FLASHING LIGHTS IN THE GRAVEYARD

Harold Mytum, **J.R. Peterson** and **Eve Campbell** describe the use of Reflectance Transformation Imaging (RTI) to understand pre-Famine memorials in County Mayo and encourage its wider use.

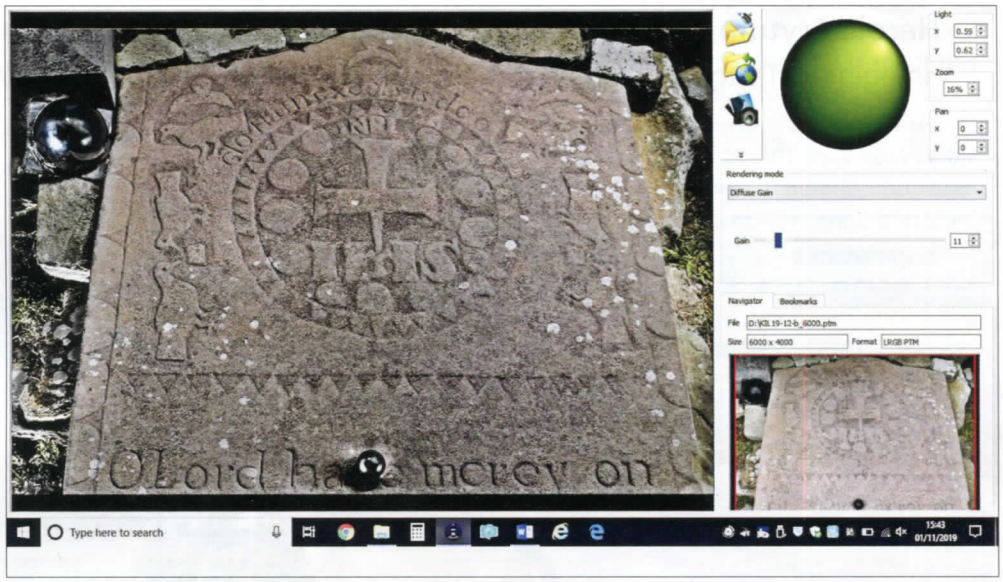
A recent survey has identified a distinctive group of ledger stone memorials in County Mayo, on Achill Island and the adjacent mainland. Many of these memorials, which were popular before the Famine, have been eroded but, with the use of Reflectance Transformation Imaging (RTI), the full range of designs has been identified. This method of recording has had limited application in Ireland but deserves to be more widely used—on memorials, on graffiti and on artefacts with surface detail.

Mayo memorials

Memorial production in nineteenth-century Ireland was regional, and numerous local traditions can be identified within a broad national set of preferences, though none until now in County Mayo. The two most common memorial types found in nineteenth-century Irish burial grounds are the headstone and the ledger—one a vertical slab, the other horizontal and normally larger and covering the whole grave. The County Mayo regional design now recognised is to be found on ledgers.

The burial ground of Killeen, Roskeen North, Burrishoole, was the focus of our study, with rapid surveys at Kildownet and Slievemore on Achill Island to the west and at Burrishoole Friary to the east. The most elaborate examples were cut from pink and red sandstones from quarries a short

Above: **Fig. 1—Using RTI to photograph the trade symbols on the bottom of a ledger to Bridget Greahan (died 1840), erected by her husband, Theady Greahan, who is not commemorated on the stone. A string is used to ensure that the flash is a set distance from the motifs; once this is moved out of the way, a digital image is taken with the camera and flash. In this exposed location at Clew Bay, a rock was suspended by rope from the tripod to reduce camera movement in the wind.**



distance away by sea; some survive in reasonable condition but many of them are badly eroded. Ledgers made from the immediately local schist rock are even more heavily weathered, though some portray traces of similar design features; they were less popular than sandstone at Killeen, though more common at the two Achill Island burial grounds.

All stone memorials are at risk of erosion but particularly ledgers, as the water on the stone surface can dissolve it or damage it through freezing. Reading inscriptions and discerning the details of any iconography can often be challenging, but the use of Reflectance Transformation Imaging (RTI) allows the recording of even quite slight traces. It has been used in Ireland by Laura McAtackney and Gary Devlin for recording graffiti (*Archaeology Ireland* **28** (2) (2014), 32–4) but deserves much wider application.

