

# Analysis of the metallurgical residues from the Water Supply Scheme excavations at Athenry, Co. Galway (E4226)

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## **Introduction**

During the excavation in the historical centre of Athenry several features and deposits were uncovered which contained material resulting from metal working (O'Neill and Delaney 2011). The bulk of the material is characteristic for iron smithing, with some possible evidence for copper working. At least one deposit, dated to the 13<sup>th</sup> to 14<sup>th</sup> century, showed the use of ceramic tuyeres for the smithing of iron. The interpretation of one feature as a 'bowl furnace' should be re-examined.

## **Methodology**

All the metallurgical material was examined macroscopically and through a binocular microscope. The magnetic component from the residues of the sieving of the samples was also examined microscopically. The assemblage was subsequently described and weighed (the microscopic material was given a symbolic value of 0.1 g) (see Catalogue).

## **Description of the material**

A total of 8725 g of metal working residues were retrieved from the different areas excavated. In general the material recovered varied from somewhat to extensively oxidised, with part of the material from context (025) being covered in a crust of cemented sand, small stones and some organic material. As a result of this, some of the material could not be optimally described and classified. Also the weights given for the slag material should be considered as higher than the original values.

All the iron slag was relatively dense and a few pieces and fragments showed the typical plano-convex bun-shape associated with Smithing Hearth Cakes (SHC's)(Pl.1). Whereas this type of material was, and sometimes still is, interpreted as 'furnace bottoms', it is now accepted as the type artefact connected with early iron smithing (Crew 1996). These 'cakes' arise from molten ceramic material from tuyeres or hearth walls fusing with iron lost from the object being altered. The weight of the SHC's from Athenry compare well with those from contexts of comparable date (Young 2011:35; Rondelez 2011a). Other pieces were interpreted as badly formed SHC's or fragments thereof. Charcoal was the only fuel which could be visibly determined.

Three pieces of vitrified ceramic material were identified, one piece being the likely remains of a ceramic tuyere, while the other two were too fragmentary to determine whether they are tuyere fragments or vitrified hearth lining. The outer surface of the likely tuyere fragment was pitted and corroded as a result of exposure to the elements (Pl.2 and 3). The slag assemblage only contained a few small pieces of the lighter material, sometimes known as 'fuel ash slag', usually associated with these vitrified ceramics.

The hammerscale, on the contrary, was generally unoxidised. Striking was the complete absence of the spheroidal variety of hammerscale, generally interpreted as originating as a result of forge-welding of iron (Dungworth and Wilkes 2009). The flake hammerscale encountered in multiple samples derives from the oxidisation of the object to be forged and is removed by hammering this object. The microscopic material from one context in Abbey Row (009) seems to be fresh pieces of metallic iron and could have come from the tools used in excavating the area.

Two contexts in Abbey Row, (007) and (017), returned copper containing material. Some of this material is readily identifiable as parts of objects (rods, sheet, pipe) and other pieces could represent copper working slag or other, heavily corroded, object fragments. The material likely represents

scrap copper alloy collected to be recycled and possible working residues. One slag fragment, from context (025), had a distinct white fabric. Similar material has been encountered at Aghmanister, Co. Cork (09E0281) and 35-39 South Main Street, Cork City (04E0371), where both iron and copper working was carried out (reports by the author in progress).

A feature at the northern end of the trench in Abbey Row was interpreted as a 'bowl furnace'. This feature did not produce any slag, nor did samples of two of its fills, (034) and (035), produce any definite hammerscale. The latter would suggest it was unconnected to secondary iron working (smithing), the former would mean that if the feature was used for iron smelting, it was completely cleaned out of slag. As there are no positive indications for metal working, this feature should probably be re-interpreted.

### **Distribution and chronology**

The largest concentration of material (1667 g) at Abbey Row was found in a deposit (025) towards the northern end of the trench, which also contained medieval pottery dated to the 13<sup>th</sup> to 14<sup>th</sup> century. Probably due to the eroded condition of the material from this layer, only one piece was identifiable as a potential SHC fragment. This assemblage also contained an eroded likely tuyere fragment, a further piece of vitrified ceramic material and the fragment of white, glassy slag, potentially the result of non-ferrous metallurgy (see above). The corroded nature of this assemblage indicates it is unlikely to be in-situ material. Some 15 to 20 m to the south, another deposit (011) returned a smaller amount of slag material (326 g). This layer contained both medieval and post-medieval pottery. Neither of these features was sampled, but a layer situated in between them (018) contained plentiful evidence of iron working in the form of hammerscale. The layer above (019) contained as yet undated pottery, so at this stage it is not possible to connect the hammerscale with either of the two slag containing deposits. Two further deposits in this trench, (024) and (028), both stratigraphically late, had respectively relatively abundant and a few fragments of hammerscale.

The same trench also returned probable evidence for copper metallurgy in the form of fragments of objects and possible slag. Except for a single small fragment from deposit (017), all this material was found in deposit (007). The latter layer remains undated at present, the former is post-medieval.

The substantial quantity of material (6364 g) from the trench at Bridge Street was entirely recovered from one deposit (071) which sealed pit (074). Deposit (071) itself is not dated, but the basal layer (073) of the pit contained 13<sup>th</sup> to 14<sup>th</sup> century pottery. The slag assemblage contained frequent SHC's, most of them rather amorphous, with the weight of the complete examples ranging between 200 and 450 g. A piece of vitrified ceramics could not be conclusively identified as either tuyere or hearth lining material. Due to the lack of hammerscale in the sample, the material in this pit should be interpreted as dumped material.

