Report No: 2012R044

Union Smelting Works, Weir Quay, Devon

Archaeological recording 2009-2010

Historic Environment Projects

Union Tin Smelter, Weir Quay, Devon

Archaeological recording 2009-2010

Client	**Bill Horner, Historic Environment, Devon County Council**
Report Number	**2012R044**
Date	**May 2012**
Status	**Final**
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Acknowledgements

This archaeological recording was commissioned by Bill Horner (Historic Environment, Devon County Council), during substantial conservation works on a Listed Grade II Building.

Within the Historic Environment (HE), Cornwall Council, the Project Manager was Colin Buck. Jacky Nowakowski edited this report. The author is grateful to Francis Shepherd for producing the CAD survey drawings and Geoff Moss for permission to access the site in 2009 and 2010 to undertake archaeological recording and for additional information. The author acknowledges advice from Peter Claughton regarding the slag mass spectrometry analysis for the poly-metallic ore sample (Appendix 3).

The views and recommendations expressed in this report are those of Historic Environment Projects and are presented in good faith on the basis of professional judgement and on information currently available.

Freedom of Information Act

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Cover illustrations

Front cover 'before' (top left, July 2009) and 'after' (bottom right, March 2010) views of the Union Tin Smelter roof repair and conservation/rebuild works to the former 'Assay Office/Ingot Store/Manager's House' (© CC HE Projects).

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Abbreviations

CC	Cornwall Council
DCC	Devon County Council
DHER	Devon Historic Environment Record
EH	English Heritage
HEP	Historic Environment Projects, Cornwall Council
IfA	Institute for Archaeology
LB	Listed Building
NGR	National Grid Reference
OASIS	Online AccesS to the Index of archaeological investigationS
TVAONB	Tamar Valley Area of Outstanding Beauty
WDBC	West Devon Borough Council
WHS	Cornwall and West Devon Mining Landscape World Heritage Site

1 Summary

In the early 19th century (1820s) a lead smelter was built at Weir Quay, Devon, to smelt silver/lead ores (initially) derived from Tamar Valley mines. In later years, a local market for tin smelting was also realised as deep tin ores were being discovered in the Tamar Valley. Built in 1849, sited higher up the valley and east of the lead smelter, the Union Tin Smelting works was the brain-child of Percival Norton Johnson (renowned mining engineer). It specialised in the smelting of tin ores reduced from other lead-based ore constituents. This small smelter finally closed in the late 1890s, after having been slightly extended between 1870 and 1883. In the early years of the 20th century, the tin smelting house was re-used as a jam factory (the troughs that held the refining furnaces made excellent coppers for boiling Tamar Valley fruit - Buck 1998). Today, the site is virtually unchanged from its original design (except for the removal of the smelter chimneys); unusually, its main smelter and office buildings are still roofed.

Following applications for planning permission and Listed Building Consent for conservation and repair works at the Union Tin Smelter, subsequent archaeological monitoring and recording at the Union Tin Smelter (only) took place from April 2009 to May 2010 at the request of Bill Horner (Devon County Council Historic Environment), during major building conservation works to the Listed Building. The works consisted of an internal rebuild of the former manager's house and east smelter roof, as well as a rebuild of a brick chimney and outhouse. Archaeological recording also took place in the lower yard area where extensive repairs and roofing took place to former storage areas. A watching brief took place along a service trench which cut through the entire length of the granite stone floor of the Tin smelter. At this time, slag samples were taken and analysed (using Mass Spectrometry). This report discusses the results of the work which was funded by Devon County Council.

This archaeological recording has provided an opportunity to analyse and record in detail the east side (extension) of the substantial tin smelter roof, which consisted of substantial timbers with an 'A' frame truss, with purlins and rafters, and to record specific timber replacements and repairs. An important record and observation has been the analysis of the history of the tin smelter floor construction, through the 'cut' and 'fill' construction technique to form three building platforms, upon which the tin smelter site was founded. The Spectrometry analysis showed that tin was present in quantity within waste slag (presumably from the adjacent lead smelter), used as a hardcore levelling material for the later tin smelter. Interestingly, the amount of tin in the waste slag suggests that the tin smelter was built to profit by focussing on the extraction of tin from complex ore bodies (which also contained lead/silver).

The project area lies within the Cornwall and West Devon Mining Landscape World Heritage Site (WHS). The WHS Management Plan (2005) has produced specific policies with regard to new development and regeneration within WHS designated areas (see Section 5.2). Structures and deposits in the study area contribute to the outstanding universal value of the World Heritage Site.

2 Introduction

2.1 Project background

Weir Quay, Devon (SX 43244 64952, Fig 1), lies within a constituent part of the Tamar Valley Mining Area of the Cornwall and West Devon Mining World Heritage Site (Site A10), and the Tamar Valley Area of Outstanding Natural Beauty (TVAONB). The Union Tin Smelter building is protected as a Grade II Listed Building (SX46NW/2/26), recorded by Devon's Historic Environment Record (DHER,) as Site 5442. The site is also within the Weir Quay/Bere Ferrers Conservation Area, and the River Tamar is part of the Plymouth Sound and Estuary Special Area of Conservation.

An application for Listed Building Consent (11150/2007/TAV and 11159/2007/TAV) in November 2007 was submitted to West Devon Borough Council for change of use of the former Assay/Store House within the Union Tin Smelter complex. Conditional Listed Building Consent for the change of use was subsequently granted. A condition of the consent was archaeological recording (photographic and descriptive) of the building prior to works commencing. This early programme of archaeological recording resulted in an impact and conservation assessment of the Union Tin Smelter complex as well as the remains of the Lead Smelter complex (which lay to its west) (Buck 2008).

Following production of this report, HE (Projects) were asked by the client (Bill Horner, Historic Environment, Devon County Council), to undertake further archaeological recording which took place in 2009-2010. The second phase of recording which took the form of survey and a watching brief were guided by specific recommendations set out in the impact and conservation assessment as set out below. The site numbers referred to below were allocated in the 2008 assessment report.