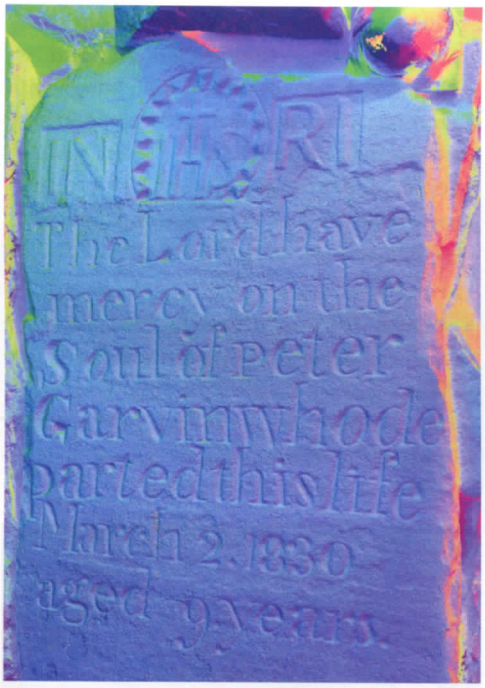
Recording with RTI

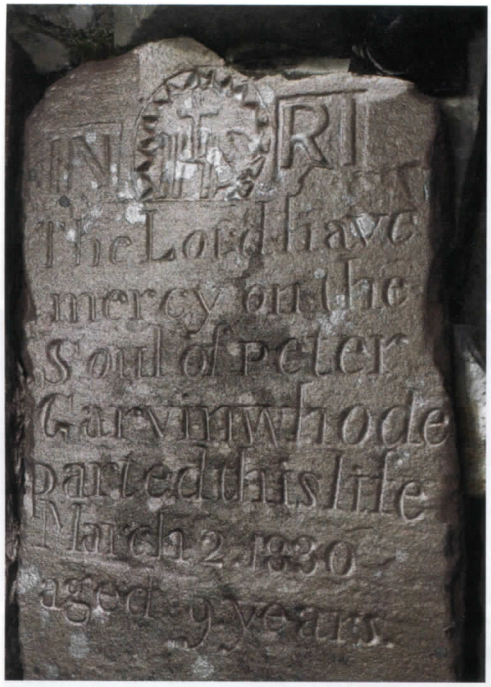
The RTI technique combines a set of digital photographs taken with a stationary camera, though with a light source moved to a different position for each image; constant distance between light and subject is maintained to avoid changes in brightness (Fig. 1). This provides a set of images with raking light from as many directions as possible. The programme can identify the position of the light source for each photograph from the position of the highlight on a reflective sphere placed within the scene, and as part of the processing it is possible to observe the distribution of flash points on the sphere to see whether they are well spread (Fig. 2); often two spheres are used to make sure that all the relevant information is captured (Fig. 3). When doing fieldwork, however, it is sometimes impossible to obtain shadow-free images from some directions (owing, for example, to other memorials or a wall); it is still possible to use the process, but the simulated light from some directions will be less effective.

Above: **Fig. 2—Blended image of the sphere, with all the flash points indicated.**

Above right: **Fig. 3—Screenshot of the RTIViewer, showing the head of the Bridget Greahan ledger, with Diffuse Gain image. Note in this untrimmed image a small reflective sphere at the bottom centre and a larger one at top right.**

Right: **Fig. 4—Mark Williams (University of Georgia, Athens, Laboratory of Archaeology) with a small RTI dome with fixed lights on the interior that he made. The dome is placed over an artefact, with a small reflective sphere to one side. The lens of a camera (held by the stand on the left) is then inserted through the hole in the top of the dome to take the multiple images.**





For photography of small objects, a dome can be constructed with fixed lights inside, each one turned on whilst an image is taken (Fig. 4). This creates a known and very even lighting pattern, and is quicker to carry out than the method described here, but is unsuitable for large objects, though an underwater dome has been developed for recording artefacts *in situ*. Domes have been used in museums to examine lithics, inscribed clay tablets, coins and a wide range of other artefacts, as well as marks on animal bone.

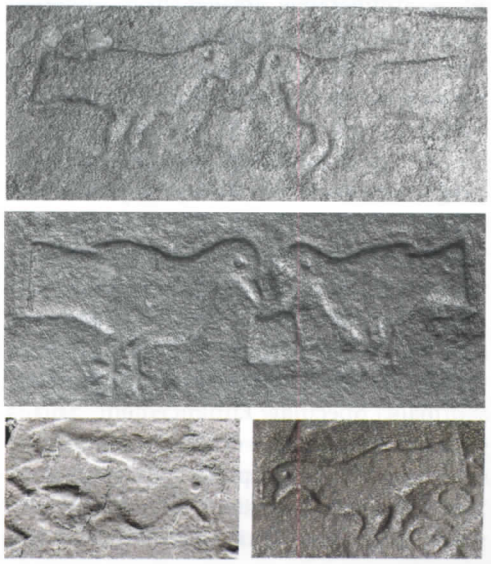
A computer programme uses the multiple images to create a dataset that can then be presented in a number of formats, after some standard checks are made on the images to ensure their quality and that the camera has not moved. A file created by this programme can then be examined with a viewer programme that is extremely easy to use, with a drop-down menu offering a range of different images of the subject. Some of these provide a static image of the object, whilst others enable the apparent direction of light to be continuously moved using a rollerball icon manipulated by the mouse (Fig. 3). The images can mimic the best angle of light to highlight features of the stone, and it is possible to enlarge particular features and examine them closely.

