

Report on the metalworking remains at Killurney 1, Co. Tipperary (15E0532)

Introduction

Excavations at Killurney 1, Co. Tipperary unearthed the remains of three slag-pit furnaces for smelting iron ore. One of the furnaces had its slag preserved in-situ and one piece of heat-affected clay from its upper fill is a partial furnace blow hole. Slag from another furnace has an impression of at least one tool, a rounded bar likely for bloom removal. A radiocarbon date from material from the basal fill of one of the furnaces puts the smelting activity in the second to mid-first centuries BC. A similar date was retrieved from a pit with smelting slag about 50m to the north likely suggesting further smelting activity.

The metalworking remains

The metalworking remains consisted of similar three features, pits set in shallow hollows, and slag from two of these and an assemblage recovered during site cleaning. The contextual data, plans and a draft report text were provided by Dan Noonan and David Hegarty of Dan Noonan Archaeological Consultancy.

The first of these features, consists of a shallow hollow C104 measuring about 1.4m by 0.6m and is flanked by a large naturally occurring stone on its western edge (Fig. 1). At its northern end, adjacent to the large stone, a pit measuring 0.45m by 0.44m and with a depth of 0.41m was located. This pit had steep sides and a rounded base. The upper fill C95 yielded over 2kg of heat-affected clay material and two pieces of slag with flow structure and adhering heat-affected clay. The colour of the clay varies from grey to pinkish, some pieces have smoothed sides (Fig. 2), others had vitrified surfaces and one piece has what appears to be part of a blow hole (diameter 20 – 25mm) (Fig. 3). Subsequent fill C100 held fragments of dense slag with flow structure. The next fill C101 had dense slag most of which consisted of a large crescent shaped piece weighing 7.4kg and which was fractured into four pieces (Figs. 4 and 5). The upper part is dull black with patches of rusty coloured material. The lower part shows clear flow structure with broadly rectangular cavities indicating that the slag solidified while flowing down over split timber

fragments. At least some of the timber fragments appear to have been horizontally stacked. The sides of one of the hollows in the slag has adhering non-charred bark (Fig. 6). The fill under this, C102, yielded further dense slag with flow structure (Fig. 7) as did basal fill C103 (Fig. 8). A radiocarbon date from material from basal fill C103 puts the smelting activity in the second to mid-first centuries BC (204 – 46 cal. BC, 2 Sigma).

About 1.3m to the south of C104, a similar hollow C110 measuring 1.51m by 1.1m and a depth of 0.22m was uncovered (Fig. 9). At the eastern side of this hollow was pit C109 measuring 0.4m by 0.35m by 0.31m deep. The fill of the hollow, C94, yielded over 11.7kg of ironworking waste. Most of this material consisted of dense slag which had solidified vertically and has hollows left after timber fragments. The largest of these hollows measured 85mm by 25mm and in one piece it was clear that the timber fragments were placed horizontally in the furnace (Fig. 10). One piece of slag with adhering heat-affected clay at its outer upper rim consisted of vertically flown slag which appears to have been prevented to flow further down and was 'pushed out' on the outer side (Fig. 11). Another fragment of dense had frothier material adhering to its upper surface. This frothy material shows the impression of a rounded tool (length 47mm, diameter 12mm) and possibly a second (diameter 12mm, depth 10mm) (Fig. 12). Fill 108 from pit C109 yielded a further 2.25kg of dense slag with flow structure and hollows after timber fragments. Some heavily vitrified ceramic material was also recovered.

A third feature, C98, was located about 3.3m to the west of pit C104. It measured 1.2m by 0.9m and had a maximum depth of 0.2m with a pit at its eastern end (Fig. 13). The limited amount of smelting waste from its fill (C93) suggests this furnace was cleaned out after use.

Also, more than 4.5kg of iron smelting waste was recovered during clearance of the general area where the above features were located. This consisted mainly of dense iron slag with flow structure and some pieces of heat-affected clay. A single fractured piece of slag weighs over 2.6kg.