- Recording in advance of (and during) re-building/repair works to the store buildings in the lower yard area (Buck 2008, Sites 25, 26 and 33)
- Recording in advance of (and during) substantial repair works to the eastern side of the main smelter roof (Buck 2008, Site 16)
- Recording in advance of (and during) rebuilding works to the outhouses of the upper yard area (Buck 2008, Sites 6 to 9)
- Archaeological monitoring of a proposed service trench which traverses the smelter building floor (Buck 2008, Site 16)

The information provided by this second phase report will inform DCC (Bill Horner) and the landowners of the results of the archaeological recording for what has been substantial repair/rebuilding works.

2.2 Aims

The purpose of the historic buildings recording and archaeological recording was to:

- Ensure an appropriate level of archaeological survey for Sites 6 to 9, 16, 25, 26 and 33 prior to the start of any site works (see Fig 2).
- Ensure that site works are undertaken in such a way as to minimise adverse impact upon the archaeological resource.
- Ensure that site works are undertaken in such a way as to allow adequate archaeological recording of remains affected by the works.
- Report on the results of the archaeological recording during the exercise and to maintain discussion and feedback with DCC (Bill Horner) and Graham Lawrence (West Devon Borough Council Conservation Officer).
- Report on the results (this report) so that the information can be deposited in Devon's Sites and Monuments Record and to meet the recording requirements of the original Planning condition.

- Disseminate the results of the project and arrange for deposition of the project archive in Plymouth Museum, and complete the EH OASIS Archaeological Data Service database.

2.3 Project methodology

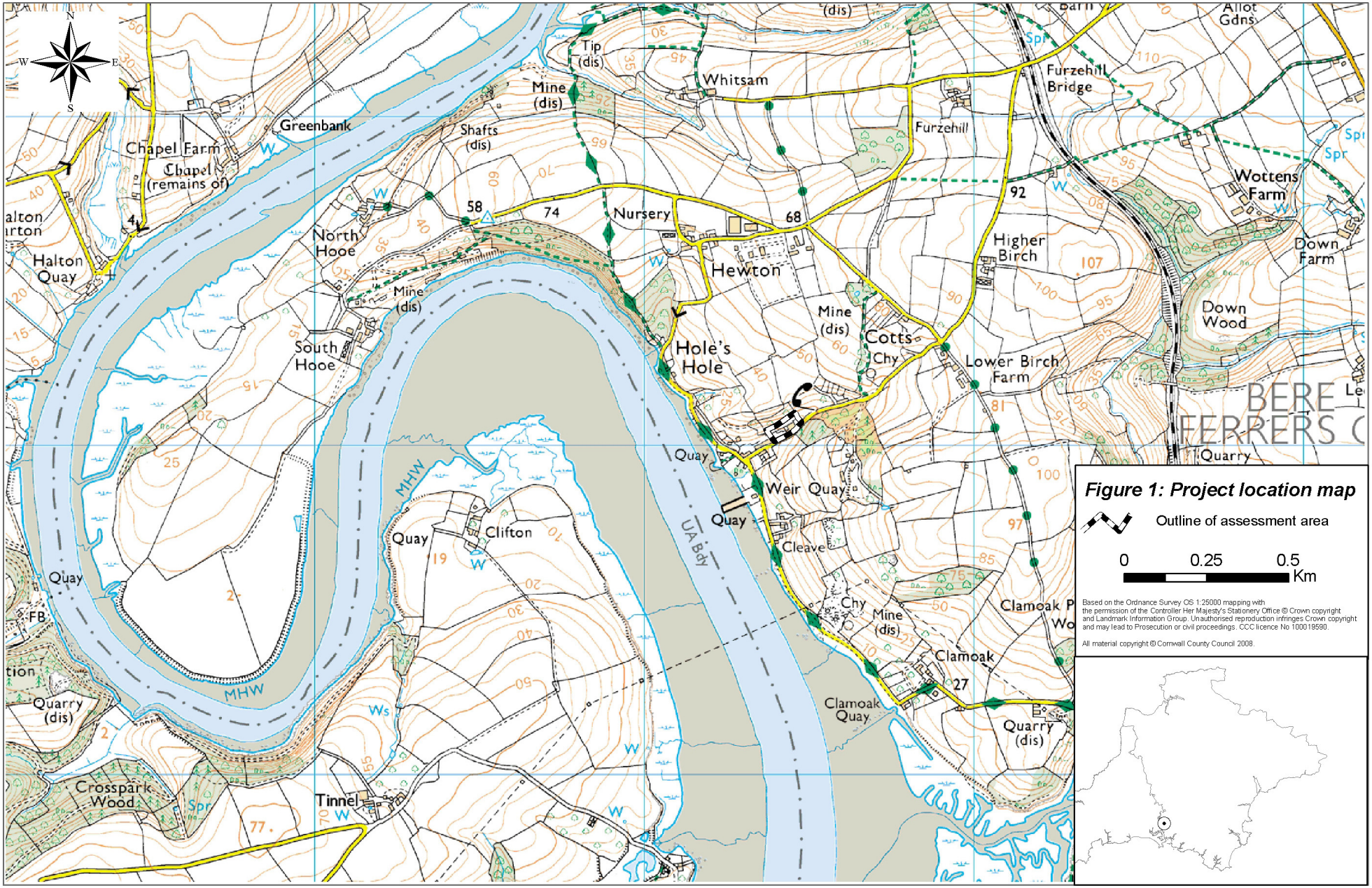
All archaeological recording work was undertaken according to the Institute of Field Archaeologists *Standards and Guidance for Archaeological Investigation and Recording.* Staff followed the IFA *Code of Conduct and Code of Approved Practice for the Regulation of Contractual Arrangements in Archaeology*.

