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The Iron Age in the Plastic Age: Anthropocene signatures at Castell Henllys, west Wales

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Plastic entering the archaeological and geological record may be the defining signature of the Anthropocene. Amidst the growing awareness of plastic in marine pollution, this study demonstrates its terrestrial ubiquity even in a well-maintained heritage reconstruction attraction. Excavation of two experimental roundhouses constructed on their original sites at Castell Henllys Iron Age fort, Wales, revealed the signatures of three decades of heritage interpretation and visitor activity. The nature and extent of cultural material accurately reflects known activities, but also reveals an unexpected amount of plastic debris in archaeological contexts, indicating how even in managed contexts, plastic is entering terrestrial deposits.

Introduction

The extensive use of plastic as an extremely adaptable material for artefacts and packaging are part of the dependency on oil which has had many implications including accelerating climate change (Boetzkes 2016). Indeed, plastic has been proposed as one of the signatures of the Anthropocene (Elias 2018; Zalasiewicz et al 2016), and some advocate that contemporary society should be termed the Plastic Age (Miller 2007; Thompson et al 2009; Riede et l 2016). In this context, the results of the excavations inside the two reconstructed roundhouses that have each stood for over three decades, are informative. They indicate the potential that archaeology of the recent past offers to the Anthropocene debate by considering the ways in which modern material culture – including plastics and plasticised items such as sweet wrappers – can become integrated within the archaeological record.

Castell Henllys is an extensively excavated inland promontory fort which has been a location for public interpretation for 40 years. Long-term experimental reconstructions of Iron Age timber roundhouses, constructed on the sites of the original excavated structures and utilising the site-specific archaeological evidence (Figure 1), are notable features of the fort (Mytum 1999; 2013a). This site is an iconic regional attraction for tourists, but it is also much used by schools as the Celts are part of the Welsh history curriculum (Mytum 2000). Pembrokeshire Coast National Park, who gained control of the site after the original owner, Hugh Foster, died, have provided educational resources and allocate dedicated costumed staff to interpret the remains and provide activities for the children. This ensures year-round use of the site and steady visiting of the roundhouse interiors.

Much ecological and earth science focus has been on the marine environment and the presence of plastic refuse (Hammer et al 2012), and on the worryingly high presence of plastic including microdebris in the riverine (Williams and Simmons 1996; Carpenter and Wolverton 2017), marine (Hammer et al 2012; Loboiron 2016; Worm et al 2017) and terrestrial (Rillig et al 2017) environments. Equivalent analysis using archaeological methodologies have not been integrated into the discussions, reducing consideration of the ways that plastics enter the terrestrial environment. This study provides an example of litter discards on what would appear to be a well-managed heritage site where modern refuse was systematically cleared away to retain the illusion of an Iron Age environment for all visitors. Unlike some other contemporary archaeology studies where plastic has been noted in zones where refuse may collect, such as areas where the urban homeless may reside (Crea et 2014) or the amount of plastic in landfill (Rathje et al 1992; Lehmann 2015), this study is on what might be considered a benign environment, so the high levels of plastic loss here is particularly poignant.

Plastic is a term which covers a wide range of products, with varying characteristics in production and use, and with very different levels of both opportunity for recycling and patterns of discard (Kershaw 2018). Whilst there are various options for recycling, a significant amount of plastic is either no recyclable, or escapes from the recycling loop into the environment (Clift et al 2019). Of particular relevance to the Castell Henllys assemblages were plastic food packaging and use products such as straws and spatulas, cling film, bottle tops, and plasticised sweet wrappers (Griffin et al 1996; Kershaw 2018, Table 2.2), mainly related to schools parties. Other plastics frequently recovered include fragments of sheeting used to protect items from the damp, and offcuts of plastic string and rope that relates to the management of the site and possibly inauthentic use during the filming of the reality television series, Surviving the Iron Age (Firstbrook 2001). For all its claims to be an experimentation in later prehistoric living, the on-site occupation involved numerous compromises between the ideals of Iron Age recreation and the use of twentieth-century volunteers to create a string of coherent television episodes.

