

# GeoArch

Report 2008/31

Evaluation of Archaeometallurgical  
residues from the M7/M8 Contract 3:  
Killeany 1 (E2171)

Dr Tim Young  
12<sup>th</sup> December 2008

# Evaluation of Archaeometallurgical residues from the M7/M8 Contract 3: Killeany 1 (E2167)

Dr T.P. Young

## Abstract

*Killeany 1 produced a range of archaeometallurgical residues dominated by materials produced during iron-working (smithing), but also including a small amount of residue produced during the handling of copper alloy. The total assemblage weighed approximately 17kg.*

*Almost all of the residues came from secondary contexts, but pit F237 appears to have been a floor level smithing hearth and yielded a rich assemblage of slag fines. A second pit, F264, has almost identical dimensions to this hearth, showed fire-reddening, but was not sampled. It too was almost certainly a smithing hearth.*

*Only 10 complete smithing hearth cakes were recovered, so full statistical treatment is not possible. The SHCs ranged from 118-5000g in weight, suggesting that both blacksmithing and bloom-refining were undertaken.*

*The small amount of residue recovered from a wide range of contexts suggests that either the smithing was a sporadic activity over a protracted period, or that there was a focus outside the excavated area.*

## Contents

Abstract .....	1
Methods .....	1
Results .....	1
Interpretation .....	2
Evaluation of potential.....	2
References .....	2
Catalogue	
Table 1 - by context and sample .....	3
Table 2 – by feature .....	5

## Methods

All investigated materials were examined visually, using a low-powered binocular microscope where necessary. All significant materials were summarily described and recorded to a database (Table 1). As an evaluation, the materials were not subjected to any high-magnification optical inspection, nor to any other form of instrumental analysis. The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional.

## Results

### Material

The collections are dominated by smithing hearth cakes (SHCs), or fragments thereof, totalling 15.3kg (90% of the assemblage by weight). Much of the remainder of the assemblage comprises slag fragments which may well be small fragments of SHCs but are not recognisable as such.

The SHCs are rather mixed in their morphology and have a wide size range. Those for which original overall weight is measurable or may be estimated weigh (in descending order):

5000, 4714, 3140, 962, 604, 538, 400, 366, 128, 118g

The smallest SHCs would probably correspond to light blacksmithing work, but there are three SHCs over 3kg in weight, which are very likely to be indicative of bloom refining.

Pit F237 yielded a good assemblage of within hearth materials, which (along with the in-situ burning) indicating that this feature is a smithing hearth. The materials included some slabby fuel-ash-like material

from the base of the hearth, together with some within-bed slag fines (spheroids, blebs and prills) and also a piece of slag with a right-angled mould, probably due to slag attaching to a tool in the hearth.

### Distribution

The summary catalogue (Table 1) has been recast to allow easier understanding of the origin of the archaeometallurgical residues (Table 2). The material shows a wide range of contexts, from a pre-enclosure field boundary, the enclosure ditch, internal features, levels 2, 3, and 4 graves and two of the cereal kilns. Combined with the relatively small amount of archaeometallurgical waste recovered this suggests that smithing may have been a sporadic activity over a long period of time, or that, alternatively, this assemblage represents material derived from activity that was taking place outside the excavated area.

Some smithing certainly did take place within the excavated area, for pit F237 can be identified as a floor-level smithing hearth. This provided evidence for the smithing of iron and the stratigraphic report indicates that fill F240 contained a piece of copper slag, although none was recovered from this context during the metallurgical evaluation. The size of the hearth (1.37m x 0.9m x 0.16m deep) compares closely with other early smithing hearths in Ireland and indeed with a typical modern blacksmith's hearth. The hearth yielded a wide range of small slag fragments, including drips and blebs from within the fuel bed, a slag mould of a tool and highly vesicular slags probably strongly influenced by fuel ash.

A second hearth is probably indicated by F264, 1.49m long, 0.94m wide and 0.17m deep, a feature with a scorched base, cut in a position probably lying to the rear of the internal bank.

Almost half the assemblage (8kg) derived from the fill of the enclosure ditch and a further 6.3kg derived from contexts associated with the two cereal kilns, F411 and F309, immediately outside the enclosure entrance. One of kilns, F141, also yielded a small amount of copper slag, probably derived from spillage into the hearth during a casting.