The project team comprised an experienced field archaeologist who is an expert in the management and recording of the industrial heritage. Fieldwork consisted of historic building and archaeological recording:

- Detailed archaeological recording was undertaken for all newly exposed architectural features and any features revealed through conservation works and the service trench excavation.
- Scaled photographs of the buildings were taken and form a major archive record of the site before site works began, and fulfilled any additional specific recommendations made by Devon's HES (Bill Horner, see Section 6).
- No Level 4 measured surveys were required so recording was confined to sketch surveys adding annotations and details to drawings and existing architect's plans. These show where substantial repairs and rebuild were carried out (see Figs 2, 19 and Appendix 1 & 2).
- The excavation of a service trench across the site was monitored and recording comprised detailed survey records, sketch plotting as well as (scaled) photography as appropriate (as permitted by safety factors).
- Where significant remains were encountered the site archaeologist was given the opportunity to make an appropriate form of record before work proceeded; where a temporary stop of work was required to undertake this, the site archaeologist made a request via owner (who undertook the site work).
- In the event that archaeological deposits of a regional or national importance were uncovered, a contingency was agreed and the opportunity for mitigation was in place where preservation *in situ* was an option. In the event that significant remains could not have been preserved *in situ*, strategies for their relocation or detailed recording would have been agreed with the Devon County Archaeologist.
- There was no planning condition for producing a record of the site following completion of the site works, although some photographs of the site on the completion of the works are included in this report.
- Any variation in named personnel for archaeological recording and historic buildings consultancy would have been agreed with DCC (Bill Horner).
- The chosen site archaeologist adhered to Health and Safety Policies (see below), under the direction of the designated Site Safety Officer.

2.3.1 Site liaison

The site archaeologist regularly liaised with the site owner (Pat & Geoff Moss) and DCC (Bill Horner), during appropriate monitoring points.


Greenbank
Chapel Farm
Chapel (remains of)
Halton Quay
North Hooe
South Hooe
Shafts (dis)
Mine (dis)
Tip (dis)
Whitsam
Furzehill
Furzehill Bridge
Nursery
Hewton
Hole's Hole
Cotts Chy
Higher Birch
Lower Birch Farm
Wottens Farm
Down Farm
Down Wood
Weir Quay
Quay
Clifton
Cleave
Clamoak
Clamoak Quay
Quarry (dis)
Crosspark Wood
Tinnel
MHW
UA Bdy
58
74
68
92
107
27
Figure 1: Project location map
Outline of assessment area
0 0.25 0.5 Km
Based on the Ordnance Survey OS 1:25000 mapping with the permission of the Controller Her Majesty's Stationery Office © Crown copyright and Landmark Information Group. Unauthorised reproduction infringes Crown copyright and may lead to Prosecution or civil proceedings. CCC licence No 100019590.
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2.3.2 Site recording techniques

Archaeological recording requirements for all of the sites were set out in the 2008 report (see above and Buck 2008) and comprised photography and detailed annotated notes on individual buildings and parts of the complex. Before the conservation works began, the HE team carried out a photographic survey of all visible buildings that were to be affected by the various schemes (if possible). Photographs were taken throughout and on the completion of the works. Survey and recording techniques during the project followed basic IfA protocols, which included quick measurements of exposed archaeological sections whilst site contractors were working.

The results of the watching brief for both the building works and the archaeological recording excavations are summarised below (Section 4). All plans, maps, photographs and texts generated during the project have been appropriately archived in the Cornwall and Isles of Scilly Historic Environment Record. Correspondence and other material related to the project has been archived into the project file (Section 6). Paperwork project files have been copied for archiving in Devon (DCC Archaeology).

The buildings survey consultancy and archaeological recording was undertaken by a single member of staff (Colin Buck). Safe working practices were observed at all times.

- Site drawings (plans, sections, locations of any finds) were made by pencil (4H) on drafting film; all plans were linked to the Ordnance Survey landline map; all drawings include standard information: site details, personnel, date, scale and compass (north) point.
- Recording was carried out in line with recommendations given by IfA. Sections and plans were drawn on site at appropriate scales which adequately recorded structures or features at appropriate levels of detail, and appropriate sections are reproduced in the archive report (at either 1:50 or 1:100) to adequately demonstrate revealed archaeological features (see Appendix 1 & 2).
- All features and finds were accurately located by means of a National Grid reference.
- A location plan (Figure 1) has been produced which will allow site detail to be accurately placed within the context of the Ordnance Survey Landline mapping.
- This report provides the results and summaries of all levels of archaeological recording which took place.

2.3.3 Treatment of finds

No finds were found. The slag samples analysed for the Mass spectrometry were disposed of.

2.3.4 Photographic recording

Archive photographic recording included:

- Black and white scaled photography using a 35mm camera and fine grain archive quality film (400ASA). Each shot was carefully composed, focused and lit (with a flash gun if appropriate).

The photo record comprised general views and examples of structural and architectural detail. Methodology for the archive standard photography was set out as follows:

- Photographic scales were used and a metric scale included in all archive recording photographs, except where health and safety considerations made this impractical.
- Selected digital colour images have been reproduced in this report.
- Black and white photographs have been archived to CC HER standards and details incorporated into the HES photo database.

- Supporting colour digital photographs were taken with a high resolution digital camera (3MP or higher). Selected examples are reproduced in the report and all are available for future presentation (e.g. powerpoint). A CD containing all digital images accompanies the report.
- Digital colour photographs will be stored according to the Historic Environment Service's guidelines. Further copies of the images are available on request and with the client's permission.

3 Site description

3.1 Location and setting

The deep, steep-sided valley of the River Tamar cuts through a rolling, cultivated landscape, flanked to the west by the distinctive granite ridge of Hingston Down and to the east by the granite uplands of Dartmoor. The Tamar Valley is considered to be one of the most attractive areas in the south-west. The lower and broader part of the valley from Cotehele House southwards (and from the junction of the River Tavy with the Tamar eastwards), has wide expanses of reed bed and mud flats, which attract a variety of wading birds. Weir Quay is sited in the base of an east-west valley with steep north and south sides fronting the River Tamar. It still has a quay albeit a small one for privately owned boats. Its significant heritage however, lies in its close relationship with silver and lead lodes which lie north and south of the valley, and which were worked as early as the 13th century (Rippon, S, Claughton PF, and Smart C, 2009) and then intermittently until the late 19th century.

Today there are two smelters which are located close to Weir Quay (spelt 'Ware' in the 19th century), which lies approximately 3 km north west of Bere Ferrers parish church, adjacent to the Devon bank of the River Tamar. The 'Tamar Lead Smelter' (SX 43335 64995) is closest to the Quay, and is on the northern side of the road leading down to the quay from Bere Alston. The 'Union' Tin Smelter (SX 43428 65050) is adjacent to but uphill (east) from the Lead Smelter site. Both sites lie within boundary perimeter walls and adjacent to the road (down to the quay). The Union Tin Smelter has not recently been habited, and retains its original buildings with contemporary features which date from 1849, its year of construction.

