

Iron Age iron smelting, Folly Court, Wokingham and the interpretation of 'dome' furnaces

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ABSTRACT: Excavations produced evidence for a Middle Iron Age iron smelting centre, probably of the 2nd century BC, with four iron smelting furnaces, three of a large 'dome' morphology and one smaller, more conventional, slagpit-type. A total of over 800 kg of slag was recovered from the site, indicating an operation of some significance. Details of furnace construction and large suites of archaeometallurgical residues were recovered for two successive examples of the 'dome' furnaces. 'Dome' furnaces are rare and poorly known from the British Iron Age, although common in parts of Europe. New evidence shows that they may have been operated on a continuum with smaller furnace types. Precise interpretation was hampered by ambiguities within the compositional modelling, but these furnaces both illustrate the sophistication of Iron Age iron smelting in Britain and demonstrate the need for its more nuanced and evidence-driven interpretation.

Introduction

The site (on the western edge of the town of Wokingham [SU 7971 6785]) was initially identified during archaeological field evaluation by West Sussex Archaeology (WSA) in May 2014 (WSA 2014b). The site of a former Guide Dogs for the Blind Association training centre, constructed in 1975 around a substantial 19th century dwelling house, Folly Court, had been acquired for residential development by Bewley Homes Plc (WSA 2014a) with the required archaeological mitigation including a field evaluation of 20 trenches. This produced widespread evidence for a system of post-medieval ditched field boundaries parallel to those recorded on an enclosure map (Berkshire Records Office No. D/P154/26B) of 1817, but Trench 2, near the northwest corner of the site, also encountered evidence for an iron smelting furnace. A further phase of investigation was therefore commissioned and an area of approximately 1200 m² was excavated around the location in July and August 2014. Details of the excavation and the extensive

programme of post-excavation analysis can be found in the grey literature reports (WSA 2018; Young 2018a).

The site lies at c. 65 m above Ordnance Datum, with a slope to the south towards a stream which feeds into the Emm Brook, which itself lies c. 700 m to the northeast. The underlying geology of the site is largely London Clay, although the boundary with the sands of the Bagshot Formation lies in the extreme north-west corner of the overall site. A layer of sand overlay the clay in evaluation trenches 1 – 11 but was absent in the remaining trenches to the south-east.

The site lies within a region from the Reading area in the west to Weybridge in the east known for its abundance of Iron Age iron production sites (Fig 1; for detailed lists of sites in the area see Hardy and Young 2019). The ore exploited within the region has been interpreted by Hardy and Young (2019) to be broadly a bog iron ore deposited from iron-rich groundwater arising from permeability boundaries within the Bagshot Formation,



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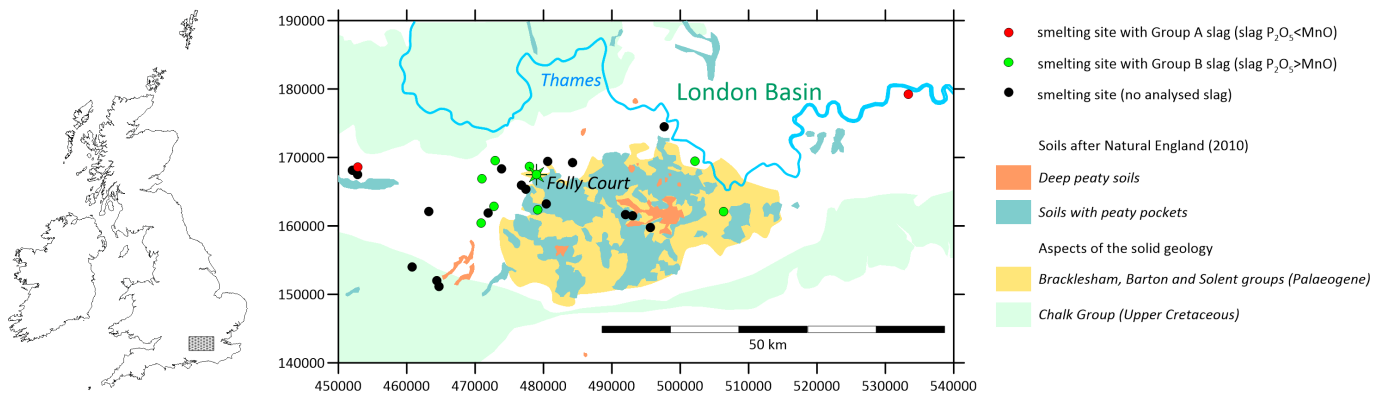


Figure 1: The location of Folly Court with respect to relevant aspects of the solid geology. Groups A and B smelting slags are after Young (2020).

including the basal contact of the Bagshot Formation with the underlying London Clay which crops out near the Folly Court site. The precise origin of the ore within the local landscape is not known but was probably within one of the small stream valleys very close to the smelting site.

The Excavation

The excavation extended over an elongate area of approximately 50 m by 20 to 25 m, parallel to the northwest boundary of the site (Fig 2). Excavation was by hand following topsoil removal by mechanical excavator.

The early archaeological features comprised two *en echelon* ditches running approximately east-west, providing partial bounds for two large smelting furnace installations and their associated working hollows and slag dumps aligned along the midline of the zone between the ditches, together with another large hollow and a probably associated small slagpit-type furnace just off that axis (Fig 2).

The eastern of the two large furnace installations had been cut by the machining of evaluation Trench 2, leading to the loss of its northern margin. The initial furnace of this installation (Furnace 1) had been rebuilt (Fig 3) on a slightly different site and orientation (Furnace 2). Both furnaces were of a broadly similar design, being approximately 1.2 m long and 0.9 m wide, with an almost planar sunken floor sloping eastwards to a wide frontal arch, the sides of which were partially supported by large slag blocks. The superstructure was not preserved significantly above contemporary ground surface in either case, but the morphology of both furnaces 1 and 2 with their wide, flat floors and large arches, indicates that they belong in the group of so-called ‘dome’ furnaces known from other sites in the area (e.g. Sadler’s End, Lewis *et al.* 2013) and more widely in central Europe (e.g. Garner 2010a; Garner 2010b; Stöllner 2014). The

term ‘dome’ is retained in parentheses because the actual form of the superstructure is unknown and it may have been closer to a ‘bottle’-shape. The furnace arches opened eastwards into an elongate pit, with a slag scatter (probably the eroded remnant of a dump) to its east. Furnace 1 was dated by a single radiocarbon determination (SUERC-74032) on Poplar/*Salix* charcoal from the basal wood furnace packing of 350 – 320 cal. BC (4.1 % probability) and 210 – 50 cal. BC (91.3 % probability), and by five sherds from a flint tempered pottery vessel of the 3rd to 2nd centuries BC, from a fill immediately behind the southern ‘orthostat’ in the furnace mouth (see Appendix). It is therefore considered likely that Furnace 1 was in operation in the second century BC.

The western installation (Furnace 3) appeared to have been of a broadly similar design and size to furnaces 1 and 2, but unfortunately a large post-medieval pit (possibly from tree-planting) had been dug through the centre of the furnace, leaving very little of the original structure.

To the west and northwest of furnace 1/2 was a rather disturbed slag spread, associated with at least one posthole and a small pit that was probably (the slag blocks with the pit had been slightly moved in their soft substrate during the machine removal of the overburden obscuring details of their original relationships) the basal pit of a small slagpit-type furnace, Furnace 4, 0.4 to 0.5 m in diameter (the term ‘slagpit furnace’ is used here in its broad sense; some researchers would confine its use to single-use furnaces, and ‘slag-drain furnaces’ for those reusable furnaces with slag clearance).

The flanking ditches are interpreted to have been broadly contemporary with the metallurgical activity; both produced small quantities of slag and the southern ditch produced a single sherd of Iron Age flint-tempered pottery, comparable to that from Furnace 1.

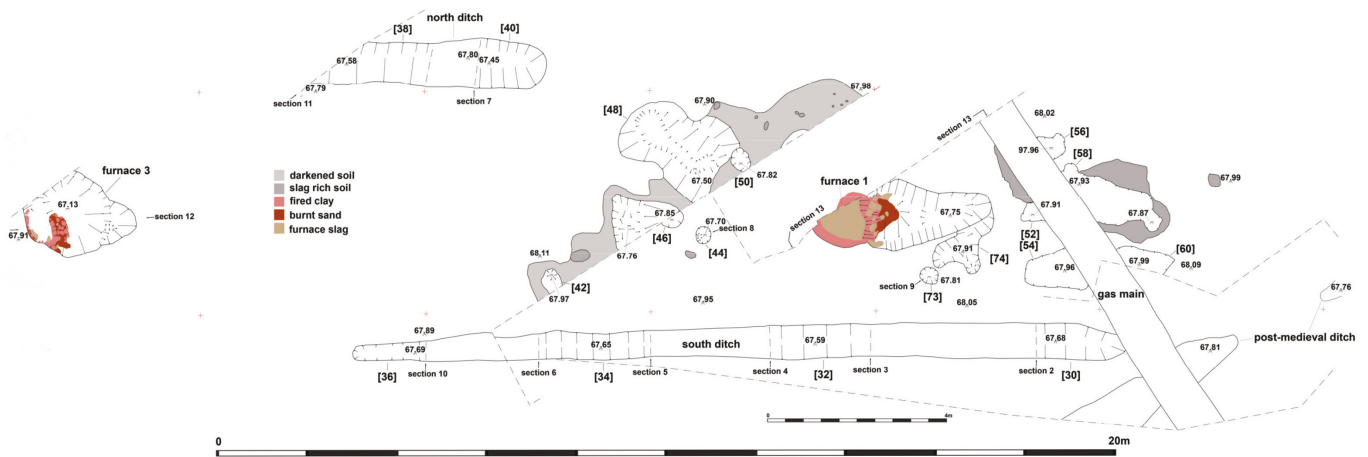


Figure 2: Plan of the excavated area showing all identified features. North to top.

