GeoArch

Report 2023/12

Assessment of residues from Ballanorris, Isle of Man

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30th April 2023

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Abstract

The submitted material comprised approximately 6.5kg (including bags) of flotation residues with a very small amount of hand-picked material. The archaeometallurgical residues and associated materials described here comprised just 48g of this collection.

The flot residues produced only tiny amounts of slag and associated materials, mostly too small for detailed interpretation, but the key pieces of archaeometallurgical evidence were a series of three small fragments (total 38g) of sandy ceramic hand-picked from context (1078). The fabric of these pieces was typical of that employed for ceramic moulds. Two of these pieces may have been from sprue cups (the inlet into the mould for the molten metal).

The presence of very small quantities of metalworking debris would be consistent with the activities of an itinerant, or at least visiting, metalworker.

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Methods

All materials were examined visually, using 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. It is particularly difficult for certainty in the optical identification of very coarse sand grade (1-2mm) and granule grade (2-4mm) particles. The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional.

This assessment was conducted in April 2023. The work was commissioned by Dr Harold Mytum of Liverpool University.

In contrast to normal GeoArch practice, the large quantity of material coupled with the tiny proportion (48g; approximately 0.1% of the submitted samples) of archaeometallurgical residues meant that it was not practical to catalogue all the supplied materials. A catalogue of the relevant materials is presented in Table 1, but only general remarks are made about the containing sediments.

Description of the assemblage

General

The submitted material comprised approximately 6.5kg (including bags) of flotation residues with a very small amount of hand-picked material. The archaeometallurgical residues and associated materials described here comprised just 48g of this collection.

Crucible?

Context (1018) produced a single tiny cubic fragment of quartz rich material 4.5mm thick which had one bright red surface. This piece (from context (1018) is likely to be a sherd from a crucible employed for handling a copper alloy, but detailed instrumental analysis would be required to confirm this.

Mould

Context (1078) produced three fragments of fired clay that can be linked to casting.

The smallest fragment (5.8g) preserves part of the lip and inner section of a casting sprue-cup (c.f. Spratling 1979, Figure 101.4). The inner diameter of the sprue below the cup is approximately 30mm, so it is likely that the object being cast was of a substantial size. The interior surface of the cup shows slight reduction, but otherwise the ceramic is an oxidised fired, friable and silty/sandy.

The largest fragment (20.78) is also in a rather coarse, friable oxidised-fired ceramic with abundant sand and silt. The orientation of the piece is uncertain. The interior is crudely cylindrical with a radius of approximately 30mm, but it is possible that the interior surface was originally more hemispherical than cylindrical; too little remains for certainty. The piece thins around the curved form from 14mm down to 7mm. The fabric of this piece suggests that it too is a piece of casting debris. The interior shows no reduction and is in the same coarse fabric as the exterior, so it seems likely this could either be a part of a very large sprue cup, or perhaps an external wrapping layer from a two-layer mould (such is commonly seen in Bronze Age investment moulds).

The third piece (11.4g) is in a similar fabric, but fired to a buff colour, with a small area of grey on one broken margin. The outside of this piece is strongly and asymmetrically carinated (perhaps to aid stability during pouring), but the interior is less well preserved (and probably over-cleaned). A strong angularity on the external surface of moulds is not a common phenomenon, so it is alternatively possible that this fragment too is part of a sprue cup.

Fired clay

Small pieces of partially vitrified ceramic, probably, but not certainly, from a hearth wall were recovered from contexts (1054) (4.43g, 10 pieces) and (1109) (0.19g).

Lining slag and other fuel ash slag (FAS)

These materials derived from the partial melting of ceramic materials (the hearth wall, substrate or accidental lithic inclusions in the hearth) included tiny grains of <0.01g from 1036, 1045, 1105, 1109, together with larger pieces from 1109 (2.29g

Coal and coal residues

Coal occurred as isolated tiny particles from contexts (1018), (1065). (1080), (1105) and in slightly larger collections of grains from contexts (1107) (0.64g), (1109) (0.05g) and (1172) (<0.01g).

Small slag grains from contexts (1045) and (1109) resembled clinker, but at this small grain size certain

distinction from other forms of residue (for instance from the partial melting of lithic grains) is difficult.