This report essentially focuses on (and brings to a higher prominence), evidence for the site's important historical heritage which is still evident over a century after these related industries and mines folded. It is for this reason that the industrial complex at Weir Quay has been included in the World Heritage Site for the Cornwall and West Devon mining landscape (Area 10).

3.2 Designations

3.2.1 International

The Cornwall and West Devon Mining Landscape World Heritage Site (WHS) seeks to demonstrate the international importance of the developments within mining and allied technologies which took place within Cornwall and West Devon during the last half of the 18th century and into the 19th century, establishing beyond doubt the contribution of this region to the development of the modern, industrialised world.

The World Heritage Site Management Plan 2005-2010, statement of Outstanding Universal Value states that: '*The Cornwall and West Devon Mining Landscape was transformed during the period 1700-1914 by early industrial development that made a key contribution to the evolution of an industrialised economy and society in the United Kingdom, and throughout the world. Its outstanding survival, in a coherent series of highly distinctive cultural landscapes, is testimony to this achievement'* (2005, 12).

The WHS for Cornwall and West Devon was designated in 2006. This demonstrates the

far-reaching effects of the technological changes on the society, economy and landscape of the area, and identified a number of areas within Cornwall and West Devon where the results of these processes are still well-preserved. The WHS areas, representative of the period of Cornish dominance of the mining world (c.1700-1860), include the project site within the Tamar Valley Area and Tavistock (Area 10). *'Area A10 is the most easterly and the second largest of the WHS Areas, this mining district A10 (i) lies in the Tamar Valley Area of Outstanding Natural Beauty and comprises both valley and upland settings for tin, copper, silver-lead and arsenic mining, ore-processing and smelting'.*

3.2.2 Statutory

- The Union Tin Smelter Works was Listed Grade II: No. 35033 (SX46SW 2/26) in 1977.
- The entire project area and area to the east and south of the site parallel to the River Tamar is within the Weir Quay Conservation Area.
- The entire project area and to the north and south of the site is within the Tamar Valley Area of Outstanding Natural Beauty (AONB).
- There is a Site of Special Scientific Interest (SSSI) designation for nationally important sites along the River Tamar banks, for the nature conservation of Estuary birds and waders.
- There is a Special Area of Conservation (SAC) designation as an important European site within the tidal limit of the River Tamar for wading birds and other similar habitats.

3.3 Brief site history of the Union Tin Smelting Works

(A detailed site history is given in Buck 2008, 17-23).

Ores from Tamar Consols and other local mines were smelted at the Lead Smelter Works. This was built in the 1820's by a company relating to the local mines. This was later acquired by Percival Norton Johnson (a metallurgist and mining engineer) in 1842 when he extended and re-equipped them to specialise in the smelting and separation of mixed lead and silver ores. Eighteen furnaces could smelt well over 300 tons of lead ore a month and employed 90 men. The deep water berth at Weir Quay was deepened to receive vessels of 400 tons, which brought coal from South Wales and ore from Spain, France, Wales and N. Ireland. In 1850 the new Pattinson process was introduced, which enabled larger percentages of silver to be extracted from lead ores. In 1852 the Tamar (Silver/Lead) Smelting Works were sold by the mine, but subsequently closed in c 1860. It re-started (as the Nascent Copper Company) in 1876, but finally closed in 1885. In the early years of both smelter sites, they appear to have worked closely together, as both were owned by local mine companies.

The adjacent Union Tin Smelting Works were built in 1849 (also under the direction of Percival Norton Johnson), and operated intermittently until its final closure in 1896. The company was offered for sale in 1855, but remained unsold. It then re-opened in 1870 (after it had closed in 1863). In the 1870s it was extended eastwards (the new roof built during this extension was subsequently re-roofed during this recent project). For a number of years the smelting house was re-used as a jam factory by the Mount. Edgecombe Estate (the troughs which had previously held metal refining furnaces made excellent coppers for boiling Tamar Valley fruit). In the 1970s the site was used as an agricultural store and a chicken rearing house. In 1977 Eric Moss purchased the site, and also used it as a store and workshop for the next thirty years.