Detailed description of the furnaces

'Dome' furnaces

Furnace 1

Furnace 1 (Fig 4) was constructed within one end of an elliptical pit (cut [020]), approximately 1.2 m wide and probably at least 2.5 m in length (the size of the original working hollow is uncertain because of its potential later modification). The pit has an evenly-curved cross-sectional profile, with a maximum depth of approximately 400 mm (close to its centre).

Within the construction pit, a local clay was placed to form a wall that was probably 200 mm in thickness close to the original ground surface, with a vertical inner face (017). The southern wall of the furnace (the northern wall was destroyed by the evaluation trench) straightened towards the mouth of the furnace and abutted a large block (25.6 kg) of dense furnace slag (the southern 'orthostat' (076)) set vertically to retain the sandy subsoil. A similar large (25.0 kg) block (078) was disturbed by the evaluation trench and appears to have formed a symmetrical feature on the north side of the arch (where a second, slightly smaller (8.6 kg) slag block (077) survived in situ). The faces of the in-situ large slag blocks were approximately 930 mm apart (suggesting the width of the furnace arch). The clay of the inner face of the wall curved into the base of the pit, continuing as a thin (<15 mm) horizontal layer of uncertain extent. Towards the mouth of the furnace, the development of a secondary concretionary layer (016) on the base of the furnace obscured the details of the stratigraphy.

The main clay floor of the furnace (015) overlay the baked clay of the foot of the walls. Whether this was a result of original sequential construction or replacement/addition of the floor later in the use of the furnace is not

clear. The floor is estimated to have been 1.15 m long and 1.0 m wide.

Towards the rear of the furnace, the floor and walls were covered with a thin (<5 mm) dark, soft, deposit with some charcoal. This deposit continued across a slightly raised platform on the floor of the furnace towards the rear, but in the centre/front of the furnace the overlying 'furnace bottom' slag (010) rested directly on either the clay floor or a concretionary layer. The significance of the concretionary layer increased through the arch and immediately outside it the concretion reached up to 80 mm thick (011).

The 101 kg consolidated 'furnace bottom' slag cake lay across the centre and front part of the furnace – the raised rear was covered in 38 kg of unconsolidated prilly sinter. Both the consolidated cake and sinter were assigned to context (010) as they were intimately associated, form-

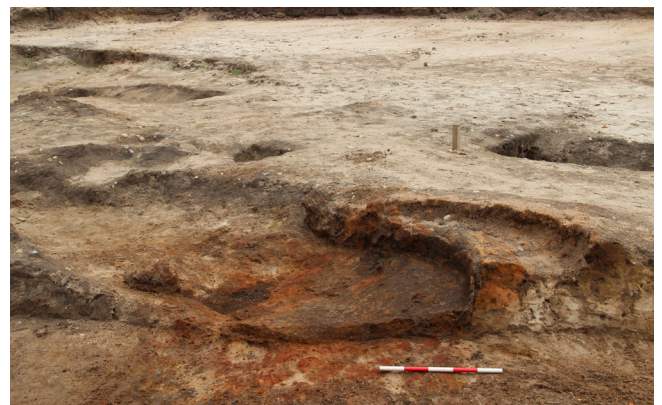


Figure 3: Photograph of furnaces 1 and 2 after excavation. The floor of Furnace 1 slopes from its back wall (near the right end of the ranging rod) towards its lowest point just inside the furnace arch (demarcated by the 'orthostat' slag blocks on either side). The external working hollow lies to the left. The back wall of Furnace 2 lies at a higher level to the right side of the photograph.

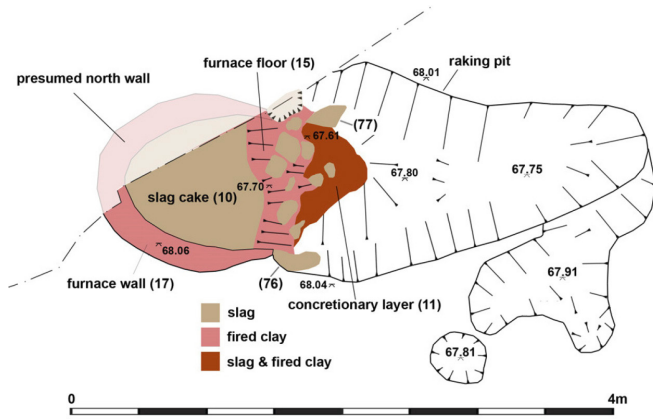


Figure 4: Plan of Furnace 1 after excavation.

ing an overall ‘furnace bottom’ weighing almost 140 kg and covering the entire preserved furnace floor. Denser slags occurred towards the northern margin of the furnace suggesting that the blowing was from the missing edge – possibly laterally or obliquely from towards the rear. The slag cake was up to 150 mm thick in the central area of the furnace, but towards the arch it thinned rapidly and was overlain by a dense layer of fired clay (part of (007), see below). A spread of sporadic large blocks of slag appeared to predate the deposition of the fired clay immediately outside the arch. The fired clay (007) was probably mainly placed as part of the construction of Furnace 2 (and derived from superstructure of Furnace 1) but it is possible that some of the clay in the arch area (which showed an original edge along part of the line of the arch) may represent either a collapsed section of wall from above the arch, or remnants of an arch blocking. The concretionary layer within, and just outside, the arch area (011) also contained many fired clay fragments – perhaps debris from temporary arch blockings during use.

Furnace 2

Furnace 2 (Fig 5) was constructed above the fill of ceramic debris (007) on a slightly different footprint to the earlier furnace, lying approximately 0.5 m further west and with its axis apparently slightly anticlockwise of that of the earlier furnace. This replacement of Furnace 1 by Furnace 2 at a higher level removed the need for the clearance of the large amount of slag present within Furnace 1 at the end of its life, but required the construction of the ramp of fired clay outside the arch down into the external pit. The maximum surviving internal height of Furnace 1 was 180 mm.

The fired clay (007) formed a floor to Furnace 2 within the arc of the wall of Furnace 1, and it sloped down through the arch area to the floor of the working hollow

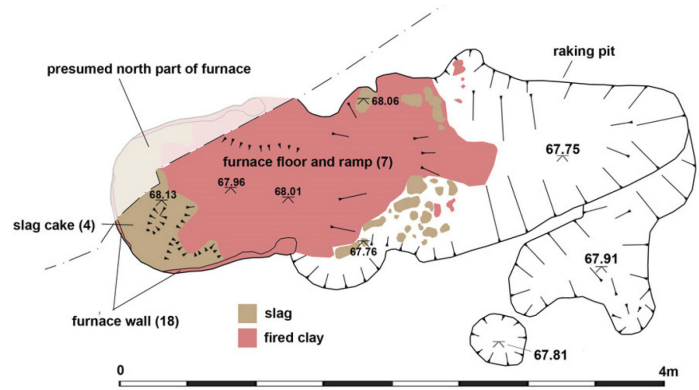


Figure 5: Plan of Furnace 2 after excavation.

well outside the line of the arch. Outside the line of the arch of Furnace 2, a zone of large slag blocks (009) lay on either side of the central fired clay ramp, possibly to retain the sandy substrate, in a similar manner to the large blocks (the orthostats) within the structure of Furnace 1.

The side of Furnace 2 was mostly preserved to a relatively lower level than that of Furnace 1, with the clay lining thickening upwards rather little within the section (*i.e.* it is mainly present as a lining to the cut of the basal pit (018) rather than including the base of the main upstanding furnace wall). The surviving maximum internal height of Furnace 2 was 180 mm. Around most of the preserved circumference outside the limits of Furnace 1, the clay coating did not extend to the base of the wall, leaving a sandy floor and lower wall (which showed evidence for significant undercutting by the slag, giving the impression, probably erroneously, of an inwardly inclined wall). Part of the wall face showed a fluted surface, possibly, but not certainly, the imprint of the construction from either fingerprints or, more likely, a wicker former.

The northern side of the furnace was missing and the edge of the arch missing or indistinct – leaving the width of arch unclear, but it was between 670 mm (if the arch was substantially narrower than the maximum width of the floor) and 900 mm. The furnace was approximately 1.26 m long. Furnace 2 was therefore apparently slightly longer and narrower than Furnace 1, with the arch possibly significantly narrower.

Furnace 2 also showed two types of in-situ residue – a granular sinter (total 31.5 kg) bearing a few sparse slag prills (003) overlying and extending around a discrete, although not entirely coherent, triangular flow slag cake (004) extending forwards from the rear wall (total 23 kg).

The sinter appeared in some areas to be two layers separated by a fine grained, dark, more clayey layer. The sinter extended through the arch area but disappeared shortly outside.

Outside the arch, the working hollow was filled with a dark sandy deposit (006), rich in slag and (particularly towards the base) fired clay fragments. Close to the furnace, this deposit is interpreted as being contemporary with, or later than, Furnace 2, but the more eastern sections cannot be tied to any particular phase with any confidence.