A further three pieces of slag (363 g) were recovered from a deposit (060) from the trench at Market Square/Burke's Lane, a SHC fragment, an oxidised lump and a small drippy piece. A stratigraphically unrelated deposit some 20 m apart (059), had a small amount of hammerscale.

### **Conclusions**

The trench at Abbey Row contained various deposits with residues of blacksmithing and probable copper working. At least some of the iron working material was produced in situ or very close by and several phases of activity are represented, the oldest dating to the 13<sup>th</sup> to 14<sup>th</sup> century. A finer chronology of, and the relations between, the different phases may be further clarified as a result of

the pottery analysis and the final working out of the trench stratigraphy. The iron working residues in the trench at Bridge Street are likely dumped material and some iron working may have taken place at Market Square/Burke's Lane.

The material at Abbey Row represents a further example of the use of ceramic tuyeres into the later medieval period. In Ireland, ceramic tuyeres were used extensively from the Early Medieval period onwards, and examples are known up till the 16<sup>th</sup>/17<sup>th</sup> century and possibly even later (Young 2004, 2008; Rondelez 2011b, 2011c). Elsewhere in Europe, this kind of tuyeres is unknown after the first millennium AD. The lack of evidence for forge welding points to the activities represented to be either manufacture of small objects (nails, knives, etc.) or repair/alteration.

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Context	Location	Sample	Find	Feature type	Weight (g)	Description
7	Abbey Row	1	1	Stoney deposit		Fragment of copper alloy object, possibly pipe
7	Abbey Row	4		Stoney deposit		9 small pieces of copper alloy (waste?, part of same object?)
9	Abbey Row	12		Clayey deposit	0.1	4 microscopic fragments of metallic iron, no oxidation (from tools during digging?)
11	Abbey Row	1		Gravelly deposit	151	Fragment of dense SHC with slight flow pattern on the base
11	Abbey Row	1		Gravelly deposit	175	4 lumps of rather dense heavily oxidised slag
12	Abbey Row	2		Fill of pipe trenches		Large block of concrete with some oxidation of iron on the exterior
17	Abbey Row	6		Brown organic deposit	5	Small piece of concreted material with Cu staining, possibly copper working slag
18	Abbey Row	13		Red silty sand	0.1	Mixture of flake hammerscale, microscopic slag fragments and iron oxides
24	Abbey Row	14		Charcoal-rich deposit	0.1	Mixture of flake hammerscale, microscopic slag fragments and iron oxides
25	Abbey Row	3		Deposit with Med. Pottery	849	Large piece of slag, probably part of a SHC
25	Abbey Row	3		Deposit with Med. Pottery	794	23 pieces of slag, some heavily corroded and encrusted
25	Abbey Row	11		Deposit with Med. Pottery	24	One piece of white, glassy slag
25	Abbey Row		17	Deposit with Med. Pottery		30 pieces of iron oxide, probably heavily corroded iron objects
25	Abbey Row		18	Deposit with Med. Pottery		2 pieces of vitrified ceramics, likely tuyere material. One with heavily corroded outer surface
28	Abbey Row	15		Silty deposit	0.1	Mixture of iron oxide and iron rich stones, only a few possible hammerscale fragments
34	Abbey Row	16		Fill of feature c.45	0.1	Mixture of iron oxide and iron rich stones, only a few possible hammerscale fragments
35	Abbey Row	17		Fill of feature c.45	0.1	Mixture of (burnt?) iron rich soil and iron oxides, very few possible hammerscale fragments
59	Burke's Lane	18		Clayey deposit	0.1	Few pieces of flake hammerscale
60	Market Square	9		Silty deposit	207	Dense fragment of substantially larger SHC
60	Market Square	9		Silty deposit	147	Rounded lump of heavily oxidised slag
60	Market Square	9		Silty deposit	9	Small fragment of drippy slag
71	Bridge Street	7		Layer over pit 74	355	Flattish, elongated dense SHC
71	Bridge Street	7		Layer over pit 74	439	Rounded, elongated and oxidised dense SHC
71	Bridge Street	7		Layer over pit 74	337	Irregular, oxidised dense SHC
71	Bridge Street	7		Layer over pit 74	265	Irregular, oxidised dense SHC
71	Bridge Street	7		Layer over pit 74	216	Rounded, oxidised dense SHC
71	Bridge Street	7		Layer over pit 74	1613	8 fragments of SHC's, dense and heavily oxidised
71	Bridge Street	7		Layer over pit 74	1678	Largish lumps of dense, heavily oxidised slag, possibly smaller badly formed SHC's
71	Bridge Street	7		Layer over pit 74	1438	37 smallish pieces of generally dense slag, some showing flow pattern
71	Bridge Street	7		Layer over pit 74	23	Piece of flat slag with a shiny upper concave surface and flow pattern on the base
71	Bridge Street		3	Layer over pit 74		5 pieces of iron oxide, probably heavily corroded iron objects
71	Bridge Street		4	Layer over pit 74		One flat piece of vitrified ceramics, either wall lining or tuyere material
73	Bridge Street	20		Fill of pit 74	0.1	Mixture of iron oxide and iron rich stones, only a few possible hammerscale fragments
1	North Gate	1		Sandy clay deposit	0.1	Small amount of microscopic, flake hammerscale
2	North Gate	2		Sandy clay deposit	0.1	Small amount of microscopic, flake hammerscale

**Plates**



Plate 1: Smithing Hearth Cake from C.71 (Bridge Street)



Plate 2: Outer surface of probable tuyere fragment from C.25 (Abbey Row)



Plate 3: Inner surface of the previous piece from C.25 (Abbey Row)