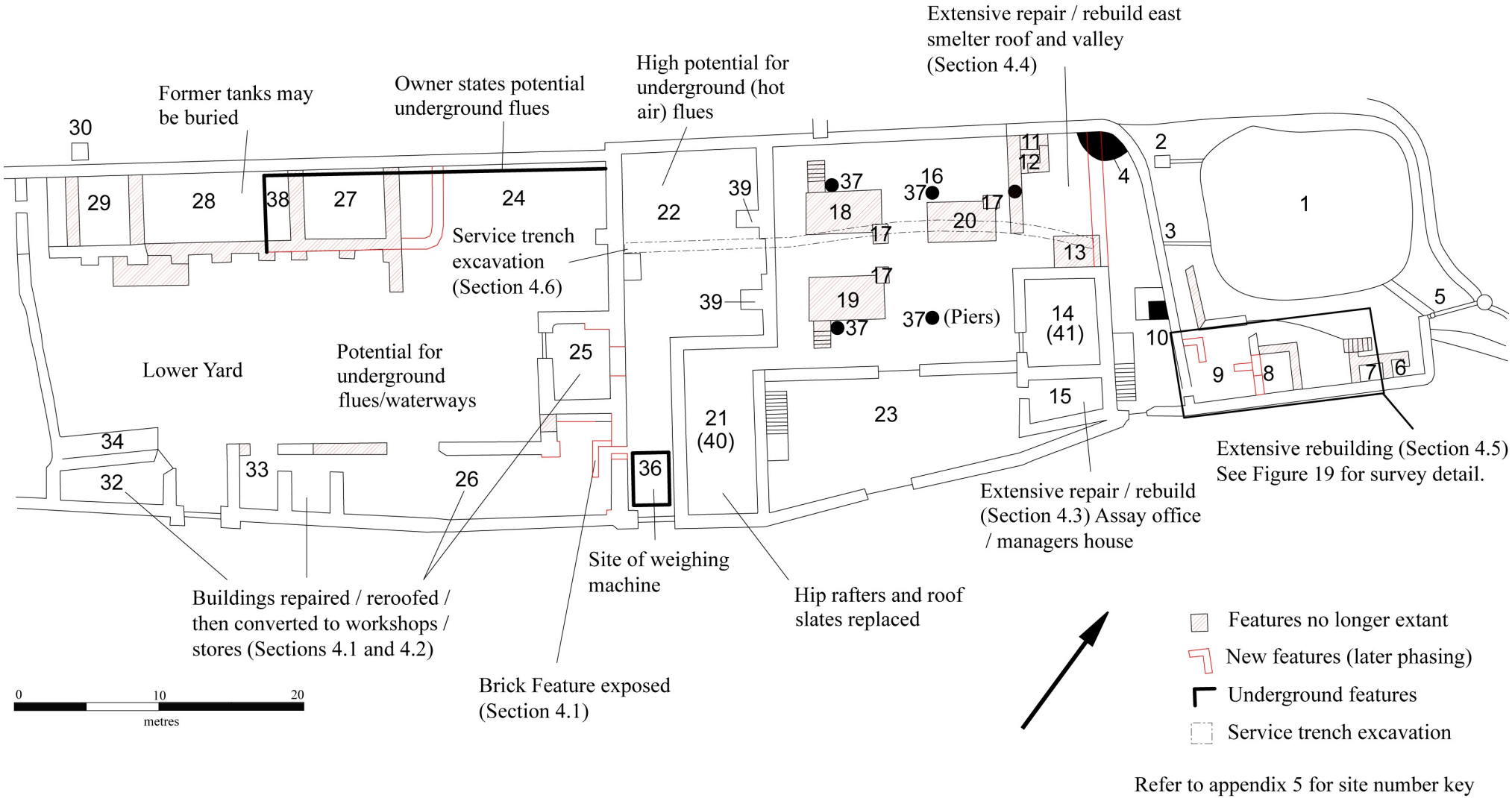


Figure 2. Plan of archaeological recording sites at the Union Tin Smelter (2009 - 2010)

4 Archaeological recording results

Building conservation works summary

The archaeological recording results are described below (see Figure 2, a site plan of the excavation areas, with appropriate Section details shown), in date order of site visits.

List of works (April 2009 - May 2010)

4.1 Repair/rebuilding of the Lower yard 'stores' (Sites 26 and 32)

4.2 Repair/rebuilding of Lower yard 'store' (Site 25)

4.3 Rebuilding of the Assay Office/Ingot Store/Manager's House (Sites 14, 15 & 41)

4.4 Repair/rebuilding of the main Smelter east roof and main valley (Site 16)

4.5 Rebuild of the (east) outbuildings (and 'copper' boiler chimney) (Sites 8, 9)

4.6 Archaeological recording of the excavated trench through the main Smelter floor

Inventory of archaeological recording **(2009-2010)**

Note:

- The inventory list is given in order of works completion
- Refer to Figure 2 (Site inventory plan) for all site numbers.
- Site inventory numbers were allocated in the Impact and Conservation Assessment (Buck 2008). A tabulated list is given in Appendix 5.

4.1 Repair/rebuilding of the Lower yard 'stores'

Civil Parish: Bere Alston

Site name: Union Tin Smelter, Weir Quay

DHER: 13882

NGR: SX 4342 6503 (centred)

Report Site No: Sites 26 and 33

Project background (Archaeological recording Project Design: Appendix 4)

In 1998 Listed Building Consent (No. 1299), was granted for conversion of some of the lower yard store buildings (No recording conditions were made). A subsequent application was granted for alterations to the outbuildings (Sites 32 and 33), with an archaeological recording condition attached. In 2007 Listed Building Consent (No's. 11150 & 11159), was granted for a change of use of the Count House to residential and substantial rebuilding works (Site 41). A PPG16 (para 30) archaeological recording condition was attached. In 2009 Listed Building Consent (No. 12626) was granted to the site owners for the conversion of additional former stores (Sites 26 and 25) to a workshop and washhouse together with maintenance/repair works to the main smelter roof (Site 16) and Boveway roofs (Site 40). A PPG16 (Paragraph 30) archaeological condition was also attached. Concise descriptions and photographs were submitted to the WDBC Conservation Officer and his approval gained, prior to works commencing. Archaeological recording in advance of the works was a planning condition.

Assessment description (Buck 2008, 27)

Lower yard with outhouses

The lower yard has a southern perimeter wall (adjacent to the road) of approximately 2.5m to 3.0m height (collapsed at its east end), and a northern boundary wall approximately 3.0m tall Buildings were attached to both of these walls. The southern wall had stores built against it, except for a main access gate at the west end, whilst

the northern wall had unroofed 'Cemented Tanks' attached at its western end. The walls for the tanks are partly obscured and mostly infilled, but are now only approximately 1.0m high (see Figure 2). Clearance will need to be undertaken to understand the evolution of this area, as it appears that a secondary low structure had been built over Site 27 and part of Site 24. These appear on the 1883 Ordnance Survey map – partially obscured by the word *'Chimneys'*, but were still extant in 1907, Buck 2008, Fig 4). This included a north oriented underground flue (0.45m x 0.55m) at its western side (Site 38). The current owner maintains that the flue then runs parallel to the north wall (underground) in an eastwards direction. The '*Chimneys*' label on the 1883 OS map is not replicated on the later OS map, but the tip or one of more chimneys is shown on an 1865 engraving (Buck 2008, Fig 4), (these appear as small round features to the east and west of the location on the 1883 OS map). Perhaps the chimneys vented the fumes from drying chambers after further ore treatment, or perhaps they served coke ovens (coke would have been produced for the smelting process).