Furnace 3

Much of Furnace 3 had been destroyed by a post-medieval pit ([079]) *c.* 1.9 m in diameter and up to *c.* 0.75 m deep, with only its western wall surviving in the west side of the pit and the eastern end of what was probably the furnace working hollow to its east. The total length of furnace and working hollow (cut [80]) was approximately 2.5 m. The width of the surviving wall of the furnace was 0.9 m, slightly less than the projected full width of the furnace. The eastern wall (026) survived to *c.* 0.35m below the surface of the sand geology. The working hollow was *c.* 1 m across at its greatest surviving width, although only the easternmost 0.5 m survived. The dimensions of Furnace 3 thus appear to be very similar to those of furnaces 1 and 2.

Narrow shaft 'slagpit' furnace

Furnace 4

The pit [50] may probably be identified as the base of a 'slagpit' style shaft furnace (Furnace 4). The orientation of the slag blocks within the pit, which like the other cut features was dug into a very soft sandy substrate, was disturbed by the machining of the overburden. The pit was 0.5 m x 0.4 m, approximately 0.2 m deep, and contained a single dark fill bearing 34 kg of slag. The residues from the pit were indicative of iron smelting in

a small non-tapping shaft furnace in which the slag had descended into a pit packed with cereals or grass (this a relatively uncommon occurrence in Britain, where most slagpit-type furnaces had a pit-packing of wood, as in the 'dome' furnaces).

Description of the archaeometallurgical residues

General

A total of over 800 kg of archaeometallurgical residue was recovered from the site (Table 1); all were examined and catalogued. Large quantities remained in situ within the 'dome' furnaces: 148 kg of residue within Furnace 1, with a further 59 kg used as orthostats to support the furnace mouth, 54 kg of residues in Furnace 2, and 18 kg within the poorly-preserved Furnace 3. In other settings, the external pit for furnaces 1 and 2 yielded 260 kg of residues, a further 110 kg came from the eastern 'scatter' and from the northern 'scatter' a total of 56 kg (including 34 kg from pit [50] interpreted as Furnace 4). In contrast, only small quantities of residue reached the bounding ditches, with just under 10 kg retrieved from the southern ditch and less than 0.5 kg from the northern.

The residues were investigated through an extensive programme entailing elemental analyses (trace and major elements) of 34 samples and microstructural investigation (with microanalyses of mineral chemistry) by analytical scanning electron microscope of six representative samples. This work has been described in full in the archive specialist analysis report (Young 2018a); examples of the major element analyses are provided in Table 2. These bulk analyses (along with those from other sites in the Surrey/North Hampshire region) fall into 'Group B' of a recent review of the residues associated with the smelting of bog ores in central southern England (Young 2020) as they show $\text{wt}\% \text{P}_2\text{O}_5 > \text{wt}\% \text{MnO}$ in their analyses, differentiating them from 'Group A' (with $\text{MnO} > \text{P}_2\text{O}_5$) which were

Table 1: Summary weights in grams of archaeometallurgical residues by facies and context.

Context	Notes	Residues							Total
		Flow slag	Massive and dense sheets	Other FB slags	Slag with cereal moulds	Sinter	Lining related	Other	
Furnace 1	construction			59155					59155
Furnace 1	use	38940		62065		38265	1079	54208	194557
Furnace 2	construction	266	1715	2660		182			4823
Furnace 2	use	23000				31500		2570	57070
Furnace 3	use?	6519	2534	768		3675	2802	1576	17874
South ditch		4066	1342	150	262		2024	1618	9452
North ditch		20	108				62	188	378
North scatter/area		10109	1460	13712	23310	1959	730	4473	55753
East scatter/dump unstratified		170397	22735	32321	1118	1396	35773	107411	371151
									31500
								Total	801713

generated from the smelting of the bog iron ores found on peaty valley floors more widely across the region.

Smelting residues: 'dome' furnaces

The residue assemblages found in situ in furnaces 1 and 2 differed from those of the external deposits interpreted to be waste from the use of the same furnaces; the furnaces were rich in sinter (38 kg in Furnace 1, 31 kg in Furnace 2) whereas the dumped material was not (total 3 kg). Small quantities (up to a few hundred grams total and typically in very small pieces) of such sinter are commonly recovered from the basal pits of 'slagpit' style furnaces, but deposits of tens of kilograms have not been recorded on other sites.

The sinter was investigated through two samples, one from Furnace 1 (FCT5; Fig 6) and one from Furnace 2 (FCT16). Both indicated that the ore employed was a finely particulate pedogenic ore of bog iron ore type, broadly resembling the ores recorded at Fleethill Farm (Young 2016c; Hardy and Young 2019).

Sample FCT5 comprised rounded composite grains of 1 mm to 5 mm in diameter, each composed of smaller sub-spherical particles from 200 μm up to approximately 1 mm in diameter suggestive of ferruginous soil 'mottles'. The relatively unaltered mottles varied from examples rich in quartz grains (e.g. Fig 6b) to fine-grained examples dominated by iron oxides. The part-reduced and reacted grains were mainly mixtures of iron oxides (the paler material in Fig 6c; probably mainly magnetite), associated with a fayalitic melt (slag) component (darker material in Fig 6c). More reduced examples showed variably phosphoric metallic iron (although this was poorly preserved; Figs 6d, 6e), inclusions of glassy siliceous slag and secondary 'rust'.

The sample from Furnace 2 (FCT16) was taken from a single larger (15 mm) ore particle mostly reduced to dispersed metallic iron in a groundmass of minerals including phosphoran fayalite, possibly potassium feldspar and magnetite, together with glass and relict quartz grains.

Table 2: Typical major elemental analyses by WD-XRF. For full analyses and accompanying trace element determinations by ICP-MS see Young (2018a). LOI = loss on ignition.

Sample	Material	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	Mn ₃ O ₄	MgO	CaO	Na ₂ O	K ₂ O	P ₂ O ₅	LOI	Total
Furnace lining													
FCT1	oxidised, Furnace 1	82.19	0.61	7.41	4.4	0.02	0.3	0.14	0.08	1.68	0.22	1.64	98.98
FCT4	reduced, main dump	84.91	0.61	7.31	2.77	0.01	0.41	0.11	0.08	1.72	0.09	0.7	98.94
Residues from Furnace 1													
FCT5	Sinter	13.49	0.11	2.57	77.35	0.38	0.1	0.43	<0.015	0.45	2.41	1.73	99.24
FCT6	Sinter	15.29	0.13	2.9	76.72	0.5	0.16	1.21	0.03	0.6	3.04	-1.52	99.36
FCT7	Flow slag upper	21.82	0.15	3.1	74.7	0.71	0.29	0.97	<0.015	0.47	3.09	-6.37	99.24
FCT8	Flow slag lower	21.23	0.11	2.17	74.98	0.53	0.24	0.57	<0.015	0.23	2.55	-4.22	98.58
FCT9	Flow slag	21.96	0.16	3.29	72.46	0.58	0.19	1.12	<0.015	0.42	3.66	-5.32	98.87
FCT10	Massive	14.13	0.1	2.17	85.84	0.34	0.16	0.7	<0.015	0.29	1.55	-6.24	99.22
Furnace 1, orthostats													
FCT11	Flow slag	22.19	0.13	2.96	74.64	0.65	0.22	1.01	<0.015	0.6	3.13	-6.82	98.95
FCT12	Massive	22.07	0.13	2.96	74.14	0.65	0.26	0.99	<0.015	0.67	3.14	-5.77	99.49
Residues from Furnace 2													
FCT17	Sinter	18.5	0.13	2.7	68.72	0.66	0.1	0.73	<0.015	0.47	2.2	4.42	98.86
FCT18	FB	25.18	0.16	3.57	68.58	1.06	0.19	1.4	0.03	0.59	2.66	-4.91	98.81
FCT19	FB	26.68	0.16	3.12	69.38	0.9	0.21	1.33	0.05	0.53	2.02	-5.66	98.99
Residues from main dump													
FCT22	Flow slag	31.08	0.23	3.95	62.88	0.72	0.3	1.29	0.03	1.2	2.33	-5.47	98.81
FCT23	Flow slag	35.34	0.19	3.15	60.18	2.33	0.26	0.89	<0.014	0.87	1.15	-5.3	99.46
Residues from cereal packed furnaces													
FCT24	FB in [50]	23.46	0.1	1.94	75.18	0.34	0.27	1.12	<0.015	0.24	1.82	-5.98	98.65
FCT27	Puddle [46]	31.11	0.15	2.97	65.35	1.56	0.24	0.85	<0.015	0.99	1.49	-5.68	99.33
FCT28	Flow slag [46]	28.54	0.14	2.62	67.72	0.64	0.25	1.04	0.05	0.43	1.26	-4.67	98.18
Residues from Furnace 3													
FCT33	Flow slag	25.49	0.14	3.35	68.47	1.3	0.21	0.38	<0.014	0.55	3.21	-4.64	98.68
FCT34	Dense	28.26	0.14	3.55	68.11	1.31	0.27	0.54	<0.015	0.66	2.78	-5.72	100.1

The large slag cake (within (010)) in Furnace 1 was formed of dense flow slags with lobes amalgamated around the moulds and remains of large pieces of

wood (mostly oak); the dump deposits were rich in similar material. These slags resemble those more commonly found within the basal pits of smaller, more

