London Gateway

Settlement, farming and industry from prehistory to the present in the Thames Estuary

Archaeological investigations at DP World London Gateway Port and Logistics Park, Essex, and on the Hoo Peninsula, Kent

Specialist Report 10
Metalworking Debris
by David Dungworth

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Introduction

The excavation at Pipeline Diversion Site A (COLP15) revealed a large, elongated pit (2640), associated with a linear structure constructed from re-used Roman roof tiles (2630). The fills of this feature contained pottery that late Bronze Age-early Iron Age in date. However, the association with the re-used Roman tile suggests that the feature was created in the later Roman period (or later). Therefore, the Iron Age pottery is regarded as residual. This feature yielded slag from three separate fills (contexts 2637, 2639, 2644; Table 10.1).

Methods

All the material submitted for assessment was examined visually, with the recording following standard guidance (HE 2015). The material was weighed, and selected fragments were photographed (Fig. 1–3). The main categories of material identified include the following:

Furnace Bottom (FB)

Large accumulations of slag which formed close to the base of an iron bloom smelting furnace (HE 2015, fig. 14). These are usually black (although the surfaces are often weathered and brown-orange in colour) and have a density consistent with a fayalitic (Fe2SiO4) composition (typically 4g/cm3). Where complete, furnace bottoms usually show an underside which has taken up the impression of the pit at the base of the furnace. Partially vitrified ceramic from the furnace structure often adheres to the outer margins of a furnace bottom. Furnace bottoms are typically 250–300mm in diameter and when complete can weigh more than 10kg. The accumulation of large masses of smelting slag in a furnace bottom indicates that the slag was not tapped from the furnace.

Slag cake (SC)

Plano-convex (or concave convex) accumulations. In some cases, the size and form of such slag cakes allows them to be identified as smithing slag cakes (SCC). SSC comprise slag that is approximately circular in plan, and is relatively small (see below). SSC forms inside a blacksmith's hearth (McDonnell 1991; Serneels and Perret 2003). Larger slag cakes are usually associated with iron smelting and are closely related to furnace bottoms (see above, Dungworth 2011).

Non-diagnostic ironworking slag (NDFe)

Fragments of ironworking slag (fayalitic) which lack any diagnostic surface morphology that would allow a distinction to be made between smelting and smithing (HE 2015, fig. 18).

Vitrified ceramic lining (VCL)

Fragments of highly fired (and often vitrified) ceramic are interpreted as fragments of a clay-built hearth (HE 2015, fig. 11).

Results

The assemblage comprises furnace bottoms, slag cakes and non-diagnostic ironworking slags, and totals just over 4.6kg. The largest furnace bottom (Fig. 1) is 210 x 150 x 110mm. This slag is far larger than the typical smithing slag cake. Starley's detailed surveys of iron smithing slag cakes show that they are somewhat smaller than this, 80±27 x 60±20 x 31±14mm (Maclean and Starley 1999; Starley 1999; Starley and Doonan 1999). At 2964g, the furnace bottom from (2644) is heavier than any of the smithing slag cakes recorded by Starley (Fig. 4).

A slag cake from context 2644 (Fig. 2) is well within the size and weight range of smithing slag cakes. However, it lacks a form (the upper surface is fractured) that would allow definite identification as a smithing slag cake. It is possible that this piece of slag formed as the result of smelting rather than smithing.

A fragment of a furnace bottom was also recovered from context 2637 (Fig. 3). This fragment has ceramic lining adhering to one side (arrowed in Fig. 3). The other side is clearly fractured and the furnace bottom would originally have been substantially larger. The upper surface is irregular and contains numerous impressions of relatively large pieces of charcoal.

Discussion

The assemblage provides evidence for the smelting of iron using a process in which slag was allowed to accumulate at the base of the furnace (rather than tapping the slag from the furnace). This technology was widely employed in the Iron Age (Dungworth and Mepham 2012; Paynter 2007) and the early to middle Saxon periods (Boyer and

Keyes 2013; Haslam 1980; McDonnell 1993). During the Roman period, iron smelting was exclusively carried out using tapping processes. It is possible that the COLP15 evidence relates to either pre-Roman or early post-Roman iron smelting. As the feature which provided the slag appears to have been created in the Roman period, there are two alternative explanations. It is possible that the filling of this feature included a high proportion of earlier (pre-Roman) residual material (including the iron smelting evidence). Alternatively, the slag could have been generated in the post-Roman period and so be broadly contemporary with the later use and fill of this feature. The apparent absence of Saxon pottery, and the presence of prehistoric pottery, suggests that the former explanation is more likely.