The store buildings shown on Figure 2 abut the south perimeter wall and are approximately 2.0m to 2.5m high and are roofless. The north side of these buildings are approximately 2.0m high and show that they were originally constructed with open fronts. The roofs were supported by stone piers, which have subsequently been infilled with stone. Within the last few years, the owner recently obtained Listed Building Consent for change of use with respect to Sites 26 and 33 in order to create stores and/or a garage. Work to create the new garage/stores has now finished. Site 32 has already been converted, utilising the existing walls and construction of a new slate roof following what would have been the original roof line. These buildings retain their original cobbled and stone floor (which is approximately 0.15m to 0.2m deep).

The ground surface has a covering (approximately 0.1 to 0.25m) of earth and mud which overlies the original cobbles and stones, as well as trees and bushes etc. The present owner has stated that the previous site owner sold some of the original flooring material so its true extent is unknown.

Archaeological recording

Site clearance of vehicles, dense vegetation, trees and other debris was undertaken prior to the first of a number of site visits by the HE team which began in early April 2009. Black and White and digital colour photographs were routinely taken (see Section 6 for photograph reference numbers), during the site visits. Some "before works" photographs were obtained on 30.9/2008 prior to works commencing (see Figure 3) for works affecting Sites 26 and 33, prior to a site visit on 3/4/2009 (during mainly road boundary wall repairs). Elevation/plan drawings for the repair/rebuilding works to these sites have not been seen. The following is therefore a description based on site inspections:

The outbuildings (or stores) were constructed against the tall south boundary wall (adjacent to the road - see Figure 3). The repair works consisted of repointing and preparing the top of the boundary wall to receive a wall plate to secure a mono-pitch roof to the store buildings within the smelter complex. A small amount of initial rebuilding was done in cement and subsequently following guidance from the WDBC Conservation Officer, lime mortar was used throughout with the sand colour chosen to reflect what was originally used (see Figure 4 below). The original extent and position for each wall was retained. The cement repointing was recessed then the walls repointed to nearly flush with the lime tan coloured finish.

The new roof profile probably replicated the original (large rafters set at right angles from the tall boundary wall). However the original roof covering would have been slate, the new design used corrugated shaped roofing. Archaeological impacts to the intact stone cobbles set in the floor have been minimal where they exist (as the latest phase of masonry walls had been retained). However, cobbles were not extant in the eastern end of Site 26, as here the earth and shillet ground steps upwards (following the upwards site topography – see Figure 5). However, at the far eastern end of Site 26,

Figure 3 Photograph (from west) of the outbuildings (Sites 26 and 33) before works © CC HE Projects 30/9/2008

Figure 4 Photograph (from west) of the outbuildings (Sites 26 and 33) during works (repointing shown in places) © CC HE Projects 24/7/2009

during clearance of rubble build-up, a brick feature was revealed. This was surveyed and photographed before it was removed (see Figure 2 survey plan drawn on to the site inventory plan). The brick feature appears to have been built of old smelter fire bricks, and was 'L' shaped. It extended up the adjacent retaining wall, and had a small opening at its base (see Figure 5). Its function is puzzling, but it may have been related to some chimneys shown on the 1880 OS map (Buck 2008, Figures 6 and 17).

Figure 5 Photograph (from west) of the revealed brick feature (within Site 26) after clearance works (before repointing) © CC HE Projects 3/4/2009

4.2 Repair/rebuilding of the Lower yard 'stores'

DHER: 13882

NGR: SX 43427 65045

Report Site No: Site 25

Project background (Archaeological recording Project Design: Appendix 4)

See Section 4.1 for background planning information.

Assessment description (Buck 2008, 27)

Lower yard with outhouses

See Section 4.1 for assessment description information.

Archaeological recording

Site clearance of dense vegetation, trees and other earth/rubble debris were undertaken after the first of a number of site visits which started in early April 2009 (see Figure 6) to carry out the archaeological and photographic recording work. Black

and white photographs and digital colour photographs were taken (see Section 6 for photograph reference numbers). Elevation/plan drawings for the repair/rebuilding works were not seen, so this description is based on site inspection.

Site 25: the store was originally constructed against the tall west (coal store) boundary wall (adjacent to the smelter - see Figure 2). It may originally have had two wide openings in its west wall, but subsequently the southern one was infilled with stone. The repair work consisted of partial rebuild of the north and south gable walls, and repointing and preparing the walls to take a new timber and slate roof (see Figure 7). The remainder of the walls were completely repointed with lime mortar following the original extent and position for each wall.

Archaeological impacts to the floor were minimal, cobbles were not located but two piers of re-used former smelter furnace fire bricks were built (inside) to provide additional structural support at the north and south walls for construction of a first floor.

Figure 6 Photograph (from west) of Site 25 before works © CC HE Projects 3/4/09

The east wall was mostly rebuilt with stone (to match existing) and re-used bricks as quoin stones. The existing doorway was utilised and the WDBC Conservation Officers instructions followed to make new single entrance door resemble the original double entrance door. This also provides access directly into the newly constructed first floor (given the height differential of the adjacent smelter building 'west' yard ground level compared to the lower yard ground level). The new pitched roof was constructed of slate, with slate fascias (Figure 7).

Note:

Rubble, vegetation and tree clearance works to the remainder of the lower yard were undertaken during site visits. It was proposed to site a sewage treatment plant in this vicinity but archaeological recording was not undertaken during this project.

Figure 7 Photograph (from west) of Site 25 with new roof © CC HE Projects 14/11/09

4.3 Rebuilding of the Assay Office/Ingot Store/Manager's House

NGR: SX 43455 65062

Report Site No: Site 41

Project background (Archaeological recording Project Design: Appendix 4)

See Section 4.1 for background Listed building consent planning information, which had an archaeological recording condition. The Weir Quay Smelters Impact and conservation assessment report (Buck 2008) included a detailed impact assessment of this building in advance of the proposed works. This included a photographic survey in 2008 (Black and White and colour digital) and a field survey record (using the architect's plans), of each of the main architectural features on each of the three floors (Ground Floor Sites 14-15, First and Second floor (Site 41) – see Buck 2008 (Section 6 and Appendix 10.5).

Assessment description (Buck 2008, 33)

Assay Office/Ingot Store/Manager's House

Ground Floor

- The former Ingot Store (Site 14), is to be converted to a bedroom and bathroom (with partition), and to include a staircase to the living room/kitchen. The original windows are to be replaced with the same style of frame and glass. The original ceiling/upper floor joists have already partly been removed and the remainder are also likely to be replaced. Impacts to the existing granite floor are not known.

