.24	1.02	1.27	2.31	1.59	1.48	1.97	1.32	1.42	1.28
MnO	0.02	0.03	0.04	0.03	0.03	0.04	0.03	0.03	0.04	0.03	0.02	0.04
MgO	0.79	0.96	1.18	0.55	0.86	1.31	1.10	0.78	1.06	0.72	0.90	0.75
CaO	1.69	2.53	2.21	1.20	0.72	1.93	1.05	0.85	0.89	0.91	0.97	1.00
Na2O	4.46	4.66	4.71	4.57	4.72	4.03	4.22	4.15	4.48	4.41	4.77	4.48
K2O	4.16	2.91	3.30	4.42	4.66	4.02	4.28	4.86	4.50	4.72	4.52	4.23
P2O5	0.04	0.05	0.07	0.05	0.03	0.10	0.05	0.04	0.04	0.05	0.06	0.05
LOI	0.37	0.30	0.65	0.29	0.71	0.44	0.74	0.50	0.64	0.32	0.62	0.49
Total	99.64	99.59	100.14	99.30	99.87	99.20	99.46	99.69	100.70	99.45	101.02	100.14
		•										
Trace el	ement (pp	<b>m)</b>										
Ba	967	734	887	775	644	1167	849	476	311	298	637	265
Ce	30	45	32	24	25	41	26	23	20	30	33	23
La	31	28	35	14	17	35	21	19	17	17	17	13
Nb	9	n.đ.	7	10	n.d.	n.d.	n.d.	14	n.d.	n.d.	n.d.	n.d.
Nd	16	27	16	11	12	23	16	10	17	19	16	10
Ni	b.d.l.	117	b.d.l.	b.d.l.	b.d.l.	178	40	b.d.l.	b.d.l.	b.d.l.	b.d.l	119
Pb	24	17	21	31	20	24	30	30	30	24	23	33
Rb	139	106	92	182	170	150	153	171	200	199	134	209
Sc	2	3	1	b.d.l.	1	4	3	1 <b>1</b> 7	4	1	2	2
Sr	361	335	348	260	280	432	375	190	151	141	264	131
Th	12	7	13	9	11	11	11	15	15	7	8	16
V	15	24	25	7	12	29	20	15	19	11	16	11 <b>11</b> - •
Y i	10	21	10	9	11	10	12	10	21	21	11	25
Zn	40	49	51	34	35	59	45	29	61	40	40	41
Zr	110	157	142	74	99	157	104	104	103	75	97	68
								•				
										,	e e service de la composition de la com La composition de la c	
Norm												
Qu	24.76	26.03	21.22	24.34	23.52	25.68	27.18	27.56	25.95	27.43	24.73	28.98
Cor	0.00	0.00	0.05	0.03	0.10	0.84	1.49	0.61	0.26	0.00	0.00	0.00
Or	24.58	17.20	19.50	26.12	27.54	23.76	25.29	28.72	26.59	27.89	26.71	25.00
Ab	37.74	39.43	39.86	38.67	39.94	34.10	35.70	35.11	37.90	37.32	40.36	37.90
An	7.83	9.48	10.51	5.63	3.38	7.72	3.99	3.10	3.16	2.42	4.10	3.88
Di	0.23	1.28	8.06	4.38	2.70	3.09	2.05	1.45	1.60	1.43	0.26	0.06
Hy	2.69	1.80	0.00	0.00	1.46	3.26	2.74	1.94	2.64	1.91	2.88	1.84
Mt	0,93	1.30	1.52	0.52	0.81	1.40	0.80	0.75	1.30	0.77	0.86	0.70
Im	0.38	0.70	0.55	0.25	0.34	0.60	0.40	0.43	0.50	0.30	0.36	0.46
Ap	0.09	0.12	0.17	0.12	0.07	0.23	0.12	0.09	0.09	0.12	0,14	0.12
										1997 - 1997 1997 - 1997 - 1997		

# **ROSSES PLUTON**

Sample Unit	ROS15	ROS16	ROS17	ROS19	ROS9	ROS13	ROS18	ROS20	ROS21	ROS26	ROS8	ROS24
OTAL		46	ÚĽ.	ÚĽ.	00	00	00	00		CO	35	65
SiO2	75.26	72.44	73.57	74.13	72.07	73.06	72.83	73.34	73.11	71.75	73.44	75.46
AI2O3	13.54	14.30	13.7	13.55	14.33	14.31	14.21	13.73	14.21	14.37	13.96	13.57
TIO2	0.07	0.30	0.16	0.15	0.18	0.17	0.17	0.17	0.17	0.21	0.17	0.08
FeO	0.16	1.18	0.62	0.49	0.43	0.59	0.45	0.62	0.64	0.86	0.6	0.13
Fe2O3	0.24	0.94	0.62	0.65	0.68	0.67	0.88	0.6	0.64	0.62	0.45	0.69
Fetot	0.42	2.25	1.31	1.19	1.16	1.33	1.38	1.29	1.35	1.52	1.12	0.83
MnO	0.01	0.07	0.04	0.04	0.02	0.03	0.02	0.03	0.03	0.04	0.03	0.01
MgO	0.34	1.13	0.67	0.7	0.62	0.7	1	0.88	0.79	1.03	0.71	0.37
CaO	0.66	0.77	0.88	0.64	1.2	1.05	0.97	1.06	1.03	0.99	0.76	0.34
Na2O	4.24	5.10	4.77	4.49	4.84	4.36	3.98	4.29	4.36	3.88	4.64	3.65
K2O	4.69	3.82	4.26	4.51	4.01	4.51	4.55	4.05	4.22	4.68	4.3	4.25
P2O5	0.02	0.03	0.01	0.02	0.07	0.03	0.06	0.05	0.04	0.07	0.04	0.01
LOI	0.33	0.55	0.48	0.59	0.65	0.6	0.63	0.64	0.71	0.76	0.61	0.9
Totai	99.57	100.76	99.84	99.75	99.14	99.22	99.79	99.53	100	98.95	99.77	99.47
		$(M_{1}, M_{2})$										
Trana ala	mont /nr	(m)										
Trace ele	ment (pp	мц								an Thuật đã		
Ba	265	236	281	300	453	979	953	834	961	692	419	5
Ce	5	27	23	20	31	25	27	34	33	42	20	13
La	10	22	17	14	14	23	20	19	21	25	13.	4
Nb	n.d.	37	19	n.d.	n.d.	n.d.	n.d. **	n.d.	n.d.	n.d.	n.d.	n.d.
Nd	8	11	16	11	19	8	12	18	15	18	12	12
Ni	b.d.i.	b.d.l.	b.d.l	b.d.i.	157	65	71	84	b.d.l.	258	134	246
Pb	30	27		21	21	27	27	19	25	24	23	19
Bb	224	262	201	212	205	115	124	129	118	237	237	296
Sc	1	6	1	3	2	1	3	3	2	3	4	2
Sr	114	103	144	132	163	326	335	297	327	266	160	57
Th	10	20	8	9	12	8	10	7	11	12	11	3
V	3	22	12	10	10	13	14	b.d.l.	14	13	12	12
Y	19	31	26	21	21	11	12	12	20	12	16	35
Zn	12	74	41	36	33	42	15	37	33	63	37	38
Zr	43	98	71	71	69	84	89	92	94	116	79	55
	1	2 2										
			•									
Norm							ай 1919 - 1919			i d'i c		
NOTIT												
Qu	30.89	25.13	26.86	27.61	24.05	27.39	29.04	29.61	28.49	26.45	26.37	36.36
Cor	0.51	0.83	0.00	0.17	0.01	0.70	1.41	0.76	0.97	1.29	0.39	2.37
Or	27.72	22.58	25.18	26.65	23.70	26.65	26.89	23.93	24.94	27.66	25.41	25.12
Ab	35.87	43.15	40.36	37.99	40.96	36.89	33.67	36.30	36.89	32.83	39.26	30.89
An	2.66	2.58	3.39	3.04	5.50	4.26	3.63	4.18	4.10	4.45	3.51	1.62
Di	1.97	1.67	0.18	2.41	3.44	1.40	1.03	1.90	2.00	3.57	2.82	1.26
Hy	0.85	2.81	1.59	0.89	0.00	1.74	2.49	2.19	1.97	1.72	1.05	0.34
Mt	0.30	1.70	0.80	0.94	0.99	0.75	0.76	0.90	0.97	0.90	0.65	0.25
Im	0.12	0.53	0.54	0.28	0.34	0.65	0.65	0.30	0.40	0.40	0,32	0.15
Ap	0.05	0.07	0.02	0.05	0.17	0.07	0.14	0.12	0.09	0.17	0.09	0.02
•												

