GeoArch

Report 2024/16

Assessment of archaeometallurgical residues from Pendinas hillfort

Dr Tim Young
9h August 2024
Updated 23rd August 2024

Assessment of archaeometallurgical residues from Pendinas hillfort

Dr T.P. Young

Abstract

Excavations at Pendinas hillfort produced a very small quantity of metallurgical residues. The most significant item was a fragment from a large ceramic tuyère, although the piece was not quite sufficient to demonstrate conclusively whether it was a fragment from a circular/elliptical-section tuyère, a 'D'-shaped example or a rectangular sectioned tuyère with rounded corners, a well-rounded form is most likely.

The context (2013) that produced the tuyère sherd also yielded two small fragments (total 27g) of dense slag, probably fragments from small smithing hearth cakes (SHCs) indicative of blacksmithing.

A single small iron slag fragment, also from a small SHC from blacksmithing, came from a separate location (context (6008).

Context (1009) produced a single tiny (0.2g) fragment of fuel ash slag. Such slag is typically not of metallurgical origin, but from a source such a long-burning domestic hearth or a cereal-drying kiln.

Context (6038) produced a small quantity of concretionary material that is most likely to have been formed in a hearth or an ash deposit.

Contents

Abstract 1
Contents 2
Methods 2
Assemblage 2
Interpretation 2
Further work 3
References 3

Methods

All materials were examined visually, using a low-powered binocular microscope where required.

The assemblage was produced during excavation by the Dyfed Archaeological Trust (now Heneb).

This assessment was conducted in August 2024 and was commissioned by Ken Murphy.

Assemblage

SF <#38> ' furnace lining' context (2013)
The main piece is a rounded fired clay mass showing a curved margin, showing a radius of approximately 60mm subtending approximately 90 degrees. The piece has a grey, reduced-fired, surface laterally, becoming vitrified and lightly slagged in the centre, but oxidised-fired internally. This characteristic morphology and pattern of alteration allows its interpretation of a fragment from the margin of a cermaic tuyère. Towards the likely original centre of the tuyère, the section shows 5mm of dark vesicular glass, over 15mm of contorted partially melted vitrified clay passing down to the planar rear face of the piece with its soft, low-fired clay.

The principal piece weighs 76g, with a detached fragment an additional 4g. The bag contains 16g of fine debris.

SF <#38> slag, context (2013)
This find includes two iron slag fragments with a very similar appearance and weathering. One piece (11.3g) has a smoothly fuel-dimpled base, is internally vesicular, and has its top fractured away leaving an area with reddish stain from weathering The second piece (15.2g) is a dense slag with large voids (and the outlines of filled voids. One surface is smooth, but with conical depressions, and has a micaceous-appearing surface. The opposing face is fractured away leaving a red stain as on the first piece. Both pieces contain charcoal debris. These pieces are fragments from small smithing hearth cakes (SHCs).

SF <#58> slag, context (6008)
This is an 18.4g fragment of dense iron slag from a sheet or cake up to 20mm thick. The basal surface shows the terminations of small descending prills with reddened surfaces. The top is strongly haematised and probably rather wispy above a variably vesicular internal texture. No fuel clasts are preserved. This piece is likely to be from a small smithing hearth cake where the air blast has carried around the cake after its formation and produced superficial oxidation.

Context (1009)
This is a tiny (0.16g) fragment of fuel ash slag. It comprises a bloated grey material, traversed by cream-coloured films.

Context (6038)
This produced a tiny assemblage (0.55g, 13 grains) of concretionary material. The grains are formed of quartz grains and charcoal fragments with a brown matrix. These grains cannot be identified fully without microscopic analysis but they are most likely to be the result of post-depositional concretion, following remobilisation of elements (probably calcium) from ash. If so, they would be indicative purely of an ash deposit, rather than any particular pyrotechnological process.

Interpretation

This small assemblage provides evidence for ironworking (blacksmithing) at Pendinas. The appear to have been incorporated into rampart deposits and the actual focus of the activity was not located.

Tuyères are an uncommon component of Iron Age metalworking assemblages in Britain. Most early ironworking in Britain appears to have employed a simple perforation through the clay wall for a blowhole; the use of a specially prefabricated tuyère is less commonly encountered. The misidentification of pieces of simple blowholes as tuyères complicates their published record, as does the similarity of tuyères to loom weights. Nonetheless, there are several known examples both of rounded (circular, elliptical or 'D-shaped') and rectangular cross section. Although only a small part of the tuyere is preserved, the 60mm radius of curvature of the preserved piece suggests that it is from one of the more rounded forms.

The rectangular-sectioned tuyères were described by Pleiner (2006, 132) as being characteristic finds from the Iron Age oppida of Europe. They are rare in Britain but are represented by examples from the Middle Iron Age for copper smelting at Four Crosses, Shropshire (Young 2006, 2010a; Havard *et al.* 2016, illus. 17), apparently for iron working at Gussage All Saints, Dorset (Spratling 1979, 129), probably for ironworking at Mucking, Essex (Dungworth & Bayley 1999) and for iron smelting at Probus, Cornwall (Young 2023). They also occur in late Iron Age or early Roman assemblage from Axminster (Young 2015) and undated fragments were also recovered from Ipplepen, Devon (Young 2022). Although Tylecote (1999) claimed that block tuyères are 'typical of the Roman period', he provided no British comparative examples besides a 100mm square-sectioned example from Carpow in Scotland (Tylecote 1986,1999) but this occurred in a dump of smithing waste in the upper fills of the legionary fortress ditch and is thus probably not culturally Roman.