Two of the roundhouses came to the end of their heritage interpretation lives in 2017 and 2018, after 35 and 30 years of use respectively. In prehistory the buildings could have continued in use as they were, or they would have required a small amount of maintenance to refurbish them, but modern health and safety concerns meant that the National Park decided on dismantling and rebuilding them. Fortunately, appreciating the value of an archaeological perspective for the redesign and rebuilding and the importance of these long-term experimental structures, the National Park arranged that both roundhouses were excavated after the dismantling phase. Investigation of the structural evidence has, as expected, thrown light on decay processes and how archaeological signatures of reconstructed buildings can throw light on interpreting later prehistoric structural remains (Mytum and Meek 2020). These excavations complement others at Butser Ancient Farm and St Fagan's National History Museum where similar results have been noted (Bell 2009; 2014). It had also been anticipated that the artefact assemblages and distributions could act as valuable tests for the correlation of accidental discard with activity patterns, given that the distinctive use of the two roundhouses was documented over their lives, as was also noted at St Fagans (Bell 2014). This was indeed the case, but the composition of the assemblages, notably in the scale of the plastic found,

was unexpected and throws light on the ubiquity of this material over the last three decades.

The archaeological study of contemporary material culture was first approached from a comparative perspective to throw light on past behaviours based on the production, use and discard of modern material culture, and sometimes included that which was industrially produced (Rathje et al 1992, Rathje and Murphy 2001). Most experiments on formation processes have used replica artefacts such as lithics or ceramics, and generally considered modification and movement of these artefacts rather than the creation of deposits incorporating them, though there are notable exceptions (Banerjea et al 2015, Lewis & Waites 2019, Wilk & Schiffer 1979). There has been even less archaeological interest in contemporary debris throwing light on tourist behaviour and heritage management, and this study offers an example of how such research could be of value.

The roundhouses and their use lives

The first roundhouse to be completely excavated and the first to be rebuilt at Castell Henllys (Mytum 1986) was a double-ring roundhouse with the conical roof supported on the exterior wall and an interior ring beam suspended on an inner ring of timber uprights. It was erected in 1982 and was dismantled in 2017. This structure, c.9.5m in diameter, was called the Cookhouse in the National Park public interpretation, and had been used for the demonstration of a domestic Iron Age roundhouse interior with central hearth and peripheral features such as beds and storage in the area between the uprights and the wall (Figure 2). Light largely came from the doorway to the south-west, with the doors being kept open whenever the site was open to the public. Even with a fire lit in the central hearth, the light levels fall considerably away from the doorway and immediately around the hearth, though not to the extent of the second roundhouse discussed here.

The main interpretation activities in the Cookhouse had been linked to cooking and weaving, with a portable loom stored within the structure and sometimes taken outside for demonstrations. Many school parties had their pupils' faces decorated with face paints in Celtic designs (Mytum 2000) by staff standing just outside the roundhouse, but the materials for this activity were stored within the building. The patterns of use in the Cookhouse included the public sitting round the fire and enjoying the atmosphere. Despite this roundhouse being the most frequently visited, relatively little debris accumulated because the public would either enter for a brief inspection of the interior, or would circulate round by the inner ring of posts and perhaps sit round the hearth and absorb the atmosphere, rather than carrying out any activity that could easily lead to any discards. Replacement of timbers (Mytum and Meek 2000) did not lead to significant opportunities for artefact deposition, and patching of the flooring at the entrance was repeatedly worn away. Although there was periodic rearrangement of interpretive items within the roundhouse, the basic layout of central hearth and seats around it, with beds to the rear remained throughout.

The Earthwatch roundhouse was erected in 1984 and dismantled and its site excavated in 2018. It had been designed with no internal earth-fast posts, which created a large open space c. 11m across. Once the National Park took over the

site, however, roof props set on stone footings were considered necessary for public safety, and this altered the use of the internal space (Figure 3). Of even more importance, however, was the provision of curved benches around the hearth and also against the wall on the southern and western portions of the house on which visitors – but particularly school parties – could sit as part of their visit linked to the Welsh national curriculum (Mytum 2013b). They were told stories about the Iron Age, and in bad weather would eat their packed lunches in this roundhouse.

