

EXCAVATIONS AT THE COKE OVENS, TONDU IRONWORKS, BRIDGEND

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EXCAVATIONS AT THE COKE OVENS, TONDU IRONWORKS BRIDGEND 2007

Gan / By

Duncan Schlee

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ARCHAEOLEG CAMBRIA
Ymddiriedolaeth Archaeolegol Dyfed Cyf
Neuadd y Sir, Stryd Caerfyrddin, Llandeilo, Sir
Gaerfyrddin SA19 6AF
Ffon: Ymholiadau Cyffredinol 01558 823121
Adran Rheoli Treftadaeth 01558 823131
Ffacs: 01558 823133
Ebost: cambria@cambria.org.uk
Gwefan: www.cambria.org.uk

CAMBRIA ARCHAEOLOGY
Dyfed Archaeological Trust Limited
The Shire Hall, Carmarthen Street, Llandeilo,
Carmarthenshire SA19 6AF
Tel: General Enquiries 01558 823121
Heritage Management Section 01558 823131
Fax: 01558 823133
Email: cambria@cambria.org.uk
Website: www.cambria.org.uk

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K MURPHY BA MIFA

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SUMMARY

In March 2007 Cambria Archaeology undertook an archaeological evaluation of the Coke ovens at Tondy Ironworks, to a specification prepared by RPS Planning and Environment, in association with Groundwork Bridgend and Neath Port Talbot and the project engineers, James and Nicholas of Port Talbot. The principal objective was to assess the construction and condition of the upstanding features, and the depth and nature of below ground remains of associated structures and surfaces, to inform future options for conservation, preservation, excavation, interpretation and visitor access.

The excavations revealed details of the construction materials and techniques of the coke ovens, embankment and probable boiler house. The character of deposits in several working areas was also evaluated.

The excavations have provided valuable information on the materials and constructional details of the oven batteries and associated working surfaces. The discovery that at least one oven was of the Brecon Dixon type, with under-floor heating using exhaust gasses was particularly interesting. Whilst the boiler house structure remains highly enigmatic, the preservation of the other structures excavated was found to be exceptionally good, with little apparent damage from the former infestation of Japanese Knotweed.

The depth of the archaeology beneath current ground level was found to be highly varied, with some features, notably the 'platform' structures and the demolished southern coke oven battery lying very close to the surface. Other areas, notably around Trenches 5B and 6B have been subject to significant ground raising. The levelling or removal of these later deposits would greatly aid the interpretation of the remains.

Many of the archaeological remains (coke waste working surfaces, refractory brick and earth and mortared core work) were found to be of a type that would not benefit from long-term exposure. Other features, notably the surviving lower courses of the oven battery retaining walls could be beneficially exposed and consolidated. This would add significantly to the visual impact of the structures, with no adverse effects.

The same can be said for the surviving parts of the embankment retaining walls. Further, to aid the conservation of the remaining embankment structure and discourage further erosion by badgers, it may be pragmatic to restore the embankment retaining walls to their full height, as was previously done with the calcining kilns at the embankment's terminus.

While some idea of the stratigraphic complexity of the site has been demonstrated, it would be premature to construct a detailed model for the phased evolution of the site from the limited information recoverable from an evaluation excavation. For example, while the extant oven batteries and the boiler house may have earlier construction or alteration phases, this could not be definitively ascertained in the present evaluation and would require further investigation to confirm. Some further information could be provided from monitoring during subsequent conservation and consolidation phases. Such work would be unlikely to yield much evidence of the former boiler house, which would require a substantial area excavation (if it were considered necessary) to understand what remains of this structure.

INTRODUCTION

Site location and description

The ironworks at Tondy (NGR: SS 8910 8445) is located to the west of Maesteg Road, Tondy, now the location of Parc Tondy. The ironworks was established in c.1838-40 by Sir Robert Price, the son of Sir Uvedale Price, the influential writer on the Picturesque. Price operated the ironworks with limited success until 1854, when it was taken over and updated by John Brogden, a Manchester-based haematite merchant and railway contractor. The ironworks narrowly survived the 1870s slump in ironmaking, but further modernisation failed to revive the site and iron production ended in 1895-6. The site continued as the engineering and administrative hub for North's Navigation Collieries, then the NCB until 1986.

The current area of archaeological evaluation is situated on a plateau above the blowing engine houses and furnace bank wall, slightly below the level of the upper part of the former company village. The plateau contains the upstanding and largely intact remains of a pair of large, stone-built calcining kilns and a stone-built approach embankment connecting the calcining kilns to the course of the former Duffryn, Llynvi and Porthcawl Rail Road. It also retains the less intact upstanding remains of a large square brick-built chimney stack and the visible remains of at least 32 beehive coke ovens, built in three batteries, two single-sided and one double battery.

Project background

The middle and upper levels of the site contains an important group of beehive coke ovens, calcining kilns, furnace bank wall, lift tower and blowing engine houses. These were designated as a Scheduled Monument in 1992. Following acquisition by the charitable sustainable environmental regeneration organisation, Groundwork Ogwr (now Groundwork Bridgend and Neath Port Talbot) in 1997, Phase 1 of a major programme of consolidation and environmental works has been carried out, funded by the Millennium Commission and others.

Following Phase 1, a Project Planning Grant has been awarded by the Heritage Lottery Fund as a precursor to proposals to complete the consolidation of the remaining Scheduled structures, including those in the coke ovens area. This archaeological evaluation, which targets the upper part of the site (above the furnace bank wall), forms part of a suite of studies, including an Access Plan, a Landscape Master Plan, an Audience Development Plan and a Conservation Management Plan, to inform the second phase of the project.

Project objectives

The principal objective was to assess the construction and condition of the upstanding batteries of coke ovens, the depth and nature of the footings of the calcining kiln approach embankment and to examine the presence or absence of below ground remains of associated structures and surfaces, notably another double battery of coke ovens, incoming railways, outgoing tramways, hard surfacing, pipework and a boiler house built to utilise waste gasses from the ovens. Nine evaluation trenches were proposed.

The following excavation objectives were outlined in the project specification:

- to better understand the long-term stability and sustainability of the Scheduled structures;

- to better understand the evolution, history and archaeological significance / importance of the structures themselves;
- to better understand whether the historic structures are being damaged or degraded through weathering, root penetration (especially the effects of Japanese knotweed) or other agencies;
- to inform future conservation and interpretation strategies, in particular whether it would be practical, informative or appropriate to excavate and interpret the structures.

Methodology

The archaeological evaluation of coke ovens area was undertaken to a specification prepared by RPS Planning and Environment, in association with Groundwork Bridgend and Neath Port Talbot and the project engineers, James and Nicholas of Port Talbot.

Except where specified otherwise, all trenches were excavated to the first significant structural archaeological horizon. Standard excavation and recording methods were employed.

EXCAVATION RESULTS

Although this evaluation has provided evidence to suggest several phases of construction, modification, demolition and later use of the site, attempting to draw conclusions about the overall phasing on the evidence from the relatively small excavated areas can be problematic.

Considering the scheduled status of the site, a minimum of structural material was removed. As a consequence, it is primarily the latest structural phase that was revealed and recorded. Later structures or features may therefore mask, or may have destroyed, evidence of earlier phases. Limited incursions into earlier deposits were only possible where they were revealed in the sides of later cuts, or in locations where earlier deposits were not sealed by significant later deposits or structures.

Mortar typology and phasing

This evaluation builds on a number of earlier phases of archaeological investigation carried out at the former Tondy ironworks. These previous investigations have revealed the importance of recording mortar types on the basis that they are very useful as dating / phasing evidence. This typology has been maintained and tested in this report. Current understanding indicated the following:

- Phase 1: A very weak and friable brown lime mortar. Provisionally dated to Robert Price's tenure of the site (i.e. founding to 1854). No features or structures exhibiting such a mortar were revealed during excavation of the coking ovens site.
- Phase 2: A tenacious, hard, mid-grey (possibly hydraulic) mortar with small black (and sometimes brick red) inclusions. Provisionally dated the tenure of the site by the Brogden family (1854 to 1888). Mortar of this type was observed in the majority of the upstanding masonry structures revealed during the excavation (i.e. the oven batteries and embankment).
- Phase 3: A very hard, very brittle, dark grey/black cementacious mortar, provisionally dating to the tenure of North's Navigation Collieries (1888 to 1947). This mortar thus spans both the ironmaking and post-ironmaking periods. Such mortar was only apparent in the sub floor brickwork structures such as culverts and the brick floor (and wall footings) of the boiler house. Later structures revealed in Trench 6A, were also characterized by the use of red brick.
- Phase 4: A normal modern cement mortar. Provisionally dated 1947 to 1986.
- Further specialised mortars are also noted, used for specific technical reasons unrelated to date. Notably these include a white lime mortar and a clay-like yellow mortar, the latter invariably used in refractory structures.

Trench 1

Trench 1 was intended to establish the character and condition of the below-ground remains of the demolished south coke oven battery and associated working surfaces. Due to the presence of trees, the trench was cut in two offset parts (A and B), from which a continuous cross section could be extrapolated.

Trench 1A (Figs. 1, 2 3 and 4, photos 2 and 5-8)

This trench was located to reveal the north edge of the demolished oven battery and part of the working area immediately to the north of that. The northern wall of the battery (701) and a portion of the masonry core stonework (716) were located. The face of 701 survives to a height of 0.60m (top at A.O.D. 77.36m) and is 1.30m wide. Its face exhibited a vertical joint between two different construction styles (photo. 5) with squared stone blocks to the east and brick courses of two kinds, to the west, perhaps suggesting a rebuild, repair or technical modification to the structure. The mortar of the stone facing (701) and of the footings for the structure (702) was a buff colour with black flecks and semi-hard, suggests they may be contemporary and attributable to Phase 2 in mortar typology.

To the north an apron working area 2.10m wide was identified (top of surface at A.O.D.76.72m) abutting the north wall. This apron was bounded to the north by a makeshift, poorly built retaining wall (705) 0.40m high (top of wall at A.O.D. 77.21m). This was constructed from re-used large yellow refractory bricks, bonded with a very hard dark grey mortar, suggesting a Phase 3 origin. A layer of compacted crushed coke (703) overlay a level surface of natural? clay (707) in the 'apron' area. Wall 705 defined the southern edge of the higher central 'platform' working area (top of wall/surface at A.O.D. 77.28m) 2.10m wide, located between the southern and central oven batteries. This 'platform' comprised various deposits of compacted crushed coke of mixed fragment size (719, 722 and 706) overlying a level clay surface (707). A wrought iron or steel pipe (709) appeared to be sealed by 719 and 722. A second, similar pipe (710) appeared to be cut (723) into these deposits. The cut and fill (717) for a brick culvert with iron plate capping (708), appeared to cut deposits 719, 722 and 706. This culvert was constructed from similar yellow refractory bricks brick, bound with a dark grey mortar, suggesting a Phase 3 origin. A series of deposits (718, 720 and 721) filling the 'apron' working area were clearly derived from the robbing and or demolition of the oven battery, c.1918.

Trench 1B (Figs.5 and 6, photos 1, 3 and 4)

This trench was placed to locate the southern face of the demolished south oven battery and to identify any evidence to suggest the manner in which the ovens were constructed. Overburden and modern track surfacing were removed to reveal a deposit of crushed brick (711), presumably derived from the demolition of the oven battery. The top of the mortared brick and stone core of the battery (713 and 714) was revealed at the north end of the trench at A.O.D.77.04m, 0.15m below ground level. This core work was clearly located well below the level of the former oven floors, but whilst apparently not formally laid, coursed or bonded, some areas appeared to have some deliberate orientation (photo. 3). Although no evidence for the arrangement of ovens in this battery could be discerned within the trench, a broader exposure might reveal such evidence.

At the southern end of the trench deposit 711 was removed (total thickness 0.5m) to reveal the top of the southern wall of the oven battery (712) at A.O.D.76.49m (1.40m wide and 0.80m below current ground level). The height of this wall was not ascertained. Several pipes and cables, all appearing to post-date the demolition of the coke ovens, were located.

As stated above, no clear evidence of the layout or structure of the coke ovens in this battery was discernable. Comparing the heights from which the ovens are constructed (see fig. 2), the southern battery has been demolished to A.O.D. 77.36m, a level around 0.60m above the wharf working surface. This is similar to the height at which the sole flues for the ovens of the double battery are constructed, suggesting that most evidence of oven structures may have been lost.

Trench 2

Trench 2 was intended to establish the character and condition of the extant central double oven battery and associated working surfaces to the north and south. Of specific interest was to ascertain the character of any surviving evidence for flues and loading tramways on the top of the oven battery. The trench was divided into three segments (A, B, and C). A half-section of the fill in a single oven was also undertaken.

Trench 2A (Figs. 1, 2, 7, 8 and 9, photos 19, 20 and 21)

Trench 2A was located on the north side of the oven battery. It revealed constructional details of the area between two coke ovens and the remnants of the north wall of the oven battery (top of wall at A.O.D. 77.34m) and its footings (top of footings at A.O.D. 76.90m). At A.O.D. 77.21m the top of remnants of a makeshift retaining wall defining the north edge of the 'apron' working area were discernable (233), though no formal structure survived. A brick culvert (238) with iron plate capping was identified in the northwest part of the trench, perhaps to drain water from the 'apron' area between the oven battery wall and the 'platform' (see fig. 7). Although the footings for the retaining wall (235) were revealed by removal of the compacted crushed coke working surface 228, no other features were discernable within the 'apron' area.

Within the area of the trench at A.O.D. 77.34m, the north wall face (230) of the oven battery (constructed from well dressed squared, regularly coursed stonework) had been robbed of its stonework to a greater degree than the corresponding walls revealed in Trenches 2C and 3C/B. It generally only survived to two courses- a height of 0.45m. The core-work (234) behind 230 (similar to 209 in Trench 2C), suggested that this battery was of simple rubble construction with a stone facing, rather than the well-constructed stone retaining walls of Trench 1. A vertical joint in the facework similar to that noted in Trench 1A, marked a change in the style and fabric of the stonework (photo. 20). Insufficient masonry was exposed to ascertain whether this represents a phase of reconstruction, a modification or an original feature.

Two box-like brick structures, presumed to have housed tie rods for patress plates were constructed into the battery; one within the stonework plinth, and one at the top of the brick core work between the ovens (photos 19 and 20). A similar third structure, with an *in-situ* iron tie rod and patress plate (010) was revealed towards the top of the battery in Trench 2B within the earth backfill 001 (photos 16-18).

The overburden debris (231) overlying the 'apron' area appeared to be derived from a robbing event, with stone and mortar fragments towards the base, overlain by brick, mortar and reddened earth backfill.

Trench 2B (Figs. 10 and 11, photos 9, 10 and 12-18)

Trench 2B was located on the top of the double oven battery, with the aim of identifying evidence for oven charging mechanisms, flues etc. Evidence of a brick-built branch flue (of unknown dimensions) was identified (008) leading from the adjacent oven to a vaulted brick box flue 007 (top of box flue at A.O.D. 79.75m). The flue was a minimum of 1.3m wide and of unknown depth, running centrally down the length. All brick was the same as for the majority of brick construction on the site: 0.22 x 0.12 x 0.075m, buff yellow coarse gritty refractory type brick, with varying degrees of heat reddening.

At the northern end of the trench a brick-built box structure housing an *in-situ* tie rod and patress wall plate was revealed (010). Apart from the brick structures, the upper part of the oven battery appeared to have been constructed from an

earth backfill (001), retained by the (now lost) masonry facing to the oven range. The function of metal object 009 was unclear, but may have been used to open and close the branch flue.

No evidence of how coal was delivered to the ovens (a central tramline down the spine of the double battery, or a pair of tramlines passing directly over the charging eyelets) was discernable within the surviving fabric of the oven battery. Both types would have used rail-mounted hoppers of some description. The indenture map suggests a single tramline running the length of the oven batteries. An enigmatic arrangement of stones in the northeast corner of the trench (003) was of uncertain function.

Trench 2C (Figs 7 and 12, photos 9 and 11)

This trench revealed the surviving fabric between two ovens on the southern range of the double oven battery, the south retaining wall (210) and footings (221) and an 'apron' working area in front of the ovens. Due to the location of the trench section and the presence of substantial tree roots, it was not possible to reveal the upper portion of the south side of the oven battery.

The southern retaining wall of the oven battery (210) stood to a height of up to 1.0m (top of wall at A.O.D. 77.98m). It was one course deep, constructed from variously sized, generally squared random coursed stone intermixed with patches of (re-used?) brick, with a random infill behind of un-coursed, random, stone and brick in a pale soft lime mortar. Brickwork 211 appears to be a modification to the existing oven structure, associated with the sub-floor flue system. The bricks of 211 are yellow, refractory type with dimensions 0.33 x 0.10 x 0.06m. The adjacent masonry of 210 was repaired with hard, fine, very dark grey mortar. Elsewhere the mortar of 210 was hard and light grey, with frequent coarse angular black inclusions, suggesting a Phase 2 origin, locally repaired with Phase 3 mortar.

A relatively soft, crumbly white lime mortar was used most evidently in the brickwork core (209) portions of the coking oven batteries. This choice of materials may have been made to facilitate the periodic repair and modification of the oven structures. Likewise, the use of earth backfill for the upper part of the oven batteries may have been to allow the flue system to be accessed more easily for repairs. The mortar used in the core construction of the northern battery is different (more yellow) to that of the central battery.

The brick footings of wall 221 extended slightly from the wall face (top of footings at A.O.D. 76.97m). At one point the footings and were cut by 217, apparently to accommodate a vertical iron post whose shadow was still visible to the west of the oven mouth. This may have been a modification to the original structure. The footings were bonded with light grey mortar with frequent black.

Directly in front of the oven range wall was an 'apron' working area (see photo. 11). This was bounded to the south by a poorly built wall (213) 0.40m high (top at A.O.D. 77.26m) built from un-mortared coarse buff yellow refractory brick (similar to those edging the sole flue mouth), of dimensions 0.42 x 0.20 x 0.10m and impressed with the name 'Jones Risca'. These were laid on a single footings course of un-frogged yellow bricks (0.23 x 0.12 x 0.07m). The floor of the 'apron' (floor level at A.O.D. 76.86m) appeared to be natural? clay (216), overlain with a layer of compacted coke dust (215). The retaining wall defined the northern extent of a raised 'platform' working area between the southern and central oven ranges. This platform (214), the upper surface of which lies at only 0.20m below ground level (surface at A.O.D. 77.31m) was composed of a thick deposit of crushed coke and brick fragments. No evidence of tram rails (for the collection

and transport of the coke) or their former presence, were identified. No evidence of *in-situ* pipework or culverts was exposed within the trench.

Four main layers of overburden could be distinguished, all apparently relating to 'tumble' resulting from a robbing episode. 224 was possibly derived from the robbing of the facing stonework (210). 223 was probably derived from core-work (209). 222 was possibly derived from the fabric of the oven structure itself. 206 was possibly derived from the heat reddened earth backfill of the oven battery.

Oven excavation (Figs. 2, 7, 8, 13 and 14, photos 9, 10 and 12-15)

Trench 2 included the excavation and recording of one of the ovens in the south range of the double oven battery. An elevation, quarter section and half section were excavated and recorded.

The dome of the oven (208) was constructed from a double skin of un-frogged light buff refractory bricks with gravel inclusions and no maker's marks. The inner skin brick dimensions were: 0.22 x 0.12 x 0.075m, side by side on bed in a header bond. The outer skin brick dimensions were: 0.23 x 0.115 x 0.065m laid end to end on bed in a stretcher bond. The oven dome was built upon a 0.60m high wall (measured from the outer edge of the oven floor) of possible Flemish bond.

Within the brickwork at the back of the oven a bricked-up eyelet marked the entrance to an exhaust flue. The eyelet appeared to be contemporary with the oven fabric, whilst its blocking was clearly inserted during the functioning life of the ovens. This was consistent with visible evidence in other ovens.

The oven had an interior diameter of 3.0m and an interior height of 1.8m. The oven floor sloped from the back down to the oven mouth, and from the sides down to the center. The oven mouth opening was 1.20m wide.

The oven floor (207) was constructed from a single course of heat-reddened refractory bricks of dimensions 0.37 x 0.30 x 0.08m, on a bed of mid-grey, very hard mortar (236) with coarse grey inclusions. It lay at A.O.D. 77.83m, 1.20m above the level of the 'apron' working area and roughly 0.80m above the level of the 'platform' surface.

Brick rubble 202 and mortar 203 (probably derived from the collapse of the front portion of the oven) sealed what appeared to be the remains of the last firing of the oven: 204 and 205. 204 was a layer of coke fragments up to 0.04m in diameter, with larger clinker-like concretions. 205 was possibly the remnant of burnt coal residue (see fig. 13 and photo. 14). Both these layers overlay deposit 206 that ran around the perimeter of the oven. This deposit of oxidized burnt brick and mortar appeared to have built up in layers. This material may have been pushed to the edge of the oven after each firing.

In the excavated portion, the southern half of the oven floor bricks (207) had been removed (fig. 14, photo. 14). The evidence of burning where the bricks had been, perhaps suggests that the bricks were removed during the practical use of the oven, possibly as a result of heat damage. It would appear from the burning pattern, damage to the sub-floor mortar bed, and the apparent deposit of spent fuel and coke in the base of the oven, that the oven was used subsequently, without replacing the floor bricks (see photos 14 and 15).

Nothing of the character of the oven mouth (from where the coke was raked) survived within the excavated portion. Cleaning the oven battery retaining wall revealed two brick arched openings (211) beneath the oven floor level. The openings were recessed from the wall face behind with bricks 237 (fig.13, photo.

12). The openings accessed a system of vaulted brick 'sole flues' (211) beneath the oven floor. The layout of the openings and sole flues corresponded to the 'Brecon and Dixon' pattern (photo. 13). In this type of oven exhaust gasses were collected from the eyelet at the back of the oven and drawn through a pair of labyrinthine sole flues to partially heat the coke charge from beneath. The twin openings to the sole flues (0.50m wide) showed evidence of having been narrowed during their working life, with brick fragments bound with mortar. Beyond the openings, the flue was subdivided into a labyrinthine system of narrower flues 0.36m wide (photo. 13). Both flue mouths appeared to have been crudely (possibly temporarily) blocked with poorly mortared bricks piled in front of them (212). The flues, constructed from pinkish un-frogged bricks (of dimensions 0.23 x 0.12 x 0.065m) generally laid on bed, as stretchers, appeared to be contemporary with the oven and possibly with the southern wall of the oven range.

Trench 3

Trench 3 was intended to establish the character and condition of the northernmost single rank oven battery, and to ascertain the nature and survival of associated working surfaces to the north and south. The trench was divided into three segments (A, B and C).

Trench 3A (Figs. 2, 15, 16, photos 25 and 26)

Located on a level platform above the oven battery, this trench aimed to ascertain what surfaces and surviving features were present in this location. At the southern end, above the ovens, the highly vitrified remains of a probable box flue (309, 307, 308) internally 1.30m wide and 0.65m high to the arch springer remnant (base of box flue at A.O.D. 80.31m). North of this was a band of dense, (natural or redeposited?) clay 311, probably the material into which the box flue was cut. This was cut to the north by an unexcavated feature filled with a dark deposit 310. No working surface or oven charging infrastructure was identified in this location. Deposit 312 is a remnant of backfill above the box flue.

North of this was a band of dense, (natural or redeposited?) clay 311 (top at A.O.D. 81.20m), probably the material into which the box flue was cut. This was cut to the north by an unexcavated feature filled with a dark deposit 310. No working surface or oven-charging infrastructure was identified in this location. Deposit 312 was a remnant of backfill above the box flue.

Trench 3B (Figs. 2, 15, 16, photos 22 and 23)

This section of Trench 3 exposed the surviving core-work between two oven structures (317). The brickwork core was of a more regular and well-constructed nature than was exhibited in the double oven battery to the south. At the interface between the brickwork core and the earth backfill (at A.O.D. 80.19m), a brick built box structure (316) with a stone capping, was identified (fig.16, photo. 22). This was similar to those noted in Trench 2A and probably housed a tie bar. The earth backfill was 0.70m thick.

The south wall of the oven battery (319) stood to a height of 1.0m (top at A.O.D. 78.22m). The lower part of the battery wall (319) was constructed of well dressed blocks of stone, and generally to a better standard than exhibited in the walls of the other oven batteries. The stonework is topped by three courses of surviving *in-situ* brickwork. How much of the robbed out portion of this oven battery was constructed from brick is uncertain. Both the lower and upper portions were bonded with Phase 2 type mortar.