The former Assay Office (Site 15) is to be converted to a bedroom, and a new doorway opening created through the west end of the north wall. Impacts to the existing brick floor are not known.

First Floor

- The original living room and the bedroom are to be formed into a large living/dining room. Therefore the original layout of the building will be permanently altered with removal of the original partition. The original windows are to be replaced with the

same style of frame and glass. The original floor joists have already partly been removed and the remainder are also likely to be replaced. The original exterior steps to the first floor will be rebuilt to a similar specification.

- The site of the original kitchen, with its Cornish Range, is to remain a kitchen, presumably using the same site for a cooker/rayburn etc. Access to the upper study will be from the kitchen area. All of the Victorian period fireplaces have intact chimneys. Presumably all of these are to be retained.

Mezzanine

- A study area is to be built into the space currently occupied by the two small bedrooms, and a bat area will be created in the upper part of the roof space as a new bat habitat. This will obviously involve removal of the existing original lath and plaster partitions as well as the original staircase. It appears the small window lights will be replaced with modern equivalents. The slate roof is to be re-hung and re-nailed and the ridge tiles re-bedded with lime mortar.

Archaeological recording

Listed Building Consent required formalised archaeological recording of the extensive works to this building, during and after the project. However, given the number of site visits to other parts of the site, some observations and photographs were taken in order to achieve an overall complete archaeological record of the works to this important Listed Building – the only complete Tin Foundry in the Cornwall and West Devon World Heritage Site.

Summary observations:

On a general note, the site contractors (Nick Fell Partnership), are specialists in historic building conservation and when repairing/rebuilding this building were very careful to replicate the original style and measurements of the building's original features. The original windows were replaced with either the original double sliding sash design or an equivalent of the design in place when works started.

On the instructions of the Conservation Officer, the former Ingot Store granite floor was buried under concrete. The brick floor in the former Assay House was too badly damaged to recover; this was removed and replaced by concrete. Following structural advice, the badly damaged original wood floor at first floor level was replaced with a concrete beam and block floor as it enhanced the stability of the building. All chimneys were renovated or rebuilt, internally and externally – all are ventilated and in full working order. The bat area was moved to the main smelter house works roof area after discussion with natural England (see Figure 16)

Figure 8 is a view of the building (and Smelter building) from the east at the start of works in early April 2009. From April 2009 the hipped roof and timbers were all removed, as was the east wall from the doorway (including the two window openings). These would have had internal timber joists and the external brick arched headers (as seen in Figure 8). The original first floor walls that remained included the north (originally gable), wall (with inbuilt Cornish range), the south wall (with window opening) and the west wall (with two windows).

Figure 9 shows the site after the masonry to the east wall had been removed, and after the reinforced concrete floor had been installed. Note the east wall south (rendered) chimney was unaffected by he works, although the other two brick chimneys were rebuilt. The section of east wall that had been removed was rebuilt (with the same stone), as were the original brick arch headers and new internal timber lintels. The west wall window lintels were also rebuilt. The roof was rebuilt with new timbers throughout (see Figure 14), and re-slated (see Figure 10) with new rooflights/vents. All internal walls were repointed and lined with a damp proofing membrane, followed by 150mm of insulation, plaster board and a final skim. On the ground floor, a new doorway was formed between the original Assay room (Site 14), and the original Tin Store (Site 15).

Figure 8 Photograph (from east) of Site 41 at the start of works

© CC HE Projects 3/4/2009

Figure 9 Photograph (from east) of Site 41 during rebuilding works

© CC HE Projects 14/7/2009

Figure 10 Photograph (from east) of Site 41 after major repair/building works

© CC HE Projects 12/3/2010

4.4 Repair/rebuilding of the main Smelter east roof and main valley

NGR: SX 43451 65070 (centred)

Report Site No: Site 16

Project background (Archaeological recording Project Design: Appendix 4)

See Section 4.1 for background planning information. The Weir Quay Smelters Impact and conservation assessment report (Buck 2008, Section 7) included recommendations which set out specific building conservation issues as part of future site management. A major problem with the smelter was the poor condition and deterioration of the main valley timber which supported the roof for the eastern extension of the Tin Smelter (and deterioration of the dry hipped rafter joins and lead flashing over all of the roof - the worst area also at the east end).

Recommendation description (Buck 2008, 35)

Main Smelter Roof: Priority areas for conservation works

The highest priority in the Tin Smelter complex is the repair of the main Smelter building roof – especially at the junctions of all the dry hipped rafters/slate roof and valleys, where presumably the lead flashing has rotted, leaving the slate edges and supporting timbers vulnerable to weathering. The north-east corner hipped section (Fig 14) was in the worst condition, although all of the remaining hipped sections appeared to leak. Structurally, an important large horizontal timber spanning the section of wall from the north-west corner of the Tin Store (Site 14) to the north side of the building is supported by a section of a very rusty scaffold tower and in places other forms of structural reinforcement (ie. Accro props) are used. A few slates from the exterior of the roof have slipped – evidence of the slow disintegration of the slate nails. Some of the top decorative apex roof tiles have also started to erode. The condition of the timber surrounds to the roof ventilator sections have not been viewed close-up but are also likely to be in poor condition.

Archaeological recording (2009-2010)

Figures 11 and 12 are internal views of the main smelter roof prior to works. The worsening deterioration of the hip joint lead flashing has had its effect on roof timbers since its construction (between 1865 and 1883). Of high structural significance however, was the condition of the main large (valley) timber spanning (north-south) across the east side of the smelter, which carried the new extended section of roof (adjoining the original eastern section of roof) via an upright steel (reused rising main pipe), above which was sited a wide lead valley for water run-off (See Figs 11 and 12).

When the smelter building was extended eastwards, a large timber (0.3m X 0.3m X 6.0m) spanned where the east end wall had been previously, its north end supported by a re-used iron rising main pipe. A wide lead valley was constructed at the foot of the original smelter half hip roof (oriented east-west), and the hipped roof then constructed (oriented north-south) to align with the adjacent Assay/Manager's House roof and north gable wall. Thus most of this (smelter extension) north side roof is at the same pitch as the main smelter roof (see Appendix 1 roof profile).