The floor within the roundhouse sloped steeply down from the north to the south, and on at least two occasions the southern part was raised to improve access to this part of the structure. This allowed the sealing of the earlier floor and any refuse on it. Only the portion close to the wall was extensively excavated, but this was in both the darkest part of the building and also where it would be expected that debris would accumulate, especially beneath the benches set against the wall here. The roundhouse floors were clay, though worn away badly where the soft gravel subsoil could be scuffed up by school parties and where insufficient patching was undertaken. Nevertheless, the artefacts reveal both a distribution of small items trodden into the floor and larger assemblages against the wall on the southern side (Table 1). Some items also entered the archaeological record by the process of sweeping the floor, with piles of debris immediately adjacent to the exterior of both door posts, beneath the eaves of the thatched roof. The oldest best before date on a wrapper was February 2002 and on a Duracell AAA battery January 1999, but only a tiny proportion of items had the date visible.

The other major location for finds was within a thick accumulation of ash in the central hearth defined by a drystone wall to create an elevated position for the fire which meant that it was not easy for a child to fall into the flames. Some debris in the hearth (such as numerous nails and staples) derived from the burning of scrap wood, with the metal fittings remaining within the ash from the timber. The materials that had not been consumed by the fire may have been thrown in by adult or child visitors, or by heritage staff after tidying up the floor, anticipating that they would be burnt. Nevertheless, a considerable amount of material accumulated within the ash, either being added when there was no fire, or placed on the cooler periphery and becoming incorporated within the ash so that it never caught light. Whatever the details of the motivation and method of deposition, the result was that the central ash deposits accumulated a considerable amount of plastic and plasticised debris that would become incorporated into the terrestrial environment when the ash was removed and dumped elsewhere.

Both roundhouses were partially demolished before excavation, with the movable internal fittings such as looms and other replica items including beds taken out before the thatching removed and then the roofing dismantled. The only exception was some of the bench seating in the Earthwatch roundhouse which were surreally left in place until removed as part of the excavation; their timber uprights sat on the floor surface and in some cases on removal left a circular patch of wood dust, a result of the woodworm infestation which affected furniture and structural timbers alike. The Cookhouse inner ring of posts was removed but, as these posts had rotted through at ground level, this did not disturb the archaeological contexts at all. In both cases, parts of the standing walling was taken down, or fell down, but there was no

effort to clear away all the debris from the dismantling so there was in effect a thin sealing deposit of superficial debris covering the latest floor surfaces.

Methodology

Artefacts recovered from each roundhouse during initial cleaning of surface deposits following demolition were recorded by quadrant, and either within or outside the wall line of the building. Thereafter, all finds from within secure contexts were all recorded in three dimensions or, where in dense concentrations, as assemblages in portions of the site c. 0.3m in diameter. Closed contexts such as postholes had the artefacts retained without further spatial definition, and the hearth ash deposits were recorded by quadrant. This level of spatial recording has allowed consideration of patterning of loss and integration within the various deposits which formed within and around the roundhouses, but the main interest here is the overall proportions of materials and the range of the debris represented in the assemblages. The artefacts have been individually catalogued, and assemblages subdivided as far as possible to the level of separate artefacts. However, for some categories such as cling film, plastic sheeting and sweet and straw wrappers, it was only possible to count the fragments. Some wrappers were sorted by colour in the large assemblages, but this study does not claim to identify the minimum number of snack bars or sweet packets. The figures thus represent plastic fragments not original plastic or plasticised items; this method of quantification is also applied in ecological studies measuring plastic waste (Cózar 2015; Eriksen et al 2014; Williams and Simmons 1996).

The Cookhouse assemblage

The assemblage from the roundhouse was a diverse collection of materials relating to the initial construction, its maintenance and use by staff, and casual losses by visitors (Table 1).