## Interpretation

As described above the assemblage is small and derived from a variety of features likely to be of different ages. The SHC assemblage is small, but comprises specimens of a wide range of sizes, indicative of a range of smithing activities.

Unless the excavated area lies at the fringes of more significant metalworking activity, these factors would suggest that metalworking (both in iron and copper alloy) took place on the site sporadically over a long period of time.

The large size of some of the SHCs can be compared with the evidence from sites such as Clonmacnoise (Young 2005), Clonfad (Young 2006a) and Woodstown (Young 2006b) to suggest that bloom refining was probably undertaken at Killeany. Other rural sites not apparently involved in the primary production of iron show a much more restricted range of SHC size (e.g. Coolamurry, Young 2008a; Navan, Young 2007; Moneygall, Young 2008b).

## Evaluation of potential

The dispersed nature (both geographically and temporally) of the assemblage from Killeany 1 greatly reduces its potential to yield additional useful information upon further analysis.

It is recommended that the material is not taken forward for additional investigation. The material from Killeany 1 is also not high priority for retention.

## References

- YOUNG, T.P. 2005. Metallurgical Residues from Clonmacnoise, Part 1: Evaluation of material from the waste water treatment works (02E1407). *GeoArch Report 2005/08*. 29pp.
- YOUNG, T.P. 2006a. Evaluation of archaeometallurgical residues from Clonfad 3, Co. Westmeath (A001:036). *GeoArch Report 2005/14*. 7pp.
- YOUNG, T.P. 2006b. Evaluation of archaeometallurgical residues from sites on the N25, Co. Waterford (Woodstown 6, Adamstown 1,2,3). *GeoArch Report 2006/15*. 38pp.
- YOUNG, T.P. 2007. Evaluation of metallurgical residues from the Navan Inner Relief Road project, Site 1 (06E274), Co. Meath. *GeoArch Report 2007/09*. 10pp.
- YOUNG, T.P. 2008a. Archaeometallurgical residues from Coolamurry 7, 04E0323. *GeoArch Report 2006/10*. 46pp.
- YOUNG, T.P. 2008b. Evaluation of archaeometallurgical residues from Moneygall, Co. Offaly, 06E0321. *GeoArch Report 2008/10*. 15pp.

<i>F</i>	<i>find</i>	<i>sample</i>	<i>context wt</i>	<i>wt</i>	<i>no</i>	<i>notes</i>	<i>propn</i>	<i>Orig. wt.</i>
4	1	296		34	3	vitified hearth lining		
4	2	297		436	1	possibly slag, but certainly mainly iron, corroding, needs x-ray		
23	4	298		62	1	dense angular slag fragment with some dimpled charcoal contact surfaces		
23	3	299		10	2	1 flown bleb, 1 rounded scrap of moderately dense iron slag		
53	17	300		118	2	small SHC, gravelly, mixed vesicular iron-rich slag and bright blue glass (55x60x35)	1	118
77		301		96	1	dark slag fragment with a microprilly surface		
103	1			3300	1	220x190x85mm, strange presumed SHC, base shows charcoal but has dense crust reaching to >40mm, but possibly dividing into two layers laterally, then more friable material, then dense upper unit with strange striated upper surface, cross cutting any original slope - looks as if it was wiped?. Possibly 70% of original whole?	0.7	4714
103	1			205	1	charcoal-rich SHC fragment, unclear if originally part of the 3300g cake		
105		302		128	1	dense slightly lobed slag block - probably most or all of small SHC, 60x60x30	1	128
126		73		98	c80	variety of pieces from dense lobes attached to right angled mould (tool, wood?), through frothy slags, to coffee bean spheroids - possible furnace assemblage		
136		303		638	3	3 pieces probably from a single slab, blebby porous open textured friable material from base of hearth/furnace. No real crust. Some textures almost like "fuel ash slag", but definitely an iron slag		
171		304		604	1	dense rusty SHC, 120x100x40, slightly dished top, partially infilled by rusty material, base slightly dimpled	1	604
193		305		12	1	green lobate slag rich in copper oxides		
193		306		46	3	small vesicular iron slag fragments		
193		307		5	2	indeterminate iron slag fragments		
193		308		468	1	core like fragment through central part of double layer SHC, 60mm thick		
240		309		2	1	dense blebby shiny prill		
315	1			3140	1	SHC, 210x210x115mm, of which bowl 80mm, bowl has raised lip giving dished top on all sides except proximal, deepest at proximal end, grades gently to distal end.	1	3140
325		310		24	2	charcoal rich soft slag fragments		
325		311		118	1	charcoal rich slag lump - possibly most of SHC?		
342	1	312		538	1	curiously shaped slag - like a mushroom - presumably an SHC pinched on extraction	1	538
343		313		116	1	amorphous block of ashy vesicular slags with charcoal moulds		
362		127		1	1	tiny fragment of complex slag with purple clinkery appearance		
382	1			5000	1	200X210X100mm, of which bowl 70mm. Sub-circular SHC, slightly lobate top with smooth blown area, this is a rather granular-appearing slag, top has some deformed "plasticity" flows - possibly associated with wall/tuyère melt	1	5000
415		314		200	1	(50)x90x30 flattish dense SHC, charcoal lobed top, base obscure, concave top. Dense crust. Most of SHC	0.5	400
431		315		54	3	3 rather prilly fragments, possibly pieces of poorly consolidated SHCs		
435		316		6	1	slag fragment		
441	1			112	1	fragment from conventional crust SHC		
441	1			962	1	140x115x55mm, really neat, dense, conventional SHC with quite deeply dimpled top, and rather lobate margins. Oval in plan	1	962
538		317		10	1	slag fragment		
538		318		12	1	smooth blebby surfaced low density fragment - looks like clinker but probably slag		
561		319		3	1	?concretion		
565		320		30	1	internally prilly/blebby even fragmental(?) fragment		