Trench 3C (Figs. 2, 15, 16, photos 22 and 24)

As with Trenches 1A, 2A and 2C, this section of Trench 3 exposed an 'apron' working area directly in front of the oven battery (318). Even though they were identified elsewhere on the site, no revetting structure for an adjacent 'platform' was apparent in Trench 3C, although a change in the levels of the working surface was observed (photo. 24). This may suggest the former presence of such a revetment. The 'apron' area working surface (318) was exposed and a small area was cleaned to reveal the underlying clay (320) (clay at A.O.D. 77.22m). No wall footings, pipework, culverts or other possible features cut into 320 were identified.

Trench 4

Trench 4 was intended to establish the original width, construction details and condition of the extant embankment leading to the calcining kilns, and to establish the presence and condition of tramway or railway features.

Trench 4A (Figs. 1, 17, 18, photos 30, 52 and 53)

Trench 4A was located on the top of the embankment (at A.O.D. 84.20m). Overburden deposits of loose dark grey oven waste(?) material 413, were removed to expose the impressions of wooden rail sleepers 405 (0.25 x 2.40m), set into a substantial deposit of compacted oven waste(?) material 407. Evidence of only one set of tracks was identified. Excavation was extended northwards to attempt to locate further rail tracks shown on maps and to clarify any surviving features on the north side of the embankment. No evidence of further tracks or northern retaining wall was revealed, although evidence of badger digging was noted (photo. 52). Compact structural deposits of oven waste(?) similar to those encountered on the south side of the embankment, but with more evidence of oxidization (reddening) were revealed (see photo. 53).

Trench 4B (Figs. 1, 17, 18, photos 27-29)

Excavation down the south face of the embankment removed loose embankment material (413) revealing two parallel wall-like structures running down the slope (Figure 17, photos 27 and 28). Structure 403 (1.75m long in plan, c.0.35m wide) was constructed from large faced stone rubble, with no mortar bonding, and a flush vertical east face (top of feature at A.O.D. 83.92m). It appeared to be revetting the material to the west, but did not extend further into the embankment than was exposed during excavation (i.e. it was not built within a construction cut).

Immediately to the east of (and parallel to) feature 403 was feature 404 (max. 0.65m wide, min. height 0.60m), constructed from irregularly stacked un-mortared wedge-shaped refractory bricks. Again 404 did not extend into the embankment any further than was excavated. The function of these features, or whether they were integral to the original embankment structure, remains uncertain. To the east of the excavated trench a large slab of intact embankment facing stonework appeared to have sheared off the main structure. This implied that the embankment had been revetted in mortared stonework at least as far as the double wall.

At the southern end of Trench 4B, a partially robbed section of the embankment retaining wall (402) constructed from roughly dressed squared stone blocks of varying sizes, built to courses, with a hard grey mortar (max. 0.65m wide), was exposed to a height of 0.60m at A.O.D. 82.03m). Its angle of batter may suggest that the gradient of the embankment sides was originally more vertical in this location than it appears at present. Alternatively, the surviving wall may mark the point at which a steeper batter commenced.

Immediately to the south of the embankment wall a small wedge-shaped area of apparently makeshift surface was exposed at C. 0.60m below ground level (A.O.D. 80.72m). The surface, which was on a slightly different alignment to and did not butt up against wall 402 was constructed from un-mortared buff yellow refractory brick (401), similar to those used in the floor of the excavated oven, but not heat affected, and slightly smaller (0.30 x 0.30 x ?m). Other bricks of standard dimensions used elsewhere on the site (0.22 x 0.12 x 0.075m) were also used in the floor, which is considered to be of Phase 3 origin.

The floor was overlain by a 0.2m thick layer of coal fragments (408) and a compacted layer of coal dust forming a possible later working surface 411 (A.O.D. 81.02m). It was not possible to ascertain how this floor feature related to the features in Trench 3A. Two deposits 410 and 409 appeared to have probably been derived from the robbing of wall 402 and subsequent erosion of the embankment.

Trenches 5A and 5B

Trenches 5A and 5B were intended to ascertain the presence, character and condition of a demolished boiler house located to the east of the southern and central coke oven batteries.

Trench 5A (Figs. 1, 19, 20 and 21, photos 38-44)

Trench 5A was located on an east-west axis to reveal the width of the boiler house. Immediately beneath the modern metallised track material (c. 0.15m), a path surface (504) was revealed (top of path at A.O.D. 76.86m). This ran on the same alignment as the trench. It was constructed with re-used refractory bricks (0.23 x 0.12 x 0.07m) with traces of hard block (Phase 3) mortar still adhering, possibly originating from the nearby, demolished chimney or boiler house floor (fig. 19).

Further excavation at the west end of the trench revealed the top of a brick wall (518) (A.O.D. 77.03m), 1.0m wide, and bonded with dark grey (Phase 3) mortar whose location was consistent with the west wall of the boiler house building represented on later historic mapping of the site. To the west of this wall a compact deposit of crushed red brick (522) was interpreted as demolition debris from the former southern oven battery, which abutted this wall. Half a dozen bricks on the east side of wall (518) were possible *in-situ* vestiges of the boiler house floor (see fig. 20 and photos 43 and 44). A brick built culvert bound with (Phase 3) dark grey/black mortar (509) and with iron capping plates was also revealed (top of culvert at A.O.D. 76.83m). No other evidence of the boiler house floor was revealed within Trench 5A. This may have post-dated the demolition of the boiler house (see boiler house discussion).

At the west end of the trench, mixed soil and crushed brick (521) associated with the brick path phase was removed to clarify the underlying stratigraphy. A substantial structure (517) 1.50m wide (truncated?) of single brick courses (buff yellow and red refractory type bricks, of standard dimensions) separated by thick bands of white lime mortar (up to 0.20m thick) was revealed at A.O.D. 76.66m, roughly where the east wall of the boiler house might have been expected. The uppermost brick course contained one brick marked 'Risca' and another marked with an 'H'. The east face of this structure had stone facing, while the west face did not. Examination of the section revealed evidence of a cut (513) that may have truncated the west face of 517, perhaps removing an original stone or brick facing. The character of this structure is unlike the corresponding wall (of brick construction) on the west side of the boiler house, but it may represent a substantial wall footing. Another suggestion is that the structure may be a flue associated with the remains of the largely demolished Phase 3 chimney-stack situated to the north. The use of white lime mortar in this structure was not observed elsewhere on the site during this excavation, perhaps suggesting the feature is of an earlier phase, or has a specialist function. The wall feature was excavated to a depth of 1.30m (depth of excavation A.O.D. 75.47m), but was not bottomed. Backfill deposits 512 within a cut (513) all continued beneath the brick pathway (504).

Wall 517 may have extended southwards into Trench 6A, but any evidence for this appeared to have been truncated by later modifications. Alternatively 517 may have formed a corner angle with wall 602 (see fig. 20). The rough character of the north side of wall 602 may suggest it was truncated by cut 513.

Cut 513 to the west, and evidence of truncation to the east face of wall 518 (see photos 43 and 44) suggested that the boiler house floor has been effectively removed within this trench. If so it had unfortunately destroyed the relationships between walls 518, 517 and the boiler house floor in this location. The presence

of the culvert is of some significance. If it was a sub-floor feature associated with the boiler house, then this suggests that only the floor of the boiler house has been removed. This in turn suggests that all the underlying deposits (including fills 512, cut 513 and feature 517) pre-date the boiler house. Alternatively, culvert 509 may post-date the boiler house, suggesting in turn that all the underlying deposits revealed in the excavation (including fills 512, cut 513) post-date the boiler house. Feature 517 might then be the only surviving remnant of the boiler house revealed in Trench 5A.

It is also still possible that parts at least of the brick path 504 may actually be remnants of the boiler house floor, although it seems curiously ill-constructed and ephemeral if this is the case. The level of 504 (top of surface at A.O.D. 76.86m) was also very similar to that of the brick floor in Trench 5B (top of surface at A.O.D. 76.75m). No evidence of footings or plinths for the boilers indicated on the 1899 indenture plan was discerned in Trench 5A.

Parts of the boiler house may be better preserved beyond the excavated trenches, where further excavation might reveal better evidence of the stratigraphic sequence. No natural geology was discerned in either of the boiler house trenches. It thus seems entirely plausible that the boiler house was deeply cut into the surrounding topography and that all of the deposits between west wall 518 and east wall/flue 517 are later fills.

Trench 5B (*Figs. 1, 23, 24, photos 33-37*)

Trench 5B was cut to locate the expected northern end of the former boiler house. A brick surface (555 and 573) was revealed about 0.70m below current ground level (surface at A.O.D. 76.75m). At the south end of the trench there is evidence for two phases of truncation, and possibly two phases of construction (photos 33 and 34).

Cut 568 appeared to cut make-up deposits (of pink mortar, stone and pink brick demolition debris) 565, 566 and a possible surface 570 (see fig. 24) at A.O.D. 75.91m. These deposits may represent an earlier phase of construction and demolition. 570 was laid upon 567, a deposit of redeposited fire-reddened earth mixed with crushed brick and mortar, interpreted as a makeup layer for 570. Cut (568) represented a phase of significant truncation, possibly associated with cut 513 in Trench 5A. The fill of cut 568 (569) consisted of brick demolition rubble, yellow clay and pale mortar. It was excavated by machine to a depth of approximately 2.5m (but was not bottomed) and was backfilled to a safe depth.

The top edge of the cut then appears to be sealed beneath deposits 564 and 563, interpreted as possible construction deposits associated with the brick surface 555. A later truncation or demolition phase had removed the southern extent of the brick floor which was sealed by layers 553 and 552.

The brick surface appeared to consist of two phases. To the south, 555 is regularly laid and consists of two courses of mortared refractory brick, overlying two layers of hardcore rubble (deposits 563 and 564). The lower course was laid on a bed of crushed yellowish cream mortar. The brick floor itself was bonded with dark grey hard mortar. To the north, the brick surface is only one course thick (573), is laid to a different orientation, and is constructed upon deposit 559, significantly different to the sub floor deposits at the south end. Patches of Phase 3 dark grey/black mortar (572) on the brick floor surface might indicate the former location of brick plinths for supporting a boiler. This possibility is supported by the indenture plan of 1899 on which the probable location of a boiler is indicated approximately in the location of Trench 5B (see fig. 1). The level of the floor in Trench 5B (top of surface at A.O.D. 76.75m) is very similar to

the level of the path 504 in Trench 5A (top of surface at A.O.D. 76.86m). Bricks were light buff yellow refractory type (0.24 x 0.12 x 0.07m).

Floor 573 was also truncated along the western edge of the trench by cut 560, and backfilled with clean, crushed, un-burnt coke (558). Removal of the fill revealed the edge of a flue or culvert (561) running beneath the floor in an SW-NE direction i.e. at an angle to the alignment of the building (see photos 35 and 36) at A.O.D. 76.12m. The overlying deposit 559 was presumably backfill of a construction cut for the culvert (as well as the bedding for brick surface 573). Brickwork 571 may be a vestige of masonry footings marking the north extent of the boiler house (see photos 36 and 37). A small portion of culvert at the northern end of the trench (570) was a continuation of culvert 669 from Trench 6B. Deposits 557 and 554 are thought to be secondary backfill deposits of cut 560.

Trenches 6A, 6B and 6C

These trenches were located to characterize the nature of three external working areas to the east of the oven batteries.

Trench 6A (*Figs. 1, 19, 20 and 22, photos 45-48*)

Trench 6A was intended to establish the existence of working surfaces and other features immediately south of the boiler house. Initially the trench was machined down to the same level as the brick path in Trench 5A. At this level, although no surfaces or structures were discernable, several deposits and the cuts for later intrusive features were identified. Excavation of a cut at the southeast end of the trench (609) revealed the presence of a brick culvert (606) at A.O.D. 76.19m, constructed from standard yellow refractory bricks with Phase 3 dark grey/black mortar and with iron capping plates. There was no evidence of an associated surface. The fills of later cuts and other redeposited material were removed by machine to reveal the presence of numerous pipes and cables running at intervals across the trench.

Portions of (unusually for the site) red brick (dimensions: 0.22 x 0.10 x 0.07m) structures (605) and (603) were also revealed in the sections (top of features at A.O.D. 76.50m). Structure 605 was bound with a hard, modern cement and was found to be part of a manhole. This was associated with a large steel pipe running north from 605 before turning at 90° to run along the north face of masonry block 603 (see fig.20). 603 is faced on its north and south sides, and appears possibly truncated on its west side. It appeared to be associated with a truncated fragment of mortar surface on its south side.

The main structural features noted in the trench were a portion of a substantial mortar surface (601) revealed 0.35m below ground level (top of surface at A.O.D. 76.18m), that appeared to run up to the remnants of a robbed out wall 602 (see fig. 20 and photos 45 and 46) constructed from randomly coursed, roughly dressed stone bonded with a very dark grey mortar. The wall survives to a width of 0.50m but may be truncated on its north side. The surface consisted of a 0.2m thick bed of compact crushed brick capped with a 0.05m thick hard grey mortar screed. Surface 601 appears to have been truncated to the east by a later phase represented by 603 and 605. This may also have removed evidence of a possible southern continuation of structure 517 from Trench 5A.

Apart from the surface (601) no obvious or consistent historic working surface was noted. Perhaps of significance is the apparent correspondence between surface 601 and the possible location of a boiler indicated on the 1899 indenture plan (see fig. 1).

Trench 6B (*Figs. 1, 25 and 26, photos 31 and 32*)

Trench 6B was cut to establish the existence of working surfaces and other features immediately north of the boiler house. Below a deposit of dumped clay (652) was a dark grey deposit of coke/coal dust (653) overlying an irregular, and in places damaged, working surface (654) of compacted ferrous gritty material, possibly derived from clinker (0.70m below ground level (at A.O.D. 77.24m). Beneath this was another similar insubstantial trampled working surface (664) at a depth of 0.80m below ground level (top of surface at A.O.D. 77.14m). In places the two were separated by looser deposits of similar material (659). Two parallel lines of ferrous concretion (670) running across the middle of the site appeared to be the remnants of heavily corroded rails separated by a 0.50m gap. These were associated with the lower surface 664. Although not identified at the time of excavation, scrutiny of photographs shows impression patterns in surface 664, to

the east of the possible rails (see photo. 31) that suggest there were originally iron plates on this working surface.

The western part of the trench was machined to a lower level to ascertain if significant earlier surfaces were present. Two culverts (668 and 669) were revealed. Culvert 668 (top at A.O.D. 77.06m) was of brick construction, capped with irregular flattish stones with an internal width of 0.39m and depth of 0.24 m. The feature appeared to be cut through surface 664 but was sealed by surface 654. Culvert 669 (top at A.O.D. 77.20m) was also of brick construction, but capped with iron plates. It appeared to cut surface 654. The culverts appeared to converge close to the southern edge of the trench. The cut (667) for culvert 669 cut through a deposit of loose black burnt coal 665, overlying possibly natural yellow clay 666 (top of 665 at A.O.D. 76.83m).

No evidence of a formal constructed working surface was apparent. The most significant would appear to be that associated with the iron plates and possible rails (664) found at a depth of 0.80m below ground level. Generally there appeared to have been a gradual accumulation and compaction of spreads of oven waste. The culverts appeared to have been cut into their associated layers rather than constructed previously, apparently post-dating an initial deposit of oven waste? (665).

Trench 6C (*Figs. 1, 27 and 28, photos 49-51*)

Trench 6C was intended to identify working surfaces and the foundation of the retaining wall of the embankment leading to the calcining kilns.

Immediately below the turf layer, the partial remains of a brick surface were revealed (811) at A.O.D. 77.07m. This surface, of possibly re-used yellow bricks bonded with Phase 3 dark grey/black mortar extended out from the embankment retaining wall, as far as the southwest face of the calcining kilns. The edge of the brick surface was supported upon a low sill constructed from a single course of larger bricks (803) thus forming a raised platform against the embankment wall (see photos 49 and 50). Four large refractory bricks laid side by side along the sill edge may represent the remains of a doorstep or sill. A single *in-situ* brick suggested there may have been additional brick courses, at least along the edge of the sill. How far the brick surface may have extended along the base of the embankment wall remains uncertain as it appeared to have been damaged or truncated. The surface butted up against the brick blocking of a low arch in the calcining kiln structure adjacent to the trench (see photo. 49). The brick surface was built upon a spread of loose mixed redeposited material (805) that extended across the entire trench. The upper horizon of this material did not appear to have formed a significant surface to the west of the bricked area.

The brick floor may be the remains of a small shed built against the corner of the embankment and calcining kiln walls in a later phase.

Deposits 805, 806 and 807 were removed down to 0.40m below ground level, where a flat and even horizon of compact ferrous-stained clay 809, in which impressions indicating the former presence of probable iron plates were discernable (see photo. 51) (top of 809 at A.O.D. 76.76m). These presumably formed a working surface during the latter phase of the ironworks. The retaining wall of the embankment also appeared to be constructed from this level, with no evidence of a foundation cut, or lower courses of masonry foundations discernable. It is possible, however, that 809 sealed earlier deposits.

DISCUSSION

Embankment

The level of the historic upper surface of the embankment (at A.O.D. 84.20m) was located at a depth of 0.20m below ground level. It was found to preserve impressions of wooden sleepers in its compacted surface. No rails, sleepers or other associated features or objects were present. From the excavated evidence, the embankment appeared to be constructed from compacted possible oven-waste material. To the east, this material was contained within a substantial battered retaining wall (top of wall at A.O.D. 82.03m). Whether the core of the embankment was constructed from different materials could not be determined from this level of investigation. If the embankment retaining wall ever extended to the vicinity of the excavated trench, the facing appeared to have been robbed. The surviving masonry wall exposed in Trench 4B may suggest the embankment wall was more vertical than it is to the east. No evidence of embankment walls or structural deposits associated with the north side of the embankment was identified.

The possible oven waste metallurgy comprising the upper part of the embankment appears to be reasonably compact on top of the embankment and is relatively clear of vegetation from Trench 4 eastwards. To the west, however, there is more vegetation and young tree growth. The sides of the embankment are more heavily vegetated and tree roots appear to have tended to break up and loosen the metallurgy, encouraging gradual erosion. This has been compounded by badger burrowing, although the extent of such damage remains uncertain. The masonry features stepping up the embankment slope appear to have little obvious structural integrity and may represent some attempt at consolidation of the embankment in this location. The instability of the banks appears to have resulted in the displacement of a large chunk of retaining wall immediately to the east of the evaluation trench.

At the south end of Trench 4B an un-mortared brick surface was located at the foot of the retaining wall at c. 0.60m below ground level (at A.O.D. 80.72m). This surface may indicate the presence of an earlier working surface beneath deposits that were exposed, but not excavated, within Trench 3A.

Demolished southern oven battery

The southern coke oven battery appeared to have been demolished to a level (A.O.D. 77.36m) 0.60m above the wharf working-surface. This is a similar level to that for the base of the sole flues in the central double oven battery. No evidence of refractory brick floors of circular ovens, or for sole flues was apparent within the trench exposure, so it appears that at this level evidence of the character and arrangement of the former coke ovens has not survived. Broader exposures may, however reveal some surviving evidence. The width of the battery, however (c. 9.30m), suggests that the ovens were either smaller, of a different type, or were arranged in a different pattern to that of the extant double range oven battery to the north. A staggered arrangement of ovens (rather than opposing, as in the central battery) seems plausible. The excavated structures appear to conform well with those represented on historic mapping.

Tree root damage to the demolished battery depends on how deeply rooted the existing trees are. Root damage is most likely to the west of Trench 1A, where saplings are denser. To the east, trees appear to run along the probable north edge of the battery. The southern edge of the battery would appear to have been demolished to a greater depth (top of structure at A.O.D. 76.49m).

No significant tree root damage was discernable within the excavated trench. Likewise, Japanese Knotweed roots do not appear to have penetrated into the

surviving fabric of the oven battery foundations. Whilst the brick and stone core work of the demolished southern battery would be difficult to conserve if excavated, the remains of the stone outer walls would appear to be robust enough for exposure to be contemplated.

Central double range oven battery

Much the majority of the existing structures of the extant central double range oven battery appear to have been constructed at one time during phase 2, following the invention of the 'Brecon and Dixon' oven in the 1860s. Evidence for an earlier phase may be represented by a portion of possible Phase 1 stonework in the battery's north wall, but further excavation would be required to ascertain this.

The ovens are arranged in opposing pairs in two parallel ranks, as is illustrated on the trench location plan (fig. 1). In addition to the ovens visible today, there may have been room for another pair of ovens at the east end of the battery (indicated on fig. 1), but if ever present, the footprint of the boiler house represented on the 1899 indenture plan (but not the 1897 Ordnance Survey map) would have removed them.

Evidence was exposed to suggest a central box flue running the spine of the battery, connected to the two ranks of ovens by branch flues. It is uncertain whether the base of the box flue was at the level of the oven base, or higher, as illustrated in fig. 2. There appears to be sufficient space in the width of the battery for either option. Excavation of the oven on the south side of the battery identified a sub-floor flue system for circulating hot exhaust gasses from the box flue to heat the oven floor. It appears that the gasses produced during coking were channelled into the sub floor flue system via the eyelets noted in the back walls of the ovens. That the sole-flue system went out of use during the working life of the ovens is clear from brick blocking of the eyelets and access arches to the sole flues and the minimal vitrification of the sole flues themselves. It is assumed from the presence of a branch flue on the north side of the range that the ovens are of the same design.

The highest standing section of the oven battery wall stood to a height of 1.0m (top of wall at A.O.D. 77.98m). These were roughly vertical. Except for the length of the surviving tie bars projecting from between the ovens, there was no visible surviving evidence to suggest the original profile of the oven battery. In fig. 2 the battery faces are represented as vertical. A batter cannot be discounted however.

Apart from the spinal flue, little evidence of arrangements on top of the oven battery was present within the excavated trench. The presence of an *in-situ* patress wall plate on the north side of Trench 2B may suggest a central channel along the top of the battery as illustrated (fig. 2), with raised platforms over the ovens. No evidence of a central tramline or other means of delivering coal to the ovens could be discerned within the area excavated. The absence of this evidence may suggest that the materials from which these features were constructed were worth removing, perhaps stonework and iron plates, rather than less valuable brickwork. Since the upper parts of the oven battery fabric consisted of earth packing, some additional form of support for the coal delivery system presumably must have existed.

Like the demolished southern oven battery, low-level 'apron' working areas were located directly in front of the former oven doors on both sides of the battery. These were defined by low platforms constructed between the south and central, and central and northern oven batteries. The platforms were up to 0.40m high, with upper surfaces lying at 0.02m below ground level (top of platforms at approximately A.O.D. 77.31m).

In general the outer stonework of the oven battery was well constructed, and today stands to between 0.45 and 1.0m high (top of stonework at A.O.D. 77.98m) from the historic working surfaces. Less *in-situ* stonework survives at present ground level, but could usefully be exposed and consolidated. The brick and earth portions of the corework of the battery were less well (regularly) constructed than that of the northern battery (Trench 3B). As a consequence, tree roots have been able to penetrate the core-work to a greater degree. Likewise, the upper portion of earth fill is vulnerable to erosion and tree root damage. The domed oven structures themselves seemed to be reasonably solid and impervious to root damage, possibly as a result of vitrification. Apart from missing refractory bricks on the floor or the partially excavated oven, the surviving oven structure is very well preserved. Core-work mortar and the mortar bedding for the oven floor would both be likely to suffer from re-exposure to the elements. Japanese Knotweed did not appear to be particularly deep rooted, or to have had a greater impact on the battery structure than other vegetation types.

Northern single range oven battery

The trench was not in a suitable position to ascertain whether the oven design was similar or different to that of the central double oven battery. Only the core-work between two ovens of this battery was exposed. A 1.0m high section of *in-situ* outer walling (top of wall at A.O.D. 78.22m) and a portion of the 'apron' working area at A.O.D. 77.22m (0.40m below ground level) were exposed. In addition to the oven range, the remains of a box flue were identified running along the top of the battery. No evidence of branch flues from the oven to the box flues was likely to be located within the excavated area, but could be expected elsewhere. Apart from a tie bar channel at the top of the brickwork portion of the core work (A.O.D. 80.19m), no other structural features were exposed. No working surface was identified above the oven battery, although one might be inferred from the brick surface at A.O.D. 80.72m (0.60m below ground level) exposed at the south end of Trench 4.

As was the case with the central double range oven battery, the robbing of facings had caused the partial collapse of corework and no evidence of the upper front portions of the oven range had survived. Consequently, no evidence of top charging doors, a tramline or rail-mounted hoppers was apparent.

This oven battery appeared to be more solidly constructed than the central oven battery and consequently, although subject to a similar degree of damage and loss of features, tree roots had not penetrated the surviving core-work to a great degree. The upper earth fill of the structure is vulnerable to erosion and tree root damage. The extant remains of the ovens themselves appeared to be in a similar state of preservation to that of the central battery: reasonably solid and impervious to root damage, possibly as a result of vitrification. Nevertheless, any core work exposed elsewhere, is likely to suffer from weathering. Japanese Knotweed does not appear to be particularly deep rooted, or to have had a greater impact on the battery structure than other vegetation types. The remaining outer walling of the battery was well preserved and could usefully be revealed and consolidated.