Roundhouse construction was represented by five circular perforated white plastic tags, each with a number and the word 'FERTÖ' in black (Figure 4), derived from bundles of reed imported from Hungary to augment the reeds cut from the nearby Nevern estuary. These tags all accumulated in the eaves drip gully dug at the point where the thatch came close to the ground. The gully was not maintained and silted up, sealing in the tags, and representing both the construction phase of the roundhouse but also the lack of gully maintenance and the speed with which it filled with silt and wind-blown leaves and some other items of refuse.

The floor was kept relatively clean; most debris accumulated around the edges of the building and under furniture. Some were explicable in terms of location: loom weights lying where the loom was stored, tools left at the base of the wall and forgotten, and a metal bowl containing small plastic tubs of face paint and a tin of beeswax placed under the raised bed at the rear of the roundhouse (Figure 5), subsequently buried under gravel sweepings from the floor which staff did not clear out of the structure but pushed under the bed. The floor-level hearth, which had undergone a series of major refurbishments, contained very little debris as it was regularly cleaned out and the ash deposited elsewhere. Other finds represent casual losses as visitors moved about the interior; these included coins, a plastic camera viewfinder and a mobile phone battery (Figure 6).

The amount of refuse in the Cookhouse was limited and only small amounts of sweet and snack wrappers were recovered. This partly reflects discard rates – visitors did not sit to consume such products regularly in this space – and that it was easier for staff to notice litter in this relatively well-lit roundhouse. Despite having the most occupants living in this roundhouse during the TV reality series, there was no definite no evidence of their presence. The darkest areas either side of the door against the wall, and either side of the beds at the rear zone farthest from the door, were areas least visited by tourists, but did accumulate some items.

The Earthwatch roundhouse assemblage

The Earthwatch roundhouse floors were less clean than those of the Cookhouse, with items trampled into the surface, but most refuse deposits again accumulated near the walls, particularly on the darkest, southern side of the building. The assemblage from this roundhouse was both substantial and included over two thousand plastic or plasticised fragments. The composition of the assemblage reflects the mix of the visitors and their activities within the roundhouse. These can be divided into three categories – the consumption of food, drinks, and sweets; other visitor losses; and materials associated with operating the heritage attraction (and probably including the period when the television series was being made and people were living in the roundhouse).

Evidence of food consumption is heavily based on plastic items, though a complete carving knife, a metal fork and spoons were also recovered. The most ubiquitous packaging item was cling film (Table 1), in pieces of varied size, and difficult to quantify because of its fragile nature. Also notable were plastic items for consuming food, such as spatulas (e.g. ‘Lunchatool’) and small forks and spoons (Figure 7). Two cheese string, two Pepperami and one Lunchables pizza wrappers, and one foil Dairylea Dunkers foil reflects similar small-sized products. One ketchup wrapper was recovered, but it seems that most food was prepared to be ready to eat without further attention. A complete Golden Wonder noodles foil lid and two lid fragments were also found (with many other foil items often associated with plastic containers or sweets), but no food pots. A more healthy eating choice is represented by 21 plasticised apple stickers, revealing a range of popular apple varieties including Braeburn, Cox, Golden Delicious, Granny Smith, Pacific Beauty, Pink Lady, and Royal Gala.

No plastic drinks bottles were recovered – any discarded would have been easily seen and recovered by visitors and heritage staff – but the tear-off sealing strips and the bottle caps themselves were common. Although four metal bottle caps and three caps or wrappers for wine bottles reflect alcohol consumption, almost all finds relate to soft drinks. A Volvic label and Calypso Tom & Jerry drink top were attributable to brands, but most of the 34 bottle caps were not. In addition, there were sealing strips and pull-off covers from bottle mouths. The other major drinks-related find category was the plastic straw from a drinks carton, and the packaging for the straw that would have been fixed to the side of the carton. There were 18 plastic straws and 210 fragments of straw packaging (Figure 8), but not a single drinks carton. Sweet wrappers were the most common single find (Table 1). Many of these are plasticised paper, and ranged from large portions of snack bar wrappers (including Dairy Milk,

Mars, Milky Way, Snickers, Toffee Crisp, Twix) to the individual sweet wrappers or bags (e.g. Campino, Fox's Glacier mint, Fruity Pops, Haribo, Juicy Chews, Maoam Bloxx chews, Polo Smoothies), but most were small items torn off and lost whilst the main part of the covering was retained or easily noticed and recovered, though some could still be identified through a distinctive design feature.