<i>F</i>	<i>find</i>	<i>sample</i>	<i>context wt</i>	<i>wt</i>	<i>no</i>	<i>notes</i>	<i>propn</i>	<i>Orig. wt.</i>
574		321		366	1	dense flat SHC, some missing from proximal end, (90)x110x45. Dimpled base, flat dense bowl to 15, showing sheaves of fayalite, upper layer is vesicular glassy lining material lying abruptly on top. Base dimpled	1	366
648		322		8	1	dense iron slag fragment		
676		323		38	3	weathered dimpled vesicular sheet fragment		
917		324		12	1	lump of corroding iron		

*Table 1: Summary catalogue by context and sample.*

<i>F</i>	<i>context descriptions</i>	<i>sample</i>	<i>wt</i>	<i>no</i>	<i>notes</i>
	<b>ENCLOSURE DITCH</b>				
4	top fill of main enclosure ditch	296	34	3	vitrified hearth lining
4	top fill of main enclosure ditch	297	436	1	possibly slag, but certainly mainly iron, corroding, needs x-ray
103	primary fill of main ditch, Zone B	#1	3300	1	220x190x85mm, strange presumed SHC, base shows charcoal but has dense crust reaching to >40mm, but possibly dividing into two layers laterally, then more friable material, then dense upper unit with strange striated upper surface, cross cutting any original slope - looks as if it was wiped?. Possibly 70% of original whole?
103	primary fill of main ditch, Zone B	#1	205	1	charcoal-rich SHC fragment, unclear if originally part of the 3300g cake
315	upper fill of main ditch, Zone A	#1	3140	1	SHC, 210x210x115mm, of which bowl 80mm, bowl has raised lip giving dished top on all sides except proximal, deepest at proximal end, grades gently to distal end.
325	fill of main ditch Zone A	310	24	2	charcoal rich soft slag fragments
325	fill of main ditch Zone A	311	118	1	charcoal rich slag lump - possibly most of SHC?
342	fill of main ditch Zones B and D	312	538	1	curiously shaped slag - like a mushroom - presumably an SHC pinched on extraction
343	fill of main ditch Zones B and D	313	116	1	amorphous block of ashy vesicular slags with charcoal moulds
415	fill of main ditch Zone G	314	200	1	(50)x90x30 flattish dense SHC, charcoal lobed top, base obscure, concave top. Dense crust. Most of SHC
			<b>8111</b>	<b>13</b>	
	<b>PRE-ENCLOSURE DITCH</b>				
53	fill of ditch f052 zones f,g	300	118	2	small SHC, gravelly, mixed vesicular iron-rich slag and bright blue glass (55x60x35)
	<b>INTERNAL FEATURES</b>				
126	fill of possible hearth f237, Zone B	73	98	c80	variety of pieces from dense lobes attached to right angled mould (tool, wood?), through frothy slags, to coffee bean spheroids - possible furnace assemblage
240	fill of pit 237, Zone B	309	2	1	dense blebby shiny prill
136	fill of pit f137 Zone B	303	638	3	3 pieces probably from a single slab, blebby porous open textured friable material from base of hearth/furnace. No real crust. Some textures almost like "fuel ash slag", but definitely an iron slag
362	fill of ph361 Zone A	127	1	1	tiny fragment of complex slag with purple clinkery appearance
431	fill of pit f425 Zone B	315	54	3	3 rather prilly fragments, possibly pieces of poorly consolidated SHCs
435	fill of possible slot trench f436 Zone H	316	6	1	slag fragment
	<b>GRAVES &amp; CEMETERY</b>				
538	Fill of Level 2 grave F513 (SK014): Zone C	317	10	1	slag fragment
538	Fill of Level 2 grave F513 (SK014): Zone C	318	12	1	smooth blebby surfaced low density fragment - looks like clinker but probably slag
561	Fill of Level 4 burial SK042: Zone C	319	3	1	?concretion
565	Fill of Level 3 burial SK051: Zone C	320	30	1	internally prilly/blebby even fragmental(?) fragment
574	Fill of cemetery ditch F567: Zone C	321	366	1	dense flat SHC, some missing from proximal end, (90)x110x45. Dimpled base, flat dense bowl to 15, showing sheaves of fayalite, upper layer is vesicular glassy lining material lying abruptly on top. Base dimpled
648	Fill of large post-cemetery pit F647	322	8	1	dense iron slag fragment