Boiler house

Remains of the demolished boiler house were elusive and the remains exposed within its footprint were contradictory or difficult to explain.

Although the west and north extent of the boiler house are reasonably clear, the southern and western extent are less apparent within the excavated areas. From the surviving evidence it appears possible that the boiler house was open sided, but defined by brick masonry footings (518 and 571) over which the brick floor

surface was constructed. The brick flooring was exposed at a depth of between 0.15m (A.O.D. 76.86m) in Trench 5A, and 0.70m (A.O.D. 76.75m) below ground level in Trench 5B. In Trench 5B, two differing floor builds (555 and 572) each with different sub-floor stratigraphy, may have been constructed at different times. Neither was as regularly or substantially built as might be expected from a major steam installation and displayed no definitive evidence of the known layout of the boilers. A better-constructed surface was revealed in Trench 6A, where a solid dark grey/black mortar surface was revealed, south of wall 602. It lies within the footprint area of the boiler house (top of surface at A.O.D. 76.18m) and may relate to one of six boilers represented on an indenture plan of the site from 1899. How this surface relates to the brick floor in Trench 5B is uncertain,

A few bricks attached to the east side of footings 518 (evidence of two courses can be seen in section in photo. 43), may be the only *in-situ* floor remnant in Trench 5A. A possible late brick path surface in Trench 5A (504) used similar bricks, which may have been re-used from the boiler house or from the adjacent demolished chimney. These were laid at a similar level (A.O.D. 76.86m) to the better laid brick surfaces (555 and 572) (A.O.D. 76.75m), but the levels of both features are so similar that some or all of the path may actually be the disturbed remnants of an otherwise *in-situ* brick floor.

The fabric and construction of feature 517 was significantly different to other masonry structures encountered during the excavation. It is as yet impossible to say whether this structure was a flue or a wall.

It has been suggested that the brick floor may not in fact be the floor of the boiler house at all and that there may be *in-situ* remains at a lower level. Although there is some evidence to suggest that there is an earlier phase of construction and demolition that pre-dates construction of the brick floor surfaces, it was not possible to characterise the nature and extent or function of this phase due to the extent of later truncation, the location of the trenches and the practical limitations of excavation.

Working areas

Working areas were investigated in several locations: between the northern and central extant oven batteries and between the central and southern (demolished) oven batteries. Working surfaces were also identified to the north, south and east of the boiler house.

Coke oven environs

Working areas in front of the coke ovens were characterised by a lower 'apron' area from between 2.0m and 2.40m wide, defined in all cases by crudely constructed low revetment walls. The floors of the 'apron' areas were noted at between 0.20m and 0.40m below the raised platform areas between oven batteries. They consisted of level (natural?) clay horizons with a build up of laminations of crushed coke above.

Raised 'platform' areas were noted between the 'aprons' to north and south. At circa A.O.D. 77.21m These were up to 0.40m above the 'apron' working areas, constructed of deeper deposits of laminated crushed black coke waste and clay deposits, all retained by the 'apron' revetment walls. Although below the working surface, pipework and culverts presumably relating to the coking process were exposed between the central and southern (demolished) oven batteries. A similar arrangement might be expected between the northern and central extant oven batteries, which were only exposed to the top of the working surface. No evidence of more substantial surfaces having been present in these locations was apparent within the excavated areas. The raised platform areas generally lie very close to the present land surface. No evidence of rails, sleepers or other features

associated with the coking operations were observed in any of the 'apron' areas, except in Trench 2C where two features of uncertain purpose were cut into the clay and sealed by the coke laminations. It is therefore uncertain whether the raised platforms and 'apron' working areas represent a later phase of working that has removed or masked an earlier working surface.

Boiler house environs

Working surfaces in Trenches 6A, 6B, and 6C were significantly different in character, both from each other, and from the oven working areas.

In Trench 6A, a well-constructed grey mortar surface was revealed, south of wall 602. How this surface relates to the brick floor in Trench 5B is uncertain, but it is within the footprint area of the boiler house and may relate to one of six boilers represented on an indenture plan of the site from 1899. Later pipework and red-brick structures appear to truncate the mortar floor phase. There is little or no surviving evidence of a surface associated with these later features.

In Trench 6B to the north of the boiler house, two phases of uneven and insubstantial compacted oven waste(?) material, appeared to form the historic working surface in this area at 0.70m below ground level. The earlier of these two surfaces showed evidence of a narrow-gauge tramway and iron concretions consistent with a working area covered with iron plates. These must have been removed before the second surface was established. These surfaces in turn overlay further waste deposits above a clay horizon, possibly similar to those exposed in the 'apron' working areas.

To the east of the boiler house, at the foot of the embankment wall, a brick surface at A.O.D. 77.07m (0.10m below ground level) is associated with a small lean-to structure possibly associated with the late-phase. This overlay a layer of similar reddish oven waste material to that found in Trench 6B, but without identifiable working surfaces. Below this at A.O.D. 77.76m (0.40m below ground level) was a clay horizon bearing the concreted imprints of iron plates that may have formed a working surface in this location during the ironmaking-phase.

Generally, the working surfaces formed from deposits of compacted oven waste are less substantial than perhaps anticipated. Where buried at sufficient depth they are reasonably stable, but where there is less overburden they are prone to be broken up by the roots of general vegetation and Japanese Knotweed, making the surface horizon less stable, especially once exposed by excavation. No major tree root disturbance was identified, but the trenches were located to avoid the likelihood of encountering tree roots where possible.

No artifacts were recovered during the excavation, and most easily removed stonework, brickwork and ironwork appears to have been long-since robbed for re-use elsewhere. Buried remains appear reasonably well preserved but, apart from vitrified brickwork and areas of facing stonework, would be vulnerable to weathering were they to be exposed without significant conservation work or protection with a sacrificial layer. Little ironwork remained *in-situ*, although the possible rails revealed in Trench 6B were heavily corroded and concreted, to the extent that their original form could no longer be easily ascertained. Buried pipe work was slightly better preserved, but most, if not all, was of later date. The best-preserved iron artifacts were the cast iron plates reused as cappings to culverts.

Cartographic evidence

Two oven ranges (the northern and central batteries?) are indicated on a lease plan of 1854. Three further batteries, including the southern (demolished) bank were added by 1875. By 1895 the boiler house had been constructed.

The difference in the construction materials and techniques and design of the northern and central batteries may suggest they were not built at the same time, or that one (possibly the northern bank?) has been rebuilt. This may be suggested by the different footprint of the northern bank illustrated in 1854 to that on later maps. If so, only the later structure of the north bank was excavated in this evaluation. An alternative suggestion based on construction differences is that the central bank has been re-built (see discussion of the northern bank, above). The later construction date for the southern battery may be reflected in its different width and possible differences in its construction (i.e. the retaining walls).

By 1895 the boiler house had been constructed, however, iron production at the site ceased at around that date, so the boiler house must be assumed to have been constructed earlier. Different footprints for the building depicted on the 1899 indenture plan and the 2nd edition Ordnance Survey map of 1897, coupled with possible archaeological evidence, may suggest the building was re-built or modified. Employing mortar type as a means of phasing, the use of a dark grey mortar in the brick floor may suggest a post 1888 date for its construction.

The indenture map seems to indicate a central 'rail' running along the top of each oven battery, presumably for the delivery of fuel to the ovens. No evidence of these tramlines was revealed in the excavated areas (see description of Trench 2B, page 8).

By 1913 the boiler house and tramways connecting the coke ovens to the charging bank were removed. The southern oven battery was demolished in 1918. The nature and extent of any subsequent building on the site is uncertain, but truncation to the boiler house floor in Trench 5B, service trenches, pipework and red-brick structures in Trench 6A, all suggest some degree of damage from later intrusions to earlier structures and deposits.

CONCLUSIONS

The excavations have provided valuable information on the materials and constructional details of the oven batteries and associated working surfaces. The boiler house structure remains highly enigmatic however. It has been possible to assess the extent of damage or degradation through weathering, root penetration and other agencies to the investigated remains, from which the long-term stability and sustainability of the Scheduled structures can be judged and their future conservation consolidation or protection proposed. The condition is generally exceptionally good, with little apparent damage from the former infestation of this area with Japanese Knotweed. The location of trenches did, however, deliberately avoid areas with mature tree growth.

The depth of the archaeology beneath current ground level is highly varied, but some features, notably the 'platform' structures and the demolished southern coke oven battery lie very close to the surface. Other areas, notably around Trenches 5B and 6B have been subject to significant ground raising. The levelling or removal of these later deposits would aid the interpretation of the remains. Many of the archaeological remains (coke waste working surfaces, refractory brick and earth and mortared core work) are of a type that would not benefit from long-term exposure. Other features, notably the surviving lower courses of the oven battery retaining walls could be beneficially exposed and consolidated. The removal of demolition 'tumble' and exposure of these walls would greatly enhance the appreciation of the surviving and demolished ovens. In some instances some re-building might be required to bring wall heights above current ground levels.

The same can be said for the surviving parts of the embankment retaining walls. Further, to aid the conservation of the remaining embankment structure and discourage further erosion by badgers, it may be pragmatic to restore the embankment retaining walls to their full height, as was done with the calcining kilns at the embankment's terminus.

While some idea of the stratigraphic complexity of the site has been demonstrated, it would be premature to construct a detailed model for the phased evolution of the site from the limited information recoverable from an evaluation excavation. For example, while the extant oven batteries and the boiler house may have earlier construction or alteration phases, this could not be definitively ascertained in the present evaluation and would require further investigation to confirm. Some further information could be provided from monitoring during subsequent conservation and consolidation phases. Such work would be unlikely to yield much evidence of the former boiler house, which would require a substantial area excavation (if it were considered necessary) to understand what remains of this structure.

THE ARCHIVE

The archive is currently being assembled by Cambria Archaeology, where it will be held in the short term. It is understood that Cadw's wish is that it should be consolidated with the remainder of the site archive currently held by Oxford Archaeology and that the archive's eventual home will be on site at Tondu, under the curation of Groundwork Bridgend and Neath Port Talbot. If this position changes, the likely home of the archive will be with RCAHMW Aberystwyth.

The archive will contain:

A. REPORT:

A paper and digital copy of the final report

B. SITE WRITTEN DATA:

184 context recording sheets and other records

C. DRAWINGS - NON PUBLICATION:

Original site drawings (27 plans, sections and elevations on 9 sheets of drafting film). EDM survey, plans, sections and elevations data on disc (circa 10 files). Paper and digital versions of drawn and digital working drawings (c.16 files and printouts)

D. PUBLICATION DRAWINGS:

Paper and digital copies of the publication
Drawings (circa 30 files and printouts)

E. PHOTOGRAPHS:

A disc containing the site photographic record and index files

F. FINDS DATA:

No finds were recovered during the excavation

G. ENVIRONMENTAL AND TECHNOLOGICAL DATA:

No environmental or technological samples were taken during the excavation

H. DOCUMENTARY DATA:

Paper copies of documentary sources.

I. CORRESPONDENCE:

Paper and digital correspondence pertaining to the project

J. GENERAL MISCELLANEOUS:

Miscellaneous paper or digital documentation

SOURCES

Boylston HM, 1928. *An Introduction to the Metallurgy of Iron and Steel*, New York

Byrom TH & Christopher JE 1910. *Modern Coking Practice*, London

English Heritage, 1997. *Monuments Protection Programme, Coal and Coke, Combined Step 1 and 3 Report*

Fulton J & Scranton PA 1906. *Coke – A Treatise on the manufacture of Coke and Other Prepared Fuels and the Saving of By-Products*

Kinchin-Smith R 1997. *Tondu Ironworks, Bridgend County Borough, Archaeological Assessment. Revised Edition.* Oxford Archaeological Unit

Mott, RA (Ed.) 1934. *The History of Coke Making and of the Coke Oven Managers' Association*, Cambridge

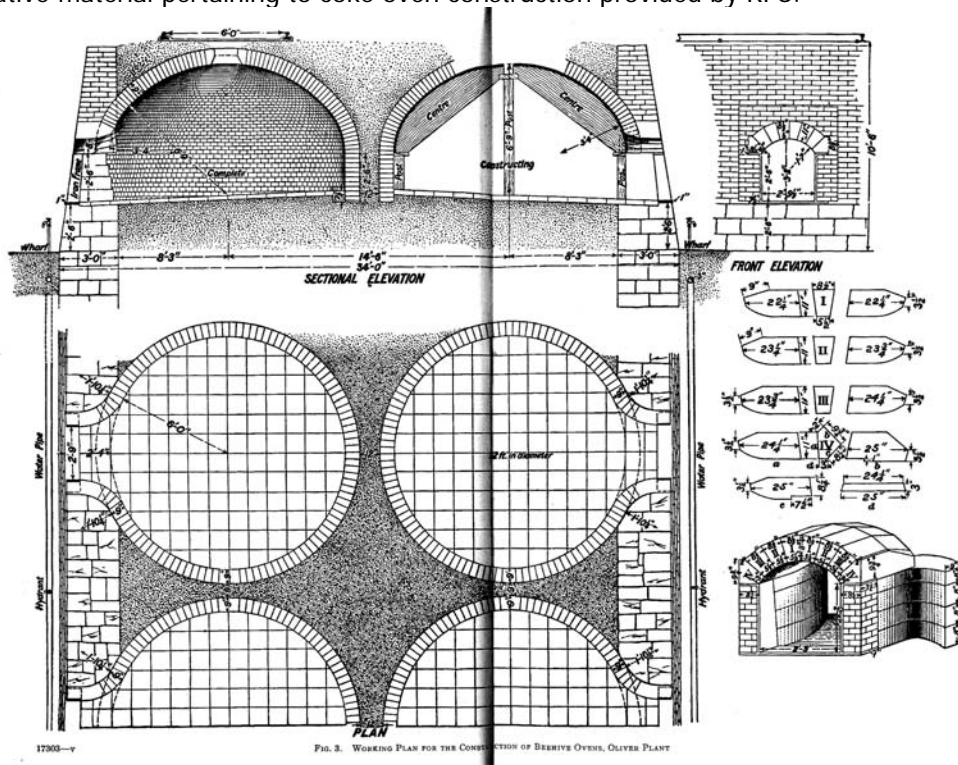
OS 25" to 1 mile (1:2500), 1st Ed. (Surveyed 1875), Glamorganshire, Sheet XXXIV.11

OS 2nd Ed 25" to 1 mile (1:2500), 2nd Ed. (Revised 1897), Glamorganshire, Sheet XXXIV.11

'Indenture map' of 1899, Cardiff Record Office (C.R.O.) D/DN/351

APPENDIX 1

Illustrative material pertaining to coke oven construction provided by RPS.



Plan and cross-section and front elevation of part of a double bank of common beehive ovens. Note provision of water standpipes for supplying hosepipes (not shown) for quenching the charge during emptying (from *Coke – A Treatise on the manufacture of Coke and Other Prepared Fuels and the Saving of By-Products*, Fulton J, Scranton PA., 1906)



FIG. 9. CONSTRUCTING BEEHIVE OVENS

A double bank of common beehive ovens under construction, c.1900 ovens (from *Coke – A Treatise on the manufacture of Coke and Other Prepared Fuels and the Saving of By-Products*, Fulton J, Scranton PA. 1906)

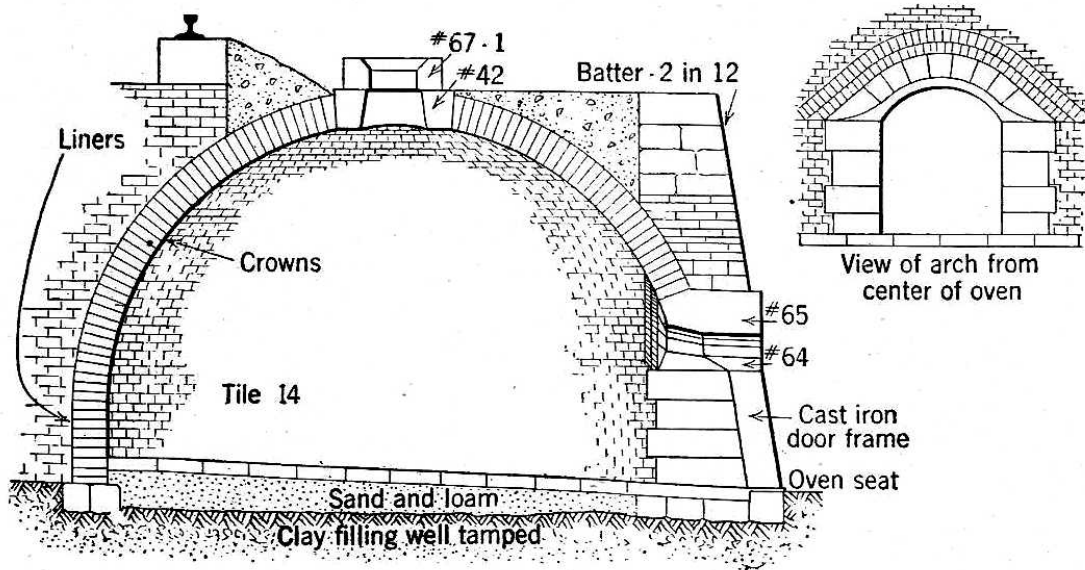


FIG. 27.—Standard Bee-hive Oven.
Courtesy Harbison-Walker Refractories Company

Constructional detail of common beehive coke oven ovens (from *An Introduction to the Metallurgy of Iron and Steel*, Boylston HM., New York, 1928)

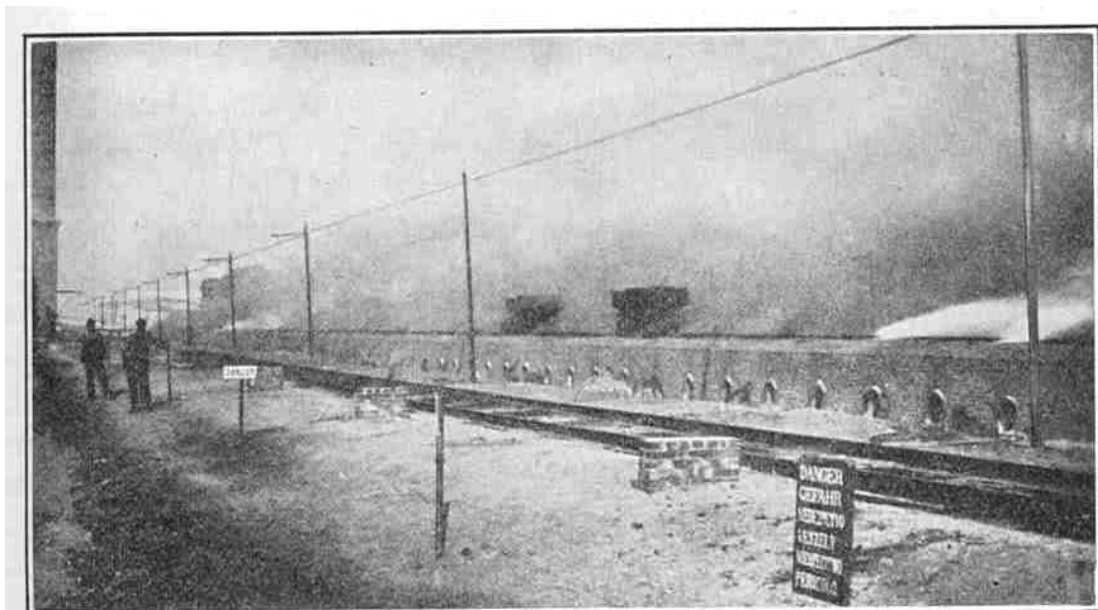
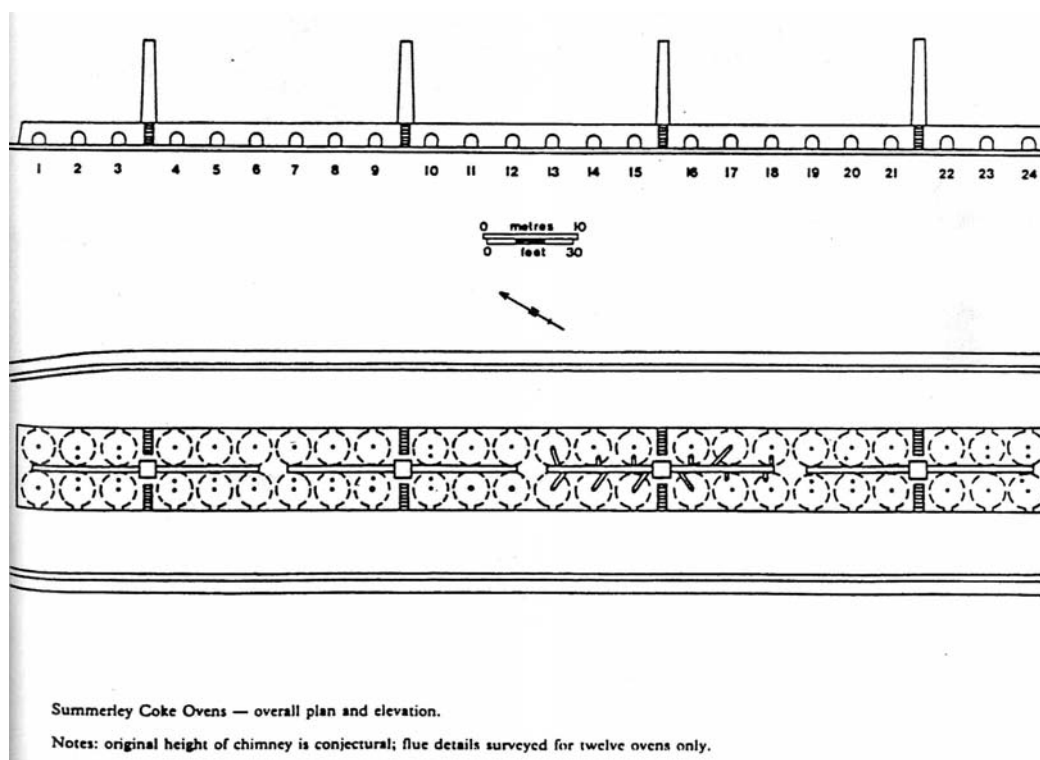


FIG. 29.—A Bank of Bee-hive Ovens with Charging Lorries on Top.
Courtesy The American Rolling Mill Company

A bank of common beehive ovens in use, clearly showing charging cars. This photo provides a clear illustration of gasses and volatile by-products being vented direct to atmosphere from the central charging eyes. (from *An Introduction to the Metallurgy of Iron and Steel*, Boylston HM., New York, 1928)



The double bank of beehive ovens at Summerley, Derbyshire, showing large spinal box flues connecting to centrally-placed chimney stacks venting to atmosphere. Note how branch flues connect both to central charging eyes (24) or to additional eyelets to rear of ovens (also 24) (From *Monuments Protection Programme, Coal and Coke, Combined Step 1 and 3 Report*, English Heritage, 1997)

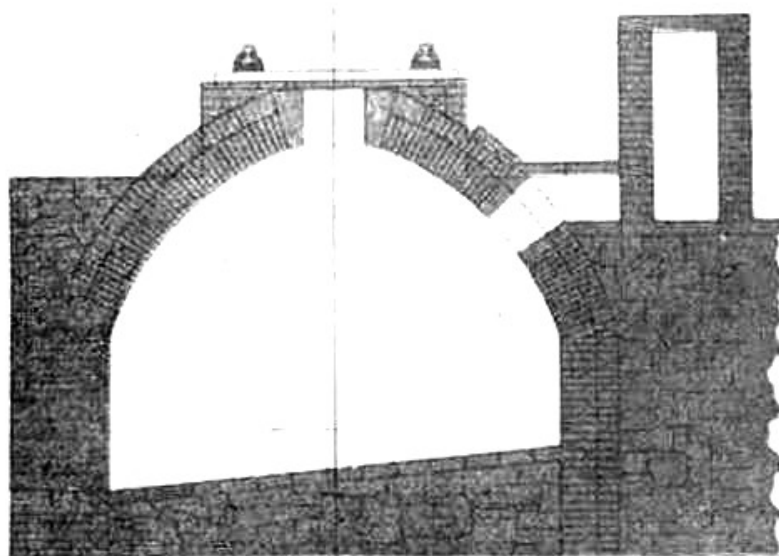


FIG. 9.
Common round beehive oven, Co. Durham, 1860.