Finally, a pit C77 measuring 1.15m by 1.10m and a depth of 0.06m was excavated about 50m north of the previously described features. Its fill C74 contained more dense slag with flow structure and pieces of heat-affected clay. This pit was covered by a stone slab which showed signs of fracturing due to heat. A piece of charcoal from this fill was radiocarbon dated to 210 – 52 cal. BC (2 Sigma).

Interpretation and conclusions

The metalworking debris at Killurney, Co. Tipperary is consistent with the remains of slag-pit furnaces. This type of furnace was the most commonly used from the 6th to 5th centuries BC until the 10th to 11th centuries AD (Rondelez 2017). These furnaces consisted of a clay shaft placed above a pit which was filled with fragments of timber. The shaft was filled with iron ore and charcoal and after firing the bloom would form at the base of the shaft while the slag would descend into the pit and solidify over, and partially replace, the timber fragments.

The remains at Killurney consisted of three furnaces with associated working hollows. It is unclear if these hollows were related to bloom removal or settings for the bellows. The bellows were most likely placed in the hollow of furnace C104 as indicated by the location of the crescent shaped slag lump which would have formed on the opposite side of the air inlet. Other working hollows, deeper and partially covered, were observed in front of slag-pit furnaces dated to the 1st century BC to the 1st century AD at Derrinsallagh 4, Co. Laois (Young 2009) which were clearly made for other purposes than bellows settings.

There have been suggestions that the wood in the pit under the furnace could have acted as fuel but the presence of unburnt bark inside of one of the hollows in the slag from furnace C104 implies this was not the case at Killurney.

The heat-affected clay with a blow-hole recovered from C95 could represent either the air inlet in the furnace wall or a fragment of a tuyere fragment. No evidence was found for smithing

activity, in particular there was no hammerscale present in the residues of the soil samples. This suggests that the blow hole, as well as the other heat-affected clay, was part of the furnace structure.

The material from Killurney also included rare evidence for the tools used in smelting. A piece of slag from furnace C110 has one, and possibly two, impressions of rounded tools on its upper surface. These are likely evidence for the use of a rounded bar to detach the bloom from the slag at the end of the smelt.

The shallow pit, capped by a large heat-affected stone and yielding further smelting debris, could be related to the processing of the blooms made in the three furnaces described above but the distance, about 50m removed, more likely suggests additional Iron Age smelting in that area.

Bibliography

Rondelez P. 2017 The Irish bowl-furnace: origin, history and demise in *Journal of Irish Archaeology*, Vol. XXVI: 101 – 116.

Young T. 2009 Detailed recording of furnace C397, Derrinsallagh 4 (E2180) in Lennon A.-M. (ed.) *Report on the Archaeological Excavations of Derrinsallagh 4, Co. Laois*. Unpublished Excavation Report, Archaeological Consultancy Services Ltd: 204 – 218.

Catalogue

Cut	Fill	Sample	Description	Weight (g)
n/a	01	21	Two adjoining pieces of flow slag with vitrified clay on the outer upper rim.	2610
n/a	01	21	Piece of flow slag with adhering vitrified clay and impressions of wood fragments (70mm by 24mm)	710
n/a	01	21	c. 35 pieces of dense flow slag	955
n/a	01	21	6 pieces of heat-affected clay with inclusions of stony material	378
77	74	15	[from flot residues] Many small to medium sized fragments of dense black slag with flow structure. Also, some small pieces of heat-affected clay	402
98	93	22	[from flot residues] Small particles of magnetic and non-magnetic slag with flow structure	10
104	95	23	Two lumps of flow slag with adhering vitrified clay	1058
104	95	23	c. 50 pieces of dense flow slag, some with adhering vitrified clay	933
104	95	23	17 pieces of heat-affected clay with some stony inclusions. The colour varies from grey to pinkish. Some pieces have a smoothed edge.	213
104	95	23	22 fragments of heat-affected clay with a vitrified outer surface. The material has frequent stony inclusions. On piece has what appears to be part of a blow hole (diameter 20 to 25mm)	1081
104	100	24	[from flot residue] Multiple small fragments of dense slag with flow structure	204
104	101	25	Four fitting pieces of flow slag with vitrified clay attached to their upper outer rim. The curve of the upper rim suggests original diameter of c. 0.4m. The upper surface has inclusions of clay and rusty material. The lower part shows impressions of wood fragments with the largest, being horizontal, measuring 110mm by 45mm. Some bark is still preserved adhering to the slag.	7386