More rounded forms are usually considered more typical of the early medieval (particularly in Ireland and in Merovingian Europe), however some Iron Age examples are known from Britain. At Threemilestone,

Cornwall (Young 2008, 2021): the most complete specimen from the ring-ditch of Middle Iron Age House 6 (c4501) suggested an ellipsoidal face, about 150mm by 100mm. Small fragments from Nesscliffe Hill Camp, Shropshire (Young 2024) are suggestive of a similar form. McDonnell (2024) has illustrated what appears to be a tuyère of this same form, from an Early Iron Age context at Wittenham Clumps, Oxfordshire, although the original curvature of the section is somewhat obscured by slag and other adhesions.

In some previous material, curvature in the proximal/distal direction also occurs and an overall form somewhat similar to that of a rugby ball in the most elongated round-sectioned examples, or half a rugby ball where there was a planar rear face, may be inferred. In the present material a curve between the face and sides is also present, slightly truncated by the slagged part of the face. This suggests that the face may have originally been bulbously protruding – so potentially of a half-rugby ball form, although the piece is insufficient to determine whether the form would have been prolate (like a rugby ball) or more oblate (closer to a curling stone in shape). Reconstruction of the original form of such tuyères is difficult because almost all archaeological examples have been used – and therefore become truncated distally through meting of the area around the blowhole.

The fuel ash slag is not indicative of originating process but is likely to be non-metallurgical. such slags typically form where a siliceous substrate becomes partially melted under the fluxing influence of calcium- and potassium-rich fuel ash. Small particles such as this may be produced in domestic hearths (e.g Young 2011), cereal drying kilns (e.g Young 2010b) and other contexts where heating persists over long periods of time.

Further work

Unless there are specific archaeological questions to be asked of the material, there would be little archaeological benefit from further investigation, so no further analysis is suggested.

References

DUNGWORTH, D. & BAYLEY, J. 1999. Crucibles, moulds and tuyeres from Mucking, Essex, Ancient Monuments Laboratory Report 72/1999. Historic Buildings and Monuments Commission for England.

HAVARD, T., DARVILL, T. & ALEXANDER, M. 2016. A Bronze Age Round Barrow Cemetery, Pit Alignments, Iron Age Burials, Iron Age Copper Working, and Later Activity at Four Crosses, Llandysilio, Powys, *Archaeological Journal*, **174**, 1-64.

MCDONNELL, G. 2024. Archaeometallurgy. pp156-159 and Fig. 89, plates 1-4, in N. Jackson, *Earth Trust Visitor Centre: Archaeological Strip, Map and Sample (SMS) Excavations, Planning Phases 1, 2 and 3 Little Wittenham, Oxfordshire.* DigVentures unpublished report. *(https://digventures.com/projects/earth-trust/).*

PLEINER, R. 2006. *Iron in archaeology; early European blacksmiths*. Praha.

SPRATLING, M. 1979. The debris of metalworking. In: G.J. Wainwright, *Gussage All Saints. An Iron Age settlement in Dorset.* London: HMSO, 125-149.

TYLECOTE, R.F. 1999. Ironworking, p. 569 in: J.N. Dore & JJ. Wilkes 'Excavations directed by J D Leach and J J Wilkes on the site of a Roman fortress at Carpow, Perthshire, 1964-79', *Proc Soc Antiq Scot*, **129**, 481-575.

YOUNG, T.P. 2006. Evaluation of archaeometallurgical residues from Four Crosses, Powys. *GeoArch Report 2006/11*. 3pp.

YOUNG, T.P. 2008. Archaeometallurgical residues from Richard Lander School (RLS04) and Truro College (TCF05). *GeoArch* Report 2007/22. 31pp. & 10 plates

YOUNG, T.P 2010a. Archaeometallurgical residues from Domgay Lane, Four Crosses, Powys. *GeoArch Report 2010/23*, 51 pp.

YOUNG, T.P. 2010b. Fuel ash slags. p. 163 in: Crane, & Murphy K., Early medieval settlement, iron smelting and crop processing at South Hook, Herbranston, Pembrokeshire, 2004-05. *Archaeologia Cambrensis*, **159**, 117-196.

YOUNG, T.P. 2011. Possible archaeometallurgical residues pp. 89-90 in: M. Collard & T. Havard. The prehistoric and medieval defences of Malmesbury: archaeological investigations at Holloway, 2005-2006. *Wiltshire Archaeological & Natural History Magazine*, **104**, 79-94.

YOUNG, T.P. 2015. Archaeometallurgical residues from Cloakham Lawn, Axminster. *GeoArch Report 2015/15*. 6pp.

YOUNG T.P. 2021. Industrial Residues. Pp. 241-250 in: J Gossip 'Section 5: Life Outside the Round: Bronze Age and Iron Age Settlement at Higher Besore and Truro College, Threemilestone, Truro, 2004–5'. Pp.147-280. In A. M. Jones & G. Kirkham (eds) *Later Prehistoric Settlement in Cornwall and the Isles of Scilly: Evidence from Five Excavations*. Oxford.

YOUNG, T.P. 2022. Assessment of residues from Ipplepen. *GeoArch Report 2022/13*, 34pp.

YOUNG, T.P. 2023. Assessment of materials from Probus, Phase 2, Cornwall. *GeoArch Report 2023/25*, 18pp.

YOUNG T.P., 2024. Assessment of archaeometallurgical residues from Nesscliffe Hill Camp, Shropshire. *GeoArch Report 2024/01*, 10pp.

GeoArch

geoarchaeological, archaeometallurgical & geophysical investigations

Unit 6,
Western Industrial Estate,
Caerphilly,
CF83 1BQ

Office: 029 20881431
Mobile: 07802 413704

E-Mail: Tim.Young@GeoArch.co.uk
Web: www.GeoArch.co.uk