Section of common beehive oven showing additional eyelet to rear, connecting to large spinal box flue on upper surface of oven bank. (From *The History of Coke Making and of the Coke Oven Managers' Association*, Mott, RA (Ed.), Cambridge, 1934)

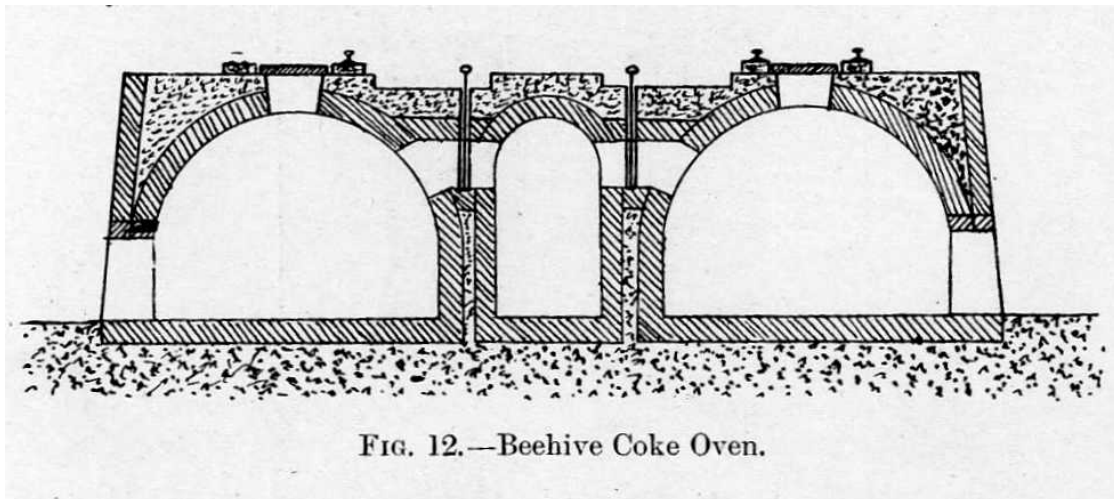
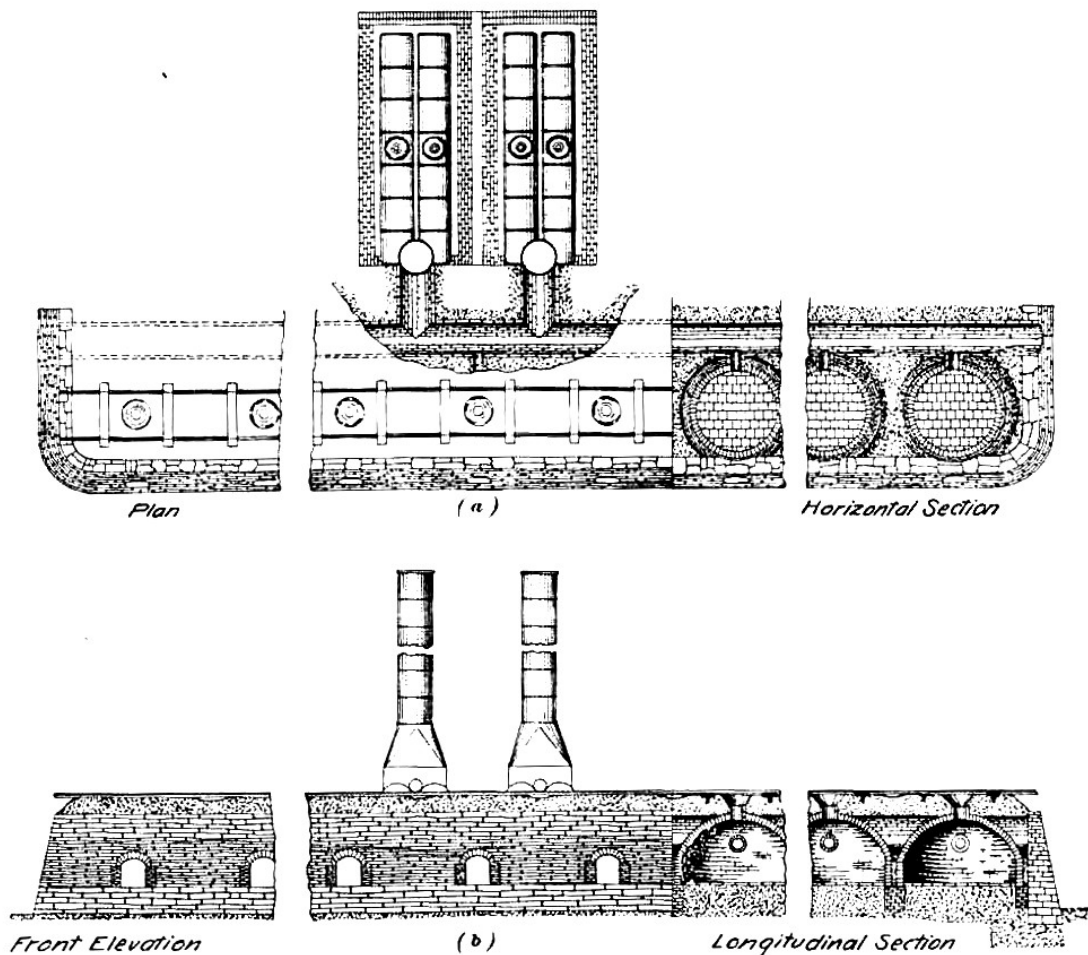


FIG. 12.—Beehive Coke Oven.

Double bank of beehive ovens with an integral vaulted passage for waste gasses, showing built-in dampers (From *Modern Coking Practice*, Byrom TH & Christopher JE, London, 1910)



(a) Top View and Horizontal Section. (b) Front Elevation and Longitudinal Section
 FIG. 15. OVENS AT PRATT MINES, ALABAMA USING GASES FOR STEAMING PURPOSES

Single oven bank with vaulted flue feeding exhaust gasses to two pairs of boilers located at right angles to rear (from *Coke – A Treatise on the manufacture of Coke and Other Prepared Fuels and the Saving of By-Products*, Fulton J, Scranton PA., 1906)

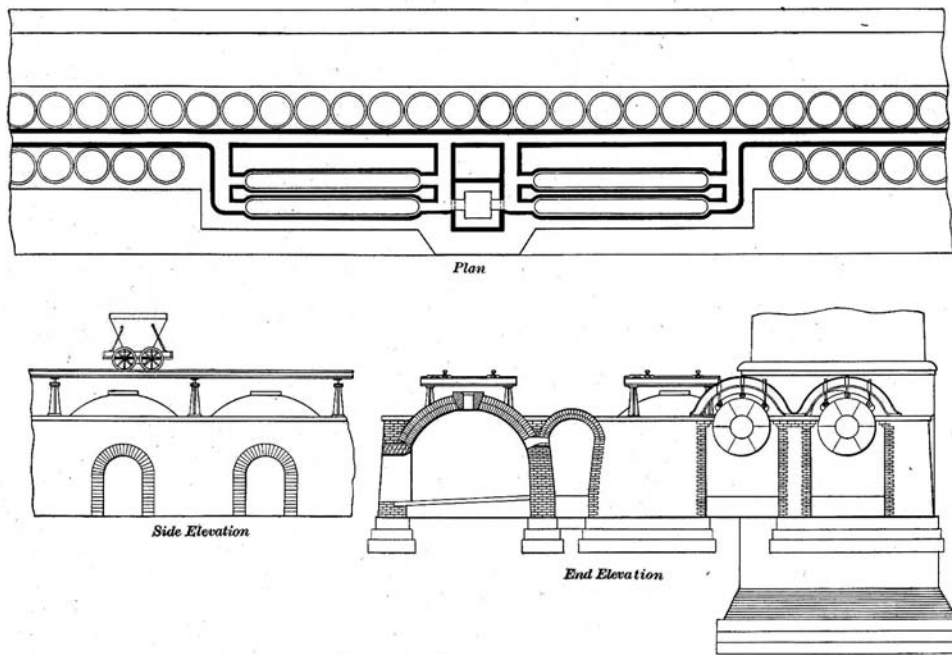


FIG. 14. COKE OVENS AT BROWNEY COLLIERY

Double oven bank with vaulted flue feeding exhaust gasses to two pairs of integrated boilers set longitudinally (from *Coke – A Treatise on the manufacture of Coke and Other Prepared Fuels and the Saving of By-Products*, Fulton J, Scranton PA., 1906)

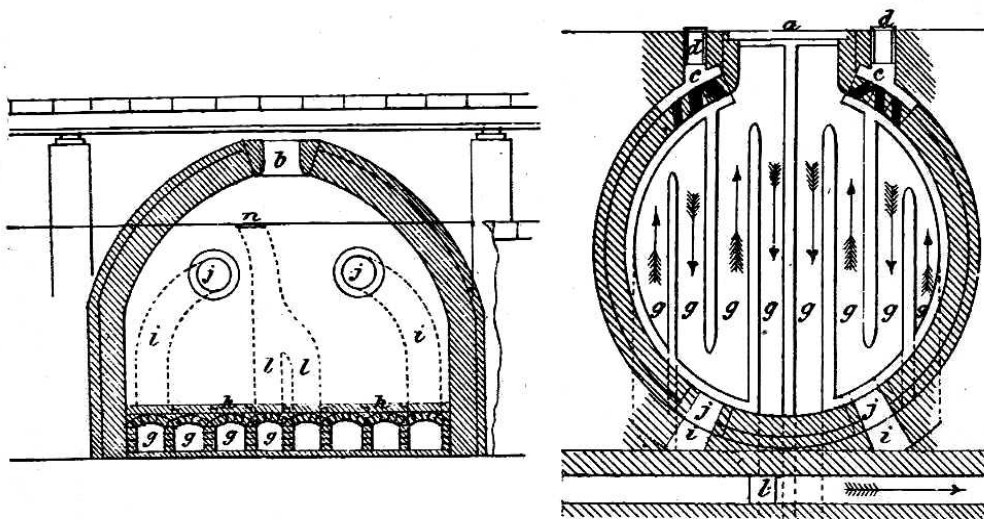


FIG. 13.

Beehive oven with sole flues for waste gases. Breckon and Dixon, Co. Durham, 1860. Cross-section through oven; plan of flues below oven sole.

A number of variant beehive oven designs aimed to increase the coking temperature, in order to speed production time. In the 'Breckon and Dixon' pattern the exhaust gasses were drawn through sole flues to heat the coke charge from beneath before passing to a high-level box flue. Other types included the 'Improved' beehive oven (a downdraught type which used positive pressure above the charge and a perforated floor beneath to reverse the normal flow of gasses) and the 'Heminway' type which used externally fired stoves to supply hot blast. It is unclear whether any such methods were used at Tondy. (Figure from *The History of Coke Making and of the Coke Oven Managers' Association*, Mott, RA (Ed.), Cambridge, 1934, other information from *Coke – A Treatise on the manufacture of Coke and Other Prepared Fuels and the Saving of By-Products*, Fulton J, Scranton PA., 1906)

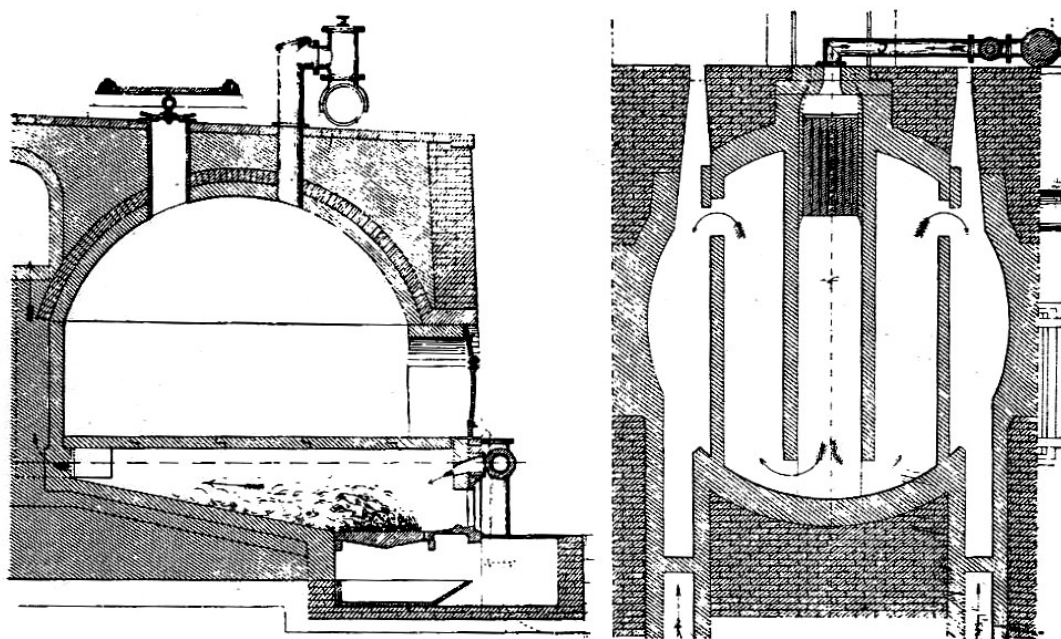


FIG. 14.

Externally-heated Pernolet by-product recovery beehive oven,
S. Brancepeth, Co. Durham, 1870. Cross-section through oven;
plan of flues below oven sole.

A number of variant beehive designs were developed in order to recover coke by-products, both in the UK and Europe. One such design was the Pernolet type, which was entirely heated from beneath using an external heat source and hot blast. There is no evidence that by-products were recovered at Tondy prior to the construction of a battery of Copée ovens to the west of the site in 1918 (Figure from *The History of Coke Making and of the Coke Oven Managers' Association*, Mott, RA (Ed.), Cambridge, 1934)

APPENDIX 2

RPS PLANNING AND ENVIRONMENT
SPECIFICATION FOR AN ARCHAEOLOGICAL EVALUATION
AT THE FORMER TONDU IRONWORKS (PARC TONDU)
TONDU, BRIDGEND

(SM No. Mid Glam 433 / NGR SS 8910 8445 (centred))

Specification prepared by Rob Kinchin-Smith of RPS Planning and Environment

1. Summary

- 1.1 *The ironworks at Tondy, nr. Bridgend was a small blast furnace ironworks established c.1838-40. The ironworks was operated with only limited success until 1854, when it was significantly remodelled and updated by new owners. It narrowly survived the 1870s slump in ironmaking but, in spite of a change of ownership in 1888 and significant modernisation and investment including a modern blast furnace, iron production ended in 1895-6. The site continued in use as the engineering and administrative hub for North's Navigation Collieries and then the NCB (West Wales area) until final closure in 1986.*
- 1.2 *Later uses were largely confined to the lower part of the site, with the remainder being largely abandoned. The upper part of the site thus retained an important and unique collection of ironworks structures, comprising beehive coking ovens, ore calcining kilns, furnace bank wall, lift tower and blowing engine houses. These relict structures, designated as a Scheduled Monument in 1992, were acquired by the charitable sustainable environmental regeneration organisation, Groundwork Ogwr (now Groundwork Bridgend and Neath Port Talbot) in 1997 with the intention that they be conserved and interpreted. Since then a major programme of consolidation and environmental works has been carried out, funded by the Millennium Commission and others. These works have seen the engine houses converted to offices and the below-ground remains of the 1888 blast furnace excavated and preserved beneath an interpretative pavement. The lift tower, furnace bank wall and calcining kilns have been stabilised, consolidated and conserved. The associated company settlement, including truck shop and Wesleyan Methodist church, survives intact. The whole settlement has been designated as a conservation area, whilst 53 terraced ironworker's cottages in two rows, built c.1870-75, have been listed Grade II.*
- 1.3 *The site, dubbed 'the most complete Victorian ironworks in Wales' lies on the Celtic (cycle) Trail and forms a local node on the European Route of the Industrial Heritage. It also forms the hub of a local network of cycle ways promoted by Groundwork. Following on from the Phase 1 consolidation project, a Project Planning Grant has been awarded by the Heritage Lottery Fund to allow the assessment of the works required as a precursor to proposals to complete the consolidation of the remaining Scheduled structures. The project planning grant also covers the evaluation of the works necessary to allow physical access to the site and its structures, for the provision of a cycle hire centre and to provide a centre for the interpretation of both the ironworks site and the wider industrial and natural heritage of the area. This archaeological evaluation thus forms part of a suite of studies, including an Access Plan, a Landscape Master Plan, an Audience Development Plan and a Conservation Management Plan.*
- 1.4 *This specification specifically deals with the archaeological evaluation of the upper part of the site, specifically the beehive coking ovens, calcining kiln approach embankment and associated surfaces. It has been prepared by RPS Planning and*

Environment, in association with Groundwork Bridgend and Neath Port Talbot and the project engineers, James and Nicholas of Port Talbot.

NOTE: The requirements detailed in paragraphs 5.1, 5.2, 5.3, 5.4, 5.5, 6.5, 6.6 and 10.1 are to be carried out by the archaeological contractor **prior** to the commencement of fieldwork.

2. Site Location & Description (Fig.1)

Grid Reference: SS 8910 8445 (centred)

- 2.1 The area under consideration lies on the west side of Parc Tondu, which is itself located to the west of Maesteg Road, Tondu. It is situated on a plateau above the blowing engine houses and furnace bank wall, slightly below the level of the upper part of the former company village, formed by Derllwyn Road and Park Terrace.
- 2.2 The plateau contains the upstanding and largely intact remains of a pair of large, stone-built calcining kilns and a stone-built approach embankment connecting the calcining kilns to the course of the former Duffryn, Llynvi and Portcawl Rail Road. It also retains the less intact upstanding remains of a large square brick-built chimney stack and the visible remains of at least 32 beehive coking ovens, built in three banks, two single-sided and one double bank.

3. Planning Background

- 3.1 As yet the proposed evaluation is not linked to any planning application. Being located wholly within a Scheduled Monument, Scheduled Monument Consent will be required
- 3.2 This specification has been prepared by Rob Kinchin-Smith of RPS Planning and Environment (acting on behalf of Groundwork Bridgend and Neath Port Talbot), to detail the proposed evaluative works, both for the purposes of obtaining Scheduled Monument Consent and to allow suitable archaeological contractor to provide a quotation.

4. Archaeological Interest

- 4.1 The ironworks at Tondu, nr. Bridgend was established c.1838-40 by Sir Robert Price, Whig MP for Yazor, Herefordshire and son of Sir Uvedale Price, the influential writer on the Picturesque. Built as a two blast furnace ironworks, it was initially served by the horse-drawn Duffryn, Llynvi and Porthcawl Rail Road. The ironworks was operated with only limited success by Price until 1854, when it was taken over by a John Brogden, a Manchester-based haematite merchant and railway contractor. Brogden and his sons significantly remodelled and updated the ironworks and opened up large coal mining reserves in the Llynvi, Ogmere and Garw valleys, which they exploited with a network of steam railways. Being situated closer to the coast than most contemporary Welsh ironworks, the ironworks narrowly survived the 1870s slump in ironmaking, albeit in receivership from 1878 to 1888. Significant modernisation and investment in a modern blast furnace were unsuccessful in reviving the site as a profitable iron-making plant and iron production ended in 1895-6. The site continued as the engineering and administrative hub for North's Navigation Collieries, then the NCB until 1986.
- 4.2 Whilst the lower part of the site, which formerly contained facilities such as offices, engineering shops, a wagon repair works, a small gasworks and brick kilns has recently been redeveloped as housing, the middle and upper levels of the site were

largely abandoned after 1888 and thus remained largely intact, forming an important and unique collection of beehive coking ovens, calcining kilns, furnace bank wall, lift tower and blowing engine houses. These were designated as a Scheduled Monument in 19XX and, following a period of total abandonment, the Scheduled structures, a wide access corridor and a significant area of woodland were purchased by the charitable sustainable environmental regeneration organisation, Groundwork Ogwr (now Groundwork Bridgend and Neath Port Talbot). Since that time a major programme of consolidation and environmental works has been carried out, funded by the Millennium Commission and others. These works have seen the engine houses converted to offices and the blast furnace foundations excavated and preserved beneath an interpretative pavement, whilst the lift tower, furnace bank wall and calcining kilns have been stabilised, consolidated and conserved. The associated company settlement, including truck shop and Wesleyan Methodist church, survives and has been designated as a conservation area.

- 4.3 The site, dubbed 'the most complete Victorian ironworks in Wales' lies on the Celtic (cycle) Trail and forms a local node on the European Route of the Industrial Heritage. Following on from the Phase 1 consolidation project, a Project Planning Grant has been awarded by the Heritage Lottery Fund to allow the assessment of the works required to complete the consolidation of the remaining Scheduled structures and to evaluate the works necessary to allow physical access to the site and its structures, for the provision of a cycle hire centre and to provide a centre for the interpretation of both the site and its archaeology and of the wider industrial and natural heritage of the area.
- 4.4 The target of the investigations proposed within this method statement is the upper part of the site, above the furnace bank wall. The principal objective is to assess the construction and condition of the upstanding banks of coking ovens, the depth and nature of the footings of the calcining kiln approach embankment and to examine the presence or absence of below ground remains of associated structures and surfaces, notably another double bank of coking ovens, incoming railways, outgoing tramways, hard surfacing, pipework or other evidence of water quenching and a boiler house built c.1888 to utilise waste gasses from the ovens. Nine short evaluation trenches are proposed. Except where specified otherwise, all of these will be excavated to the first significant structural archaeological horizon
- 4.5 The purpose of the excavations is five-fold:
- to better understand the long-term stability and sustainability of the Scheduled structures;
 - to better understand the evolution, history and archaeological significance / importance of the structures themselves;
 - to better understand whether the historic structures are being damaged or degraded through weathering, root penetration (especially the effects of Japanese knotweed) or other agencies;
 - to inform future conservation and interpretation strategies and whether it would be informative or appropriate to excavate and interpret the structures, and
 - if it were appropriate to expose further historic fabric, how this might be consolidated or otherwise protected from further damage.

5. General Instructions

5.1 Health and Safety

- 5.1.1 Whilst the areas to be excavated have been used for the production of coke, the primitive methods used resulted in all byproducts being burned off to atmosphere, or later in boilers. Whilst much of the site is covered with coke waste (coal dust and ash), previous contamination testing has not revealed any areas where levels of

contaminants present a risk to health, subject to normal precautions (no smoking or eating on site, hand washing before meals).

- 5.1.2 The archaeologists on site will naturally operate with due regard for Health and Safety regulations. Regard should also be taken of any reasonable additional constraints that the site owner or Cadw may impose. The excavation will require the preparation of a Risk Assessment of the site in accordance with the Health and Safety at Work Regulations. Any Health and Safety issues that may hinder compliance with this specification should be discussed with RPS at the earliest possible opportunity (see section 12.2).

5.2 Confirmation of Adherence to Specification

- 5.2.1 Prior to the commencement of any work, the archaeological contractor must confirm adherence to this specification in writing to RPS, or state (with reasons) any proposals to vary the specification. Should the contractor wish to vary the specification, then the written confirmation of Cadw to any variations will be required prior to work commencing. Unauthorised variations are made at the sole risk of the contractor. Modifications presented in the form of a re-written specification/project design will not be considered by RPS. Any technical queries arising from the specification detailed below should be addressed to RPS without delay.

5.3 Confirmation of Timetable and Contractors' Qualifications

- 5.3.1 It is estimated that the evaluation should not take more than two weeks on site. It is currently hoped that the evaluation will commence in the week commencing 5th March 2007.
- 5.3.2 Prior to the commencement of any work, the archaeological contractor must provide RPS in writing with:
- a projected timetable for the site work;
 - details of the staff structure and numbers;
 - names and CVs of key project members (the project manager, site supervisor, any proposed specialists, sub-contractors etc.).
- 5.3.3 All project staff provided by the archaeological contractor must be suitably qualified and experienced for their roles. The timetable should be adequate to allow the work to be undertaken to the appropriate professional standard, subject to the ultimate judgement of both RPS and Cadw.

5.4 Notification

- 5.4.1 The excavations will be monitored as necessary and practicable by RPS in the role of the site owner's agent, and by Cadw in its role as curator. RPS should be provided with as much notice as possible in writing (and certainly not less than one week) of the intention to start work. A copy of the archaeological contractor's risk assessment of the site should accompany the notification.
- 5.4.2 Cadw should be notified in writing of the commencement of fieldwork at the same time as RPS.
- 5.4.3 As a courtesy, the curatorial branch of the Glamorgan Gwent Archaeological Trust should also be notified of the intention to commence fieldwork.

5.5 Documentary Research

- 5.5.1 An overview of the archaeological/historical background of the site and environs is provided by the report on the site previously prepared by Oxford Archaeological Unit for Groundwork Bridgend (OAU 1997). Key site staff are expected to have familiarised themselves with this material.

5.6 Location of Services, etc.

- 5.6.1 The archaeological contractor will be responsible for locating any drainage pipes, service pipes, cables etc which may cross any of the trench lines, and for taking the necessary measures to avoid disturbing such services.