### **APPENDIX 5.2 - CONTINUED**

# ROSSES PLUTON

Major element (wt%)

Sample	ROSBAP	ROS10A	ROS10B	ROS31
Unit	G3	G4	G4	MG
SiO2	75.57	74.93	75.50	69.92
A12O3	13.59	13.39	13.51	15.36
TiO2	0.06	0.12	0.09	0.27
FeO	0.10	0.28	0.31	1.16
Fe2O3	0.30	0.65	0.18	0.86
Fetot	0.40	0.93	0.49	2.02
MnO	0.01	0.01	0.01	0.02
MgO	0.30	0.50	0.44	1.38
CaO	0.34	0.48	0.38	1.88
Na2O	4.82	3.70	4.23	4.56
K2O	4.57	4.61	4.52	4.23
P2O5	0.02	0.04	0.00	0.05
LOI	0.56	0.90	0.69	0.50
Total	100.24	100.15	99.88	100.18

#### Trace element (ppm)

Ba	b.d.1	93	91	1443
Ce	1	4	17	27
La	2	8	12	20
Nb	33	29	16	7
Nd	b.d.l.	2	12	7
Ni	b.d.l	b.d.l	b.d.l.	b.d.l.
Pb	20	b.d.i.	24	27
Rb	292	288	267	106
Sc	1	3	b.d.l.	1
Sr	32	66	62	519
Th	2	b.d.l.	10	16
V	9	16	12	26
Y	11	15	15	. 7
Zn	6	14	7	44
Zr	19	45	41	112

#### Norm

Qu	27.90	33.64	32.25	20.81
Cor	0.14	1.54	1.17	0.00
Or	27.01	27,24	26.71	25.00
Ab	40.79	31.31	35.79	38.59
An	1.56	2.12	1.33	8.95
Di	1.32	1.65	2.08	0.04
Hy	1.59	0.48	1.10	4.43
Mt	0.43	0.59	0.30	1.25
im	0.11	0.23	0.12	0.51
Ap	0.05	0.09	0.00	0.12

# ARDARA PLUTON.

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Sample Unit	ARD1 Outer	ARD1F Outer	ARD1A1 Outer	ARD1B Outer	ARD1C Outer	ARD1D Outer	ARD1E Outer	ARD3A Outer	ARD4 Int'mde	ARD2 Int'mde	ARD5 Inner	ARD6 Inner
SiO2	62.01	61.85	63.22	62.36	61.18	62.57	61.68	63.83	69.47	69.18	69.65	70.69
AI2O3	17.42	16.96	16.65	16.51	16.23	17.28	16.36	16.20	15.73	15.34	15.20	15.22
TiO2	0.85	0.85	0.84	0.82	0.66	0.90	0.75	0.76	0.33	0.32	0.27	0.25
FeO	2.60	2.79	2.65	3.11	2.97	2.75	2.89	2.39	1.16	1.24	1.10	1.06
Fe2O3	1.68	1.34	1.48	1.50	1.88	1.94	1.55	1.58	1.09	0.69	0.69	0.54
Fetot	4.57	4.55	4.35	4.71	4.88	4.84	4.76	4.24	2.38	2.07	1.91	1.72
MnO	0.05	0.05	0.05	0.06	0.08	0.06	0.06	0.05	0.05	0.04	0.04	0.06
MgO	2.00	2.13	2.76	2.76	4.40	3.28	3.57	2.35	2.11	2.17	1.54	2.50
CaO	3.41	3.74	2.97	3.53	3.41	4.06	3.67	3.15	1.87	1.52	1.95	1.46
Na2O	4.51	4.52	4.10	4.43	4.85	4.52	5.14	4.75	5.96	5.48	5.51	3.54
K2O	4.31	3.97	4.15	3.81	3.20	3.47	2.59	3.99	2.83	3.53	2.96	3.31
P2O5	0.19	0.27	0.17	0.17	0.16	0.20	0.19	0.15	0.05	0.11	0.03	0.03
LOI	0.45	0.26	0.58	0.49	0.65	0.39	0.72	0.51	0.77	0.66	0.49	0.49
Total	99.12	99.16	100.11	100.79	99.70	99.12	100.80	100.28	101.56	100.41	99.27	99.30
Trace ele	ment (pp	<b>m)</b>										
Ra	810	703	666	713	607	737	470	670	640	660	499	522
Ca	019	117	73	60	40	61	470	96	23	26	400	232
	31	63	50	40	42	41		40	20	20	10	24
La Nh	20	nd	nd	- 40 	- 00 -	n d	nd	17	24 nd	+	nd n	5
Nd	46	50	44	2 20	18	31	23	30	14	11.	0	11
Ni	h d i	hdi	81	66	7	87	43	hdi	167	151	ьdі	h d 1
Ph	43	40	34	30	23	26	26	41	22	25	30	35
Bh	193	184	202	159	137	145	106	186	88	102	87	91
Sc	8	7	8	7	10	8	9	5	3	2	4	3
Sr	473	461	482	525	596	571	690	463	600	513	574	495
Th	29	29	29	23	13	13	10	24	8	12	6	8
V	95	106	105	102	109	111	106	93	41	35	33	29
Ŷ	32	23	24	23	15	17	13	24	. 9	9	9	7
Zn	71	62	69	73	71	77	69	67	61	45	43	38
Zr	442	337	283	238	201	232	167	292	100	105	91	94
			4. <sup>10</sup> - 1 <sup>00</sup>									
Norm							en An e					
0	8 5 8	8 90	0 20	9 79	8 53	7 38	8 20	10.76	16 74	14 45	19.61	28 40
Cor	0.00	0.00	0.42	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	20,78
Or Or	25 47	23 46	24 53	22 52	18.01	20.51	15 31	23 58	16 72	20.86	17 40	10 56
An	14 56	14 26	13.62	13 01	13.06	16.61	13.02	11 10	7.91	6.82	9.00	7 05
Ah	38 16	38.25	34 69	37.49	41 04	38.25	43 50	40.19	50 43	46 37	46.63	20.00
Di	0.91	2.06	10.97	2.02	2.24	1.78	2.45	2.86	0.90	5.45	1.18	5.60
Hv	7 15	7.77	4,35	9.31	12 92	9.67	11 20	6 89	5 84	4.32	4.57	4 08
Mt	2 44	1.94	2.15	2.17	2.73	2.81	2.25	2 29	1.58	1 00	1.00	0.79
lim	1.61	1.61	1.60	1.56	1.25	1.71	1.42	1.44	0.63	0.61	0.51	0 47
An	0.45	0.64	0.40	0.40	0.38	0.47	0.45	0.36	0.12	0.26	0.07	0.07
	<b></b>											
## **APPENDIX 5.3 - CONTINUED**

## ARDARA PLUTON.

#### Major element (wt%)

Hy

Mt

llm

Ap

2.91

0.75

0.51

0.07

2.28

0.55

0.34

0.05

3.05

1.65

0.55

0.09

· ·				11111		e de la composición d
Sample Unit	ARD7 Inner	ARD3B Inner	ARD10 Inner	ARD11 Inner	ARD12 Inner	ARD13 Inner
SiO2	69.66	71.24	69.19	72.18	69.42	69.30
A12O3	15.63	15.44	15.20	14.79	15.54	15.38
TiO2	0.27	0.18	0.29	0.13	0.29	0.30
FeO	1.03	0.59	0.80	0.37	1.32	1.19
Fe2O3	0.52	0.38	1.14	0.49	0.65	0.71
Fetot	1.66	1.04	2.03	0.90	2.12	2.03
MnO	0.02	0.01	0.04	0.01	0.03	0.04
MgO	1,64	0.69	2.11	0.86	1.74	1.73
CaO	1.32	1.45	1.43	1.20	1.79	2.15
Na2O	5.69	6.07	5.49	5.61	6.24	5.85
K2O	3.41	2.70	3.24	3.45	2.92	2.91
P2O5	0.03	0.02	0.04	0.03	0.05	0.05
LOI	0.37	0.45	0.58	0.61	0.63	0.47
Total	99.70	99.29	99.65	99.76	100.78	100.21
Trace e	lement (pr	om)				
Ba	598	584	590	594	560	655
Ce	27	b.d.i	25	20	27	18
La	17	12	18	17	14	17
Nb	4	n.d	n.d	n.d	n.d	7
Nd	15	. 5	16	8	11	12
Ni	b.d.l	b.d.l	171	b.d.l	b.d.l	b.d.l
Pb	27	31	27	30	25	25
Rb	72	54	91	85	80	75
Sc	1 1	3 .	2	11	1 Sec. <b>1</b>	4
Sr	518	747	525	440	578	684
Th 👘	2	7.	s <b>8</b> -	े <b>11</b> -	2 × 4	6
V	29	16	36	11	34	33
Y	5	6	11	7	·	· · 9 · · .
Zn	74	31	48	20	45	45
Zr	98	73	100	71	106	95
	•					
Norm						18 . <b>1</b>
Qu	16.38	21.27	17.15	22.65	15.39	17.14
Cor	0.25	0.00	0,16	0.00	0.00	0.00
Or	20.15	15.96	19.15	20.39	17.26	17.20
An	6.35	6.91	6.83	4.99	5.77	7.11
Ab	48.15	51.36	46.46	47.47	52.80	49.50
Di	5.08	0.12	5.35	0.61	2.25	2.58