The operation of the heritage attraction at times involved use of plastic sheeting, for example to protect items in the roundhouses during rethatching, and plastic string or rope is sometimes used by staff before being replaced by a more sympathetic alternative. A small number of plastic clothing items were found – a button and toggle from a waterproof jacket, and there were personal items including a pair of children's spectacles and five hair bobbles and bands.

The large number of items from the Earthwatch house reflects discard rates – children in particular sat and consumed sweets and pack lunches regularly in this space – and the lower light levels within the building so that it was harder for staff to notice any litter. Added to this, the built-up hearth and the repeated raising of the floor to the south created artefact traps where material could accumulate (Wilk & Schiffer 1979).

Fragmentation

The process by which the items became fragmented can be identified through study of the pieces of litter compared with the complete items from which they came. The primary pattern was human agency, tearing open a chocolate bar wrapper, or removing a straw wrapper from its drinks carton as part of the process of piercing the carton with the straw (Figure 9). Relatively few whole wrappers were recovered, suggesting these were retained by the consumer or easily collected by the heritage staff, though some larger parts were crumpled up and so were less visible. The dropping of the fragments may have been accidental – indeed the wrapper may have just been opened and the torn fragments were by-products, but they could have been deliberately dropped as this socially unacceptable behaviour would not be easily observed inside the roundhouses. Some packaging may have been torn into small pieces by fidgeting children, and some items were probably deliberately deposited, including an almost complete Godzilla-themed thermos wrapper, but other larger items, such as a complete pair of child's spectacles, were presumably lost accidentally (Figure 10). Another process of fragmentation was rodent activity; refuse including plastic and plasticised items were taken down into burrows made in the soft deposits where the upright structural timbers had rotted below-ground. Thus, not only human but rodent agency incorporated plastic and other refuse within archaeological deposits as they formed.

Narrow rings of plastic used to seal bottle caps in place also occur, a throw-away item similar to the aluminium ring pulls there were also found (MNI six of the older detachable types, MNI ten of the fixed type but which had been wrenched off and, in many cases, then folded). Although the attached ring pulls should reduce discard, clearly some users relish the challenge of separating these from the can, and this may not be easily resolved by manufacturers. There were also, however, a substantial number of plastic bottle tops, which would have rendered the containers unusable, probably dropped and rolled away and not recovered in the dark space.

Many items reveal fragmentation caused by deliberate human agency and rodent action, but some of the breakage may have been through attrition from trampling; there is no obvious evidence of decay in the relatively short period that the items have been buried.

Conclusions

The artefact assemblage at the Cookhouse and Earthwatch roundhouses at Castell Henllys reveal many aspects of heritage activity at the site over the last 30 years and, by extension, the ways in which late twentieth- and early twenty-first-century life is creating distinct patterns which can be seen as part of the Anthropocene signature. One of the most significant features of the assemblages is that they show some common patterns of behaviour by visitors and staff in the two structures, but other distinct differences in light level and organised activity also play their part. The better-lit Cookhouse has fewer lost items, but clearly represents the initial thatching using bundles with plastic tags, and subsequent face-painting activities that took place immediately outside, with the materials stored within the roundhouse. In contrast the Earthwatch roundhouse reveals the consumption of packed lunches by school parties particularly vividly. It is notable that children are a major contributor to plastic pollution in this context, partly because of the sorts of sweets and snacks they consume which are marketed for them. The brightly coloured, plasticised wrappings and the packaged snack foods such as Dairylea dunkers and small drinks cartons with plastic straws are specifically designed and marketed to parents for pack lunches. It is these items that comprise the dominant archaeological signature for contemporary heritage visiting activity, and the ubiquity of plastic is overwhelming. The National Park is planning to use the results of the excavation in its education campaigns to encourage visitors and school parties to care for the environment and not leave any litter behind.