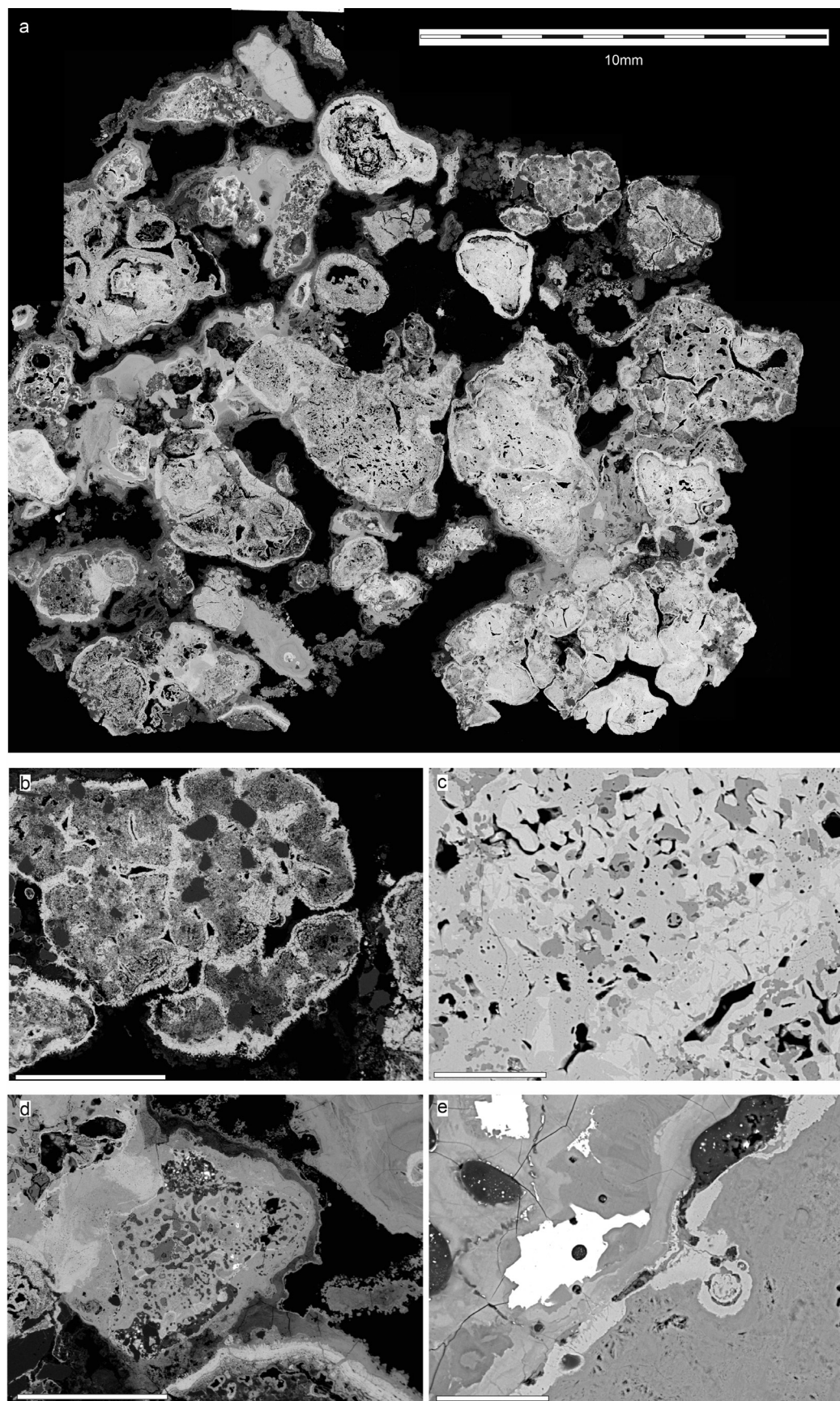


Figure 6: Backscattered electron photomicrographs of sinter from Furnace 1 (sample FCT5).

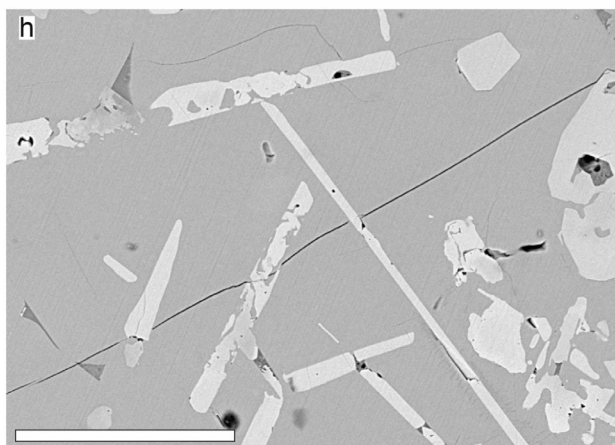
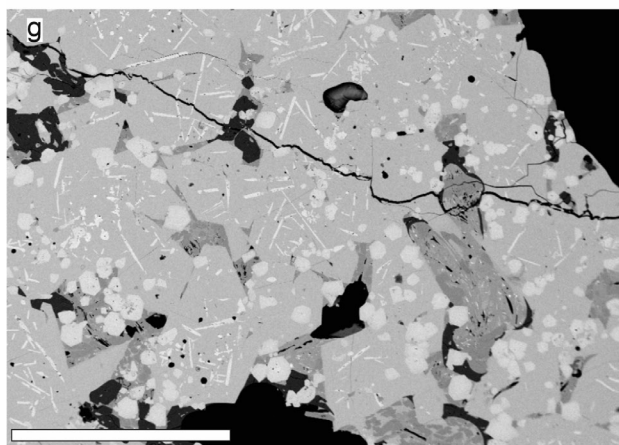
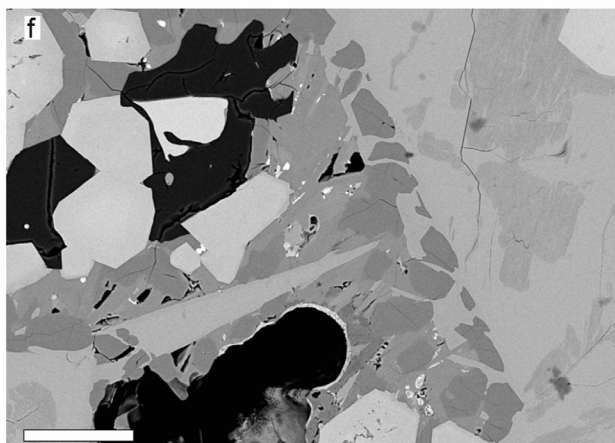
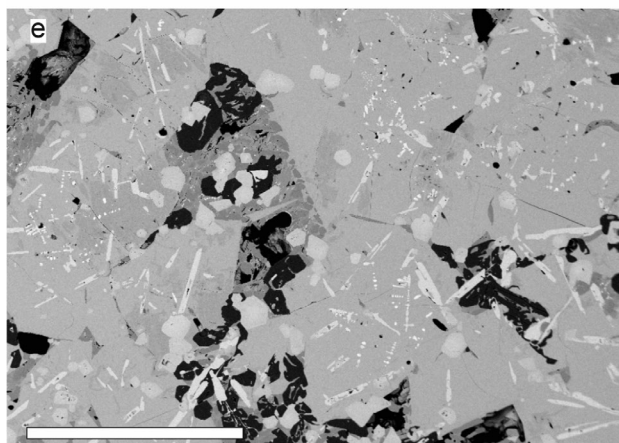
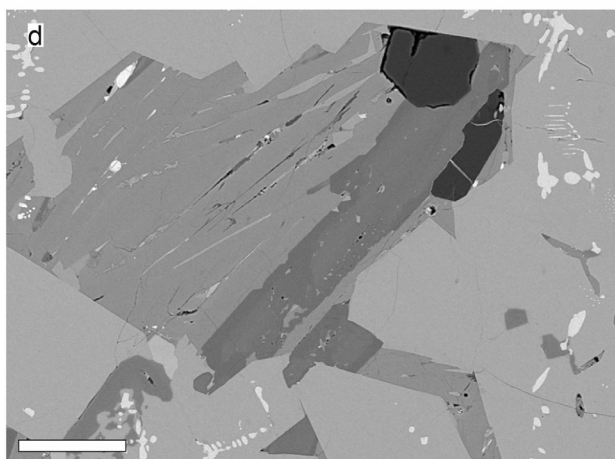
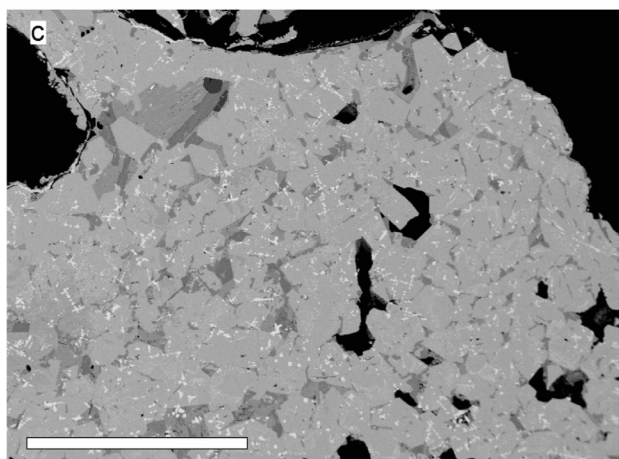
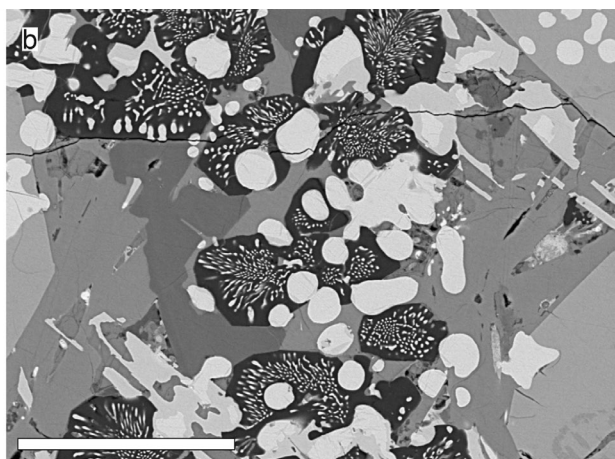
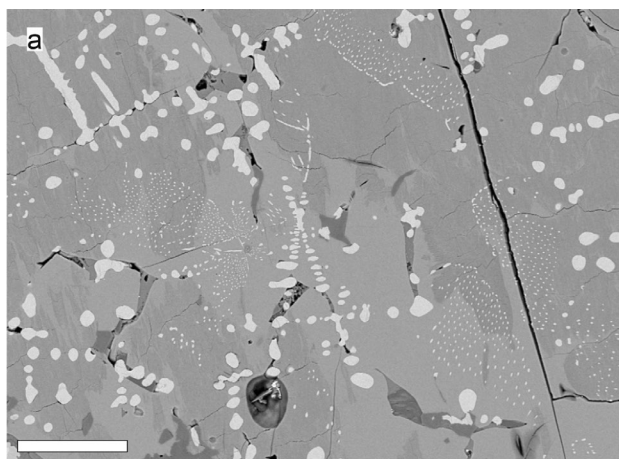
a. Montage showing characteristic texture of the sinter.