104	101	25	12 pieces of dense flow slag	799
104	101	25	[From flot residue] Many small to medium sized fragments of dense black slag with flow structure	489
104	101	25	50+ fragments of dense to rather dense slag, most showing flow structure and/or hollows left after wood fragments	87
104	102	27	[From flot residue] Most of the residue consists of small to medium sized fragments of dense black slag with flow structure. Some evidence of the slag having flown over cut pieces of timber. Some small pieces of heat-affected clay also included.	906
104	103	29	[From flot residue] Most of the residue consists of small to medium sized fragments of dense black slag with flow structure	365
109	108	32	50+ fragments of dense to rather dense slag, most showing flow structure and/or hollows left after wood fragments	2250
109	108	32	Piece of heavily vitrified ceramic material	89
110	94	26	Piece of dense slag with vertical flow structure. Has vitrified clay attached on its outer upper rim. The outer lower rim appears 'pushed out', i.e. the slag was stopped from flowing further down. The lower inner side shows hollows left after wood fragments.	2158
110	94	26	Two fitting pieces of dense slag. Vitrified clay is attached to their upper outer rim. The curve of the upper rim suggests original diameter of c. 0.3m. The inner side of one piece has hollows left after wood fragment (max. 70 by 25mm). The other piece has two hollows after wood fragments (max. 82 by 25mm) which would have been placed horizontally above each other.	2024
110	94	26	Three pieces of dense slag with adhering vitrified clay. Two have hollows left after wood fragments (max. 85 by 25mm).	1315
110	94	26	Fragment of dense heavy slag with lighter, frothier material on its upper side. The frothy material shows one and possibly two impressions of rounded implements, likely	1234

			tools. The largest and most convincing of these measures 47 mm by 12mm diameter. The other impression consists of a rounded hollow measuring 12m across and 10mm deep. It also has embedded in the frothy material several fragments of vitrified clay.	
110	94	26	Two pieces of dense slag with clear flow lobes. Some vitrified clay is adhering to their outer sides	798
110	94	26	Piece of rather dense slag with light frothy material on its upper side.	248
110	94	26	100+ pieces of dense to very dense slag mostly showing either clear flow structure or impressions of wood fragments and often both	3386
110	94	26	Rather light pieces of slag showing flow structure and impression of a wood fragment	253
110	94	26	Three light fragments of slag mixed with vitrified clay material	306

Figures



Fig. 1. Post-ex of furnace and working hollow C104



Fig. 2. Furnace wall fragments from C95 in furnace C104. Fragment in the middle has a smoothed side



Fig. 3. Furnace wall fragments from fill C95 in furnace C104. Fragment on the right has a partial blow hole



Fig. 4. Crescent-shaped slag lump from fill C101 in furnace C104. Upper surface



Fig. 5. Crescent-shaped slag lump from fill C101 in furnace C104. Lower surface showing flow structure



Fig. 6. Slag lump from fill C101 in furnace C104 showing hollow after timber fragment with adhering unburnt bark



Fig. 7. Slag with flow structure from fill C102 in furnace C104



Fig. 8. Slag with flow structure from fill C103 in furnace C104



Fig. 9. Post-ex of furnace C110



Fig. 10. Slag with horizontally placed timber fragments from fill C94 in furnace C110



Fig. 11. 'Pushed-out' slag with adhering furnace wall from fill C94 in furnace C110



Fig. 12. Frothy slag with one, possibly two, tool marks from fill C94 in furnace C110



Fig. 13. Post-ex of furnace C98