6. Fieldwork Methodology - Archaeological Evaluation

6.1 Trench Size and Location

- 6.1.1 The targeted excavation work will involve the excavation of ten trenches totalling 240m², as outlined in red in attached plan. These are considered the minimum number needed to sample the demolished south oven bank, the upstanding central oven bank (including one oven), the upstanding northern oven bank, the calcining kiln approach embankment, the demolished post-1888 boiler house and intervening areas of supposed hard surfacing and tramways. The contractor should also make provision for a contingency area of up to 20m². The use of the contingency will depend upon the results obtained during the initial excavations and will be implemented at the discretion of RPS. The decision to invoke all or part of the contingency area will be issued in writing, if necessary in retrospect after site discussions.

- 6.1.2 The evaluation trenches should be located as shown on RPS plan 'Trench locations'.

- 6.1.3 The specific trenches proposed are as follows:

Demolished South Double Coke Oven Bank (c.1850s-1860s)

Trench 1 (forms intermittent transect with Trenches 2, 3 and 4)

Target: Lost south double coke oven bank (demolished c.1918) and associated working surfaces / tramways

Specific purpose of Trench: To establish what remains of demolished south coke oven bank (demolished c.1918) and of historic working surfaces / tramways adjacent. If present, also to establish condition and completeness and to understand what damage has been caused by tree roots and Japanese knotweed infestation

Remains anticipated: Circular refractory brick floors of ovens separated by rubble fill, foundations of facework. Probable hard surfacing and possible tramways and drains to either side

Trench area: 18m x 2m

Anticipated excavation depth: To uppermost structural horizon (Probably <0.5m)

Extant Central (Double) Coke Oven Bank (c.1840s)

Trench 2 (forms intermittent transect with Trenches 1, 3 and 4)

Target: Extant central double coke oven bank and associated flues, tramways and working surfaces. Cranked trench, southern part half-sections deposits in one oven, remainder targets structure between ovens.

Specific purpose of Trench: To establish condition of extant oven bank and ascertain what remains of flues or loading tramways on former upper surface and to establish presence / absence of historic working surfaces / tramways immediately adjacent. Also to establish condition and completeness of remains and to better understand what damage has been caused by tree roots and Japanese knotweed infestation. This trench includes a half-section of the fill in a single oven.

Remains anticipated: Remains of hemispherical refractory brick oven with brick floor, rubble corework and footings / lower courses of facework. Probable hard surfacing

and possible tramways and drains to either side. Potential for traces of loading tramways and refractory brick flues in upper surface of oven bank.

Trench areas: 7.5m x 2m and 12m x 2m

Anticipated excavation depth: To uppermost structural horizon (Probably <0.2m over top of ovens; <0.75m to N. and S and within oven)

Extant North (Single) Coke Oven Bank (c.1840s)

Trench 3 (forms intermittent transect with Trenches 1, 2 and 4)

Target: Extant north single coke oven bank and associated working surfaces

Specific purpose of Trenches: To establish condition of extant oven bank and ascertain what remains of flues or loading tramways on former upper surface and to establish presence / absence of historic working surfaces / tramways immediately to south (working surface) and to north (at foot of calcining kilns approach embankment). Also to establish condition and completeness of remains and to better understand what damage has been caused by tree roots and Japanese knotweed infestation.

Remains anticipated: Rubble corework and footings / lower courses of facework. Probable hard surfacing and possible tramways and drains to south. Potential for traces of loading tramway and refractory brick flues in upper surface of oven bank.

Trench area: 15m x 2m

Anticipated excavation depth: To uppermost structural horizon (Probably <0.2 to 0.5m over top of ovens and to N.; <0.75m to S)

Calcining Kilns Approach Embankment (c.1840s)

Trench 4 (forms intermittent transect with Trenches 1, 2 and 3)

Target: Extant but eroded approach embankment

Specific purpose of Trench: To establish former width of extant approach embankment, to establish level of historic upper surface and to ascertain what remains of former tramway and replacement railway.

Remains anticipated: Former upper surface of embankment, possibly with stone sleeper blocks and / or timber sleepers or impressions of either

Trench area: 12m x 2.0m

Excavation depth: To earliest post-construction horizons, both on top of, and to sides of, embankment (Probably <0.5m)

Upper (Coke Oven Waste Gas) Boiler House (c.1890)

Trenches 5a and 5b (form continuation of Trenches 6a and 6b)

Target: Lost six-boiler boiler house built c.1890 to utilise waste gasses from coking ovens and any associated working surfaces / tramways

Specific purpose of Trench: Transverse section to establish what remains of boiler house built c.1890, in the area immediately adjacent to the south double coke oven bank, demolished c.1918). If remains are present, also to establish condition and completeness of remains (notably foundations / flues) and to better understand what damage has been caused by tree roots and Japanese knotweed infestation.

Remains anticipated: Refractory brick flues and boiler-support structures and hard surfacing / floors adjacent. Possibly foundations of an enclosing structure (uncertain)

Trench area: 5a - 15m x 2m

5b - 12m x 2m

Anticipated excavation depth: To uppermost structural horizon (Probably <0.5m)

Other Working Surfaces

Trench 6a (forms continuation of Trench 5a)

Target: Buried historic working surfaces / tramways.

Specific purpose of Trench: To establish historic ground levels and existence of any buried historic working surfaces / tramways

Remains anticipated: Possible metalled or compacted surfaces, possibly with evidence of tramways

Trench area: 10.5m x 2m

Anticipated excavation depth: To uppermost ironmaking-phase horizon, locally sondaged to assess presence / absence of earlier surfaces beneath (Probably <0.5m)

Trench 6b (forms continuation of Trench 5b)

Target: Buried historic surfaces and foundation of Phase 1 retaining wall of calcining kilns approach embankment.

Status: Within Scheduled area and within Conservation Area.

Trees: No

Specific purpose of Trench: To establish historic ground levels and existence of any buried historic working surfaces / tramways. To assess footings of Phase 1 retaining wall

Remains anticipated: Possible metalled or compacted surfaces, possibly with evidence of tramways

Trench area: 10m x 2m

Anticipated excavation depth: To uppermost ironmaking-phase horizon, locally sondaged to assess footing of retaining wall and presence / absence of earlier surfaces (Probably <0.5m, locally <1.0m)

Trench 6c

Target: Buried historic surfaces and foundation of Phase 2 retaining wall of calcining kilns approach embankment

Specific purpose of Trench: To establish historic ground levels and existence of any buried historic working surfaces / tramways. To assess footings of Phase 2 retaining wall

Remains anticipated: Possible metalled or compacted surfaces, possibly with evidence of tramways

Trench area: 8.0m x 2m

To uppermost ironmaking-phase horizon, locally sondaged to assess footing of retaining wall and presence / absence of earlier surfaces (Probably <0.5m, locally <1.0m)

Note: The above proposed archaeological strategy has not yet been agreed by Cadw, but on the basis of experience it is thought to represent the minimum possible that would achieve the structural and archaeological objectives of this stage of the project. The precise detail of the trench layout may be subject to some variation on the advice of Cadw.

6.2 Method of Excavation

- 6.2.1 Except where structures are upstanding, the excavation areas may be opened using an appropriate machine fitted with a wide toothless ditching bucket. The topsoil and recent overburden should be removed down to the first significant archaeological horizon in successive level spits of maximum 0.2m thickness. Under no circumstances should the machine be used to cut arbitrary trenches down to natural deposits. All machine work must be carried out under direct archaeological supervision and the machine halted if significant archaeological deposits are encountered. The top of the first significant archaeological horizon may be exposed by the machine, but must then be cleaned by hand and inspected for features. Excavation should then continue manually. On upstanding remains it will be necessary to clean off loose post-ironmaking deposits, roots and plants so as to expose the underlying masonry, brickwork or corework. Such excavation and cleaning will clearly have to use manual methods only. Great care will be needed in removing roots. These should be gently disengaged using a trowel, or cut off using secateurs.
- 6.2.2 All archaeological remains will be hand excavated in an archaeologically controlled and stratigraphic manner sufficient to meet the aims and objectives of the project. The excavation will investigate and record all inter-relationships between features. The following excavation strategy will be employed:

- Deposits will be planned both at their first visible and their fullest extent. All stratigraphic relationships will be fully explored and documented, if necessary by means of half-sections or quadrants.
 - Linear and discrete features: all stake-holes, post-holes, pits, hearth bases, and other structural/industrial features will be 50% excavated in the first instance, recorded in section, and then fully excavated. All intersections will be fully investigated to determine the relationship(s) between the component features.
 - Built structures: walls, floors, tramways etc will be excavated sufficient to establish their form, phasing, and construction techniques. All intersections will be investigated to determine the relationship(s) between the component features. Facing masonry and exposed corework will be cleaned and exposed in order to allow detailed planning and assessment of condition.
- 6.2.3 If features are encountered which the archaeological contractor considers to be too massive to be excavated by hand using the appropriate tools, this should be drawn to the attention of RPS immediately. The controlled use of a mechanical excavator may in principle be used to excavate/partially remove/test the following types of deposit once appropriate records have been made, but the written agreement of RPS (which may be issued in retrospect after discussions on site) must be sought in each instance in advance of work commencing:
- extensive deposits of made ground or levelling layers
 - extensive deposits of less sensitive material, such as fuel ash or coke waste
 - compacted deposits which can not be removed by hand or with hand tools
 - any deposits identified as contaminated
 - Areas of homogenous deposits which do not appear to have particular archaeological sensitivity (e.g. brick rubble, made ground)
 - concrete or other substantial 'modern' (post-ironmaking) intrusions (note: concrete intrusions are not necessarily of post-ironmaking date and might easily belong to the post-1888 reinvestment in the ironworks)
- 6.2.4 All finds are to be recorded by context. Individually significant finds ("small finds") are to be recorded three dimensionally and identified using a sequence of unique numbers. The presence and nature of late 20th century material should be noted (quantified and summarily described) but finds of this date need not be retained for processing. Finds judged to be of 19th and early 20th century date or earlier should be retained.
- 6.2.5 Samples for environmental analysis and scientific dating should be taken if suitable material is encountered during the excavation. Provision should also be made for specialist sampling if appropriate. (Also see paragraph 7.5.)
- 6.2.6 All trenches will be backfilled and pre-excavation ground levels reinstated at the close of the excavation. To avoid unnecessary spread of invasive plant species, material should be excavated and stockpiled adjacent to each trench, in order that the excavated material will be replaced as far as possible in, or close to, its original location. The potential for invasive species to be present should be borne in mind when moving around the site, and when leaving the site or removing plant from it.
- 6.3 Method of Recording**
- 6.3.1 The trenches are to be recorded according to the normal principles of stratigraphic excavation. The stratigraphy of each area is to be recorded, even when no archaeological deposits have been identified.
- 6.3.2 Section drawings (at a minimum scale of 1:20) must include heights A.O.D. Plans (at a minimum scale of 1:50) must include A.O.D. spot heights for all principal strata and any features. At least one section of each trench edge, showing a representative and complete sequence of deposits from the modern ground surface down will be drawn.

6.3.3 Trenches will be planned at a minimum scale of 1:20, with regularly laid / coursed bricks / stone blocks drawn individually. The individual stones / bricks of corework need not be precisely drawn, but any rendering or schema used to represent corework should be realistic in appearance

6.3.4 The actual areas of excavation and all archaeological features should be accurately located on a site plan and recorded by photographs, scale drawings and written descriptions sufficient to permit the preparation of a detailed archive and report on the material. The trench locations, as excavated, will be accurately surveyed, tied into the O.S. National Grid and located on an up-to-date 1:1250 O.S. map base.

6.4 Sampling Strategy

6.4.1 Appropriate deposits must be sampled for retrieval and assessment of the preservation conditions and potential for analysis of industrial deposits, specifically coal, coke and iron ore. A sampling strategy must be agreed with a recognised specialist. Prior to the commencement of work on site, the sampling strategy is to be submitted in writing for the written agreement of RPS. Any proposed amendments to the sampling strategy will also require the written agreement of RPS.

6.5 Conservation Strategy

6.5.1 A conservation strategy must be developed in collaboration with a recognised laboratory. All finds must be assessed in order to recover information that will contribute to an understanding of their deterioration and hence preservation potential, as well as identifying potential for further investigation. Furthermore, all finds must be stabilised and packaged in accordance with the requirements of the receiving museum. As a guiding principle, only artefacts of a "displayable" quality would warrant full conservation and, where appropriate, metalwork and coinage from stratified contexts may require to be x-rayed, and conservation costs should also be included as a contingency.

6.6 Human Remains

6.6.1 Any human remains that are discovered must initially be left in-situ, covered and protected. RPS will be notified at the earliest opportunity. If removal is necessary the remains must be excavated archaeologically in accordance with the Guidance for Best Practice for Treatment of Human Remains Excavated from Christian Burial Grounds in England published by English Heritage (2005), a valid Department of Constitutional Affairs licence and any local environmental health regulations.

6.8 Treasure Act

6.8.1 The terms of the Treasure Act 1996 must be followed with regard to any finds that might fall within its purview. Any finds must be removed to a safe place and reported to the local coroner as required by the procedures as laid down in the "Code of Practice". Where removal cannot be effected on the same working day as the discovery, suitable security measures must be taken to protect the finds from theft.

7. Monitoring

7.1 The project will be monitored as necessary and practicable by RPS as the client's agent and by Cadw. Cadw will be afforded access to the site at any reasonable time. It is usual practice that the visit is arranged in advance, but this is not always feasible.

- 7.2 RPS and Cadw's representatives will be provided with a site tour and an overview of the site by the senior archaeologist present and should be afforded the opportunity to view all trenches, any finds made that are still on site, and any records not in immediate use. It is anticipated that the records of an exemplar context that has previously been fully recorded will be examined. Any observed deficiencies during the site visit are to be made good to the satisfaction of RPS and Cadw's representatives, by the next agreed site meeting.

8. Archive Deposition

- 8.1 Before commencing any fieldwork, the archaeological contractor must determine the requirements for the deposition of the excavation archive. Any costs associated with deposition will need to be included within the contractor's tender.
- 8.2 It is the responsibility of the archaeological contractor to endeavour to obtain consent of the landowner, in writing, to the deposition of finds with a public body.
- 8.3 It is the responsibility of the archaeological contractor to meet Cadw's requirements with regard to the preparation of fieldwork archives for deposition.

9. Post-excavation Assessment and Reporting

9.1 Artefacts, Samples and Dating

- 9.1.1 Upon completion of fieldwork all finds shall be cleaned, identified, marked (if appropriate) and properly packed and stored in accordance with the requirements of national guidelines. Where appropriate, metalwork and coinage from stratified contexts will be x-rayed (as per paragraph 6.6) and assessed by a conservator. Any samples taken shall be processed appropriately.
- 9.1.2 All artefacts will be assessed by a qualified and experienced specialist. Assessment should be generally based on MAP2 but should include:
- preparation of a descriptive catalogue;
 - dating (where possible);
 - an assessment of the significance of the assemblage;
 - an assessment of the potential for further analysis to contribute to the interpretation of the archaeology of this site;
 - an assessment of the potential for further analysis to contribute to artefact studies;
 - recommendations for additional artefact illustration/photography;
 - an assessment of the condition of the assemblage and recommendations for conservation, retention/discard and archiving.
- 9.1.3 All environmental material will be assessed by a qualified and experienced specialist. Assessment should be generally based on MAP2 but should include:
- preparation of a descriptive table/catalogue;
 - identification of material suitable for scientific dating;
 - an assessment of the significance of the assemblage;
 - an assessment of the potential for further analysis to contribute to the interpretation of the archaeology of this site;
 - an assessment of the potential for further analysis to contribute to environmental studies;
 - an assessment of the condition of the assemblage and recommendations for retention/discard and archiving.

- 9.1.4 Scientific dating should be undertaken at this stage if it is required to fulfil the aims of the project. The contractor may contact RPS for advice.

9.2 Archive Consolidation

- 9.2.1 The site archive will be checked, cross-referenced and internally consistent. A fully indexed archive shall be compiled consisting of all primary written documents, plans, sections, photographic negatives and a complete set of labelled photographic prints/slides.
- 9.2.2 The complete archive (including finds) will be prepared in accordance with the requirements of the receiving body (see section 8 above).
- 9.2.3 The original archive is to accompany the deposition of any finds, providing the landowner agrees to the deposition of finds in a publicly accessible archive (see paragraph 8.2 above).

9.3 Report Format and Content

- 9.3.1 Details of the style and format of the evaluation report are to be determined by the archaeological contractor. However, it should be fully illustrated and include:
- background information;
 - a description of the methodology;
 - a full description of the results;
 - an interpretation of the results in a local/regional/national context as appropriate;
 - a re-evaluation of the aims and objectives of the project;
 - recommendations for further artefact and environmental analysis;
 - recommendations for additional scientific dating;
 - recommendations for publication if warranted;
 - the intended long-term storage location of the archive;
 - a full bibliography.

Appendices to the report should include:

- unedited copies of specialist reports;
 - a quantified index to the site archive, including finds and samples;
 - a copy of this specification.
- 9.3.2 Location plans should be produced at a scale which enables easy site identification and which depict the full extent of the site. A scale of 1:50,000 is not regarded as appropriate unless accompanied by more detailed plan(s). The location of the trenches (as excavated) should be overlaid on an up-to-date 1:1250 O.S. map base.
- 9.3.3 Site plans should be at an appropriate, measurable scale showing the trenches as excavated and all identified (and, if possible, predicted) archaeological features/deposits. Trench and feature plans must include A.O.D. spot heights for all principal strata and any features. Section drawings must include A.O.D heights and be cross-referenced to an appropriate plan.
- 9.3.4 Finds that are critical for dating and interpretation should be illustrated.
- 9.3.5 The evaluation report should be produced with sufficient care and attention to detail to be of academic use to future researchers.

10. Evaluation Report Submission and Deposition

10.1 The archaeological contractor will supply a copy of the evaluation report directly to RPS (and via RPS to Cadw) within a period of six weeks following completion of fieldwork (i.e. by the 30th April 2007). Completion of this project is dependant upon receipt by RPS (and via RPS by Cadw) of a satisfactory report which has been prepared in accordance with this specification. Any comments made by RPS or Cadw in response to the submission of an unsatisfactory report will be taken account of in finalising the report, within a timescale which has been agreed with RPS.

10.2 The report will be supplied on the understanding that it will be added to the South East Wales Sites and Monuments Record and will become publicly accessible once deposited, unless confidentiality is explicitly requested, in which case it will become publicly accessible six months after deposition. Copyright - Please note that by depositing this report, the contractor gives permission for the material presented within the document to be used by RPS, the South East Wales SMR and Cadw, in perpetuity, although The Contractor retains the right to be identified as the author of all project documentation and reports as specified in the Copyright, Designs and Patents Act 1988 (chapter IV, section 79). The permission will allow RPS, the South East Wales SMR and Cadw to reproduce material, including for non-commercial use by third parties, with the copyright owner suitably acknowledged

11. Dissemination

11.1 The results of the evaluation may warrant further analysis and reporting and/or publication in an appropriate archaeological journal. The evaluation report will contain detailed recommendations for both analysis and publication but the requirement will ultimately be at the decision of Cadw. The archaeological contractor should make provision for the project manager/supervisor to attend a meeting with RPS and Cadw (in Cardiff) to discuss and finalise the requirements for any such further analysis or reporting. The necessity for a meeting will be at the decision of RPS and Cadw and the meeting may take the form of a telephone call.

11.2 The final text and illustrations (to a publication standard) for any further reporting will be submitted directly to RPS within a timescale agreed by both parties. Any comments made by RPS or Cadw in response to the submission of an unsatisfactory report will be taken account of in finalising the report, within a timescale which has been agreed with RPS.

11.3 The report will be supplied on the understanding that it will be added to the South East Wales Sites and Monuments Record and will become a public document after an appropriate period of time (generally not exceeding six months).

11.4 Completion of this project is dependant upon receipt by RPS of i) a satisfactory final report and, should publication be warranted, ii) a copy of a letter from an appropriate journal editor confirming acceptance of the article.

12. General Considerations

12.1 Authorised Alterations to Specification by Contractor

12.1.1 It is recommended that archaeological contractors should carry out a site inspection prior to submitting a tender. If, upon visiting the site or at any time during the course of the recording exercise, it appears in the archaeologist's professional judgement that:

- i) a part or the whole of the site is not amenable to recording as detailed above, and/or
- ii) an alternative approach may be more appropriate or likely to produce more informative results,

then it is expected that the archaeologist will contact RPS as a matter of urgency. If contractors have not yet been appointed, any variations which RPS considers to be justifiable on archaeological grounds will be incorporated into a revised specification, which will then be re-issued to the developer for redistribution to the tendering contractors. If an appointment has already been made and site work is ongoing, RPS will resolve the matter in liaison with Cadw and Groundwork Bridgend and Neath Port Talbot.

12.2 Unauthorised Alterations to Specification by Contractor

- 12.2.1 It is the archaeological contractor's responsibility to ensure that they have obtained RPS's consent in writing to any variation of the specification prior to the commencement of on-site work or (where applicable) prior to the finalisation of the tender. Unauthorised variations may result in a breach of Scheduled Monument Consent and are therefore made solely at the risk of the contractor.

12.3 Technical Queries

- 12.3.1 Any technical queries arising from the specification detailed above, should be addressed to RPS without delay.

12.4 Publicity

- 12.4.1 If the project is to be publicised in any way (including media releases, publications etc.), then it is expected that Cadw and RPS will be given the opportunity to consider whether its collaborative role should be acknowledged, and if so, the form of words used will be at Cadw / RPS's discretion.

12.5 Valid Period of Specification

- 12.5.1 This specification is valid for a period of one year from date of issue. After that time it may need to be revised to take into account new discoveries, changes in policy or the introduction of new working practices or techniques.

Rob Kinchin-Smith
RPS Planning and Environment
Mallams Court
18 Milton Park
Abingdon Oxon OX14 4RP

28th November 2006

Telephone: 01235 838236
Mobile: 07818 091862
Fax: 01235 820351
Email: kinchin-smithr@rpsgroup.comT

EXCAVATIONS AT THE COKE OVENS TONDU IRONWORKS BRIDGEND

RHIF YR ADRODDIAD / REPORT NUMBER 2007/37

**Ebril 2007
April 2007**

Paratowyd yr adroddiad hwn gan / This report has been prepared by
Duncan Schlee

Swydd / Position: Archaeologist

Llofnod / Signature Dyddiad / Date

Mae'r adroddiad hwn wedi ei gael yn gywir a derbyn sêl bendith
This report has been checked and approved by Nigel Page

ar ran Archaeoleg Cambria, Ymddiriedolaeth Archaeolegol Dyfed Cyf.
on behalf of Cambria Archaeology, Dyfed Archaeological Trust Ltd.