2.06

0.71

0.25

0.07

4.49

1.03

0.57

0.12

5.15

0.94

0.55

0.12

## **APPENDIX 5.4**

## FANAD PLUTON

Major element (wt%)

Sample Unit	FAN15A Fanad Pen	FAN17 Fanad Pen	FAN11 Fanad Pen	FAN1 Fanad Pen	FAN12 Fanad Pen	FAN41 Fanad Pen	FAN2 Fanad Pen	FAN7 Fanad Pen	FAN13 Fanad Pen	FAN10 Fanad Pen
SiO2	55.81	61.93	64.37	64.37	64.15	62.82	63.03	62.07	57.30	64.86
AI2O3	17.84	17.78	15.46	15.23	15.50	15.99	15.29	15.90	17.49	14.99
TiO2	0.80	0.64	0.54	0.57	0.58	0.64	0.59	0.64	0.98	0.53
FeO	3.90	2.75	22.10	2.20	2.50	2.06	2.47	2.57	3.62	2.24
Fe2O3	1.87	1.17	1.41	1.48	1.42	2.25	1.47	1.58	2.27	1.18
Fetot	6.13	4.23	3.74	3.92	4.20	4.54	4.21	4.44	6.29	3.67
MnO	0.07	0.04	0.05	0.05	0.05	0.06	0.05	0.06	0.07	0.04
MgO	5.24	2.72	3.34	3.49	3.97	3.76	3.56	3.81	3.38	3.35
CaO	6.78	2.58	3.54	3.70	3.74	3.50	3.81	4.21	4.47	3.36
Na2O	3.64	4.25	4.34	4.09	4.00	3.83	4.27	4.23	3.59	4.25
K2O	2.08	4.27	3.37	3.37	3.01	3.60	3.31	3.46	3.00	3.64
P2O5	0.14	0.22	0.13	0.14	0.14	0.24	0.17	0.23	0.45	0.13
LOI	1.09	0.71	0.52	0.57	1.24	0.76	0.56	0.60	1.74	0.53
Total	99.61	99.38	99.40	99.51	100.58	99.67	99.47	99.65	99.11	99.36
_										na serie de la composición de la compo La composición de la c
Trace eler	ment (ppm)	l Alexandra								
Ba	1181	4367	1390	1519	1415	1517	1429	1561	2029	1409
Ca	34	28	53	52	43	58	66	61	68	44
La	25	36	32	34	31	30	35	46	40	28
Nb	9	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	7
Nd	21	15	28	23	27	40	45	38	50	27
NI	b.d.l	b.d.l	72	89	66	58	109	196	b.d.l	5
Pb	13	9	20	20	23	22	15	16	12	23
Rb	30	67	70	74	65	74	71	. 74	59	80
Sc	22	4	7	7	10	9	7	9	8	7.
Sr	1418	1124	884	899	921	949	966	940	1372	835
Th 📜	3	b.d.l	10	8	13	. 8	4	8	8	10
٧	110	68	67	76	76	86	74	77	108	65
Y	17	17	11	12	3	12	15	18	14	13
Zn	70	53	52	55	59	28	56	63	77	52
Zr	111	361	133	135	160	141	146	163	125	148
Norm										
01	6 16	11 92	14 91	16.04	16.31	14 33	13.64	11 32	0 4 9	15 43
Cor	0.00	1.99	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.00
Or	12 25	25.22	19.87	19.87	17.76	21.27	19.54	20.43	17.70	21.49
An	26.21	11.41	12.77	13.27	15.47	15.83	12.80	14.49	19.30	11.10
Ab	30 79	35.93	36 71	34 56	33 83	32.36	38 08	35 77	33 41	35 93
DI	5 30	g 20	3 20	3 40	1 75	12 50	4 02	4 17	14 90	3,80
Hv	11 50	6 77	7 40	7 58	Q 74	9 9.5	7 70	8 34	8 41	7.96
Mt	2 71	1 70	2 04	2 15	2 0R	3 30	2 13	2 30	4 70	1 71
lim	1.52	1 20	1.03	1.10	1.10	1.22	1.12	1 22	1.86	1.01
An	0.30	0.50	0.30	0.30	0.30	0.54	0.37	0.54	1 04	0.30
Ru	0.00	0.60	0.00	0.00	0.00	0.56	0.00	0.00	0.90	0.00

## **APPENDIX 5.4**

## FANAD PLUTON

Major element (wt%)

Sample Unit	FAN16A Fanad Pen	FAN16B Fanad Pen	FAN13A Fanad Pen	FAN46 Rosguill	FAN30 Rosguill	FAN46D Rosguill	FAN29 Rosguill	FAN28 Rosguill	FAN23 Rosguill	FAN24 Rosguill
SiO2	58.40	58.86	52.46	58.61	57.82	59.20	64.92	62.91	60.42	63.17
AI2O3	19.01	18.90	20.10	18.20	18.57	18.27	17.43	17.05	18.13	17.45
TiO2	0.80	0.79	1.00	0.91	0.92	0.88	0.57	0.69	0.71	0.60
FeO	3.33	3,67	5.56	3.23	2.92	3.11	1.86	2.05	2.58	2.07
Fe2O3	2.22	1.77	1.99	2.02	2.46	1.98	1.93	1.85	1.87	1.72
Fetot	5.55	5.44	7.55	5.63	5.70	5.44	4.00	4.16	4.74	4.02
MnO	0.04	0.04	0.06	0.05	0.05	0.04	0.03	0.04	0.04	0.05
MaQ	2.90	2.95	4.36	3.34	3.15	2.94	1.97	2.41	2.55	1.86
CaO	4.22	4.03	6.30	4.75	4.71	4.28	2.97	3,35	3.55	3.13
Na2O	4.55	4.54	3.97	4.37	4.95	5.03	4.47	4.78	4.45	5.06
K2O	3.05	3.05	2.23	2.83	2.46	2.98	3.76	3.25	3.69	3.22
P2O5	0.20	0.24	0.28	0.36	0.24	0.22	0.25	0.18	0.20	0.17
LOI	0.50	0.71	1.24	0.56	1.47	0.54	0.48	0.44	0.57	0.44
Total	99.22	99.55	99.55	99.61	100.03	99.82	100.85	99.26	99.05	99.17
				i en se	19 ye 40	00.02				
Trace eler	ment (ppm)									
					1. E.					
Ва	3709	3761	1643	2499	2546	2824	3988	2770	3909	2924
Ce	43	67	46	50	55	68	79	64	79	53
La	42	51	33	43	50	43	65	54	70	40
Nb	6	3	6	n.d.	n.d.	7	n.d.	n.d.	n.d.	11
Nd	20	35	27	35	28	35	34	31	38	27
Ni	b.d.l	b.d.l	b.d.l	149	b.d.l.	b.d.l.	31	117	53	b.d.).
Pb	16	12	17	17	15	13	18	15,	16	19
Rb	45	45	58	58	51	58	57	51	56	53
Sc	5	4	10	8	b.d.l.	8	2	5	4	3
Sr	1717	1678	1717	1422	1430	1433	1292	1230	1481	1218
Th	2	4	2 /	6 . <sup>6</sup> . 7	3.3	i <b>(1</b> 75)	111	5 5	4	6
v	62	68	102	89	95	89	44	66	62	50
Y	5	4	12	14	13	9	11	9	8	24
Zn	74	73	96	78	82	75	63	64	68	69
Zr	439	443	285	295	306	332	349	293	392	353
			1.510			1.1.5.116.	115 - X 1			
					•					
Norm						a series a s		· · · · · · · · · · · · · · · · · · ·		
Qu	6.49	5,43	1.64	8.22	5.50	5.61	15.93	12.38	9.62	12.37
Cor	1.04	1.36	0.36	0.17	0.00	0.00	1.19	0.00	0.85	0.33
Or	17.98	17.98	13.14	16.70	14.53	17.59	22.21	19.21	21.77	18.98
An	19.63	18.49	29.48	21.25	21.20	18.47	13.14	15.47	16.31	14.51
Ab	38.50	38.39	33.57	36.98	41.85	42.54	37.82	40.44	37.61	42.80
Di	6.26	8,90	10.15	7.30	0.51	1.06	10.50	12.30	13.00	12.00
Hv	5.22	4,35	7.23	8.31	7.60	6.83	4.90	5.99	6.34	4 63
Mt	3 22	2.57	2.89	2.90	3 57	2.87	2.80	2.70	2.80	2 50
lim	1.52	1.50	1.90	1.73	1.75	1.67	1.08	1.30	1.40	1 14
An	0.47	0.54	0.64	0.84	0.54	0.50	0.57	0 40	0 47	0.37
Ru	0.76	0.74	0.93	0.85	0.67	0.45	0.54	0.64	0.66	0.54