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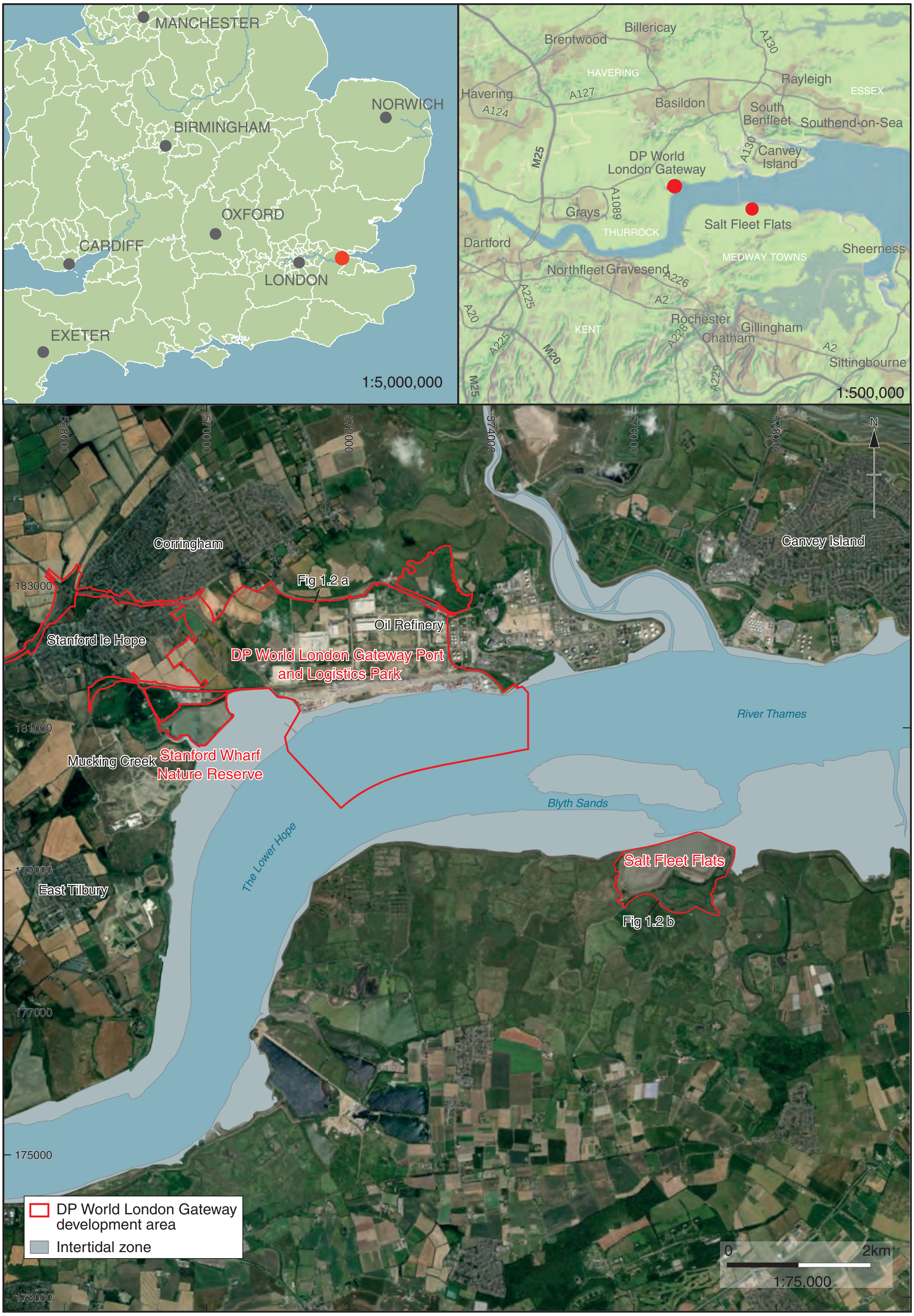
Metalworking Debris Table