Archaeology for all periods is dependent on material culture that has become incorporated into deposits and so available for archaeological recovery in the present. What is distinctive in recent deposits is the amount and range of materials, including the presence of high levels plastics, including plasticised packaging, especially in this case for sweets and drinks. Whether the Anthropocene should be defined by the presence of plastics or not, the highly controlled examination within a long-term experimental and interpretation context discussed here has at least provided incontrovertible evidence to support the use of the term the Plastic Age for the late twentieth and early twenty-first century. With many initiatives to now switch from disposable plastic and plasticised items, this may be a narrow chronological horizon, but an archaeologically distinctive one.

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Table 1

Roundhouse Finds

	Cookhouse	***Earthwatch***
Metal		
Ring pulls	4	16
Bottle caps	5	7
Coins	7	15
Tools	7	6
Foil	23	128
Nails	100	290
Other	48	76
Plastic/Plasticised paper		
Thatching tags	5	0
Face paint containers	5	0
Bottle caps and rings	12	34
Straws	4	18
Straw wrappers	44	210
Sweet wrappers	103	997
Apple stickers	1	21
Other food related	9	234
Clothing	1	17
Other incl. sheets, bags	87	507
All other materials	151	183
Total of all materials	422	2759

Figures and captions

Figure 1. View of the Cookhouse (right) and the Earthwatch roundhouse (left) prior to their dismantling and excavation.

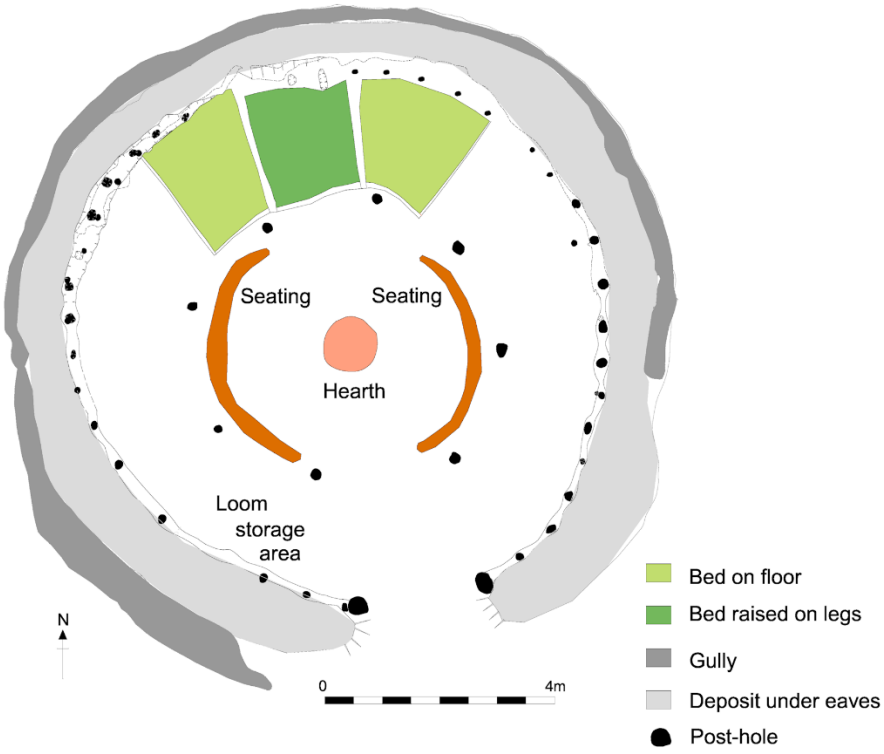

Figure 2. Plan of the Cookhouse structural elements and some of the internal features.