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## **APPENDIX 5.4 - CONTINUED**

## FANAD PLUTON

Major element (wt%)

Sample Unit	FAN25 Rosguill	FAN27 Rosguill	FAN21 Melmore	FAN22 Melmore	FAN43 Melmore	FAN18 Melmore	FAN 19 Melmore
SiO2	63.74	62.04	56.04	56.71	56.85	56.43	55.44
AI2O3	16.99	18.11	20.09	18.55	19.17	19.44	20.09
TiO2	0.63	0.67	0.88	0.95	0.88	0.85	0.87
FeO	2.54	2.18	3.60	3.43	3.04	3.50	3.66
Fe2O3	1.51	1.82	2.15	2.39	2.22	1.93	2.02
Fetot	4.33	4.24	6.15	6.20	5.60	5.83	6.09
MnO	0.04	0.03	0.04	0.06	0.05	0.04	0.05
MgO	2.16	2.26	3.44	3.38	3.04	3.13	3.23
CaO	2.95	3.21	5.05	4.68	3.87	4.80	5.02
Na2O	4.49	4.67	4.47	4.29	4.40	4.72	4.82
K2O	3.51	3.83	2.72	2.95	3.52	2.95	2.80
P2O5	0.18	0.21	0.29	0.27	0.35	0.30	0.27
LOI	0.18	0.39	0.52	0.96	1.35	0.42	0.60
Total	99.65	99.66	99.66	99.00	99.08	98.91	99.28
Trace ele	ment (ppm)	)					
Ba	3363	4199	4157	2504	3362	3897	3888
Ce	86	102	61	47	56	71	42
La	74	81	45	28	53	52	46
Nb	n.d.	n.d.	n.d.	11	5	3	3
Nd	43	47	30	44	31	35	23
Ni	b.d.l.	185	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.
Pb	16	15	16	21	13	15	14
Rb	57	57	41	64	74	43	42
Sc	4	4	5	12	b.d.l.	5	4
Sr	1207	1408	2094	1657	1760	1925	1991
Th	10	6		ິ <b>4</b> ີ	6	9	3
<b>V</b>	56	58	93	103	76	123	75
Y I	13	13	8	37	11	7	7
Zn	72	60	79	76	73	73	76
Zr	357	376	446	237	309	424	338
							· . · · ·
Norm							
Qu	15.17	10.57	4.52	6.17	5.97	3.60	2.60
Cor	0.86	0.93	1.30	0.44	1.92	0.48	0.70
Or	20.71	22.60	16.03	17.42	20.76	17.42	16.60
An	13.52	14.62	23.19	21.44	16.97	21.84	23.00
Ab	37.97	39.49	37.82	36.29	37.19	39.91	31.70
DI	10.00	11.00	15.00	17.00	13.00	17.00	18.00
Hy	5.37	5.62	8.56	8.41	7.57	7.79	2.00
Mt	2.20	2.64	3.21	3.50	3.22	2.80	2.90
Ilm	1.20	1.27	1.67	1.80	1.67	1.52	1.71
Ap	0.40	0.47	0.67	0.64	0.81	0.71	0.64
Rú	0.58	0.63	0.84	0.88	0.82	0.81	0.20

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## APPENDIX 5.5

# MAIN DONEGAL PLUTON

Major element (wt%)

Sample Unit	DON17 Dark	DON25 Dark	DON26 Dark	DON12 Dark	DON7B Dark	DON7A light	DON38 light	DON33 light	DON35 light	DON27 light	DON16 light	DON40 light
SiO2	66.26	68.99	66.68	69.15	71.24	70.53	70.52	74.65	72.16	71.65	73.19	70.78
TiO2	0.44	0.38	0.16	0.41	0.25	0.29	0.27	0.12	0.17	0.21	0.13	0.26
AI2O3	16.72	15.83	18.68	15.83	14.93	14.87	15.25	12.94	14.45	15.12	13.76	15.22
FeO	2.32	1.61	0.57	2.03	1.21	1.21	1.20	0.55	0.83	0.89	0.65	1.10
Fe2O3	0.79	1.01	0.47	0.86	0.68	1.07	0.44	0.27	0.45	0.41	0.62	0.60
Fetot	3.37	2.80	1.10	3.12	2.02	2.15	1.76	0.88	1.37	1.40	1.34	1.82
MnO	0.02	0.04	0.02	0.05	0.03	0.02	0.03	0.02	0.03	0.04	0.01	0.03
MgO	0.72	1.32	0.73	1.50	1.19	1.09	1.02	0.72	0.66	0.88	0.67	1.06
CaO	0.96	2.62	3.46	2.83	2.85	2.74	2.14	0.96	1.65	2.00	1.19	2.50
Na2O	5.43	5.64	7.53	5.28	5.58	4.29	4.90	3.43	4.27	5.29	3.30	4.39
K2O	3.12	2.40	0.99	1.80	1.17	2.81	3.52	5.12	4.32	2.64	5.31	3,11
P2O5	0.02	0.06	0.06	0.12	0.10	0.10	0.08	0.02	0.02	0.04	0.05	0.13
LOI	0.60	0.56	0.62	0.12	0.54	0.58	0.08	0.67	0.36	0.51	0.37	0.54
Total	98.66	100.64	100.03	100.25	100.02	99.47	99.89	99.44	99.47	99.78	99.33	99.84
									ta ya shi			
Troop of	mant /nn	<b>m</b> )										
Hace en	ament (bb	n11)										
Ba	110	529	49	108	124	1009	925	890	1126	1126	894	860
Ce	33	33	57	41	23	42	40	29	30	b.d.1	271	36
La	23	21	37	34	10	34	35	20	31	22	36	24
Nb	n.d.	15	56	19	n.d.	n.d	9	6	7	10	n.d.	n.d.
Nd	20	22	33	15	16	21	12	10	7	b.d.l.	73	17
N	b.d.l.	b.d.l.	b.d.l.	b.d.l.	228	b.d.l.	b.d.l.	b.d.i.	b.d.l.	b.d.l.	113	146
Pb	17	18	25	12	17	19	20	22	24	22	29	21
Rb	110	112	48	108	65	95	102	138	135	124	153	102
Sc	7	5	2	6	4	2	1, 1	b.d.l.	b.d.l.	2	2	- <b>1</b>
Sr	341	403	665	272	433	346	449	288	339	382	304	468
Th .	5	13	23	14	4	13	12	15	18	12	14	10
V	24	36	12	36	20	b.d.l.	21	11	13	15	14	22
Y	12	12	14	18	11	7 🖓	9	2	10	9	6	8
Zn	89	67	32	82	53	53	42	22	29	44	28	50
Zr	174	213	88	166	140	144	131	57	107	93	99	120
Norm										1		
Qu	19.35	20.03	11.33	23.61	25.20	24.51	22.88	32.05	26.48	25.29	28.80	23.70
Cor	0.82	0.00	0.00	0.33	0.16	0.00	0.00	0.05	0.00	0.00	0.54	0.40
Or	11.25	14.14	5.85	10.63	27.17	16.60	20.76	30.23	25.50	15.59	31.40	18.40
An	13.87	10.82	14.27	13.28	8.70	12.90	9.24	4.66	7.54	9.71	5.60	11.60
Ab	45.00	47.68	63.67	44.63	33.99	36.30	41.43	29.00	36.08	44.74	27.90	37.20
DI	3.61	1.14	2.02	10.80	1.10	0.06	2.00	3.73	0.45	7.00	4.48	8.27
Ну	4.51	3.06	1.10	3.73	2.21	0.00	2.51	1.79	1.61	2.19	0.13	0.00
Mt	1.34	2.30	0.70	1.30	0.99	1.55	0.60	0.40	0.65	0.59	0.90	0.87
lim	0.84	0.72	0.30	0.80	0.50	0.60	0.40	0.23	0.32	0.40	0.25	0.49
Ru	0.38	0.00	0.00	0.35	0.22	0.00	0.00	0.10	0.00	0.17	0.00	0.00
Ар	0.24	0.13	0.13	0.27	0.13	0.24	0.17	0.03	0.03	0.07	0.12	0.31