TABLE 10.1: SUMMARY OF METALWORKING SLAG (COLP15)

Context	Type	Weight (g)
2637	FB (fragment)	788
2639	NDFe	11
2644	FB	2964
2644	SC	486
2644	NDFe	203
		4652


MANCHESTER
NORWICH
BIRMINGHAM
OXFORD
CARDIFF
LONDON
EXETER
1:5,000,000
Brentwood
Billericay
A130
HAVERING
Rayleigh
ESSEX
Havering
A127
A124
Basildon
South
Benfleet
Southend-on-Sea
M25
DP World
London Gateway
Canvey
Island
Grays
A1089
THURROCK
Salt Fleet Flats
Dartford
MEDWAY TOWNS
Sheerness
Northfleet
Gravesend
A226
A2
A225
A20
Rochester
Gillingham
Chatham
KENT
A228
A225
M20
A2
Sittingbourne
M25
A229
1:500,000
568000
570000
572000
574000
576000
578000
N
Corringham
Canvey Island
183000
Fig 1.2 a
Oil Refinery
Stanford le Hope
DP World London Gateway Port
and Logistics Park
181000
River Thames
Mucking Creek
Stanford Wharf
Nature Reserve
Blyth Sands
The Lower Hope
179000
Salt Fleet Flats
East Tilbury
Fig 1.2 b
177000
175000
DP World London Gateway
development area
Intertidal zone
0
2km
1:75,000
173000

Figures

Figure 1. Furnace Bottom from (2644)

Figure 2. Slag Cake from (2644)

Figure 3. Furnace Bottom fragment from (2637)

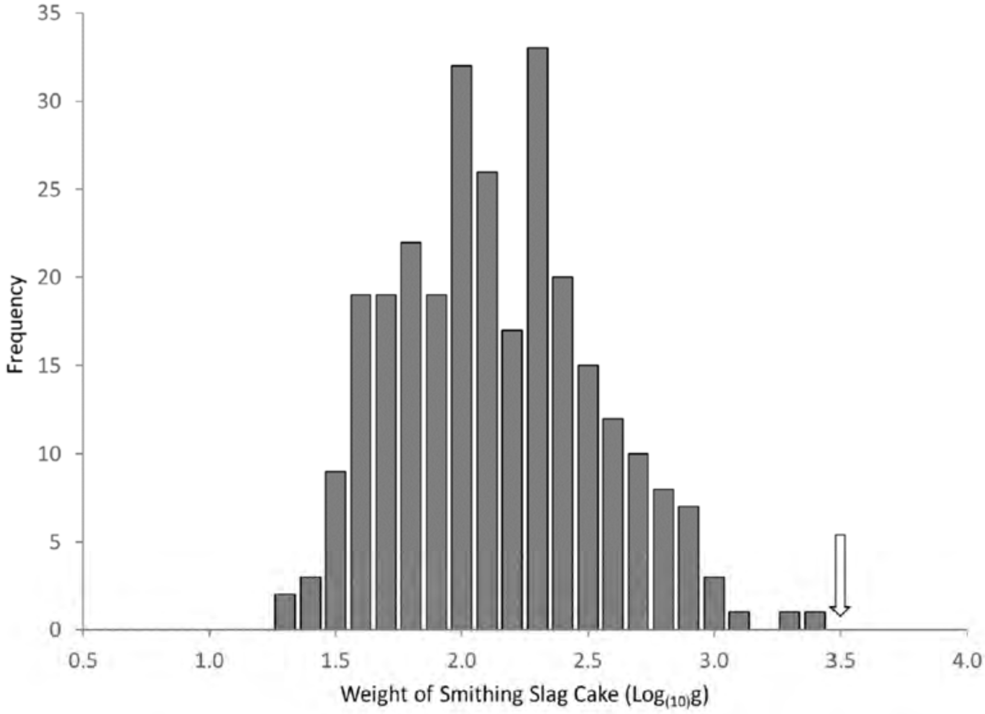


Figure 4. Distribution of smithing slag cakes (data from Maclean and Starley 1999; Starley 1999; Starley and Doonan 1999). The arrow marks where the Furnace Bottom from (2644) would fall on this distribution

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