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Pyrotechnological residues from Mount St Albans, Newport and Tyn y coed, Vale of Glamorgan

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Abstract

The submitted material comprises two fragments, one from each of the recently-excavated sites at Mount St Albans, Newport, and Tyn y coed. Dinas Powis, Vale of Glamorgan.

A small particle from Mount St Albans was a fragment of fuel ash slag. Such material is likely to be non-metallurgical in origin and may have derived from, for instance, a domestic hearth or a cereal-drying kiln.

The particle from Tyn y coed was of coke, probably an unintentional residue from the burning of coal, rather than a fragment of metallurgical coke. It is not possible to discriminate between the various potential origins of coke, although domestic hearths and steam boilers are probably the two most-commonly-encountered sources.

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Methods

All materials were examined in July 2017 visually with a low-powered binocular microscope where required. As an assessment, the materials were not subjected to any high-magnification optical inspection, not to any form of instrumental analysis. The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional.

This project was commissioned by Dr Andrew Seaman, of Canterbury Christ Church University.

Results

MSA16 (1220): A small (15mm, 12mm x 9mm), crudely sub-spheroidal bleb of highly vesicular ('frothy'), superficially pale, but internally dark greenish-grey slag. It is not certain whether the particle morphology is original, or purely the result of abrasion. One small area of the particle surface shows a preserved smooth surface, but the exterior is mostly covered by a thin concretionary layer directly over the vesicular slag.

Such a slag may be identified as a 'fuel ash slag'. These are formed by the fluxing action of a fuel ash (typically rich in alkali- and alkali earth- elements) on a clay-like substrate. Reaction produces a viscous melt (often a partial melt in which remnant quartz and sometimes other grains, survive as relicts; known as a buchite). The viscosity of the melt is such as to prohibit the escape of gaseous material, mostly water vapour and carbon dioxide) liberated by dehydration and decarboxylation of the substrate minerals.

TYC13 (702): This is a small fragment of coke, 23mm x 21mm x 12mm, with a convex original outer surface forming two sides and fractures the others. The outer surface shows several small patches of fractured plant remains and further examples can be identified as thin tabular voids internally. One larger such body shows the tabular void filled with a fibrous, charcoal-like material. The majority of the piece is very finely vesicular, with the intervening material having a bright, almost metallic, lustre.

Coke is the organic product of incomplete combustion of coal. Although coke was (and is) manufactured deliberately as a fuel for many industrial (particularly metallurgical) processes, the same material can be produced accidentally in coal-fired hearths and will be a significant component of the 'ash' removed from them.

Interpretation

MSA16 (1220): fuel ash slags may be formed in many types of hearths, but are most characteristic of non-metallurgical hearths. In metallurgical contexts in which the metal is directly present in the earth (deliberately, as in iron working, or accidentally as spills in non-ferrous metalworking) the slag phase incorporates some of the metal and entirely different materials would be formed. Fuel ash slag may be a significant part of the residue assemblage from non-ferrous metalworking, for instance in the melting of copper alloy in which the metal is securely contained within a crucible.

The most common archaeological occurrences of fuel ash slag relate, however, to non-metallurgical processes, particularly to the use of cereal drying kilns. It has been documented from cereal kilns at South Hook (Young 2010a, 2010b), Ysgol Bro Dynefor, (Young 2015), and Bornais (Young 20015, 2016).

Other origins include a possible source in lime-burning (Young 2012b) and in the conflagration of buildings constructed with daub (Young 2012b). Large domestic hearths were probably responsible for the 'Iron Age Grey' slags that occur particularly in Middle Iron Age contexts in central and eastern England (Cowgill 2000, 2008; Cowgill *et al.* 2001; Swiss & McDonnell 2001; Young 2009, 2011; Young & Bowstead Stallybrass 2003), and which share many structural and morphological features with the coarse fuel ash slags from external hearths at Bornais (Young 2012a). The generation of fuel ash slags in these settings is also similar in many ways to the formation of 'cramp' (Photos-Jones *et al*. 2007).

With such a small fragment of fuel ash slag from Mount St Albans, determination of an origin from within these closely-related settings is not possible.

TYC13 (702): The origin of the coke particle might have been from the burning of coal in a metallurgical context (Roman and Medieval and post-medieval blacksmiths commonly employed coal as fuel for instance), but it is equally, if not more likely that the origin was non-metallurgical.

Coke may be dispersed from domestic coal fires (particularly post-medieval) and a common source in rural areas is as ash from the firebox of steam-powered machinery (e.g. traction engines of the late 19th and early 20th century).

It is not possible to distinguish between these various possible origins. It should be noted that the use of coal as a fuel has not been reported from neither certain pre-Roman nor certain early medieval contexts in Wales.

Further work

No additional work is recommended on the specimens. Retention of the specimens within their respective site archives could be considered a relatively low priority.

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