# APPENDIX 5.5 - CONTINUED

# MAIN DONEGAL PLUTON

Major element (wt%)

Sample Unit	DON8D light	DON30 light	DON8A light	DON28 light	DON13 light	DON1 light	DON4 light	DON31 light	DON11 light	DON42 light	DON3 light	DON39 light
SiO2	69.64	67.76	70.09	72.94	71.18	69.32	70.13	70.68	73.30	71.19	70.43	70.01
TiO2	0.38	0.27	0.24	0.09	0.25	0.30	0.23	0.24	0.17	0.22	0.21	0.30
AI2O3	15.26	15.83	15.54	14.70	15.16	15.89	15.06	15.13	14.56	14.76	14.88	15.34
FeO	1.60	0.99	1.10	0.46	1.19	1.69	0.93	1.08	0.72	1.06	1.58	1.46
Fe2O3	1.09	1.14	0.60	0.19	0.59	0.45	0.68	0.37	0.45	0.52	0.41	0.63
Fetot	2.74	2.24	1.82	0.70	1.76	2.33	1.71	1.57	1.24	1.70	1.62	2.25
MnO	0.02	0.02	0.02	0.01	0.03	0.03	0.02	0.03	0.01	0.03	0.04	0.02
MgO	1.50	0.76	0.84	0.51	0.87	1.18	0.99	0.95	0.68	0.89	1.47	1.16
CaO	2.80	1.74	1.86	1.50	2.06	2.58	1.52	2.22	1.59	1.83	1.78	3.01
Na2O	4.11	4.50	4.94	4.69	4.57	4.30	4.01	4.52	4.30	4.02	4.32	4.10
K2O	2.55	4.05	3.81	4.68	3.27	2.99	5.09	3.34	4.27	4.60	3.71	4.27
P2O5	0.14	0.10	0.05	0.04	0.05	0.07	0.09	0.04	0.01	0.07	0.09	0.13
LOI	0.84	0.32	0.36	0.43	0.42	0.65	0.47	0.11	0.60	0.42	0.80	0.50
Total	99.99	97.60	99.56	100.29	99.61	99.64	99.32	98.81	100.72	99.40	99.36	100.08
				-								
Trace ele	ement (pp	m)										
		•										
Ba	949	675	755	954	588	832	1183	726	894	963	1256	1945
Ce	71	24	25	15	47	44	30	26	59	52	43	92
La	60	21	19	16	33	35	29	18	37	41.	26	74
Nb	n.d.	n.d.	9	4	11	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Nd	31	11	18	14	19	18	13	12	35	27	24	42
Ni	183	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	251	b.d.l.	b.d.l.	b.d.l.	226	b.d.l.
Pb	12	21	26	26	21	22	32	19	26	27	17	19
Rb	92	124	128	127	119	103	163	108	137	152	115	123
Sc	5	2	b.d.l.	b.d.l.	2	b.d.i.	2	b.d.l.	b.d.l.	2	3	2
Sr	396	358	286	353	306	500	380	378	283	296	474	481
Th	16	14	1	7	10	16	9	8	18	16	6	17
V	44	19	18	9	27	33	19	22	15	17	`22	26
Y ·	8	15	11	- <b>6</b> .	9	9	12	8	11	10	9	12
Zn	63	39	54	15	53	55	48	43	29	46	50	50
Zr	185	98	125	59	139	161	141	96	102	128	134	200
Nausa					1.1.1					i an st		
NORT											$(\{a_i\}_{i \in I})$	
Qu	23.50	19.47	21.68	24.34	26.51	25.78	22.88	25.55	27.57	25.15	25.41	24.17
Cor	0.60	1.12	0.02	0.00	0.46	1.03	0.41	0.12	0.00	0.00	0.74	0.63
Or	21.60	23.90	22.49	27.61	19.32	17.65	30.06	19.71	25.22	27.17	21.88	25.22
An	5.89	7.98	8.93	5.26	9.93	12.43	6.98	10.80	7.85	8.65	8.26	9,13
Ab	34.30	38.10	41.80	39.65	38.65	36.35	33.88	38.23	36.35	33.99	36.50	34.67
Di	3.00	5.34	0.03	1.33	7.07	10.30	5.60	8.03	5.20	7.00	6.70	2,70
Hy	2.10	0.00	3.50	1.20	0.00	0.60	0.80	0.00	0.00	0.21	2.10	3.60
Mt	1.30	1.65	0.90	0.30	0.86	0.65	1.00	0.50	0.70	0.80	0.60	0.91
llm	0.40	0.51	0.50	0.20	0.57	0.57	0.40	0.50	0.32	0.40	0.40	0.60
Ru	0.00	0.00	0.22	0.00	0.22	0.26	0.21	0.21	0.15	0.17	0.17	0.28
Ap	0.30	0.24	0.10	0.07	0.10	0.13	0.20	0.07	0.00	0.13	0.20	0.30

## **APPENDIX 5.5 - CONTINUED**

## MAIN DONEGAL PLUTON

#### Major element (wt%)

Sample Unit	DON39 light	DON6B light	DON5 light	DON8BT light
SiO2	70.01	71.32	73.50	70.99
TiO2	0.30	0.20	0.13	0.22
AI2O3	15.34	14.65	14.29	15.04
FeO	1.46	0.97	0.82	2.24
Fe2O3	0.63	0.53	0.10	0.40
Fetot	2.25	1.61	0.98	1.63
MnO	0.02	0.02	0.03	0.03
MgO	1.16	0.94	0.64	0.92
CaO	3.01	1.79	0.69	2.39
Na2O	4.10	3.87	4.63	4.36
K2O	4.27	4.18	4.33	3.11
P2O5	0.13	0.08	0.03	0.04
LOI	0.50	0.40	0.29	0.34
Total	100.08	99.04	99.76	99.07
	· · · · · · ·			

#### Trace element (ppm)

Ba	1945	1349	649	647
Ce	92	32	19	34
La	74	26	19	27
Nb	n.d.	11	n.d.	n.d.
Nd	42	20	8	26
Ni	b.d.l.	b.d.l.	b.d.l.	b.d.l.
Pb	19	19	22	18
Rb	123	138	155	106
Sc	2	b.d.l.	<b>1</b>	3
Sr	481	389	270	341
Th	17	4	7	8
V	26	21	15	24
Y	12	13	9	10
Zn	50	41	40	43
Zr	200	89	71	94

#### Norm

Qu	24.17	27.81	27.67	25.20
Cor	0.63	0.68	0.80	0.00
Or	25.22	24.66	25.55	18.40
An	9.13	8.41	3.24	11.10
Ab	34.67	32.73	39.18	39.20
Di	2.70	6.78	2.66	0.43
Hy	3.60	2.34	1.59	3.70
Mt	0.91	0.77	0.14	0.58
llm -	0.60	0.38	0.25	0.42
Ru	0.28	0.18	0.10	0.01
Ар	0.30	0.17	0.07	0.09

## **APPENDIX 5.6**

# TRAWENAGH BAY PLUTON

Major element (wt%)