Swydd / Position:

Llofnod / Signature Dyddiad / Date

Yn unol â'n nôd i roddi gwasanaeth o ansawdd uchel, croesawn unrhyw
sylwadausydd gennych ar gynnwys neu strwythur yr adroddiad hwn

As part of our desire to provide a quality service we would welcome any
comments you may have on the content or presentation of this report

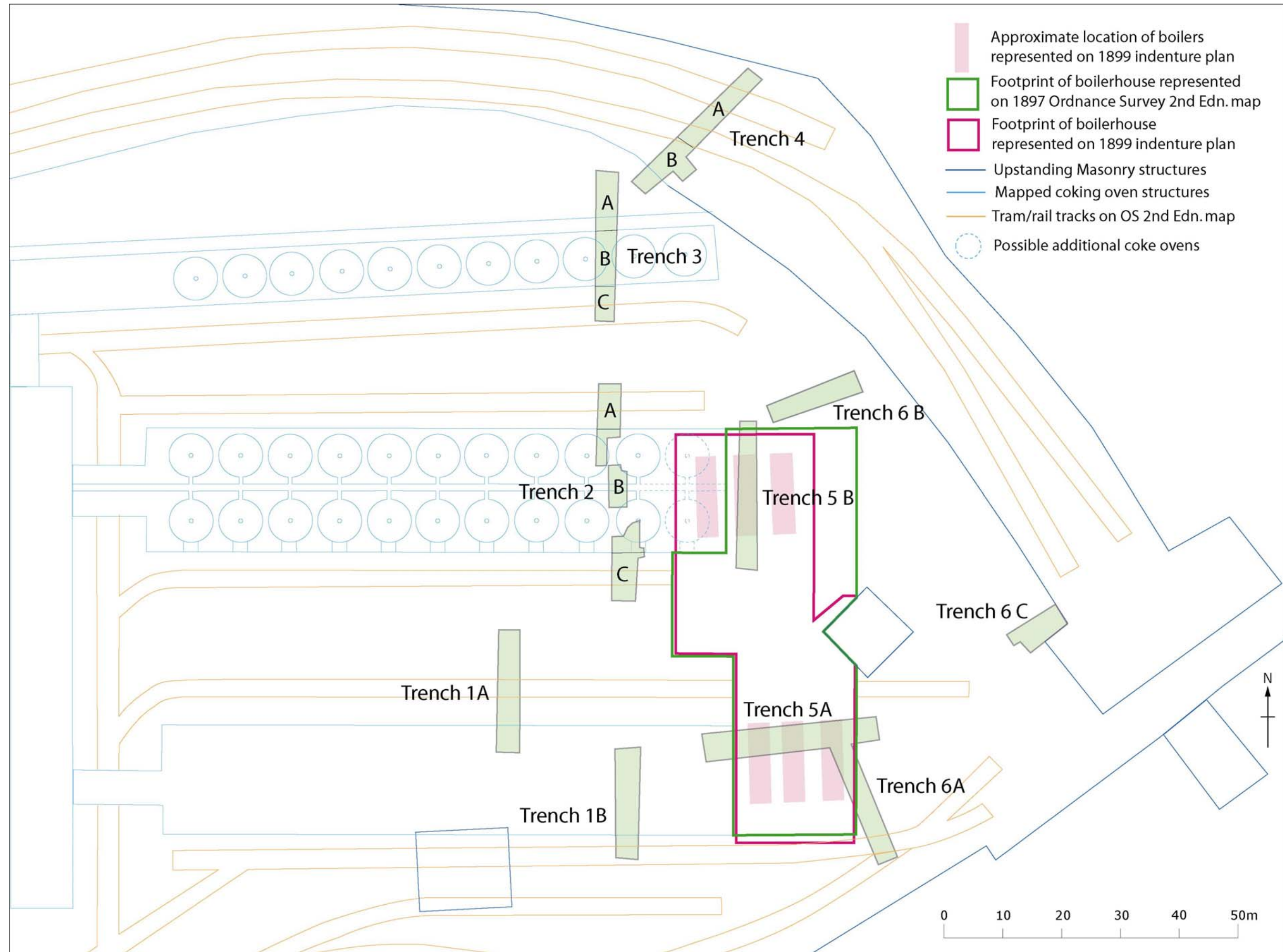


Figure 1: Site plan and trench locations

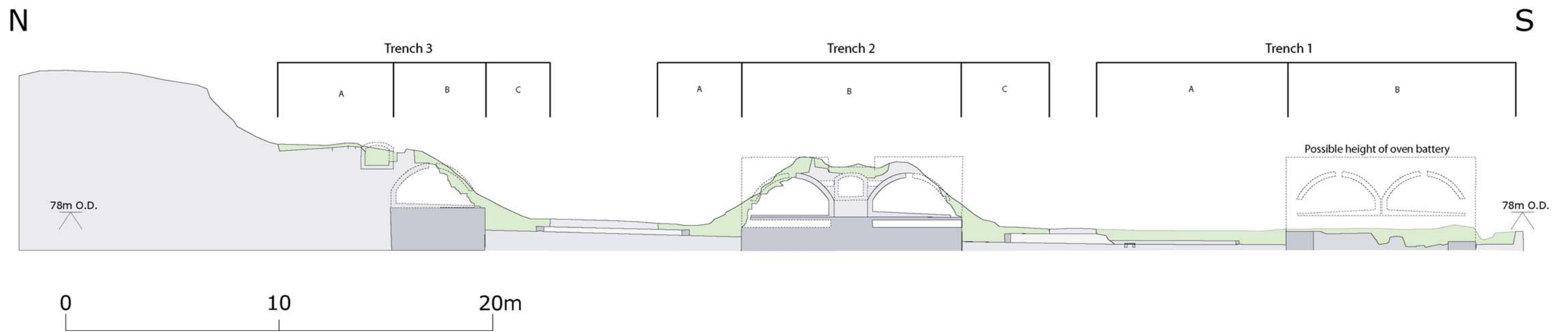


Figure 2: Composite transect across oven batteries

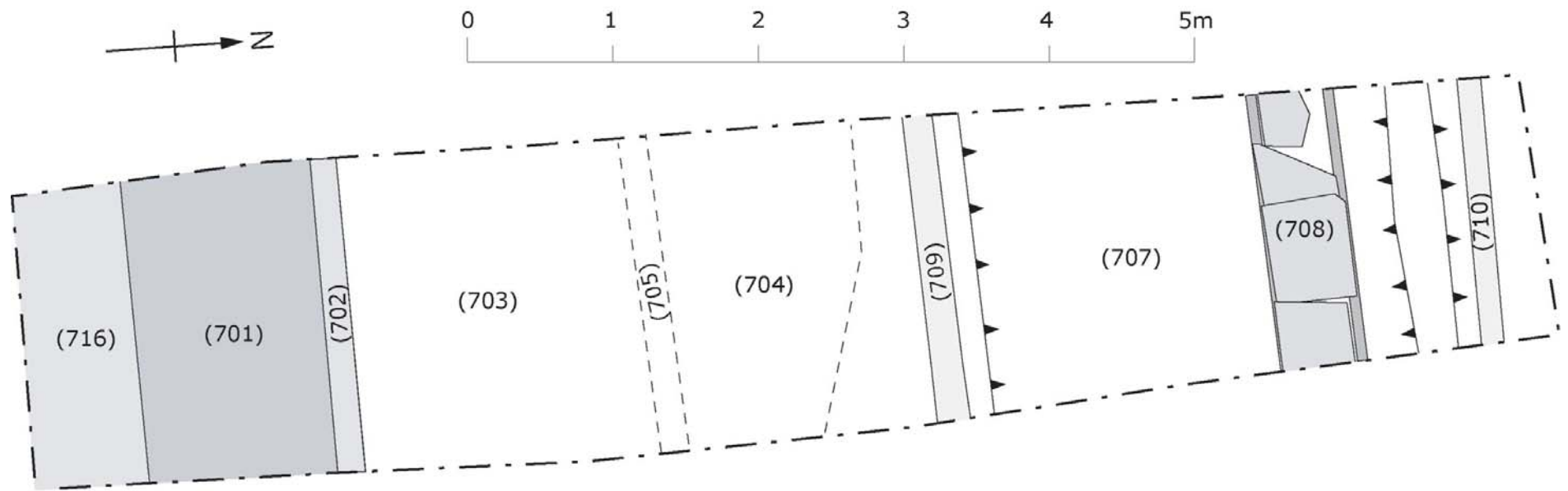


Figure 3: Plan of Trench 1A

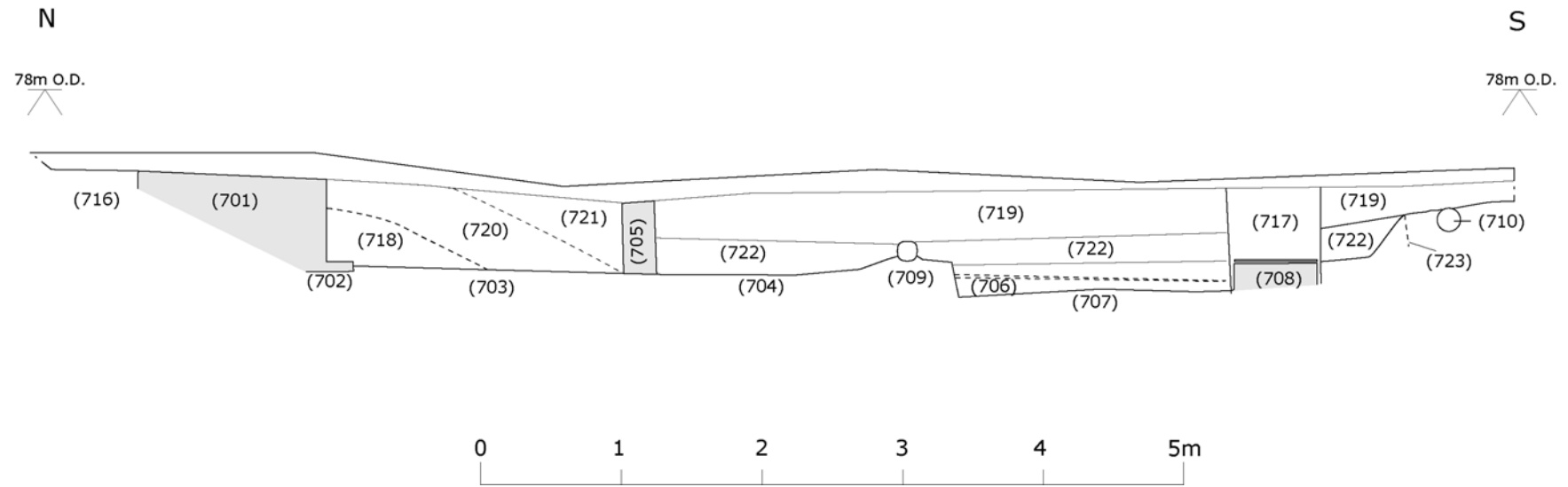


Figure 4: East facing section of Trench 1A

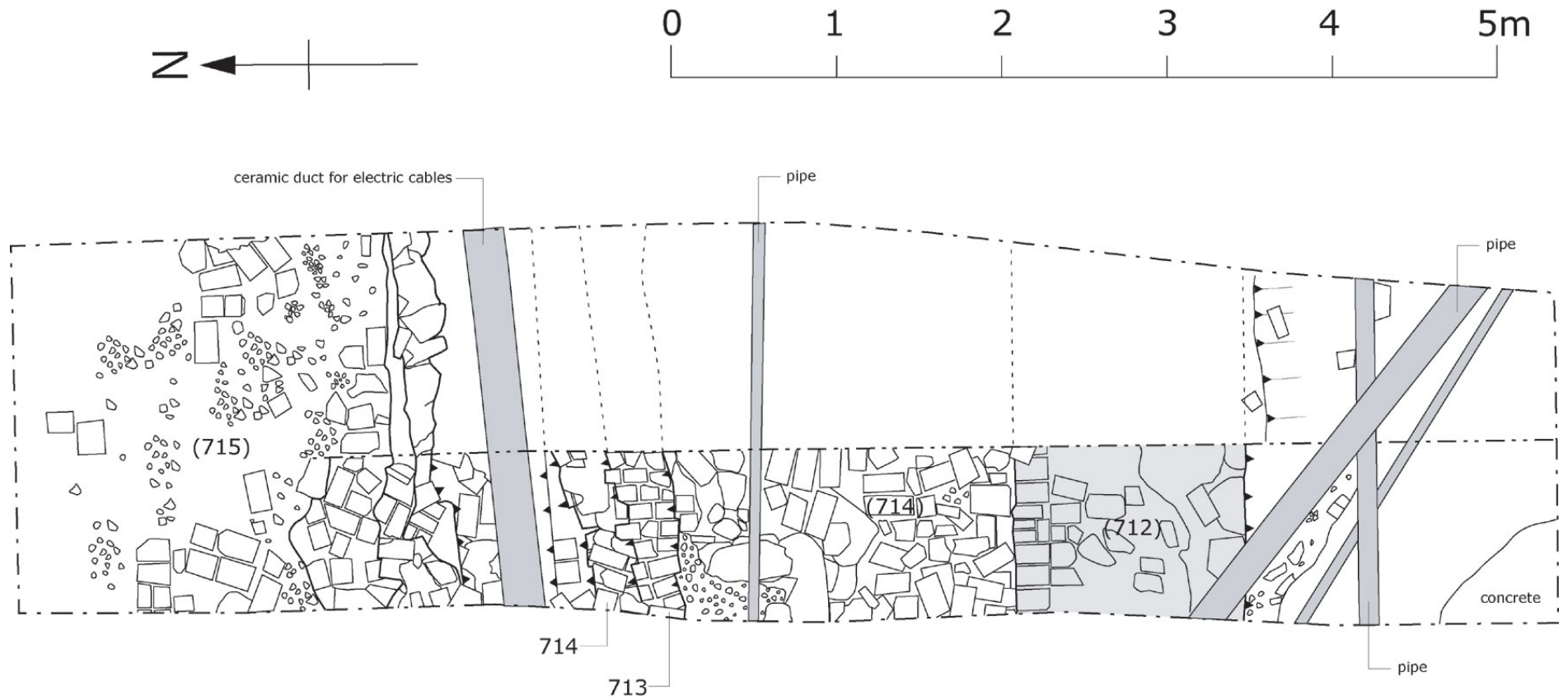


Figure 5: Plan of Trench 1B

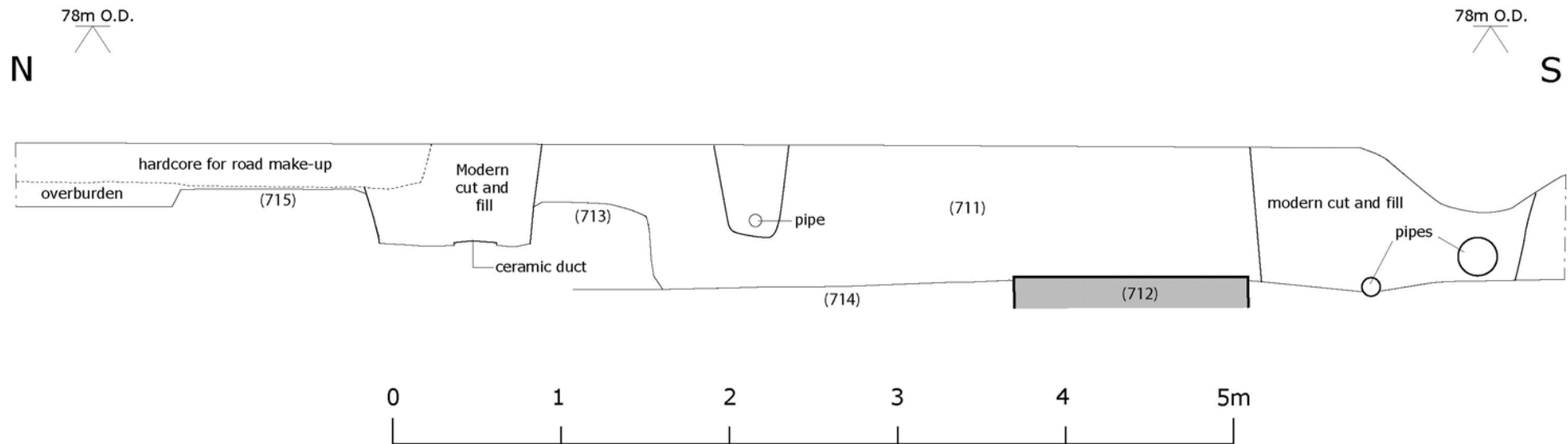


Figure 6: West facing section of Trench 1B.

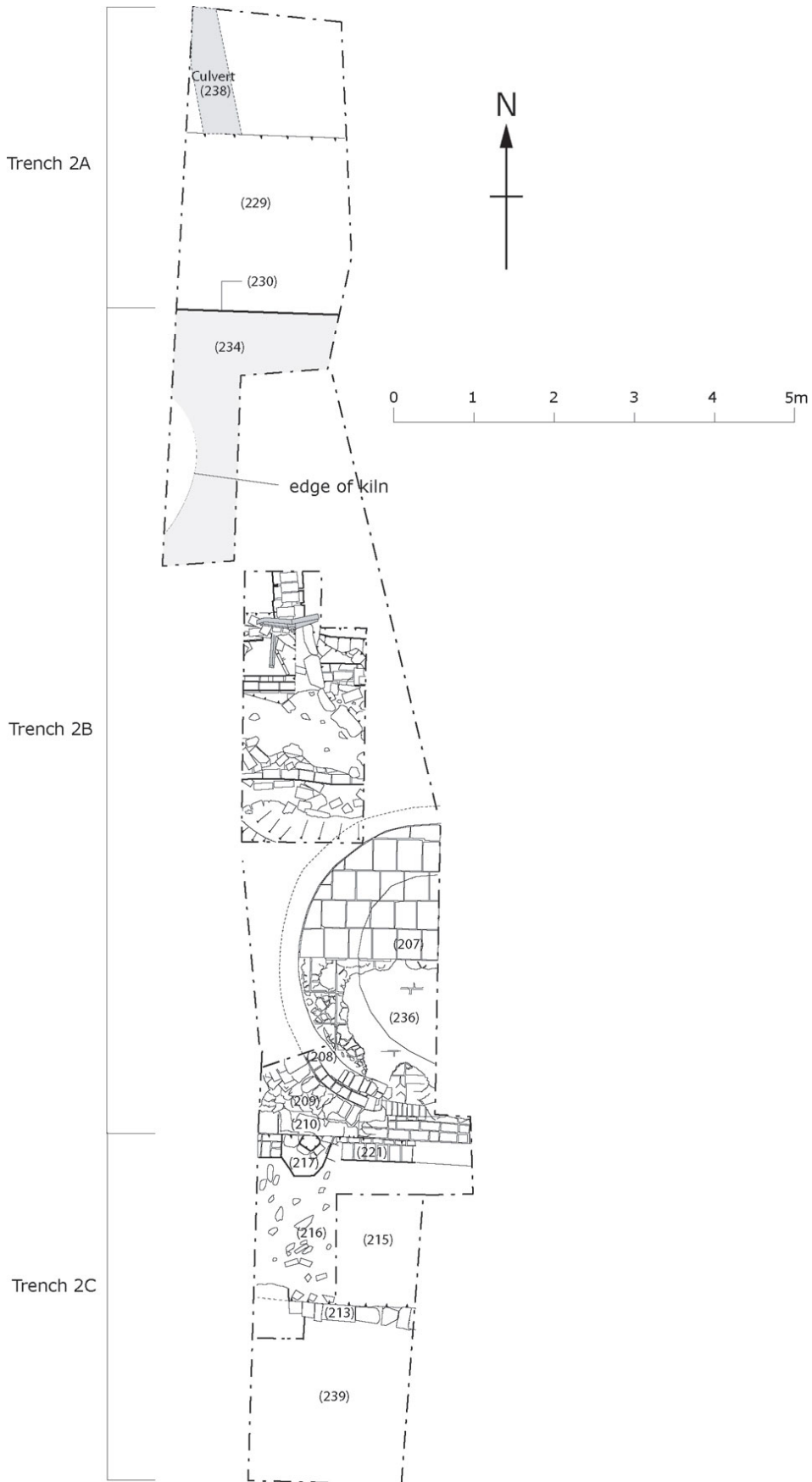


Figure 7: Composite plan of Trenches 2A, 2B and 2C.

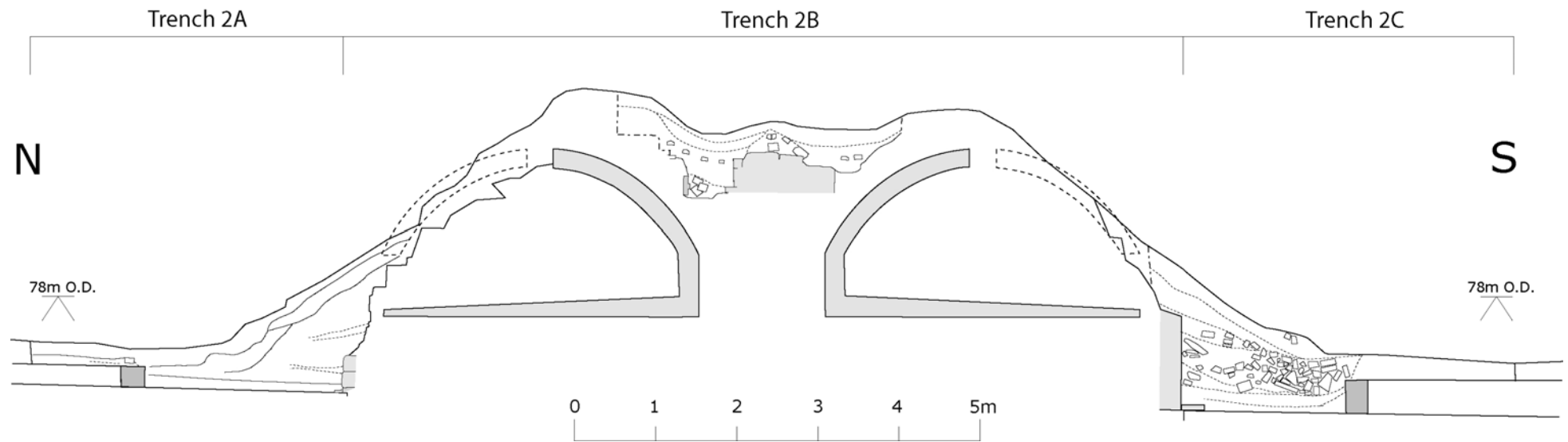


Figure 8: Composite section of Trenches 2A, 2B and 2C.