The viewing options after processing include selecting the best oblique angle of light using the default, though in many cases the contrast is more striking in the Diffuse Gain option (Fig. 3). These both provide full-colour images, which in some cases is desirable.

One of the outputs, termed the Normals image, colours the surface according to its geometry (Fig. 5, left). This is visually distracting, but converting the image to monochrome, and increasing contrast and sharpness, can remove this visual impact (Fig. 5, right). If the lichen is thick and completely fills in the incised or sculpted detail, as was the case with some of the Killeen monuments, RTI cannot reveal the buried elements, but where it largely involves colour variation (which was the situation for most of the memorials) this was very effective. Indeed, the minimisation of the distraction of colour differences can be one of the major advances of RTI for memorials, combined with its effective revealing of incised detail. It is often the Normals image that gives the best overall picture of the subject as a whole, although the details can be displayed by adjusting the Zoom.

Another option is Specular Enhancement, which creates a shiny effect, reminiscent of a damp surface (Fig. 6). This can often produce the most dramatic increase in detail on particular features, with the simulated light direction adjusted to best portray the element of the design under consideration. The layout of incised lines for text, details of letter-forms and tooling marks can be made visible. These images can retain some colour, but adjustment can make them monochrome, which is often when the effects are most dramatic.

Several of the ledgers featured birds in the symbolism, and it has been possible to focus on these with the Normals and Specular Enhancement options (with the display variables of Diffuse Colour, Specularity and Highlight Size adjusted to



Above: **Fig. 5—Normals image (left) of the head and text of the ledger for Peter Garvin (died 1830). The yellow and green highlights, which can be distracting, are not noticed in a monochrome image (right).**

Above right: **Fig. 6—Specular Enhancement image revealing the tooling that created the false-relief IHS with cross and inverted heart at the head of a ledger for Tully Malloy (undated).**

Right: **Fig. 7—A selection of bird motifs from ledgers, using Normals and Specular Enhancement images.**

Left: **Fig. 8—Image of the trade tools at the foot of the Bridget Greahan ledger, using different options: (a) Diffuse Gain image with colour but lichen prominent; (b) same image with Normals option; (c) same image with Specular Enhancement option; (d) Normals image converted to a monochrome image with adjusted contrast and sharpness.**

Below: **Fig. 9—An eroded schist ledger at Kildavnet. The best oblique light option (top) reveals the cut-back recesses for the cross and IHS, but greater detail of the cross and letter-forms is visible with the Diffuse Gain option. Note that the whole design is not set at right angles to the sides of the stone.**

create the most effective image) to create some comparative images from different memorials by increasing the Zoom to fill the screen before capturing the image by clicking the mouse on the camera icon (Fig. 7).

The great advantage of the RTIViewer programme is that it is very easy to switch between the various options to compare the results, capturing images whenever necessary. The trade tools images at the foot of Bridget Greahan's ledger provide an effective illustration of the different qualities of the images—Diffuse Gain, Normals, Specular Enhancement and a monochrome version of the Normals image edited in a standard photo-editing package (Fig. 8). Just two ledgers at Killeen included trade tools, but it is notable that this example commemorates a woman and displays a saw, chisel, plane and axe. The eroded schist memorials yielded few traces of designs or text in natural light or to the touch, but by using RTI the team has managed to recover more detail of the design (Fig. 9) and in some cases the extent of the text, and even to transcribe parts of the text, which has at least demonstrated that these were indeed inscribed and part of the literate culture of pre-Famine commemoration.

For many gravestones, oblique sunlight is sufficient for an excellent image, but there are many cases where the RTI method will be valuable. It is also a technique that allows detailed examination of incised and carved surfaces—such as graffiti, tooling, sculpture and metalwork—and of moulded and cast items. Institutions may wish to invest in creating a dome, but the RTI described here is possible for anyone with a reasonable standard of photographic equipment and a willingness to invest a little time in learning the processing package. The RTIViewer, for those looking at and interpreting the files, is easy to upload and use by anyone with a computer, and the developers of these systems should be thanked for providing them free to those who wish to explore the world of RTI.

Acknowledgements

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Further reading

Mytum, H. 2018 Nativity scenes on gravestones in County Louth, Ireland. *Church Monuments* **32**, 121–51.

Mytum, H. and Peterson, J.R. 2018 The application of Reflectance Transformation Imaging (RTI) in historical archaeology. *Historical Archaeology* **52** (2), 589–603.

Mytum, H., Chapman, K., Peterson, J.R. and Cross, A. 2017 Reflectance Transformation Imaging (RTI): capturing gravestone detail via multiple digital images. *Association for Gravestone Studies Quarterly* **41** (2), 3–10 (https://livrepository.liverpool.ac.uk/3009787/).