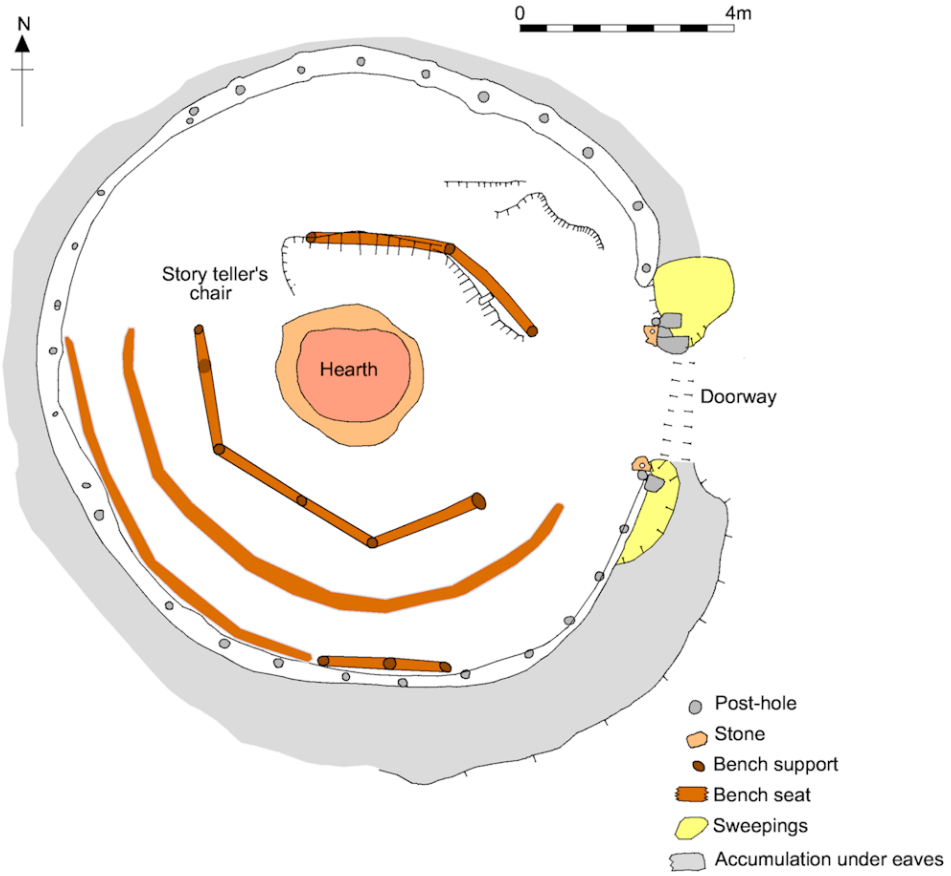

Figure 3. Plan of the Earthwatch roundhouse structural elements and the benches.

Figure 4. Plastic disc from a bundle of Hungarian thatching reed, lost 1982.

Figure 5. Finds from the Cookhouse associated with heritage interpretation. Face paint containers.

Figure 6. Finds from the Cookhouse associated with visitors. Mobile phone battery and camera eyepiece.

Figure 7. Plastic items associated with consumption of packed lunches.

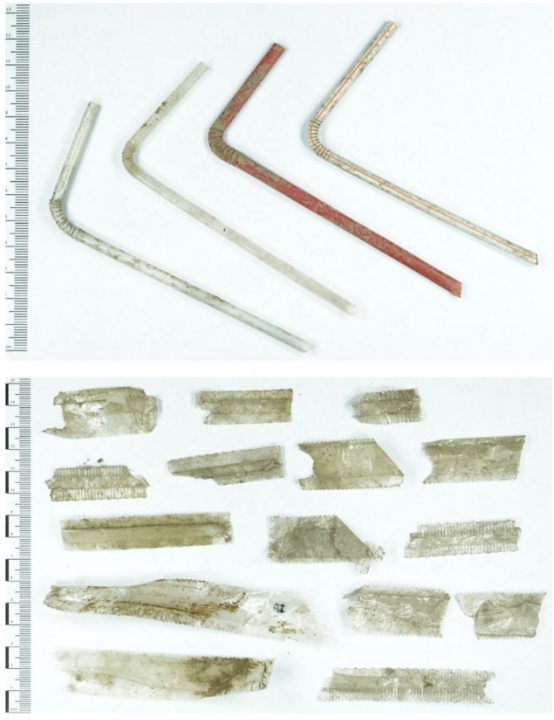

Figure 8. Examples of plastic straws and straw wrapper fragments.

Figure 9. Examples of the small fragments of sweet wrapper recovered.

Figure 10. Child's plastic spectacles.