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Assessment of residues from Ranch Car Park, Seaton Sluice, Northumberland (RCP21)

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Abstract

The submitted material comprises three pieces of dense grey slag containing fragments of partially melted shale. All three showed considerable abrasion from the beach environment.

The entrapment of shale, presumably coal shale, fragments indicates that the residues derived from a process in which the coal fuel was consumed in approximately the same space as that in which the slag formed. The identification of such residues in the absence of certain evidence for the original morphology and surface features is problematic.

Two of the three pieces resemble forge slags, in particular slags from coal-fuelled blacksmithing. The third piece has a coarser texture (with both larger shale fragments and vesicles), which hints at an origin in a larger scale setting. This piece is unusually dense for a simple clinker, perhaps suggesting either a higher temperature origin than typical or the fluxing influence of, for instance, an elevated iron content. This piece could be either an industrial forge slag or an unusual clinker.

In summary, the pieces cannot be interpreted unambiguously because of the absence of diagnostic morphological evidence in the abraded samples, but an origin as forge slags would appear likely, although it cannot be excluded that they are unusually dense clinkers. A salt production origin could not be excluded.

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Methods

All materials were examined visually, using a low-powered binocular microscope where required and catalogued (Table 1). The identifications of materials in this report, as an assessment, are necessarily limited and must be regarded as provisional.

The material derives from fieldwork at Ranch Car Park, Links Road, Seaton Sluice, Northumberland, NE24 3PQ, that was undertaken by Border Reivers Archaeology Unit, with site-code RCP21. This assessment was conducted in October 2021 and was commissioned by Jon Welsh.

Description of the assemblage

The submitted material comprised three fragments of medium to dark grey vesicular, dense, slag that bear abundant pale clasts of vitrified and bloated shale (Table 1).

All three pieces showed signs of abrasion and rounding from reworking in a beach environment. Item #1 show little indication of its shape before this abrasion. Item #2 had a crudely plano-convex shape, which may be partially original. Item #3 was a small fragment of slag in a sheet-like form.

Item #1 is highly vesicular with large (generally up to 8mm) vesicles, although the vesicle size varied between different areas of the piece. The piece has a shape suggestive of an angular fragment rounded by tumbling in the beach environment. The included shale fragments are both large (up to 30mm) and very heavily vitrified and bloated.

Item #2 is formed of a slightly darker slag that #1, with slightly smaller vesicles than #1 and with a wide range of degree of partial melting of the shale clasts. The piece has a crudely plano-convex shape, although as with #1 this likely to have been modified by abrasion. The convex surface shows several areas of elongate concave zones, although it is unclear if these were original surface features or merely parts of eroded elongate large vesicles. The more planar and the lateral surfaces have a slight suggestion of a structure formed of coalesced blebs, each 10mm of less in size.

Item #3 is a small fragment of slag in a sheet-like morphology. One surface is crudely planar, with multiple slightly maroon-surface convex lobes and evidence for small shale inclusions. The opposing surface is grey, slightly convex and finely vesicular. The lobate surface is tentatively interpreted as the base of slag flow over a substrate rich in shale debris.

Interpretation

The entrapment and partial melting of the shale, presumably coal shale, fragments indicates that the residues derived from a process in which the coal fuel was consumed in approximately the same space as that in which the slag formed. The identification of such residues in the absence of certain evidence for the original morphology and surface features is problematic.

The most common form of residues containing shale clasts are simple non-metallurgical clinkers – the inorganic residues from the burning of coal. Clinker may possess a wide range of density but is rarely as dense as the current examples. Clinker may form in a wide variety of coal-fuelled hearths, but probably the most common sources of dense clinkers were steam boilers. Item #1 shows particularly large and sub-spheroidal vesicles, possibly indicating a relatively high-temperature context of formation that has allowed development of a relatively homogeneous residue, which might be consistent with an origin in a boiler firebox. The high density of the present materials probably suggests a relatively high iron content. This might be due to an origin in a metallurgical process but might alternatively be associated with the use of an iron-rich coal.

Early Ordnance Survey mapping shows the only pyrotechnological industry close to the site is a brick and tile works. In theory, clinkers could be formed in the firebox for a brick kiln, but the author is aware of no described examples of clinkers formed this way with which to compare the present material. Similarly, salt boiling is known to have taken place close to the site but the author cannot find any similarity with the waste from earlier post-medieval sites or within the literature. The Seaton Sluice residues suggest very prolonged high temperatures, which may have been achieved in intensive salt production, more intensive than what is envisioned for medieval salt production.

Slags from foundry cupolas may also show inclusions of coal shale, but the resultant slags are usually glassy (because of their rapid quenching) and largely non-vesicular. It would appear unlikely that the present specimens are cupola slags.

The third group of shale-bearing slags are those forming the spectrum of forge slags from ironworking. These are commonly (although not universally) dense, for the addition of iron to a clinker allows it to be more fully fluid at lower temperatures. The group ranges from simple blacksmithing slags at one extreme, through to slags produced from some more highly mechanised processes at the other. The crudely plano-convex form of item #2 shows some similarity to a blacksmithing slag. In this interpretation the weight and dense nature of the piece would probably suggest formation in a process entailing considerable iron loss, perhaps one involving a high degree of forge welding.

No detailed interpretation of the current material can be made without a degree of ambiguity. On their own, pieces #2 and #3 would most easily be interpretable as forge slags rather than as boiler clinkers. The homogeneous and coarsely vesicular nature of piece #1 is less compatible with this origin. This piece is

unusually dense and coarsely textured for a simple clinker, perhaps suggesting either a higher temperature origin than typical or the fluxing influence of, for instance, an elevated iron content. In summary, the pieces are, if sharing a common origin, best interpretable as forge slags, but with an origin as unusually dense clinkers not entirely excluded. The likely date of industrial residues with abundant coal shale such as these would be late 18th to mid-20th centuries. The coastal location of the deposit is problematic as the residues are broadly similar in appearance to clinkers from steam boilers which were often dumped at the coast or directly into the sea from ship boilers.

Further work

Further analytical work on these pieces might be able to shed a more precise light on their interpretation (through, for instance, the search for hammerscale inclusions and consideration of the bulk elemental composition). These approaches would not permit discrimination between the different contexts in which simple clinkers can form. Given the unstratified nature of the pieces, however, no further analysis of these pyrotechnological residues is currently recommended.

Table 1: summary catalogue of materials. Weights in g.

item	context	item description
#1	u/s	334g slightly rounded block, but probably originally an angular fragment from a larger mass, 100x 90x50mm, of mid-grey slag bearing abundant rounded vesicles (up to 8mm typically) and with some elongate cavities exposed on surface. Slag also bears abundant clasts of off-white vitrified and bloated shale clasts of up to 30mm.
#2	u/s	422g crudely plano-convex, 110x80x55mm, worn block of dark grey slag. The vesicles are slightly smaller than in item #1 above and shale clasts more abundant; lateral margins show accumulation of the material as small lobes/blebs approximately 10mm across.
#3	u/s	16g fragment, now worn, from a slag sheet. One face shows a irregular but fairly smooth, locally haematised surface, the other shows some slightly raised semi-droplets and vesicles containing shale fragments.

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