Sample Unit	TRA1 Bi gra	TRA2 Bi gra	TRA5 Bi gra	TRA6 Bi gra	TRA8B Bi gra	TRA3 Mu gra	TRA4 Mu gra	TRA7 Mu gra
SiO2	72.27	72.75	71.87	72.76	69.89	73.63	75.46	74.86
AI2O3	14.33	14.11	14.37	14.44	15.56	14.03	13.35	14.59
TiO2	0.18	0.18	0.18	0.19	0.29	0.03	0.04	0.03
FeO	1.12	0.79	0.83	0.80	1.59	0.13	0.12	0.12
Fe2O3	0.13	0.55	0.56	0.55	0.71	0.31	0.16	0.24
Fetot	1.37	1.43	1.48	1.44	2.48	0.45	0.29	0.37
MnO	0.04	0.03	0.02	0.03	0.05	0.10	0.04	0.04
MaQ	1.04	0.91	0.76	0.77	1.13	0.29	0.26	0.27
CaO	1.75	1.51	1.32	1.70	2.58	0.42	0.39	0.32
Na2O	4.33	4.20	4.40	4.25	5.83	4.65	5.44	5.62
K20	3.31	4.04	4.50	3.93	1.27	4.35	3.87	4.15
P2O5	0.04	0.04	0.03	0.03	0.09	0.04	0.00	0.01
LO	0.75	0.63	0.69	0.43	0.48	0.50	0.41	0.59
Total	99.39	99.82	99.61	99.87	100.69	98.49	99.54	100.40
		n an sea San san sa	en de te ester de 23		an a			
Trace eler	ment (ppn	n)						* • • • * •
Ba	539	708	990	828	191	b.d.l	b.d.l	b.d.1
Ce	34	15	32	30	28	9	15	2
La	17	4	26	20	19	6	4	4
Nb	n.d	n.d	n.d	n.d	15	n.d	40	40
Nd	21	12	18	12	13	9	9	n.d
Ni	139	b.d.l	b.d.l	209	b.d.l	133	b.d.l	b.d.l
Pb	22	23	23	29	16	16	25	13
Rb	133	109	136	133	77	345	266	369
Sc	2	p'q'l	1	3	5	2	1	b.d.l
Sr	298	338	328	307	310	10	4	11
Th	7	4	7	12	10	6	9	2
V	15	15	9	20	21		2	3
Y .	10	9	17	12	13	19	29	9
Zn	37	33	41	41	75	22	18	22
Zr	87	87	105	99	138	30	27	13
•								
Norm								
Qu	26.52	26.40	24.77	26.04	12.54	28.26	28.02	24.87
Cor	0.54	0.18	0.00	0.18	0.00	1.00	0.00	0.30
Or	19.56	23.88	26.59	23.23	26.59	25.71	22.87	24.53
An	8.42	7.23	6.17	8.24	3.00	1.82	0.58	1.52
Ab	36.64	35.54	37.23	35.96	49.33	39.35	46.03	47.56
Di	6.90	5.82	0.15	5.87	7.62	1.44	1.07	1.20
Hy	1.15	0.38	2.79	0.00	1.77	0.18	0.25	0.18
Mt	0.19	0.80	0.81	0.80	0.25	0.45	0.23	0.35
llm	0.34	0.34	0.34	0.36	0.55	0.06	0.08	0.06
Ap	0.09	0.09	0.07	0.07	0.21	0.09	0.00	0.02

## **APPENDIX 6.**

## RARE EARTH ELEMENT ANALYSES.

Notes.

(1) All Barnesmore analyses are taken from Dempsey (1987).

(2) All Thorr analyses are taken from Oglethorpe (1987) except TH1, TH5, TH6B and TH4.

Outer : Outer unit of Ardara. I'mediate : Intermediate unit of Ardara. Inner: Inner unit of Ardara. Fan penin: Fanad peninsula. Bi-granite : Biotite granite of Trawenagh Bay. Mu-granite: Muscovite granite of Trawenagh Bay. Contact : Contact facies of Thorr. Trans : Transitional facies of Thorr. Hbl bear : Hornblende bearing Normal facies of Thorr. Hbl free : Hornblende free Normal facies of Thorr. Qz Mzd : Quartz monzodiorite. Gdr : Granodiorite.

## APPENDIX 6 - RARE EARTH ELEMENT ( DONEGAL GRANITES)

										· · · · · ·		1. S.
Pluton Unit Rock type Sample	Ardara Outer Qz Mzd ARD1F	Ardara Outer Qz Mzd ARD1A1	Ardara Outer Qz Mzd ARD1B	Ardara Outer Qz Mzd ARD1C	Ardara Outer Qz Mzd ARD1D	Ardara Outer Qz Mzd ARD1E	Ardara I'mediate Gdr ARD2	Ardara I'mediate Gdr ARD4	Ardara Inner Granite ARD11	Ardara Inner Granite ARD13	Fanad Fan penin Qz Mzd FAN11	Fanad Fan penin Qz Mzd FAN16
La	67.58	59.87	38.28	27.56	36.66	38.28	15.37	15.17	14.98	15.36	29.68	33.7
Ce	156	120	87.8	56.2	79.2	71.9	34.8	32.3	28.1	33.2	59.6	60.2
Pr	13.4	14.5	7.85	5.78	7.03	6.54	4.18	3.91	2.61	3.34	5.67	6.16
Nd	59.5	51.9	36.7	24.8	31.4	28.8	15	15.66	10.8	14.6	27.3	24.1
Sm	9.66	9.65	7.24	4.16	4.87	5.16	3.36	3.17	1.78	2.48	4.59	3.36
Eu	1.69	1.59	1.39	1.07	0.97	1.21	0.69	0.75	0.51	0.66	1.19	1.55
Gd	6.28	6.35	4.9	3.06	3.39	3.75	2.05	2.38	1.48	1.8	4.46	2.21
Ho	0.85	1.00	0.67	0.48	0.49	0.41	0.39	0.27	0.01	0.27	0.43	0.29
Er	2.53	2.83	2.12	1.67	1.46	1.14	1.14	0.8	0.13	0,89	1.34	0.63
Dy	4.65	4.63	3.76	2.48	2.59	2.56	1.69	1.53	0.65	1.47	2.9	1.1
Yb	2.19	1.92	2.04	0.91	0.99	1.23	0.72	0.72	0.4	0.61	1.07	0.58
Lu	0.26	0.22	0.25	0.12	0.12	0.15	0.1	0.1	0.04	0.06	0.12	0.08
Total	324.59	274.46	193	128.29	169.17	161.13	79.49	76.76	61.49	74.74	138.35	133.96

Pluton	Fanad	Fanad	Fanad	Fanad	Fanad	Fanad	Fanad	Main Don	Main Don	Main Don	Main Don	Main Don
Unit	Fan penin	Fan penin	Fan penin	Melmore	Rosguill	Rosguill	Rosguill	Dark band	Dark Band	Light band	Light band	Light band
Rock type	Qz Mzd	Qz Mzd	Qz Mzd	Qz Mzd	Qz Mzd	Qz Mzd	Qz Mzd	Trondhj	Trondhj	Gdr	Gdr	Granite
Sample	FAN17	FAN1	FAN10	FAN46	FAN23	FAN25	FAN29	DON17	DON26	DON30	DON1	DON16
La	31.48	41.28	26.06	27.28	76.07	68.04	50.6	20.03	53.7	27.48	49.07	50.42
Ce	51.66	71.8	65.99	67.8	137	108.2	97.5	43.44	94	54.4	93.4	98
Pr	5.17	6.83	6.75	6.84	14.07	10.35	8.35	4.42	9.75	4.85	9.06	9.92
Nd	19.1	30.7	26.32	32.84	49.1	38.13	29.8	16.48	33.9	20.2	28.2	32.7
Sm	3.02	5.06	4.06	5.33	6.65	4.91	3.43	3.73	6.85	4.07	4.66	5.6
Eu	1.44	1.27	0.92	1.81	2.1	1.48	1.21	0.61	0.76	0.68	0.79	0.71
Gd	2.63	3.33	2.55	3.61	3.64	3.12	1.95	3.1	4.4	3.12	2.58	3.15
Но	0.59	0.35	0.29	0.3	0.54	0.48	0.17	0.39	0.58	0.33	0.42	0.42
Er	1.43	1.21	0.73	0.84	1.83	1.05	0.52	0.95	1.68	0.99	1.46	1.26
Dy	2.44	2.26	1.68	2.14	2.38	1.98	0.95	2.31	2.83	2.31	1.84	1.9
Yb	0.7	1.14	0.72	0.72	0.96	0.8	0.29	0.72	0.75	1.13	0.84	0.54
Lu	0.09	0.13	0.1	0.09	0.13	0.08	0.05	0.1	0.1	0.12	0.11	0.09
Total	119.75	165.36	136.17	149.16	294.47	238.62	194.82	96.28	209.3	119.7	192.4	204.71