Material resembling coke was recovered from contexts (1036), (1080), (1105), and (1109). The certain distinction of coked material derived from coal, as opposed to that derived from the combustion of other forms of organic material, is not possible at this grain size.

Coal may have arrived at the site either through human agency (transport of coal around the region is documented from the Roman period, Smith 1997, and more widely after the 13th century) or through derivation from glacial deposits.

The use of coal, as potentially evidenced by the presence of coke or clinker, would indicate human agency, but the small grain size of the possible examples of these materials makes their identification uncertain. Small particles of coal, clinker and coke are also commonly intrusive into deposits (for instance by worm action) where they derive from the use of steam-driven agricultural machinery in the 19th and early 20th centuries and from waste from domestic hearths spread on fields as a component of manuring.

Fayalitic(?) slag

Small fragments of slag apparently rather richer in iron than the facies described above and with a probable fayalite-bearing mineralogy, occurred in contexts (1024) (droplet), (1065), (1080), (1109) (droplets). The droplets show some superficial similarity to spheroidal hammerscale (Young 2011) but are sufficiently irregular to indicate their origin from fluid slag moving through a hearth bed. The fluidity of such liquid slag is typically due to the influence of the high iron content, but in small quantities such materials can arise from iron rich substrates, weathering crusts or individual rock fragments and their presence does not necessarily indicate the working of iron metal.

Iron

Two small fragments of rust (mineralised iron) were recovered, a wire-like fragment from context (1105) and a small flat fragment from context (1080).

Host sediment

The submitted materials included a remarkably diverse range of rock types (granite, gabbro, microgranite, rhyolite, schist, slate, mudstone, arkose, quartzite, limestone, chert, vein quartz and sulphide concretions). In addition, the coal described above may also belong here. This diversity is likely to reflect the derivation of the sediments from glacial deposits.

Much of the confusion in the initial classification of the samples was apparently caused by the very variable preservations of the rocks that had been limestones, but which had become variably decalcified and silicified, generating a great diversity of materials with different colours, textures and hardness.

These sediments were also overprinted by two sets of diagenetic alteration: firstly, through the mobilisation of iron and manganese, with the formation of various iron pan materials, including ferruginous/manganiferous peds and tubular concretions as well as crusts and, secondly, through the cementation of gravelly sediments by a probably calcareous cement into conglomerates that had been themselves reworked.

Distribution of the assemblage

The distribution of resides by context is provided in tables 1 and 2. No detailed information has been supplied on the geographical distribution or stratigraphical relationships of the contexts, so no interpretation can be made of the distribution of the residues.

Interpretation

The evidence for metallurgical activity at the site was exceptionally sparse. The mould fragments, the possible crucible sherd and the dominance of lining slags/FAS over denser slag varieties, suggest the working of copper alloys was undertaken on the site. The amount of more iron-rich residues is very small (<0.1g) providing no significant evidence for ironworking.

That so little residue was lost into the sampled sediments suggests that the working of copper alloys was itself not a regular activity (although in the lack of detailed information about the sampled deposits, their derivation from areas deliberately kept clean during occupation cannot entirely be excluded). Since craft skills like casting require considerable experience, an intermittent activity suggests one undertaken by people from outside the settlement – by itinerant workers for instance.

The evidence bears close comparison with that from Ballacegan (Young 2023), differing only in which aspect of the technical ceramic involved in casting copper alloys was preserved (at Ballacegan it was a substantial piece of crucible, rather than mould fragments seen at Ballanorris). It would appear likely that the two sites interacted with the supply of metal and production of metal artefacts in a similar manner.