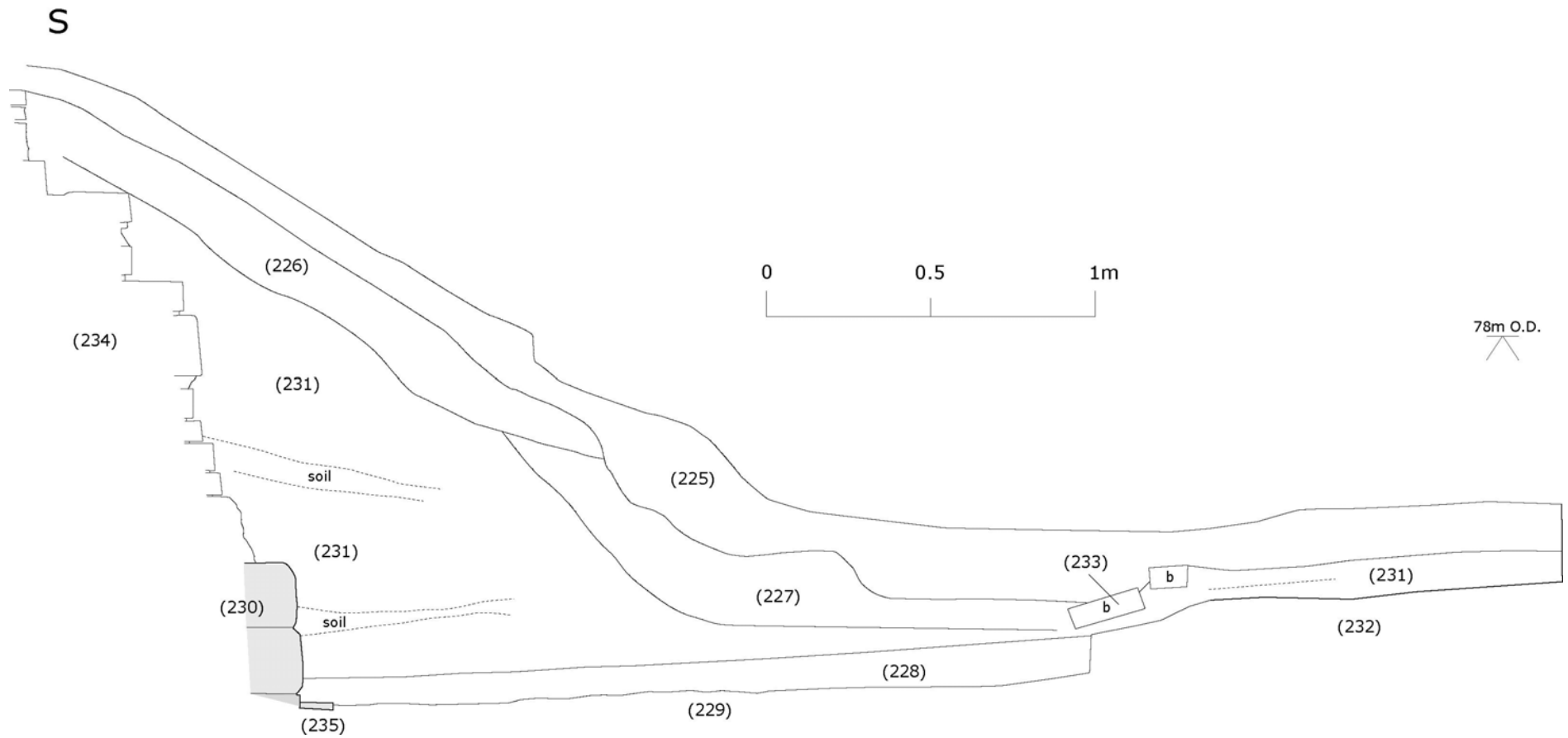


Figure 9: East facing section of Trench 2A

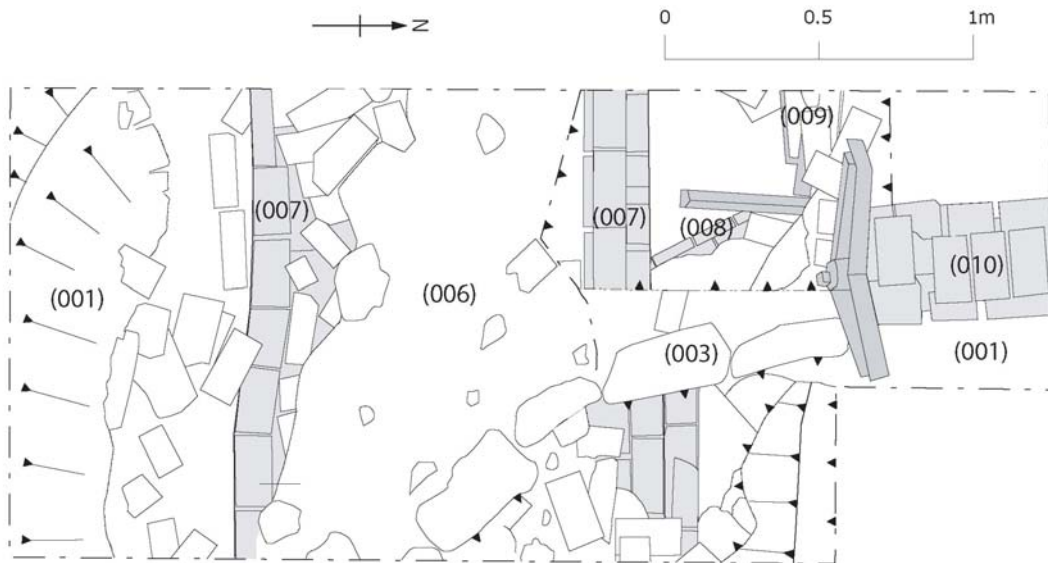


Figure 10: Plan of Trench 2B

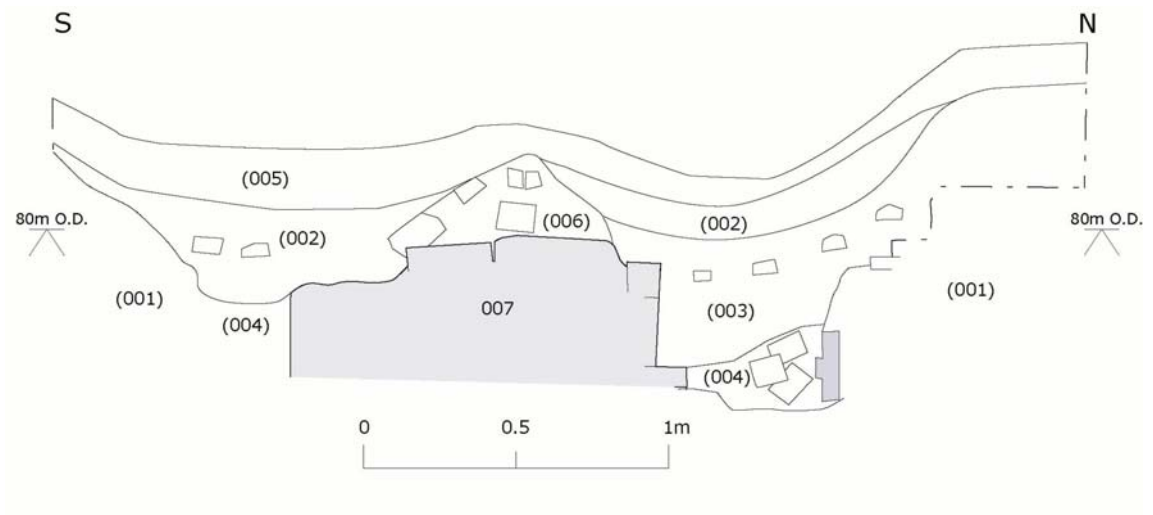


Figure 11: East facing section of Trench 2B

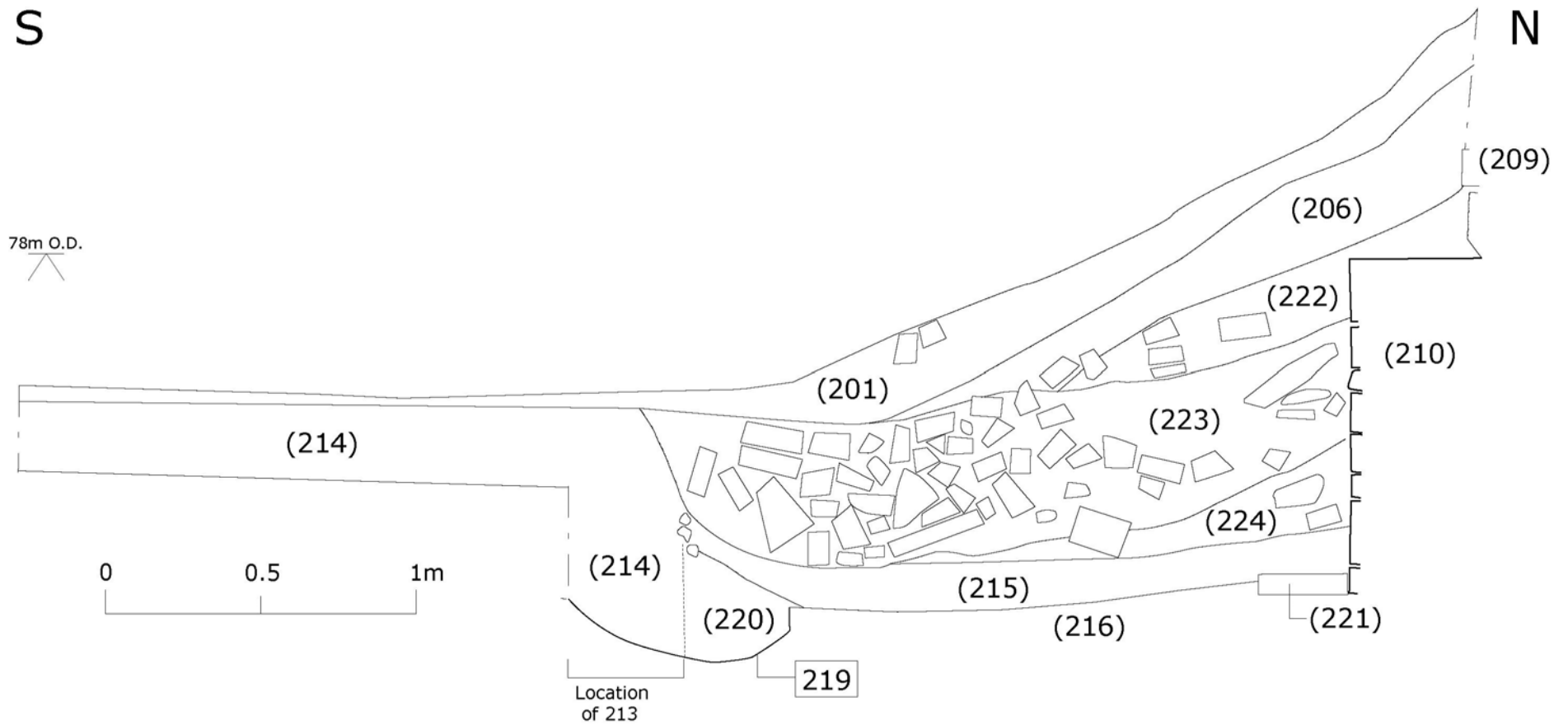


Figure 12: East facing section of Trench 2C

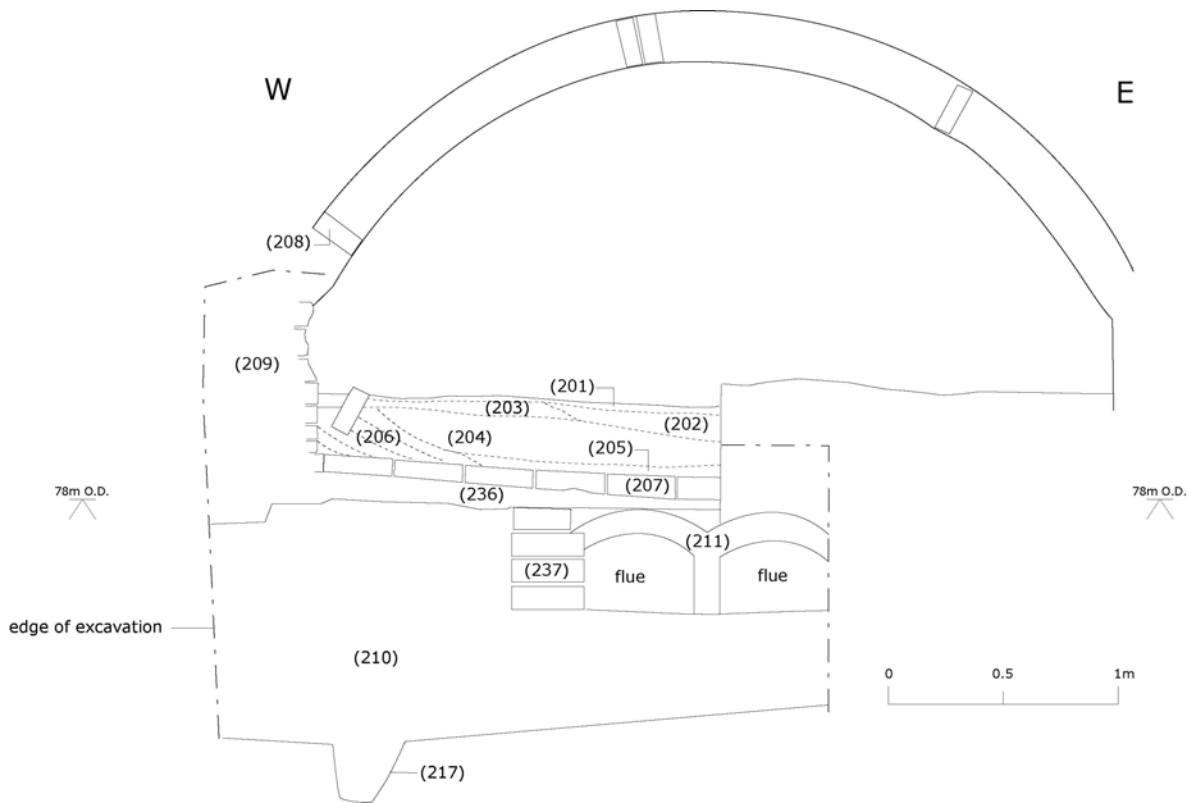


Figure 13: Composite section through oven.

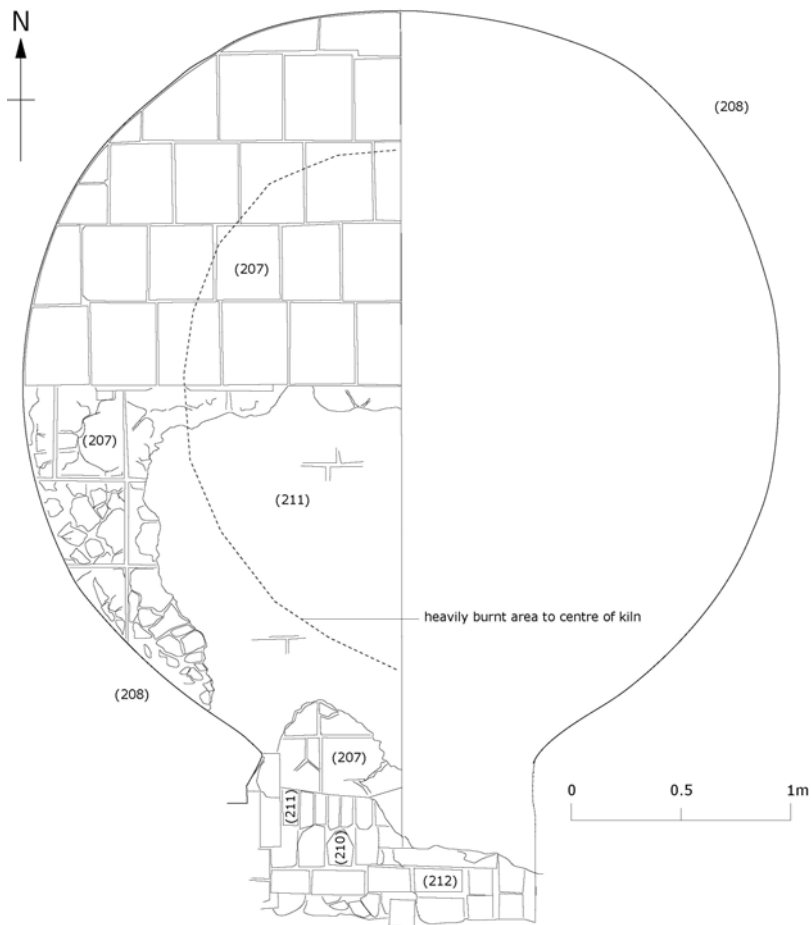


Figure 14: Plan of oven floor.



Figure 15: Composite plan of Trenches 3A, 3B and 3C.

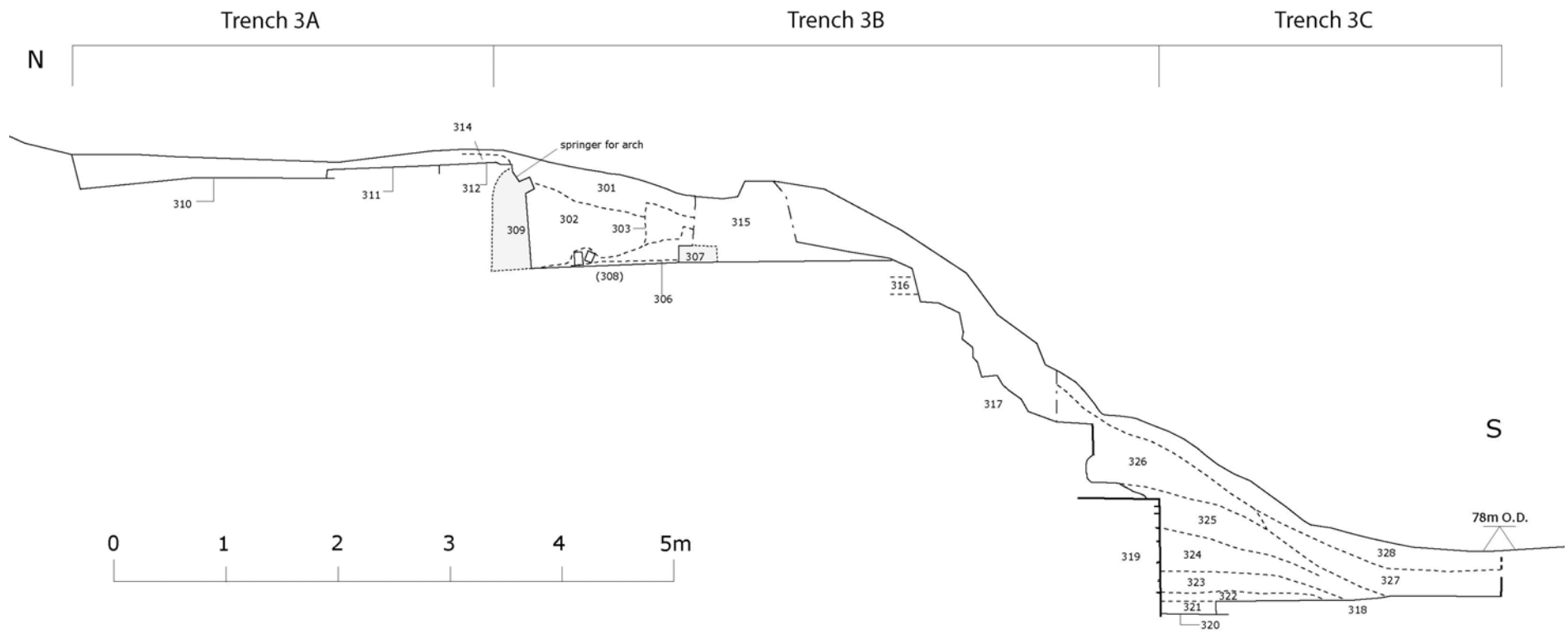


Figure 16: Composite section along Trenches 3A, 3B and 3C.

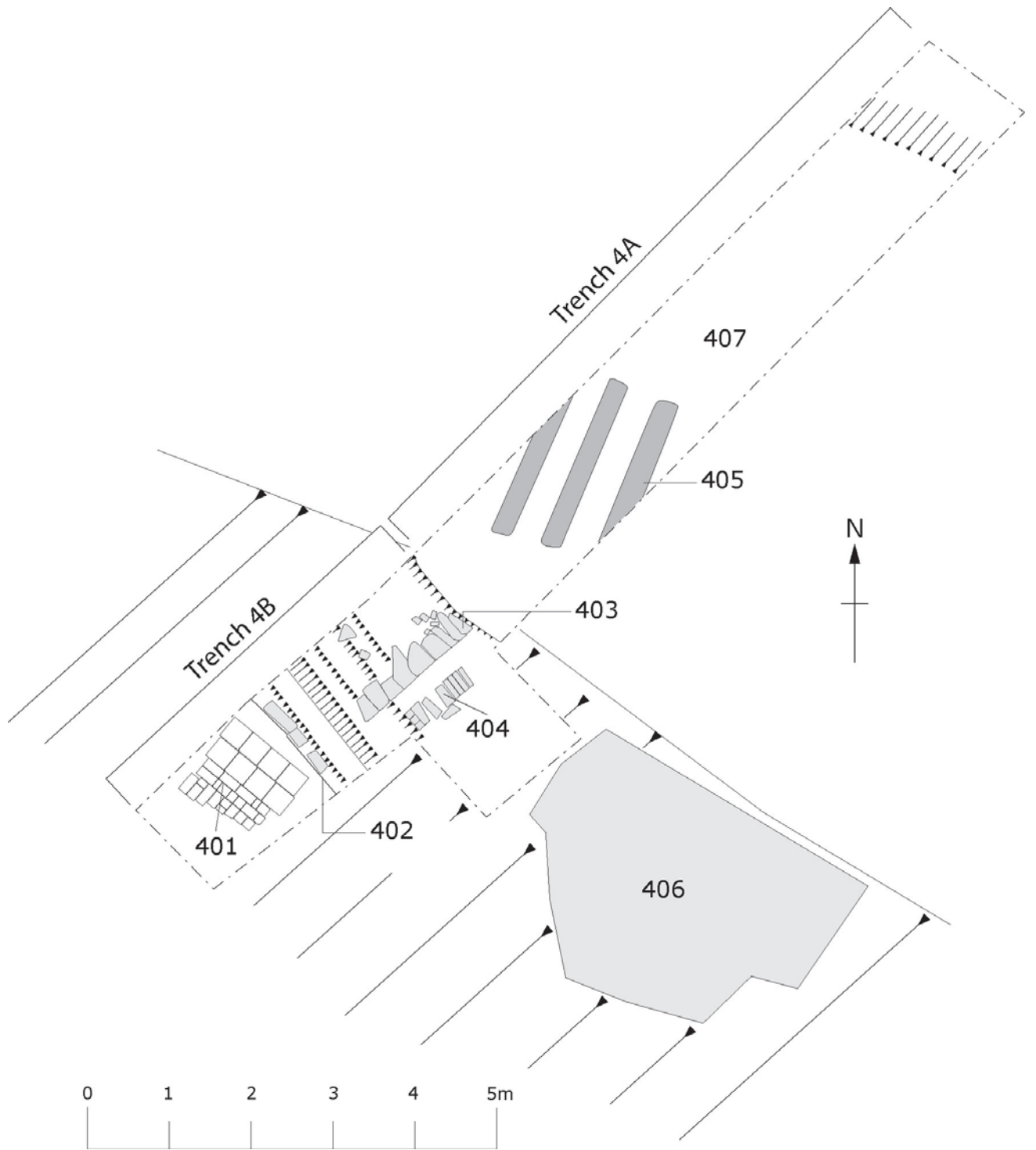


Figure 17: Composite plan of Trenches 4A and 4B.

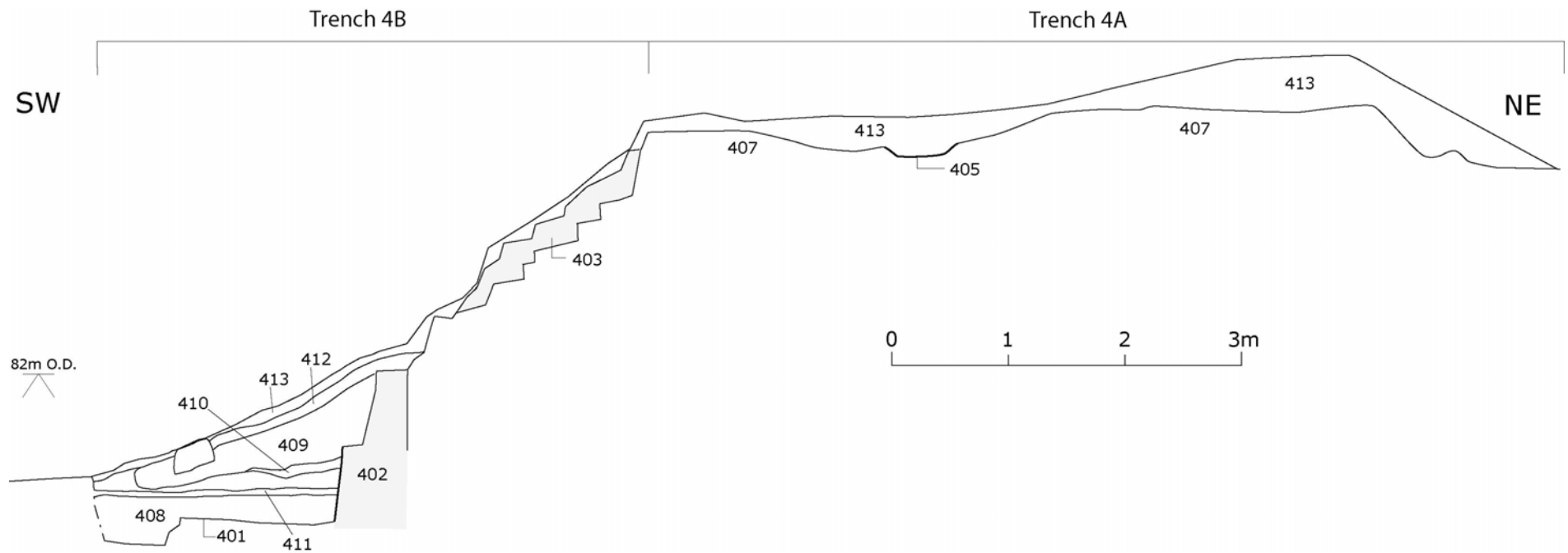


Figure 18: Composite section along Trenches 4A and 4B.



Figure 19: Plan of Trenches 5A and 6A - later phases.

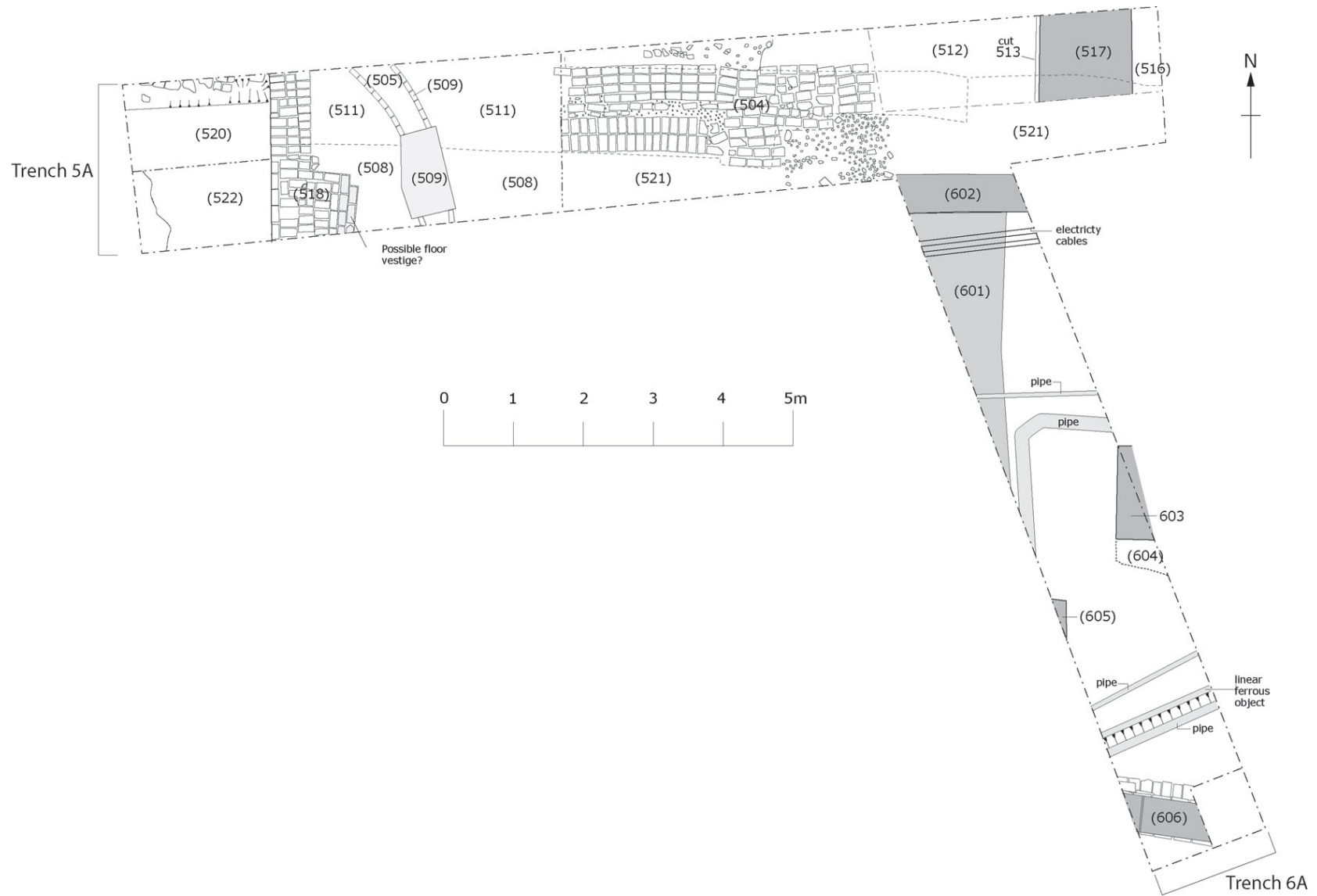


Figure 20: Plan of Trenches 5A and 6A - earlier phases.