b. Particle showing little alteration and fresh quartz grain inclusions (dark grey). The microstructure shows denser iron oxide rims (pale) over porous interiors. Scale bar 1 mm.

c. Detail of the interior of a grain showing dehydration and partial melting. The pale materials are various iron oxides containing much porosity (black) and a glassy material of fayalitic-composition (mid-grey). Scale bar 50 µm.

d. Weathered grain showing reduction to metallic iron. The mid-grey areas in the central grain are mostly rust after metallic iron. The white areas are relicts of phosphoric iron. Scale bar 1 mm.

e. Detail of the grain shown (d). The weathered iron grain (upper left) is overgrown (lower right) by secondary rust. The phosphorus-rich materials (bright) are preserved as cores of some grains and as films along the grain boundaries of the weathered iron. The iron contained rounded glassy siliceous slag inclusions, which themselves bear prills of phosphoric iron. Scale bar 50 µm.



conventional, slagpit furnaces. A rather lower-density flow slag, without large wood moulds occurred in Furnace 2. Detailed microstructural investigation of the flow slags was undertaken through analysis of samples from one of the 'orthostat' blocks (that to south of the arch of Furnace 1) because these were less weathered than the in-situ materials. A sample (FCT11) was taken from the typical flow slag with descending flow lobes from the lower part of the block and a second sample (FCT12) from the overlying sheet of apparently massive, coarser-grained slag.

Despite very similar bulk elemental compositions (Table 2), the two samples showed quite distinct microstructures (Fig 7). The flow slag (FCT11) showed a small proportion of primary wustite (FeO ; Fig 7a), some of which occurred in hammerscale-like plates, and the wider appearance of wustite as a cotectic with the subsequent olivine. In contrast, there was very little primary wustite in the sample from the slag sheet, but there was abundant magnetite (Fig 7e–h). In both samples the primary oxide was followed by iscorite (ideally $\text{Fe}_7\text{SiO}_{10}$; Figs 7b, 7h). The iscorite was limited to the interstitial areas in FCT11 (where it was mostly phosphoran, *sensu* Young and Hart 2021), but occurred more generally in FCT12 (where it was mostly non-phosphoran). Sample FCT12 was also unusual in showing areas with the development of large, coarse leucite (ideally $\text{K}[\text{AlSi}_2\text{O}_6]$) dendrites, which whilst occurring mainly interstitially (see below) may be rather early in the paragenesis (perhaps reflecting the importance of the contribution of wood-ash to the generation of this slag).

The olivine in both samples was phosphoran fayalite with a very small range of octahedral substitution ($\text{Ca} < 1\%$ substitution, $\text{Mg} < 2.5\%$ substitution and Mn

1.1 to 1.4 % substitution), but with tetrahedral substitution in almost all analyses exceeding the 0.03 atoms per formula unit (APFU) which defines phosphoran fayalite (Boesenberg and Hewins 2010) and of up to 0.5 APFU marginally. The olivine has a grain size of approximately 0.5 mm in FCT11, but commonly over 2.0 mm in FCT12, indicating their difference in cooling rate.

FCT11 showed hercynite in association with the later stages of the fayalite, and both samples showed an unusual abundance and range of phosphate minerals (mainly phosphate 'C' in FCT11 and phosphate 'D' in FCT12; the informal naming of phosphate minerals A–D following Young 2016b) commencing alongside the later stages of the fayalite (Figs 7b, 7e, 7f). Areas interstitial to the olivine showed further development of these phosphate minerals, followed by phosphate 'A' as a major phase (followed in turn by small quantities of phosphate 'D' and iron sulphides). Either leucite (sometimes as a major dendritic phase in FCT12) or a leucite-wustite cotectic (in FCT11) occurs alongside the phosphorus-rich phases in the interstices.

Iscorite is an uncommon phase in iron smelting slags, because it is an indicator of a degree of oxidation of a slag during solidification. It has, however, been encountered rarely in the margins of tapped slag lobes at Churchill's Farm, Hemyock (Smart *et al.* 2018) and was observed in the smelting slags at Fleethill Farm (Young 2016b). Small amounts of magnetite and (probably) iscorite were noted in slags on the frontal margin of a furnace bottom (interpreted as having been modified under the influence of air entering the furnace through its frontal arch) from a large Roman 'dome'- or 'bottle'-shaped furnace at Bexhill (Young 2022a, 12). It is an abundant phase (in its phosphoran variety) in nineteenth century

(Previous page) Figure 7: Backscattered electron photomicrographs of slags produced in a large furnace. The samples of flow slag FCT11 (a–d) and the overlying sheet slag FCT12 (f–h) are drawn from the south orthostat of Furnace 1, context (076).

a. Flow slag: typical microstructure dominated by fayalite and wustite in a variety of relationships. Scale bar 100 μm .

b. Detail of area of flow slag FCT11 with complex interstitial mineralogy. The pale grains with rounded outlines are wustite, overlain by the slightly darker elongate iscorite. The dark phase in a cotectic relationship with some of the wustite is leucite. The remainder of the space interstitial to the olivine (pale grey near margins of view) comprise two phosphate minerals. The mid-grey mineral is phosphate 'A' and the darker grey is phosphate 'C'. Scale bar 100 μm .

c. Overview of a region of FCT11 with typical microstructure. There is little wustite and the interstitial areas are mostly filled by phosphate minerals and occasionally by leucite. See (d) for detail. Scale bar 1 mm.

d. Detail of an interstitial region shown in (c). The dominant fayalite (pale grey near margins of view) contains a small amount of both primary and cotectic wustite (white). The fayalite is overgrown by leucite (dark), by large grains of phosphate 'C' with a slightly zoned composition, by the elongate paler phosphate 'A' and finally by phosphate 'D' and iron sulphide. Scale bar 100 μm .

e. Typical texture of the sheet slag FCT12. The dominant fayalite olivine (pale grey) follows wustite (rounded blebs), iscorite (elongate) and magnetite (polygonal). See (f) for details. Scale bar 1 mm.

f. Detail of part of the view of (e). The phosphoran fayalite olivine in this view is somewhat altered, giving a streaky appearance (upper right). The polygonal grains enclosed by both the fayalite and in the interstitial area are magnetite. The outer margins of the fayalite are intergrown with the darker of two phosphate minerals (Phosphate 'B'), with an elongate second phosphate mineral (potassium-rich phosphate 'A') filling much of the interstitial volume. The dark areas are grains of leucite. Scale bar 100 μm .

g. Overview of an area of similar mineralogy to that shown in (e), but particularly rich in euhedral magnetite. Scale bar 1 mm.

h. Detail of a region of olivine in FCT12 that encloses grains of magnetite (right) and elongate iscorite. Scale bar 100 μm .