Pluton Unit	Main Don Light band	Main Don Light band	Rosses porphyry	Rosses porphyry	Rosses G1	Rosses G1	Rosses G1	Rosses G2	Rosses G2	Rosses G2	Rosses G2	Rosses G2
Rock type	Granite	Granite	Granite	Granite	Granite	Granite	Granite	Granite	Granite	Granite	Granite	Granite
Sample	DON5	DON3	ROS29	ROS3	ROS11	ROS12	ROS4AP	ROS17	ROS14	ROS15	ROS5	ROS16
La	14.27	41.37	26.66	34.17	30.18	23.58	13.7	14.66	17.17	7.12	16.17	18.2
Ce	28.2	72.1	53.2	63.5	60.52	44.69	32.68	29.1	32.2	17.1	32.27	38.8
Pr	3.23	7.2	5.16	6.81	6.34	4.46	3.46	2.92	3.21	1.87	3.4	3.96
Nd	10.3	25.2	21	22.6	23.09	16.7	13.3	12.6	13.2	6.1	14.45	15.9
Sm	2.28	4.53	3.04	4.63	3.81	3.04	2.99	3.37	3.88	1.99	3.61	4.36
Eu	0.34	0.92	0.63	0.67	0.72	0.55	0.42	0.37	0.73	0.28	0.46	0.35
Gd	1.52	2.56	2.04	2.71	2.55	2.3	2.32	3.43	2.98	2.08	3.3	3.98
Ho	0.35	0.42	0.33	0.48	0.29	0.39	0.29	1.05	0.7	0.5	0.59	0.79
Er	1.07	1.28	1.09	1.37	0.73	0.78	0.75	2.81	1.83	1.49	1.62	1.99
Dy	0.15	1.82	1.62	2.23	1.68	1.66	1.79	4.65	3.6	2.45	2.91	4.17
Yb	0.69	0.77	0.72	0.88	0.72	0.7	0.66	2.54	1.68	1.6	1.45	1.87
Lu	0.09	0.1	0.08	0.08	0.1	0.09	0.09	0.29	0.16	0.2	0.2	0.25
Total	62.49	158.3	115.57	140.13	130.73	98.94	72.45	77.79	81.34	42.78	80.43	94.62

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### APPENDIX 6 : CONTINUED.

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Pluton	Bosses	Rosses	Rosses	Rosses	Rosses	Trawenach	Trawenach	Trawenad	t Trawenaoh	Trawenach	Thorr	Thorr
Unit	G3	G3	G3	G3	G4	Bi-ora	Bi-ora	Bi-ora	Mu-ora	Mu-ara	Hhi free	Hbl free
Bock type	Granita	Granita	Granite	Granita	Granite	Granite	Granite	Granite	Granite	Granite	granite	oranite
Sample	ROS18	ROS13	ROS20	ROS21	ROS10B	TRA5	TRAG	TRA1	TRA4	TRA3	5H	THI
1.0	05 16	94 97	17.0	19.00	17.07		20 76	17 99	7 55	6 07	20.2	11 67
La	20.10	51.37	20.1	97 77	04.00	47.00	20.70	22 69	1.00	41 0	60.0	11.0/
	40.1	50.1	39.1	37.77	24.00	47.00	39.7	32.00	10.0	11.0	09.0	32.0/
Pr Na	4.00	5.2	4.08	3.9	2.3/	4.81	4.00	3.40	1.32	1.13	. 7.5	2.94
	17.3	20.4	14.97	14.4	1.05	10.39	14.7	2 00	7.50	0.40	20.0	4.2
Sm	3.04	3.82	2.8	2.02	1.90	2.78	2,00	2.99	3.76	2.80	4.83	1.04
EU	0.6	0.75	0.51	0.53	0.22	0.59	0.55	0.42	0.06	0.03	0.77	0.37
Ga	2.1	2.26	2	1.96	1.91	1.78	1.99	2.32	4.04	2.74	3.7	1.44
Ho	0.32	0.4	0.29	0.25	0.5	0.28	0.35	0.29	1.27	0.46	0.67	0.19
Er	0.87	0.92	0.92	0.68	1.25	0.78	0.89	0.75	3.38	1.30	1,98	0.8
Dy	1.66	1.91	1.62	1.45	2.13	1.58	1.48	1.79	6.13	3.25	3.29	1.13
Yb	0.85	0.58	0.92	0.67	1.5	0.64	0.87	0.66	3.15	2.14	1.5	0.75
Lu	0.07	0.06	0.13	0.1	0.2	0.09	0.12	0.11	0.37	0.24	0.22	0,11
Total	101.62	123.77	85.14	82.35	62.88	99.59	87.97	76.1	54.69	38.2	151.2	63.31
Pluton	Thorr	Thorr	Thorr	Thorr	Thorr	Thorr	Thorr	Thorr	Thorr	Thorr	Thorr	Thorr
Unit	Contact	Contact	Contact	Contact	Contact	Contact	Trans	Trans	Hbl bear	Hbi bear	Hbi bear	Hbl bear
Rock type	Qz Mzd	Gdr	Gdr	Qz Mzd	Qz Dio	Oz Mzd	Qz Mzd	Qz Mzd	Qz Mzd	Qz Mzd	Qz dio	Qz dio
Sample	31/35	338	425	50AS	52S	253S	35BT	44BT	TH5	TH6B	TH4	361
1	10.0		94 7	40.0	16.0	11 6	10.4		20.3	11 67	10.0	
	20.1	77.0	54.7	42.0	25.2	26.5	29	03.0	£0.0	33.97	20.1	770
00	29.1	. //.2	02.2	09.0	30.2	20.0	20	20.0	7 5	06.07	4 5	0 5
Pr .	4.5	8.5	0.3	10.5	- 4.9	3.4	3.2	110	7.0	2.94	4.5	0.0
Na	19.5	29.2	21.0	37.2	20.2	13.2	11.5	11.9	20.0	9.2	19.5	29.2
Sm	0.90	4.21	3.12	0.57	5.10	2.01	1.9	2.34	4.83	1.84	2.90	4.21
EU	2.46	1.58	1.07	1.37	1.40	1.35	1.18	1.15	0.77	0.37	2.46	1.58
Gđ	6.9	3.3	2.4	5.1	5.4	2.1	1.1	2.2	3.7	1.44	6.9	3.3
Ho	2.28	0.84	0.66	1	1.31	0.64	0.39	0.85	0.67	0.19	2.28	0.64
Er	6.51	1.96	1.85	2.51	3.49	1.7	1.2	1.99	1.98	8.0	6.51	1.96
Dy	10.18	3.12	2.7	4.16	6.14	2.25	1.16	2.78	3.29	1.13	10.18	3.12
YD	5.3	1.31	1.43	1.67	2.59	1.74	1.04	1.37	1.5	0.75	5.3	1.31
Lu	0.7	0.19	0.22	0.25	0.37	0.28	0.18	0.21	0.22	0.11	0.7	0.19
Total	105.6	172.5	138.3	202.5	102.4	66.3	56.3	63.5	151.2	63.31	105.6	172.5
Pluton	Thorr	Thorr	Thorr	Thorr	Thorr	Thorr	Thorr	B'more	B'more	B'more	B'more	B'more
Unit	Hbl bear	Hbl bear	Hbi bear	Hbi bear	Hbi bear	Hbi bear	Hbl bear	G1	G1	G2	G2	G2
Rock type	Qz Mzd	Qz Mzd	Qz Mzd	Qz Dio	Qz Mzd	Qz Mzd	Diorite	Granite	Granite	Granite	Granite	Granite
Sample	481	531	381	3981	401	471	2771	G1/2	G1/21	G2'/39	G2'/52	G2'/90
La	10.4	11.4	34.7	42.6	16.2	11.6	28.4	20.7	23.72	15.7	15.4	11.48
Ce	23	23.8	62.2	89.8	35.2	25.5	64.8	42.5	40.49	26.3	26	21.43
Pr	3.2	3.5	6.3	10.3	4.9	3.4	8.4	n.d.	3,72	n.d.	n.d.	1.75
Nd	11.5	11.9	21.6	37.2	20.2	13.2	31.6	15	12,4	9.1	10.7	5.53
Sm	1.9	2.34	3.12	6.57	5.18	2.51	5.31	2.24	2.09	1.3	2	1.03

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## APPENDIX 6 : CONTINUED.

Pluton Unit Rock type Sample	B'more G2 Granite G2'/131	B'more G2 porp. Granite G2PF/138	B'more G3 Granite G3/186	B'more G3 Granite G3/215
La	6.06	10.38	6.57	7.5
Ce	20.14	11.68	11.76	11.53
Pr	1.16	1.24	1.03	0.97
Nd	3.72	3.89	3.08	3.5
Sm	0.78	0.69	0,59	0.68
Eu	0.18	0.11	0.06	0.07
Gd	0.7	0.64	0.53	0.55
Ho	0.18	0.14	0.15	0.18
Er	0.53	0.41	0.47	0.41
Dy	0.78	0.62	0.57	0.69
Yb	1.03	0.89	1.24	0.9
Lu	0.2	0.17	0.26	0.2
Total	32.11	30.86	23.56	23.27

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## APPENDIX 7.

## SAMPLELOCATION.

Notes.

(1) The sample locations are given using the 1:50000 map by Ordnance Survey of Ireland (Sheet No: 1, 2, 6 and 10 - Map App. 7)



Map App. 7 : Map (1 : 50000) of the northwestern Ireland showing sheets 1, 2, 6 and 10 used in this study.