References

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Table 1: summary catalogue of submitted macroscopic materials. Weights in g. Assm = assemblage. Labels edited for brevity and spelling.

project	area	context	sample	label	item wt.	item no.	notes
BN11		1018	1	reddened material	0.22	1	small cubic fragment 4.5mmthick of quartz rich material with a bright red surface - could be a tiny sherd of crucible
BN11		1018	1	slag no-mag	<0.01	1	coal
BN11		1024	6	metal ball droplet	<0.01	1	spheroid cf SHS
BN11		1036	8	slag (non-mag)	<0.01	1	part of a pale bleb of FAS
BN11		1045	21	slag glassy	<0.01	1	coke
ditto					<0.01	1	droplet of glassy vesicular slag
BN11		1045	21	slag (dense and mag)	0.81	1	coarsely crystalline white material, maroon skin on one surface, more FHS-like on the other, 4mm thick, could have been applied to metal, but probably just clinkery
BN11		1054	11	reddened cong	4.43	10	fired clay - largest piece showing vitrification
BN11		1065	13	slag no-mag	<0.01	2	coal
BN11		1065	13	metal? Mag	<0.01	1	tiny planar piece of vesicular green weathered slag
BN11		1078		fired clay	20.78	1	large piece of orange fired clay, sandy, form is bowl-like
ditto					11.43	1	fired sandy clay, buff coloured
ditto					5.83	1	mostly oxidised fine sandy/silty ceramic, approximately 40mm diameter inside neck, widens after 12mm below, surface has thin grey veneer
BN11		1080	17	burnt cong	0.25	1	small 'scale' of mineralised iron 9mm x 8mm x 1mm
BN11	TrA	1080	17	non-magnetic slag	<0.01	8	coal
BN11	TrA	1080	17	slag	<0.01	1	coke?
BN11	TrA	1080	17	slag both mag and non-mag	<0.01	2	eroded vesicular greenish iron slag?
BN11		1105	25	slag glassy	<0.01	2	coal
ditto					<0.01	2	coked material
ditto					<0.01	2	FAS droplet
BN11		1105	25	slag glassy	<0.01	1	coal
ditto					<0.01	10	coked material
BN11		1105	25	burnt cong/slag mag and non-mag	0.02	assm	Fragmented piece of mineralised iron - possibly shaft of nail/tack or piece of wire
BN11		1107	26	slag glassy, mostly non-mag	0.64	assm	this includes a few stones, but is mostly coal and burnt residues
BN11		1109	28	slag (green)	0.19	1	vitrified ceramic grain
ditto					0.17	1	fragment of bloated lithic
BN11	A	1109	39	slag	2.29	4	tiny fragments of vitrified (slightly bloated) fired clay, reddish silty/sandy ceramic tiring to pale to greenish slag
BN11		1109	39	burnt material	<0.01	1	tiny fragment of clinker-like slag
BN11		1109	39	slag glassy and metallic	<0.01	2	coke
ditto					<0.01	2	clinker
ditto					<0.01	1	coal
ditto					<0.01	1	quartz-rich vesicular slag
BN11		1109	28	magnetic slag droplets	<0.01	3	weathered green vesicular slag droplets
BN11		1109	39	metal including droplets	1.22	assm	assemblage of small maroon surfaced planar slag fragments, several small slag droplets, one piece of charcoal and a couple of small stones also. The slags resemble slag more than clinker, but at this sale hard to be certain.
BN11		1109	28	slag?	0.05	4	coal
BN11		1109	28	slag	<.01	1	quartz-rich lining slag
ditto					<0.01	1	flat-based clinker-like bleb/adhesion
BN11	A	1170	42	mag mat	<0.01	1	possible slag fragments
BN11		1172	41	slag glassy	<0.01	5	coal

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Table 2: distribution of residue facies by context. Weights in g.

context	crucible?	mould	lining slag	ceramic	fayalitic slag?	iron	coal	clinker?	*total*
1018	0.22						<0.01		*0.22*
1024					<0.01				*<0.01*
1036			<0.02						*<0.02*
1045								0.81	*0.81*
1054				4.43					*4.43*
1065					<0.01		<0.01		*<0.02*
1078		38.04							*38.04*
1080					<0.01	0.25	<0.01		*0.25*
1105						0.02			*0.02*
1105			<0.01				<0.02		*<0.03*
1107							0.64		*0.64*
1109			1.22	2.65	<0.01		0.05	<0.03	*3.92*
1170					<0.01				*<0.01*
1172							<0.01		*<0.01*
total	*0.22*	*38.04*	*1.22*	*7.08*	*<0.05*	*0.27*	*0.69*	*0.81*	*48.33*

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