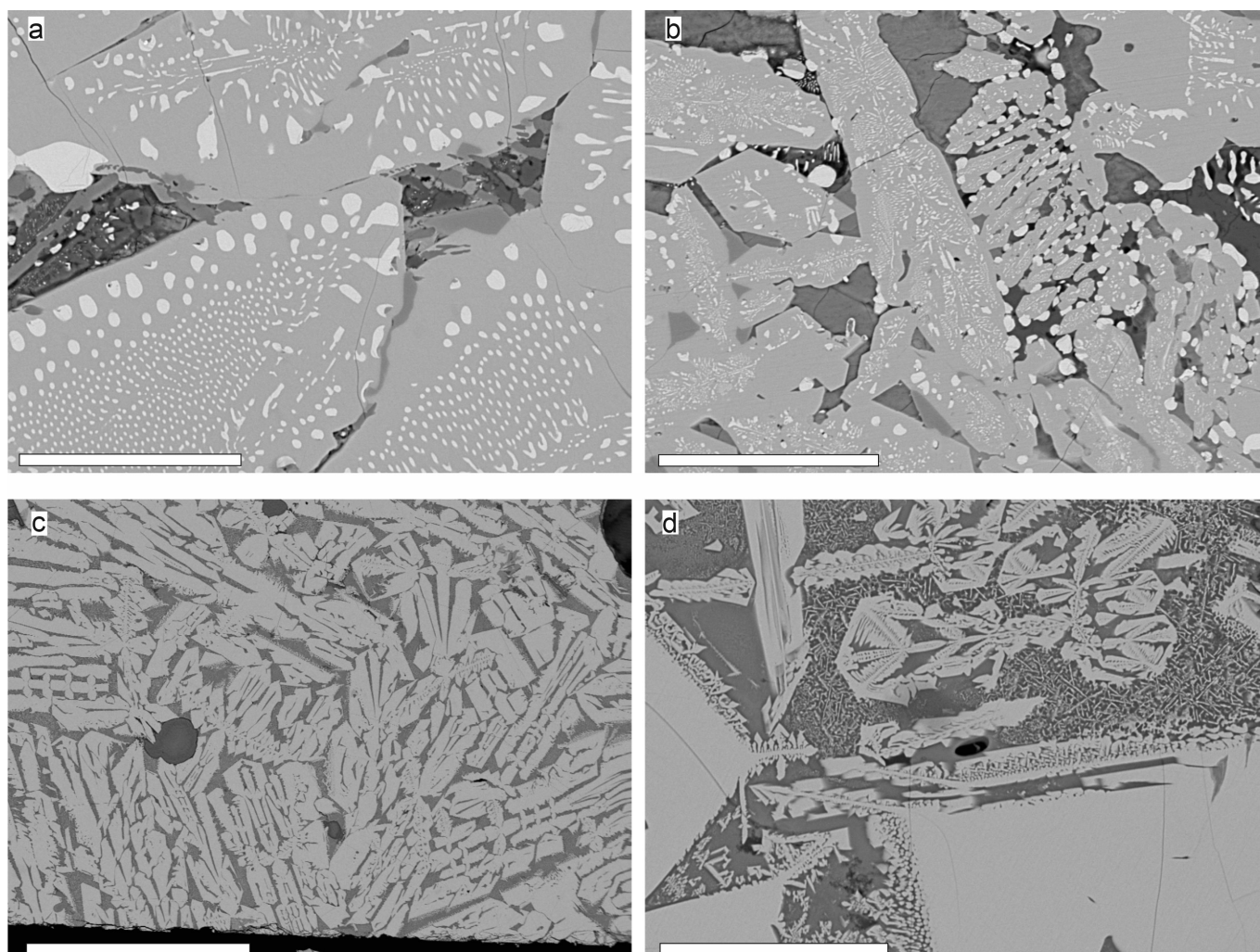


Figure 8: Backscattered electron photomicrographs of slags produced in small, cereal-packed furnaces. Furnace bottom sample FCT25 from context (51) and slag ‘puddle’ FCT27 from context (47).

a. Furnace Bottom, FCT25: typical microstructure dominated by fayalite with cotectic wustite. The small interstices are bordered by fayalite with inclusions of both ‘Phosphate C’ and hercynite. The interstices are commonly badly weathered. Scale bar 100 μm .

b. Furnace Bottom, FCT25: an unusual variant on the microstructure in which preserved interstitial areas show a leucite-wustite cotectic and blebs of wustite (with exsolved magnetite lamellae) overlie the margins of the fayalite. Scale bar 100 μm .

c. Slag puddle, FCT27: a typical microstructure of quench-texture olivine in a glassy matrix. Scale bar 1 mm.

d. Slag puddle, FCT27: detail of the microstructure showing the fine olivine dendritic quench texture around the crystal terminations and the finely crystalline nature of the matrix, with a plate-like morphology, of uncertain mineralogy. Scale bar 100 μm .

refinery slags (Young and Hart 2021) in which air was blasted into the molten slag. The oxidising influence of air entering the furnace through the large frontal arch thus seems likely to be implicated in the generation of the mineralogy of the furnace bottom slags.

The components of the slag assemblage from the external ‘dump’ deposits are (1) flow slag totalling 170 kg, (2) dense sheets and tapslag-like flows totalling 23 kg and (3) 32 kg of other furnace bottom slags which occurred together with (4) 82 kg of indeterminate slags. The flow slags from the waste deposits resemble those both from the base of Furnace 1 and from the southern orthostat, commonly showing moulds that indicate the former presence of large wood pieces. The ‘other’ furnace

bottom slags are dominantly those rich in the smaller moulds and remains of the particles of the charcoal fuel; similar materials form the majority of the two northern orthostats from Furnace 1. The dense slag sheets resemble the sheet component within the southern orthostat, but also grade into examples with a flow lobed surface (taking on a resemblance to a tapped slag) and these often show strong secondary reddening; these features again suggesting the influence of an open frontal arch.

Smelting residues: narrow shaft ‘slagpit’ furnace

Residues showing the use of cereal or grass (for simplicity this will appear subsequently solely as cereal) for the pit-packing in a relatively narrow slagpit type furnace, quite different from the dome furnaces, were

encountered in the 'northern scatter' in 'hollows' [46] and [50], and to lesser elsewhere (see below). A 22 kg block of furnace bottom slag together with a further 12 kg of furnace bottom fragments and flow slags were recovered from fill (051) of pit [050], tentatively identified as Furnace 4.

The furnace bottom slag from pit fill (051) had a structure of amalgamated flow lobes (sample FCT25). The slag is moderately coarse-grained, indicative of a slow cooling rate, and the margins of the flow lobes do not show development of oxide crusts, both features typical of slagpit residues. The dominant phase is olivine with cotectic wustite (Figs 8a, 8b). The olivine is phosphoran and shows a very restricted range of composition close to end-member fayalite, with very low levels of substitution of magnesium, manganese and calcium. The outer part of the olivine contained or was associated with grains of both phosphate 'C' and hercynite. Interstitial areas were poorly preserved, with some containing remnants of a leucite-wustite cotectic alongside the hercynite and phosphate 'C' (Fig 8a), but others just weathered glass (Fig 8b upper).

A sample (FCT27) from a slag puddle from fill (047) was, in contrast, a very simple material, comprising quench-textured olivine (with a high level of manganese substitution) in a finely-crystalline groundmass (Figs 8c, 8d). The ground mass included elongate, probably plate-like, crystals of uncertain mineralogy (Fig 8d).

Slags with evidence for cereal packing were recovered in only small quantities outside these features: from the working hollow of Furnace 2 (682 g), the South ditch (260 g), pits/hollow [44], [48] in the 'north scatter' (1310 g) and pits/hollows ([52], [54] and [58] associated with the east scatter (436 g). These occurrences suggest that the use of a cereal-packed slagpit furnace (probably Furnace 4) was broadly contemporary with that of the dome furnaces.

Smithing residues: macroresidues

The most common macroscopic evidence for iron working (smithing) are smithing hearth cakes (SHCs), usually plano-convex or concavo-convex slag masses that form just below the blowhole in the smithing hearth. The identification of smithing at Folly Court was hampered by the similarity of some of the more sheet-like smelting slags to SHCs. The five SHCs identified with reasonable confidence form a very low proportion of the overall assemblage (<1 % by weight) and have a range of weights of 332 g to 1120 g. SHCs interpreted as deriving from middle Iron Age bloomsmithing at

Tregurra (Young 2015a; Young 2016c; Young 2022b) show a very similar weight range of up to 1165 g.

Smithing residues: microresidues

Microresidues from smithing occurred widely, if generally in low abundance, in wet-sieved samples. Only those from layer (13) (a thin dark horizon on the north side of the working hollow for furnaces 1 and 2) and fill (55) (the fill of a hollow associated with the eastern scatter) show what may be primary smithing microresidue assemblages; other samples contain very low concentrations. The most likely interpretation of context (013) is that it formed on a surface broadly contemporary with the earlier fills of the working hollow. The microresidues included both flake and spheroidal hammerscale, slag flats and slag blisters (classes after Young 2011). Slag droplets in the samples might be from either smithing or smelting.

Interpretation

The 'dome' furnaces

The most striking observation about the residue assemblages is that those in situ within the furnace structures differ from those of the external dumped deposits derived from them; furnaces 1 and 2 contained large quantities of sinter (38 kg in Furnace 1, 31 kg in Furnace 2) but only a total of 3 kg was recovered from the dumped deposits. This might be explained by either that the formation of sinter in large quantities was unintentional and coincident with the last uses of both of furnaces 1 and 2, or that sinter may have been a routine material produced during a smelt, but systematically recycled.

The nature of the blowing of the furnaces at Folly Court is uncertain. For Furnace 2, the flow slag was triangular, in plan running from the rear wall towards the arch, possibly suggesting blowing from the centre of the back wall but no significant heat alteration of the substrate was noted. There was no observed directionality in the slag cake in Furnace 1, but heat alteration of the subsoil was particularly marked on the damaged north side of the furnace so blowing from the northern side is most likely. The intensity of this alteration suggests repeated heating and it is possible that both furnaces were blown from this side. There were no fragments of blowholes or tuyères recorded.

In both furnaces 1 and 2 the sinter occurred primarily towards the rear of the furnace. One likely interpretation of the sinter is that it indicates the location of an extensive 'deadzone' in which ore would descend with incomplete reduction, because of a limited ability for the air blast to penetrate across the enormous furnace chamber.

The production of iron in the Berkshire/Surrey iron-making area was complicated by the high level of phosphorus in the ore, probably approximately 2 % phosphate. During smelting, reduced phosphorus (phosphide, P^-) may enter the iron, whereas phosphate (PO_4^{+}) will be captured in the slag. Although phosphorus has usually been deemed deleterious to the quality of iron in the industrial period, phosphoric iron (0.1 wt% to 1 wt% P) was widely employed in the Iron Age as a hard material, suitable for the edges of cutting tools. Soft, low-phosphorus, iron was also required, so control of the phosphorus content of the iron was important. There are techniques for adjusting the phosphorus content of iron through reprocessing (remelting) the metal, but a high degree of control can also be achieved through management of the conditions of smelting (Sauder 2013).

