GeoArch

Report 2023/27

Assessment of materials from land west of Kelham Notts. (KCA/23/EV)

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22nd September 2023

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Abstract

The submitted assemblage comprised 25 pieces (522) of pale fuel ash slag (FAS) from stratified contexts and 10 pieces of unstratified residues from the burning of coal.

The most likely origin of the fuel ash slags is from Iron Age hearths, but it is also possible that they derive from corn-drying kilns. The coal residues are most likely to be waste from steam-powered agricultural equipment.

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Methods

All materials were examined visually, using a low-powered binocular microscope where required. The identifications of materials in this report, as an assessment during which no instrumental analysis was undertaken, are necessarily limited and must be regarded as provisional.

This assessment was conducted in September 2023 and was commissioned by Rhiannon Philp of Archaeology Wales. The materials derive from the work of Archaeology England on land west of Kelham, Nottinghamshire (project KCA/23/EV; NGR: SK 76640 55525).

Results

General

The submitted assemblage comprised 25 pieces (522) of pale fuel ash slag (FAS) from stratified contexts and 10 pieces of unstratified residues from the burning of coal.

The summary catalogue is presented as Table 1.

Fuel ash slag

The submitted collection includes 25 fragments (53g) of variegated fuel ash slag (FAS). Despite deriving from a variety of locations, with a variety of current spot dates, the FAS is remarkably consistent in texture and appears likely to have originated in the same way.

The slag contains some denser, grey, less porous cores in some places and typically becomes paler towards the outside of each component lobe of slag. In some pieces the grey zones show a distinct violet tint.

The slag is internally vesicular, locally extremely so. It shows complex external forms with deep dimples. These resemble the fuel dimples found on metallurgical slags, but in some cases, these may have held inclusions of the substrate (in some instances a pink-coloured clay bearing coarse quartz grains).

The external surfaces do not bear any other indication of their contact with either the hearth wall or the fuel.

The largest fragment, a 205g piece from context (29020) showed surfaces that suggest it had become worn through reworking, despite the typical fragility of this class of pyrotechnological residue.

Coal residues

The material that was submitted as unstratified comprised 4 pieces of clinker (16g) and 3 pieces of just mildly vitrified shale, presumably coal measures shale. All the fragments are extremely small (average weight 3.4g).

Interpretation

The fuel ash slags are typically formed through partial melting of a substrate under the fluxing action of alkaline and alkali earth elements contributed by both the fuel and substrate. The major fluxing elements are calcium and potassium in wood or charcoal burning hearths.

The partially melted material will contain relict grains (mostly of quartz) and develops a highly vesicular texture because gasses cannot escape through the extremely viscous melt. The gasses will include water vapour and carbon dioxide (the latter particularly from

the decomposition of calcium carbonate minerals).. In geological terms such a material is a 'buchite'.

Fuel ash slags are not characteristic of any particular process but indicate a hearth, particularly one cut into an unconsolidated substrate, that has spent a considerable time at elevated temperature. Several archaeologically significant processes/installations may produce FAS under appropriate conditions. Probably the most common of these is within cereal drying kilns. (e.g. South Hook, Young 2010a, 2010b; Llandeilo, Young 2015; Bornais, Young 2012a, 2020). Larger hearths may produce correspondingly larger and thick FAS blocks. Mound1 at Bornais, for instance, produced a large quantity of FAS in much larger fragments of sheet-like cakes (Young 2012a), apparently from large Late Norse hearths. Similarly, domestic hearths are the probable source for the 'Iron Age grey slags' that occur in Middle Iron Age contexts and that have been particularly recorded in central and eastern England (Cowgill 2000, 2008; Cowgill et al. 2001; Swiss & McDonnell 2001; Young 2009, 2011, 2013; 2023 Young & Bowstead Stallybrass 2003). A particularly large deposit was encountered in association with the hillfort bank at Malmesbury (Young 2011).

The particular association of FAS of this type with the Middle Iron Age is likely to be cultural, perhaps due to the continuous maintenance of a substantial hearth. The relative abundance of occurrences in the East Midlands is likely to be reflective of the widespread occurrence f calcareous substrates in that general region.

The residues from the burning of coal are also rather non-specific. However, the most likely derivation of such materials into the topsoil is from the former use of steam-powered agricultural equipment in the late 19th and early 20th centuries.

Further work

No further investigation of these materials is recommended.

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Table 1: summary catalogue, weights in g,

context	weight	number	notes
2003	100	11	pale vesicular fuel ash slag
3032	135	5	pale vesicular fuel ash slag
15020	<1	3	pale vesicular fuel ash slag
15024	82	5	pale vesicular fuel ash slag
29020	205	1	pale vesicular fuel ash slag in single worn block
u/s	16	4	clinker
	8	3	partially vitrified shale

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