SAMPLE	PLUTON	UNIT	ROCK TYPE	SHEET	<b>GRID REF</b>	
NUMBER						
ROS2	Rosses	G1A	Granite	1	824120	
ROS4	Rosses	G1	Granite	1 .	734147	e por este s
ROS4AP	Rosses	G1A	microgranite	1	735146	
ROS5	Rosses	a a <b>G2</b> - a an	Granite	1	745139	
ROS6	Rosses	G2	Granite	1	758152	
ROS7	Rosses	G2	Granite	1	799158	
ROS8	Rosses	G3	Granite	1	773148	
ROS8AP	Rosses	G3	microgranite	1	774148	
ROS9	Rosses	G3	Granite	1	780155	
ROS10A	Rosses	G4	Granite	<b>1</b>	776126	
ROS10B	Rosses	G4	Granite	1	777126	
ROS11	Rosses	G1	Granite	1	763109	
ROS12	Rosses	G1	Granite	1	786114	
ROS13	Rosses	G3	Granite	1	764163	
BOS14	Rosses	G2	Granite	· · · ·	765167	
BOS15	Rosses	G2	Granite	1	761168	
BOS16	Rosses	G2	Granite	1	762168	
BOS17	Rosses	G2 C	Granite	1	767166	
ROS18	Bosses	63	Granite		762164	化成素的
ROS10	Bosses	62	Granite	4	762165	
POS19	Bosses	62	Granite	I 	703105	
	Russes	GS CO A	Granite		704101	
NU321	Rosses	GS	Granite		703102	
HU524	Rosses	G3	Granite		778124	
HU526	Hosses	G3	Granite	1	777126	
RUS27	HOSSES	G3	Granite	1	778127	
ROS31	Hosses	Microgranite	Granite	1	734178	
ROS28	Rosses	Porphyry	Porphyry gr	1	754210	
ROS3	Rosses	Porphyry	Porphyry gr	1	775185	
ROS29	Rosses	Porphyry	Porphyry gr	1	763109	
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ARD1A1	Ardara	Outer	Qtz monzodiorite	10	734987	
ARD1B	Ardara	Outer	Qtz monzodiorite	10	734986	
ARD1C	Ardara	Outer	Qtz monzodiorite	10	733985	
ARD1D	Ardara	Outer	Qtz monzodiorite	10	732984	
ARD1E	Ardara	Outer	Qtz monzodiorite	10	733983	
ARD1F	Ardara	Outer	Qtz monzodiorite	10	733989	
ARD1	Ardara	Outer	Qtz monzodiorite	10	730988	
ARD3	Ardara	Outer	Qtz monzodiorite	10	764975	
ARD2	Ardara	Intermediate	Granodiorite	10	750972	
ARD4	Ardara	Intermediate	Granodiorite	10	760973	
ARD3B	Ardara	Inner	Granite	10	765976	
ARD5	Ardara	Inner	Granodiorite	10	755952	
ARD6	Ardara	Inner	Granite	10	745937	e standarden Standarden
ARD7	Ardara	Inner	Granodiorite	10	736933	
ARD12	Ardara	Inner	Granodiorite	10	755954	an a
ABD10	Ardara	Inner	Granite	10	744042	
ABD11	Ardara	Inner	Granite	10	748045	
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ARD13	Ardara	Inner	Granodiorite	10	757956	
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TRA1	Trawenagh Bay	Bi granite	Granite	1	802074	
TRA2	Trawenagh Bay	Bi granite	Granite	. 1	786052	
TRA3	Trawenagh Bay	Musc granite	Granite	1	781072	
TRA4	Trawenagh Bay	Musc granite	Granite Code	1	772092	
TRA5	Trawenagh Bay	Bi granite	Granite	10	768033	
TRA6	Trawenagh Bay	Bi granite	Granite	1	780075	
TRA7	Trawenagh Bay	Musc granite	Granite	1	778077	
TRA8	Trawenagh Bay	Bi granite	Granite	1 1	805046	
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TH1	Thorr	Hbl free	Granite	1	725228	
TH2	Thorr	Hbl bearing	Granodiorite	1	724153	
ТНЗ	Thorr	Hbl bearing	Diorite	6	975224	
TH4	Thorr	Hbl bearing	Quartz diorite	1	814097	
TH5	Thorr	Contact	Quartz monzodiorite	1	827141	
TH6	Thorr	Hbl bearing	Quartz monzodiorite	1	828207	
TH7	Thorr	Hbl bearing	Granodiorite	1	815225	
TH8	Thorr	Hbl bearing	Granodiorite	1	811338	
TH9	Thorr	Hbl free	Granodiorite	· • •	806300	
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		· · · · · ·				
DON1	Main Donegal	Light band	Granodiorite	6	O65223	
DON3	Main Donegal	Light band	Granodiorite	6	049225	2 
DON4	Main Donegal	Light band	Granodiorite	6	043230	
DON5	Main Donegal	Light band	Granite	1	055225	
DON6B	Main Donegal	Light band	Granite	1	852093	
DON7A	Main Donegal	Light band	Granite	1	856083	
DON8A	Main Donegal	Light band	Granodiorite	an <b>i</b> Site	863074	
DON8BT	Main Donegal	Light band	Granite	1	863074	
DON7B	Main Donegal	Dark band	Trondhiemite	1	856083	
DON8D	Main Donegal	Light band	Granodiorite	1	863074	
DON11	Main Donegal	Light band	Granite	u 🛉 estel	876065	
DON12	Main Donegal	Trondhiemite	Trondhiemite	1	876065	
DON13	Main Donegal	Light band	Granite	· • •	O61886	
DON16	Main Donegal	Light band	Granite	1.	868065	
DON17	Main Donegal	Trondhiemite	Trondhiemite	1	868065	
DON25	Main Donegal	Trondhiemite	Trondhiemite	6	055225	
DON26	Main Donegal	Trondhiemite	Trondhiemite	6	055225	
DON27	Main Donegal	Light band	Granite	6	055225	
DON42	Main Donegal	Light band	Granite	1	880065	
DON30	Main Donegal	Light band	Granodiorite	6	061226	
DON31	Main Donegal	Light band	Granite	6	061266	
DON33	Main Donegal	Light band	Granite	2	094242	
DON35	Main Donegal	Light band	Granite	2	094242	
DON38	Main Donegal	Light band	Granodiorite	2	085261	s.
DON39	Main Donegal	Light band	Granodiorite	2	081264	
DON40	Main Donegal	Light band	Granite	2	081264	
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FAN1	Fanad	Fanad peninsula	Qtz monzodiorite	2	173448
FAN2	Fanad	Fanad peninsula	Qtz monzodiorite	2	173449
FAN7	Fanad	Fanad peninsula	Qtz monzodiorite	2	172450
FAN8	Fanad	Fanad peninsula	Qtz monzodiorite	2	172450
FAN10	Fanad	Fanad peninsula	Qtz monzodiorite	2	161450
FAN11	Fanad	Fanad peninsula	Qtz monzodiorite	2	161444
FAN12	Fanad	Fanad peninsula	Qtz monzodiorite	2	154441
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FAN14	Fanad	Fanad peninsula	Qtz monzodiorite	2	196444
FAN15	Fanad	Fanad peninsula	Qtz monzodiorite	2	217467
FAN16	Fanad	Fanad peninsula	Qtz monzodiorite	2	155427
FAN16A	Fanad	Fanad peninsula	Qtz monzodiorite	2	154426
FAN17	Fanad	Fanad peninsula	Qtz monzodiorite	2	166422
FAN18	Fanad	Melmore	Qtz monzodiorite	2	125445
FAN19	Fanad	Melmore	Qtz monzodiorite	2	125445
FAN21	Fanad	Melmore	Qtz monzodiorite	2	126442
FAN22	Fanad	Melmore	Qtz monzodiorite	2	130438
FAN23	Fanad	Rosguill	Granodiorite	2	107415
FAN24	Fanad	Rosguill	Granodiorite	2	106413
FAN25	Fanad	Rosguill	Qtz monzodiorite	2	106411
FAN27	Fanad	Rosguill	Granodiorite	2	106412
FAN28	Fanad	Rosguill	Qtz monzodiorite	2	102421
FAN29	Fanad	Rosguill	Qtz monzodiorite	2	101423
FAN30	Fanad	Rosguill	Qtz monzodiorite	2	096421
FAN41	Fanad	Fanad peninsula	Qtz monzodiorite	2	231479
FAN43	Fanad	Melmore	Qtz monzodiorite	2	135436
FAN46	Fanad	Rosguill	Qtz monzodiorite	2	095422
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