The presence of primary magnetite and of iscorite in many of the smelting slags is unusual, for these phases contain both Fe^{2+} and Fe^{3+} , suggesting a less reducing environment than typical. Paynter *et al.* (2015) described magnetite in smelting slags of a particularly aluminous composition, but that is not the case at Folly Court. A less-reducing environment than normal, that allowed formation of magnetite and iscorite would also be compatible with conditions for promoting phosphorus partition into the slag rather than the metal. The effect of oxygen potentially introduced to the furnace via the large furnace arch, even if it was only opened for short periods of time, remains unknown.

It is, therefore, possible to envisage the 'dome' furnaces of Folly Court being employed to smelt iron in controlled manner, so as to reduce the phosphorus uptake by the iron. The big furnaces could have produced much iron and had room for good separation of slag from the iron, but perhaps gave greater scope marginally for incomplete reaction and the production of sinter than in more typical furnace types.

Elemental analyses show that minor variability in the composition of the ore prevents construction of a rigorous mass balance model for the smelting in the 'dome' furnaces. A rather crude mass-balance calculation for Furnace 1, however, suggested that the 110 kg of slag in Furnace 1 could have been produced from 238 kg of ore with the composition of the ore calculated at Fleethill Farm (Hardy and Young 2019; Young 2016b), during the production of 86 kg of iron; clearly indicating that the 'dome' furnaces could produce a very large quantity of iron in a smelt. A bloom of much over 10 kg would not, however, easily be workable or even be splittable with Iron Age manual technology. There is no indication at

Folly Court that the 'dome' furnaces were blown through multiple blowholes, permitting development of multiple blooms, although this cannot completely be excluded. Alternatively, the furnace may have been manipulated to generate successive small blooms. This would have allowed the production of iron pieces small enough for manual compaction but at the expense of requiring constant attention to the smelt, perhaps helping to explain the large frontal arch.

The only other well-documented Iron Age 'dome' furnace from the region is Furnace (505) at Sadler's End, 2.1 km northwest of Folly Court (Lewis *et al.* 2013). At first sight, the 'dome' furnaces of Folly Court and Sadler's End appear completely morphologically different to the main corpus of known Iron Age smelting furnaces, exemplified by the detailed work of Crew in North Wales, first in excavating the sites of Bryn Castell and Crawcwellt West (Crew 1987; Crew 1989; Crew 1998; Crew 2009) and then by reconstructing the technology in a ground-breaking series of experiments (Crew 1991; Crew 2013). The furnaces that Crew studied were, however, amongst the smallest recorded from the British Iron Age (internal diameters of 25 to 30 cm; Crew 1991, 21). More recently, furnaces of a variety of intermediate size have been investigated, most particularly those at Tregurra (Young 2015a; Young 2016c; Young 2022b) and Tolgarick Farm (Young 2016a) near Truro, Cornwall. Moreover, there is much in common in the detail of the residue assemblages between those of the 'dome' furnaces and those of the smaller varieties known elsewhere, in particular the use of a packing of split or round wood for the chamber or pit at the base of the furnace.

At Tregurra, evidence supported the interpretation of at least two of the furnaces as having originally been bottle-shaped. Furnace [2398] had a pear-shaped basal pit, indicating an approximately circular furnace, 550 mm in internal diameter, with a wide arch towards the northeast, and blown from the southwest. Furnace [2567] was of a similar size, orientation and structure to [2398], but probably with a slightly narrower arch and gave a ^{14}C date of 410 – 350 (71.4 %) and 300 – 230 (24.0 %) cal. BC (SUERC-64586).

At Tolgarick Farm, furnace [2178] (dated to 370 – 160 (94.2 %) and 130 – 120 (1.2 %) cal. BC; SUERC-67876) was probably a 'domed'- or bottle-shaped furnace constructed over a pear-shaped cut, 1.15 m in length, 0.80 m wide and at least 200 mm deep, with a 0.8 m internal diameter furnace chamber and a 0.5 m wide arch to the northeast. It produced an in-situ 'furnace bottom' with

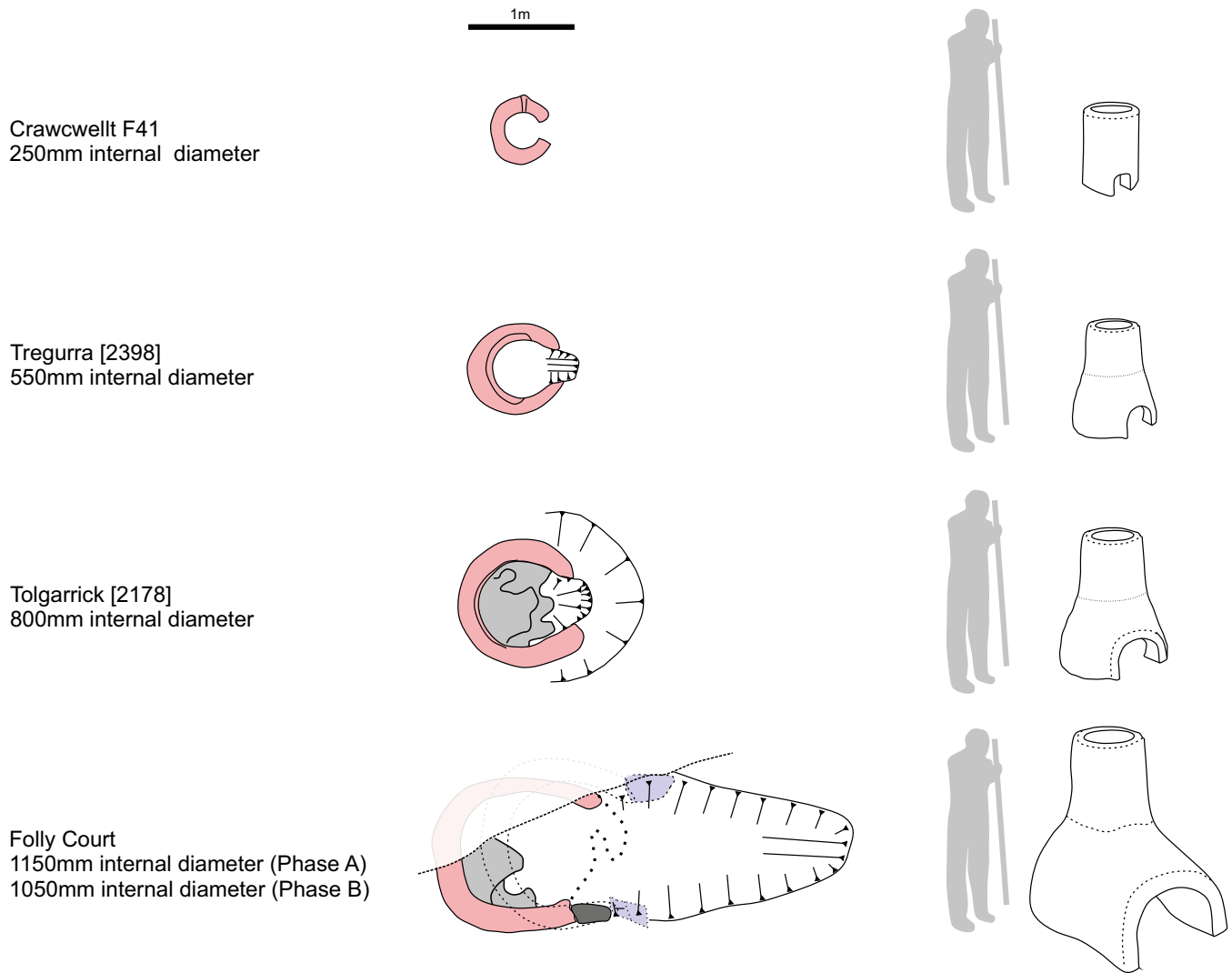


Figure 9: Examples of furnaces in plan and tentative reconstruction illustrating the spectrum of furnace types employed in the Middle Iron Age in Southern Britain. Figure after Young 2016c, Figure 11.

an overall weight of 100 kg. As at Tregurra, the furnace had probably been blown from the side opposite the arch.

Closer to Folly Court, the Middle Iron Age smelting at Fleet Hill Farm, 5.5 km south-southwest of Folly Court (Hardy and Young 2019; Young 2016b), was probably also in medium-sized furnaces; ‘furnace bottoms’ of at least 20 kg were probably produced in furnaces of 450 to 500 mm internal diameter, although details of the furnace morphology were not preserved.

This evidence, both structural and from the residues, suggests that the technology of the ‘dome’ furnaces lay on a continuum with that of smaller furnaces with wood-packed basal pits and was not part of some entirely separate process (Fig 9).

The ‘narrow shaft’ furnace

The presence of a second type of furnace at the site was indicated by the residues from a small slag-pit furnace with evidence for a cereal pit-packing. This furnace was not directly dated, but fragments of similar slag from elsewhere on the site suggest that the two furnace types were broadly coeval. The presence of slag pieces on the dump also supports the idea that these furnaces were intended to have the slag cleared for re-use of the structure.