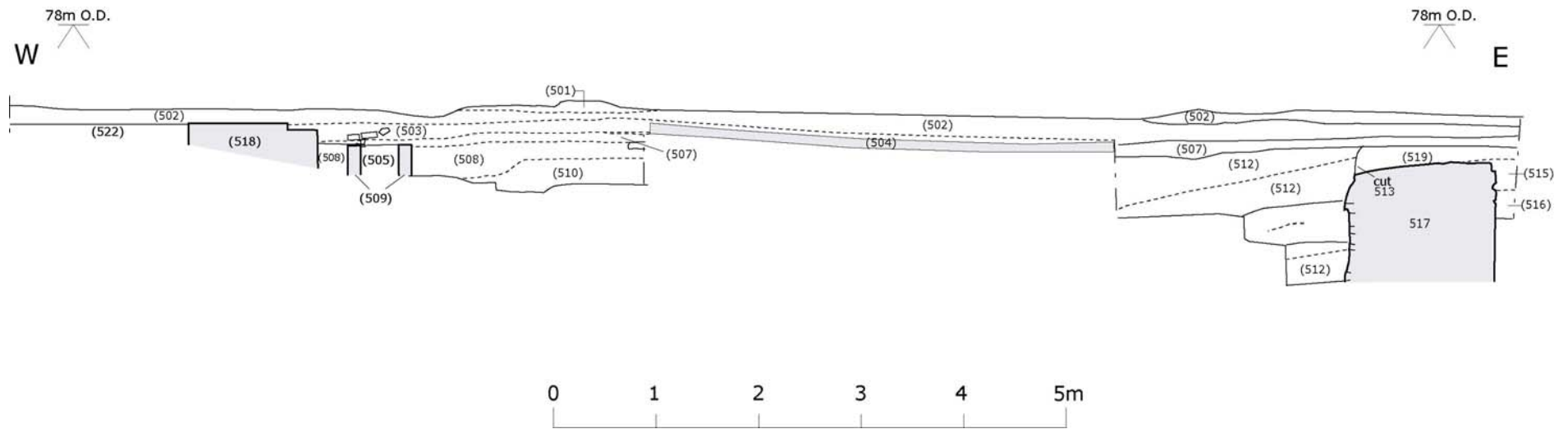


Figure 21: South facing section of Trench 5A.

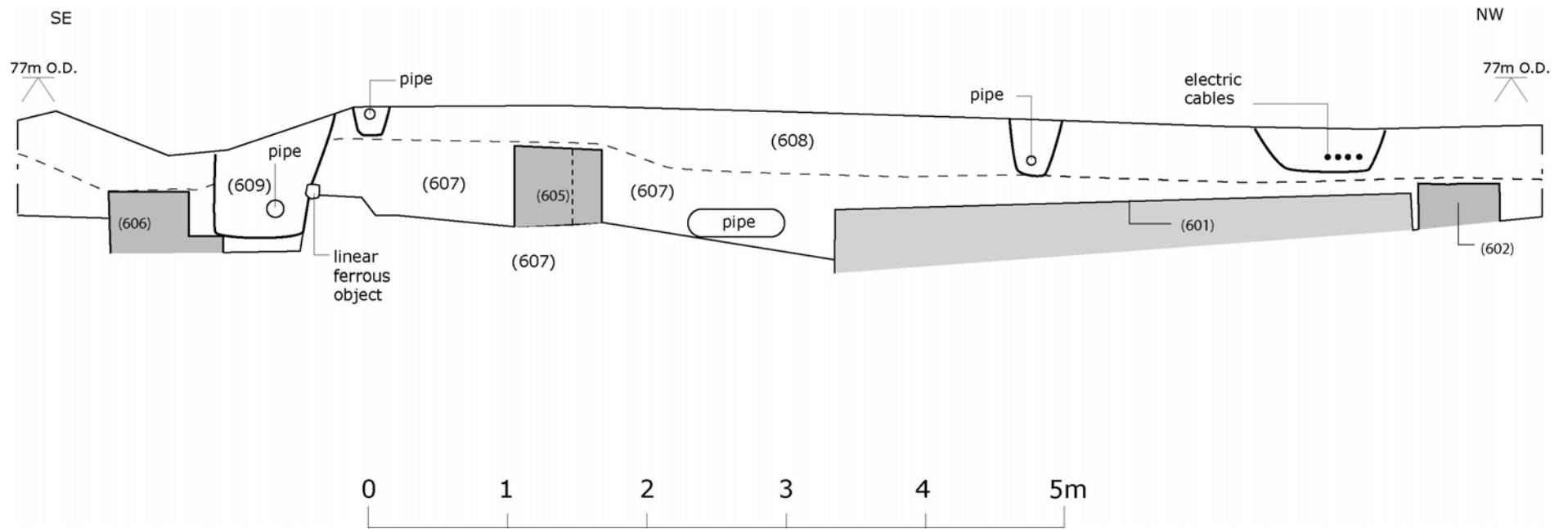


Figure 22: East facing section of Trench 6A



Figure 23: Plan of Trench 5B

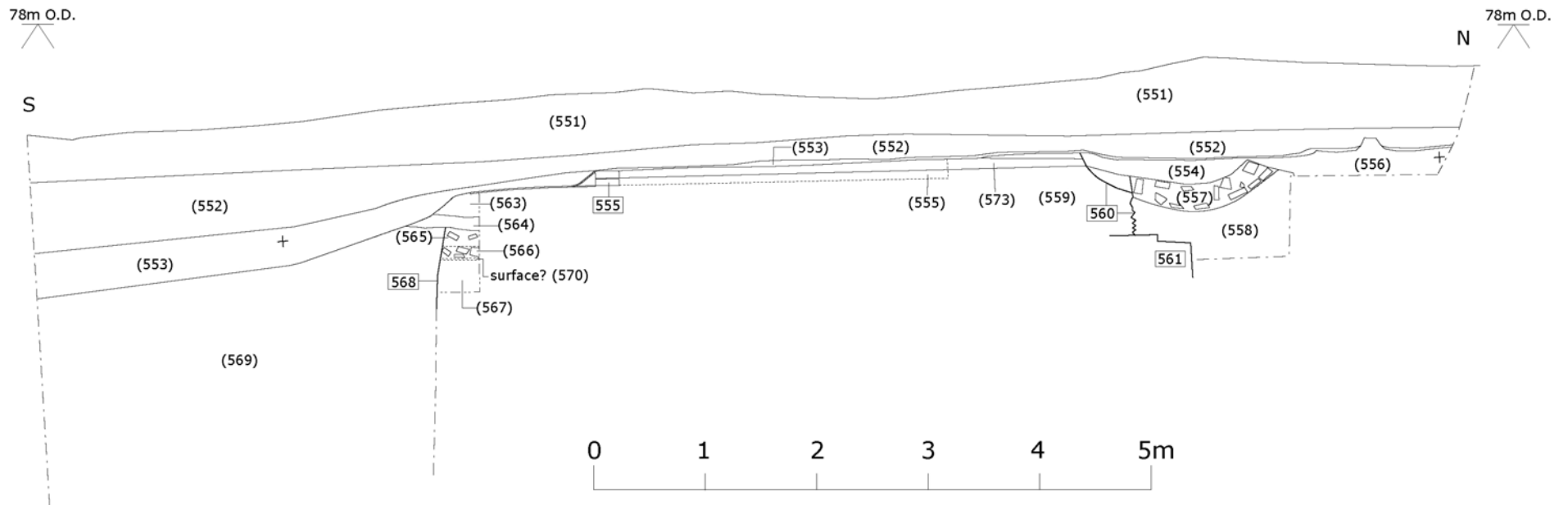


Figure 24: East facing section of Trench 5B

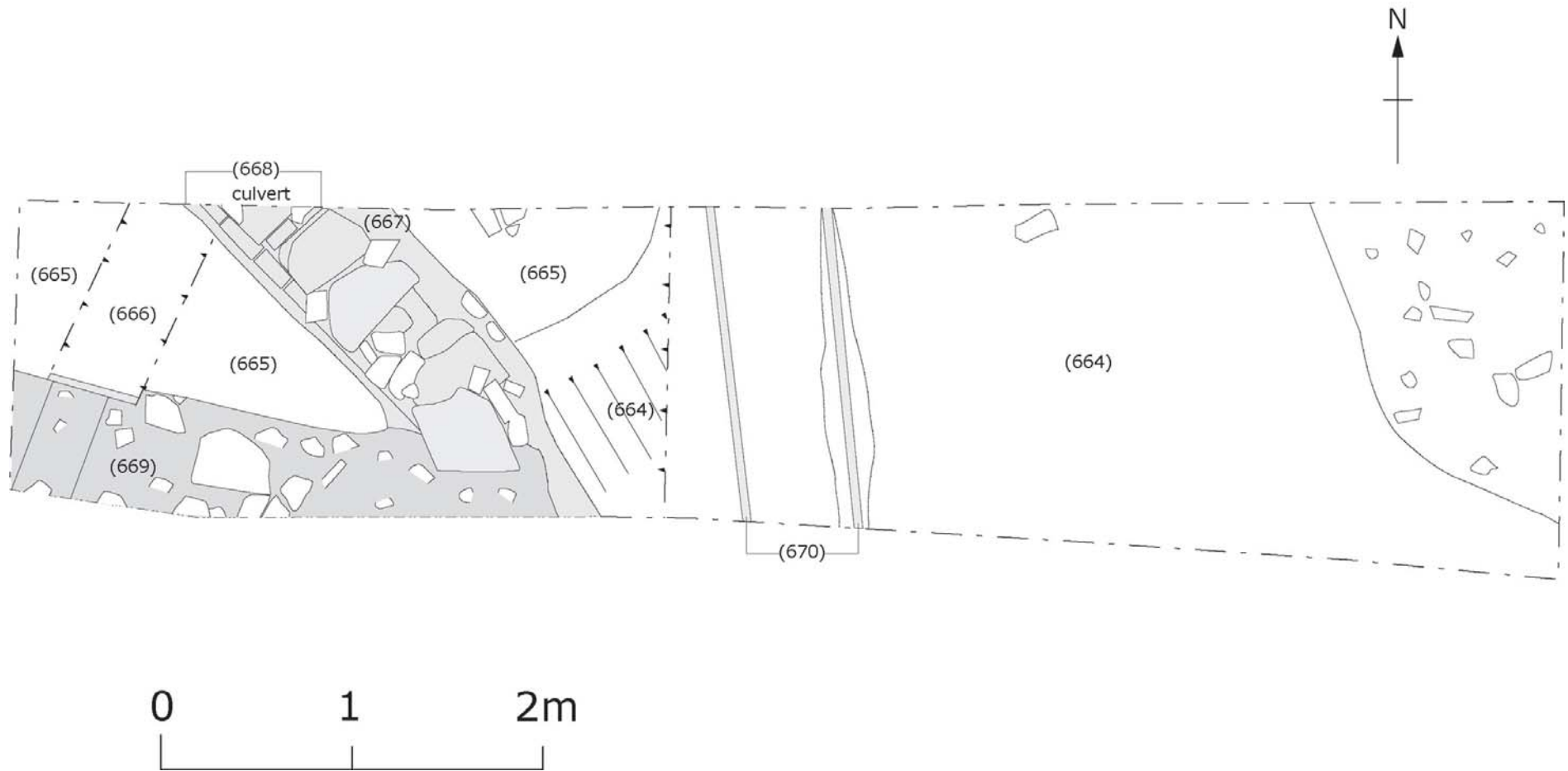


Figure 25: Plan of Trench 6B

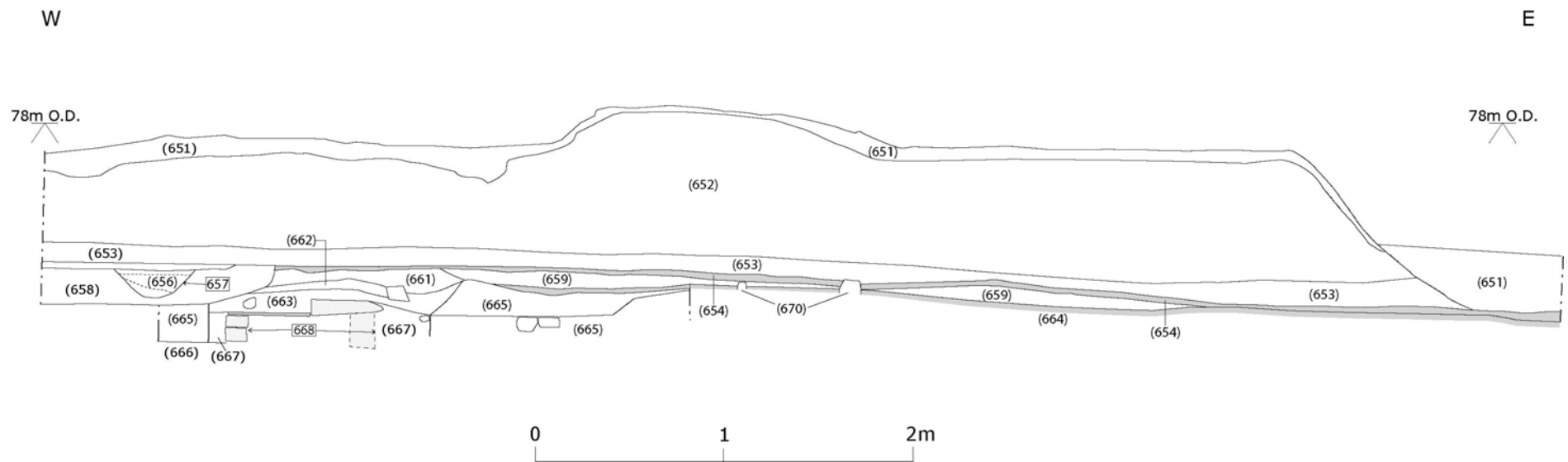


Figure 26: South facing section of 6B.

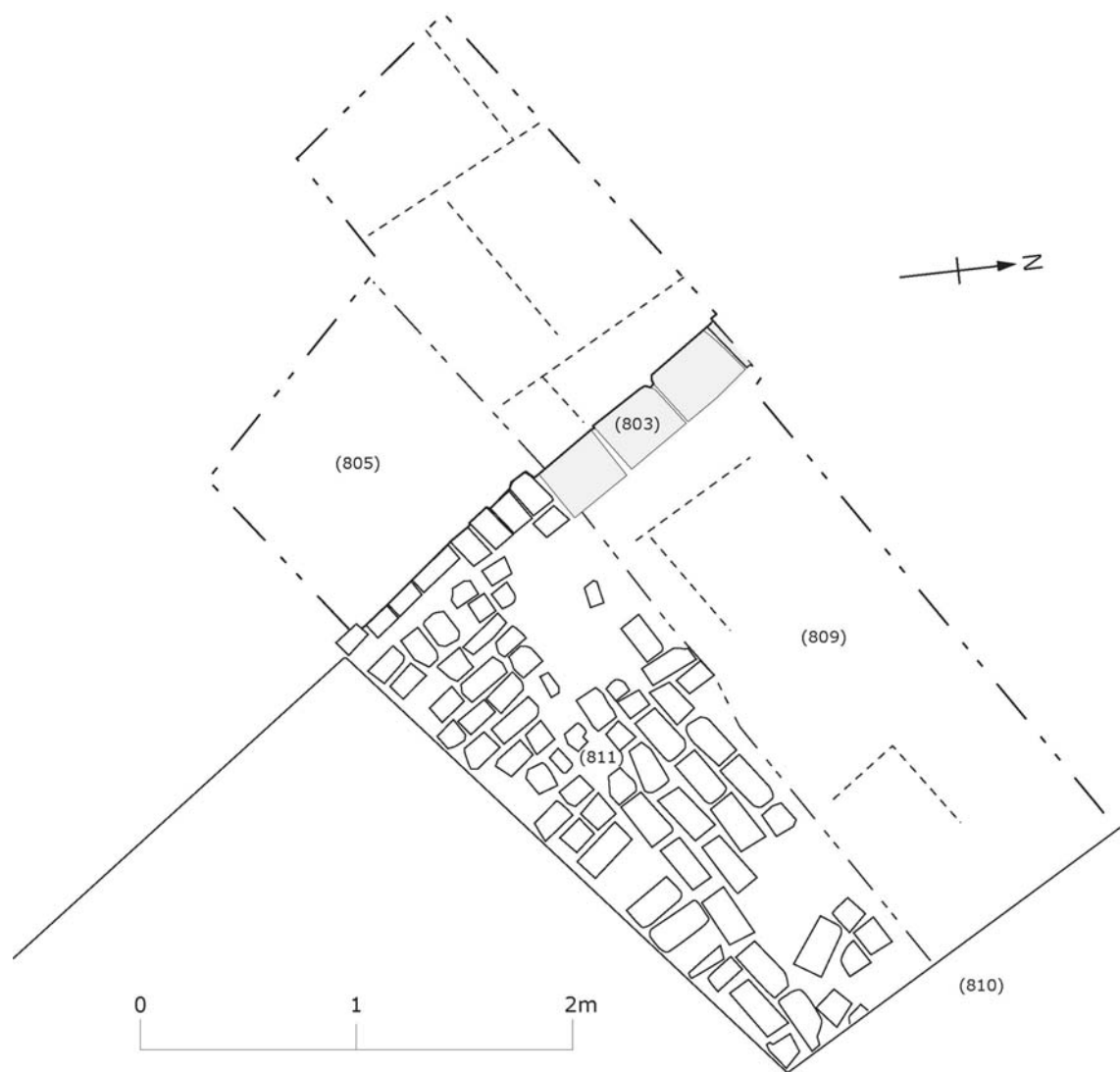


Figure 27: Plan of Trench 6C

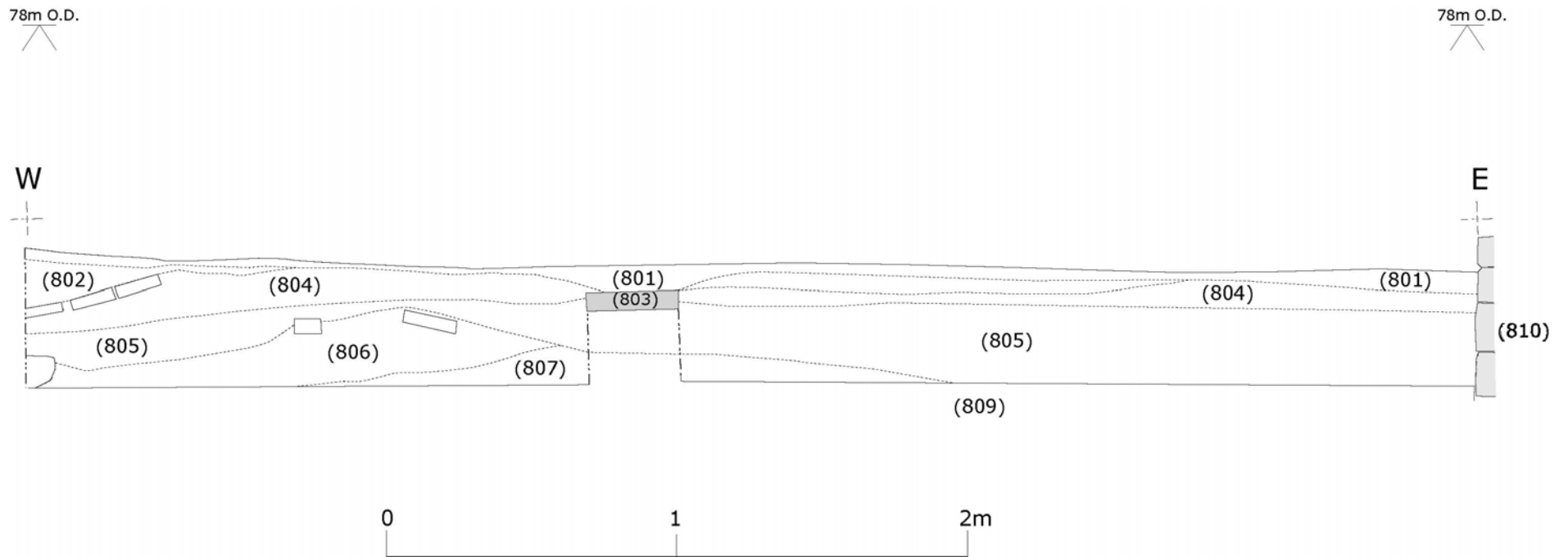


Figure 28: South facing section of Trench 6C



Photo 1: Trench 1B looking north



Photo 2: Trench 1A looking north



Photo 3: Trench 1B. Detail of core work, looking west



Photo 4: Trench 1B. Detail of southern wall of southern battery, looking east



Photo 5: Trench 1A. North wall of southern battery, looking south



Photo 6: Trench 1A. Low brick wall (in section) separating the 'apron' (right) and 'platform' (left) working areas, looking west



Photo 7: Trench 1A. Iron plates capping culvert



Photo 8: Trench 1A. Wrought iron or steel pipe 709



Photo 9: Trench 2C looking north



Photo 10: Trench 2C. South wall of oven battery



Photo 11: Trench 2C looking west showing features cut into 'apron' surface



Photo 12: Trench 2C. Entrances to sole flues of southern coke oven



Photo 13: Trench 2C. Detail of flue structure beneath coke oven



Photo 14: Trench 2C. South facing section through coke oven deposits



Photo 15: Trench 2C. Burning pattern and missing oven floor tiles etc.



Photo 16: Trench 2B looking east



Photo 17: Trench 2B looking north



Photo 18: Detail of patrass plate in Trench 2B looking east



Photo 19: Trench 2A. North side of oven battery, looking south



Photo 20: Trench 2A. Detail of robbed north wall of battery looking south



Photo 21: Trench 2A. East facing section



Photo 22: Trench 3B/C looking north



Photo 23: Trench 3B/C. Detail of south wall of north oven battery



Photo 24: Trench 3C. West facing section



Photo 25: Trench 3A looking south



Photo 26: Trench 3A. North wall of box flue



Photo 27: Trench 4B looking north



Photo 28: Trench 4B looking south



Photo 29: Trench 4B south end, looking west



Photo 30: Trench 4A looking south



Photo 31: Trench 6B. Remnants of rails and iron plate impressions, looking north



Photo 32: Trench 6B looking east, showing culverts etc.



Photo 33: Trench 5B looking west. South end of truncated Boiler house floor



Photo 34: Trench 5B. Sub-floor deposits



Photo 35: Trench 5B looking east. Truncated floor with underlying culvert



Photo 36: Trench 5B looking south



Photo 37: Trench 5B looking east. Possible north wall (right) of boiler house floor



Photo 38: Trench 5A looking west, showing brick path



Photo 39: Trench 5A looking east, showing possible wall foundation or flue



Photo 40: Trench 5A looking west, showing excavation below path



Photo 41: Trench 5A looking north, showing sub-path stratigraphy



Photo 42: Trenches 5A and 6A, looking south



Photo 43: Trench 5A looking south, showing culvert (left) and wall footing (right) presumed to represent the west wall of the former boiler house. Note possible vestige of floor (at red end of scale and in section)



Photo 44: Trench 5A looking west, showing wall footing presumed to represent the west wall of the former boiler house. Note possible vestige of floor to left



Photo 45: Trench 6A looking south



Photo 46: Trench 6A north end, looking east with wall 602 and floor 601



Photo 47: Trench 6A looking west. Pipe and masonry block 603



Photo 48: Trench 6A looking south, showing culvert 606



Photo 49: Trench 6C looking south



Photo 50: Trench 6C looking west



Photo 51: Trench 6C looking north, showing iron plate impressions



Photo 52: Trench 4A looking west, showing badger disturbance



Photo 53: Trench 4A looking west, showing north side of embankment