<i>F</i>	<i>context descriptions</i>	<i>sample</i>	<i>wt</i>	<i>no</i>	<i>notes</i>
676	Fill of cemetery ditch F503: Zone C	323	38	3	weathered dimpled vesicular sheet fragment
917	Fill of hearth F938: Zone H	324	12	1	lump of corroding iron
<b>KILN F309</b>					
77	deposit on west side of kiln F309, Zone D	301	96	1	dark slag fragment with a microprilly surface
382	fill of pit F442, possibly associated with kiln F309	#1	5000	1	200X210X100mm, of which bowl 70mm. Sub-circular SHC, slightly lobate top with smooth blown area, this is a rather granular-appearing slag, top has some deformed "plasticity" flows - possibly associated with wall/tuyère melt
<b>KILN F141</b>					
23	top fill of kiln f141	298	62	1	dense angular slag fragment with some dimpled charcoal contact surfaces
23	top fill of kiln f141	299	10	2	1 flown bleb, 1 rounded scrap of moderately dense iron slag
171	fill of kiln F141, Zone G	304	604	1	dense rusty SHC, 120x100x40, slightly dished top, partially infilled by rusty material, base slightly dimpled
193	fill of kiln F141, Zone G	305	12	1	green lobate slag rich in copper oxides
193	fill of kiln F141, Zone G	306	46	3	small vesicular iron slag fragments
193	fill of kiln F141, Zone G	307	5	2	indeterminate iron slag fragments
193	fill of kiln F141, Zone G	308	468	1	core like fragment through central part of double layer SHC, 60mm thick
<b>OTHERS</b>					
105	plough furrows	302	128	1	dense slightly lobed slag block - probably most or all of small SHC, 60x60x30
441	non archaeological	#1	112	1	fragment from conventional crust SHC
441	non archaeological	#1	962	1	140x115x55mm, really neat, dense, conventional SHC with quite deeply dimpled top, and rather lobate margins. Oval in plan

Table 2: Summary catalogue recast and structured by originating feature

# GeoArch



*geoarchaeological, archaeometallurgical & geophysical investigations*

54 Heol y Cadno,  
Thornhill,  
Cardiff,  
CF14 9DY.

*Mobile:* 07802 413704  
*Fax:* 08700 547366  
*E-Mail:* [Tim.Young@GeoArch.co.uk](mailto:Tim.Young@GeoArch.co.uk)  
*Web:* [www.GeoArch.co.uk](http://www.GeoArch.co.uk)