In many respects these residues are very similar to residues from cereal-packed furnaces recorded elsewhere; slag flow within a pit with cereal packing is quite different from that in one with wood packing. The moulds of the cereal are typically seen on the margin, sometimes as horizontal layers within the upper part of the fill and sometimes as impressions on the surface of the slag ‘puddle’ that commonly forms in the base

of the pit. All these textures are quite different from the flow-lobed, anastomosing prills that form between the moulds of wood packing. It is suspected that an unawareness of these textural differences has led to under reporting by archaeologists of cereal packing in Britain. Examples are not currently documented from the Middle Iron Age, with the possible exception of unpublished material seen by the author from East Yorkshire. Late Iron Age material has recently been recorded from Lockleaze Roman Villa site (Young 2018b) and a Roman example has been illustrated from Leda Cottages, Kent (Paynter 2007, figure 4). Most known examples are from the early medieval period, including those from Eckington, Derbyshire (Allen *et al.* 2018), Yorkley (Young 2015b) and Clearwell Quarry (Paynter 2002), both in Gloucestershire, and from Churchills Farm, Hemyock, Devon (Smart *et al.* 2018).

The elemental analyses of the residues from the cereal-packed furnaces present a problem when considered with the graphical approach to mass balance employing the same parameters as those used for Furnace 1 (see above). Five out of the eight analyses plot below the mixing line between the analyses of furnace ceramic from Furnace 1 lining and the model ore. The data points must plot above the mixing line, or they would imply that another component has been added to the mix, rather than iron extracted from it, suggesting in turn that one or both of the endpoints of the mixing line is incorrect. The most likely reasons for this would be that Furnace 4 had a less aluminous furnace lining, or that sand from the substrate was also entering the slag forming process; lowering the alumina of the bulk silicate contribution to just 3 wt% would produce a solvable model.

An alternative and entirely speculative interpretation would be that the furnace was not for smelting at all but was for remelting iron produced in the other furnaces, either perhaps to modify the carbon and/or phosphorus contents or to extract the iron from the sinter, using a flux of smelting slag. Remelting of bloom iron is commonly undertaken in shallow hearths (the Evenstad process; Evenstad 1790 and in translation, Jensen 1968; Wagner 1990) but it is also possible to reprocess iron, or iron/slag mixtures, by passing them through a small shaft furnace.

Discussion

The excavation has revealed considerable detail on the structure and use of unusual 'dome' furnaces in the Middle Iron Age at Folly Court. Instead of being an entirely separate class of furnace, they appear to represent one end of a continuum in design and use.

Examples of, probably 'bottle'-shaped, furnaces have been presented, intermediate between the 'dome' and the cylindrical shaft furnaces. All usually employed a split or roundwood packing to the basal pit (perhaps more usefully considered as basal chamber in the larger varieties).

The size of the 'dome' furnaces and the amount of flow slag in the base of Furnace 1 suggest that their output would have been a substantial amount of iron, perhaps in excess of 80 kg. Unusual features of the mineralogy of the slags from other contexts hint at the entry of oxygen into the furnace via the large arch, possibly because the arch was open to allow bloom manipulation (including the creation of multiple blooms during a smelt) and/or as a possible smelting strategy to minimise phosphorus uptake by the iron.

Only the example at Sadler's End and perhaps that at Tolgarrick, discussed above, previously documented 'dome' furnaces in the British Iron Age. They have, however, a much wider range in continental Europe, where they have been recorded in a swath from eastern Austria (Burgenland), southeast Germany (Kelheim), west-central Germany (Siegerland) and western Germany (Saarland); a zone corresponding to that of the core area of the La Tène culture. Pleiner stated that their use commenced during Hallstat D (600-450 BC), but many of the occurrences have now been redated as La Tène, with the known large 'dome' furnaces in Siegerland being apparently of the period mid-4th to 2nd centuries BC (Garner 2010a; Garner 2010b; Stöllner 2014).

'Dome' furnaces are relatively well-known from the Roman period in SE England, with spectacularly well-preserved examples having been excavated by the Wealden Iron Research Group at Little Furnace Wood and by Oxford Archaeology on the Bexhill by-pass scheme (Young 2022a), both of which await full publication. These furnaces differ in key details from the British Iron Age examples, including having the furnace chamber sunken into a bank with a clay furnace setting, the tapping of at least some of the slag produced and having an association with multi-perforate block tuyères. It seems likely that these represent a reintroduction of a somewhat evolved 'dome' furnace style during the Roman period rather than the result of evolution within Britain.

The use of cereal-packed slagpit furnaces in the British Iron Age is also poorly documented. Although they too are slightly better known in the Roman period in Britain, most known examples are early medieval. The factors

that might have influenced the use of a cereal packing instead of the more conventional wood packing are not known. The question of the relative role of the narrow shaft furnaces and the large 'dome' furnaces has been raised previously at Sadler's End (Lewis *et al.* 2013), although it is unclear on that site whether the narrow furnaces were wood or cereal-packed. Whether the comparison is relevant may be a debatable point, but the combination of cereal-packed slag-pit furnaces and apparently coeval slag tapping furnaces was a problem on the 9th to 10th-century site at Churchills Farm, Hemyock (Smart *et al.* 2018), with the date ranges for the two classes of furnaces being indistinguishable despite the use of Bayesian statistics with a large number of ^{14}C determinations.

Very small variations in the chemical composition of the ore mean that comparison between various suites of slag is very difficult and it is not possible to generate robust, unambiguous, mass balance models. Nonetheless, the site provides some of the best British evidence for the use of a sophisticated approach to iron-making in the Iron Age, possibly in order to control phosphorus uptake in the iron.

One line of investigation that requires detailed further work is the relationship between the 'dome' furnaces of the middle Iron Age and those of the Roman period (both in the sense of how the two types of furnaces were worked and of whether they are related in an evolutionary sense). They have previously been considered as two distinct forms of furnace, but recent investigations of Roman examples (Young 2022a) suggest the technology was less distinct than supposed.

The substantial 'furnace bottom' slag blocks of the large 'dome' furnaces indicate that they would have been capable of producing large amounts of iron, perhaps in repeated cycles of charging and extraction within a single smelt. Nonetheless, the similarity of the wood-packing in the basal chamber to that in conventional small furnaces, indicates that the slag results essentially from a single smelt process; any stop-start within the high temperature process would entirely negate the purpose of the initial wood packing.

Given the uncertainty over the details of the technology, consideration of the societal context of the use of large dome furnaces must also be necessarily speculative. The production of particularly large blooms of iron cannot have been their purpose, for it would not have been possible to work iron on the scale of the 86 kg bloom suggested by the mass balance modelling with

manual Iron Age smithing technology. The advantage in producing multiple small pieces of iron in a large furnace (whether simultaneously on different air inlets, or as suggested above more likely in the present case, sequentially) compared with multiple smelts in small furnaces, is unclear. The advantage might be economic (such as a reduced consumption of charcoal), material (if, for instance, the 'dome' furnaces permitted the production of iron with a lower phosphorus content) or societal (the coming together of a group of people at a large smelting event, that produced iron for that whole group). Such questions will only be able to be answered once an improved understanding of the technology has emerged. Glib assertions on the nature of Iron Age technology must be resisted, as must interpretations based solely on ethnological data from unrelated cultures. Further careful excavation, observation and detailed analysis of these and related Iron Age furnace types is required, followed by practical experimentation and reconstruction.

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Appendix: Iron Age pottery

by Jane Timby

The archaeological work resulted in the recovery of 16 sherds of pottery weighing 179 g dating to the post-medieval and later prehistoric periods. The pottery was associated with five contexts investigated within and around three Iron Age furnaces.

The upper topsoil produced four body sherds and one base sherd from a later prehistoric vessel in a grey sandy ware (IASA1). The subsoil over the furnaces contained one post-medieval red ware and one sherd of Iron Age sandy ware (IASA2). The latter shows three pairs of lightly tooled spaced horizontal lines. The large pit cut into Furnace 3 produced two post-medieval sherds one being a rim from a white salt glazed bowl, a ware popular in the 18th century. Accompanying this was one sherd of unglazed red earthenware.

A single flint-tempered (IAFL) body sherd weighing 17 g was recovered from the southern ditch, associated with furnaces 1 and 2, and five sherds from a single vessel



Figure 10: Sherd from a Middle Iron Age globular vessel, from a fill lying behind the southern 'orthostat' of Furnace 1.

(96 g), also in flint-tempered ware, were recovered from a sandy deposit behind the southern orthostat of Furnace 1. The latter is a handmade globular-bodied, high shouldered vessel with a short everted rim. It is red-brown in colour with occasional black patches on the exterior and black on the interior and has a burnished finish on both surfaces. The internal burnishing may suggest this is a bowl rather than a jar. The upper body is decorated with two parallel tooled horizontal lines defining a band just below the shoulder of the vessel (see Fig 10).

The furnace vessel, along with the other seven later prehistoric sherds, is typical of Middle Iron Age pottery (3rd to 2nd century) from the locality. Local parallels for contemporary assemblages can be found at Perry Oaks, Heathrow (Every and Mephram 2006), Caesar's Camp, Heathrow (Grimes and Close-Brooks 1993) and the hillforts at Hascombe and Holmbury, Surrey (Seager Thomas 2010).

Description of Iron Age fabrics

IASA1: a mid-grey fabric containing a common frequency of moderately well-sorted, fine (0.5 mm and less), sub-angular to rounded, quartz sand, with rare larger rounded grains up to 3 mm in size. In addition, the matrix contains sparse rounded grey clay pellets and dark grey, rounded, argillaceous inclusions 2–3 mm and rare, burnt out, organic matter.

IASA2: a dark grey-brown ware with a black core. The matrix contains a sparse scatter of ill-sorted rounded quartz and rounded grains (0.5 mm and less) of brown iron/glaucanite. Rare inclusions of angular flint, mica and organic matter.

IAFL: a brown to black ware with a dark grey-black interior/core. The paste contains a sparse temper of angular, calcined flint fragments up to 1 mm in size. No other visible constituents.

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