Figure 12 shows that the lead valley flashing above the timber had failed years ago, and as a result the wet timber had deteriorated. This had necessitated the construction of temporary supporting scaffolding (by the former owner Eric Moss). As a major priority the new site owners (Geoff Moss), commissioned the contractors working on the Assay/Managers House rebuild (Nick Fell Partnership), to undertake the additional works of replacing the large timber beam and re-roofing the east end of the smelter building (at the same time as re-roofing the Assay/Managers House, see Figure 14).

Prior to start of the roof works, with funding from Devon County Council, the roof interior was photographed (in black and white and digital colour) prior to scaffolding being erected internally and externally. This permitted further detailed photography and archaeological records to be taken (25/8/09). Appendix 1 is a measured survey plan and elevations, indicative of the roof design before it was dismantled. This shows the general structural roof design of this extended section of the main smelter roof.

A single 'A' frame Truss Rafter (see Figure 11 photographed from below), which measured 3" x 9½" (at base) and 2¾" x 8¾" (the uprights), is set near the end of the large timber (see Figure 15). This supported two sets of purlins (4" x 5") on each side of the roof, and was supported on the Assay Office/Ingot Store/Manager's House north gable wall. The hip rafters (12" x 2¼") and ridge timber (12" x 3") also met at the top of the 'A' frame truss. The rafters (2½" x 2" @ 14" centres) were supported by the purlins and battens (1" x 2½" @ 10" centres) set on the rafters (see Appendix 1).

The main north side of the roof had two hip rafters and a central main rafter (10" x 3"), connecting to the main 'A' truss rafter, which supported three purlins and numerous rafters and battens to the slates (no felt). The smaller east side of the roof had two purlins, fifteen rafters and of course the wall plate. The smaller west side of the roof also had two purlins and numerous rafters. A truss valley timber (10" x 2") was set above the main structural timber to take the rafters from both this section of roof and the adjacent east side of the main smelter roof. This was supported on small pieces of timber to the top of the main structural timber (12" x 12" x 20ft). Figures 11, 12 and 15 show this roof arrangement in detail. To undertake the necessary replacement of the main valley timber, it was necessary to take off the slates and timbers of the adjacent east side of the main smelter roof. The roof timber arrangement for this eastern hipped section was similar to that of the main north side of the roof described above (two hipped rafters with purlins and smaller rafters supporting the battens). However the purlins were of rather haphazard design – none extended to each of the two hip rafters.

After removal of the slate (most nails rotted), the contractors found that the batten nails to the rafters had also badly deteriorated. Most of the rafters had woodworm, and the tops of most hip rafters had deteriorated as water had leaked through the disintegrating hip lead flashing.

Figure 11 Photograph (looking north upwards) of Site 16 (Smelter roof 'A' frame truss) before major roof rebuilding works © CC HE Projects 14/7/2009

Figure 12 Photograph (looking north east upwards) of Site 16 (Smelter roof/wet main valley timber) before roof rebuilding works © CC HE Projects 14/7/2009

The main 'A' frame truss rafter had serious cracks at each end which needed to be re-scarfed and bolted with plates (see Figure 15). The timbers that could not be re-used were removed; some large timbers were scarfed and/or repaired and then re-fitted back on the roof. However, all of the battens and smaller rafters were replaced, as well as a number of purlins.

Figure 13 shows the main smelter roof with a few remaining main timbers of the extension. Figure 14 in comparison shows a view of the roof structure before it was re-slated (including some second hand and re-used slates). Between taking these photographs, the new large main valley beam was craned into place and then the new rafters, purlins and hip rafters rebuilt. Figure 15 shows in detail the newly installed main valley beam, the new rafters, purlins and 'A' frame scarf repair. Figure 16 provides a view (looking upwards from the smelter floor), of the new bat 'floor' and roof space, which needed to be built to protect and allow to thrive a protective species of bat. This new floor was built from the house gable wall, on the horizontal section of the main 'A' frame truss rafter and a new 12" x 3" beam (replacing a rotted smaller equivalent). Figure 17 is a view (looking south) of the newly rebuilt roof, new lead valley, and newly rebuilt hipped section of the main smelter roof.

Figure 13 Photograph (looking south) of Site 41 (Smelter roof) during major roof rebuilding works © CC HE Projects 25/8/2009

Photographs of the building before roof works began show that the slate hip 'covers' to all of the smelter house hip joins consisted of joined 'dry' slates. This photograph shows that the newly rebuilt east smelter roof uses lead covering for the hipped slate joint, whilst the main smelter roof uses curved roof tiles.

Figure 14 Photograph (looking south) of Site 41 (Smelter roof) during major roof rebuilding works © CC HE Projects 25/9/2009

Figure 15 Photograph (looking west) of Site 41 (Smelter roof valley timber/re-scarfed 'A' frame truss) during roof rebuilding works © CC HE Projects 25/9/2009

Figure 16 Photograph (looking east) of Site 41 (Smelter bat floor) during major roof rebuilding works © CC HE Projects 18/11/2009

Figure 17 Photograph (looking south) of the newly built roof and lead valley after major roof rebuilding works. The curved roof tiles are temporary, to protect the main smelter roof ridge until the roof is re-slated. © CC HE Projects 12/3/2010

4.5 Rebuild of the (east) outbuildings and 'copper' boiler chimney

NGR: SX 43470 65066

Report Site No: Sites 8 & 9

Project background

The Listed Building Consent for works affecting Sites 8 and 9 required archaeological recording. During the large scale repair/rebuilding works to the nearby Assay Office/Ingot Store/Manager's House, the owner requested to re-roof and re-use the outbuildings to its east (that is Sites 8 and 9, Figure 2). Devon County Council (Historic Environment) commissioned HE (Projects) in November 2009 to undertake archaeological survey and photographic recording in advance of excavation of the ground surface for service piping and complete rebuilding of the extant chimney flue/fireplace.

Historical background

Given that the Tin Smelter had been built in 1849, it is likely that the Assay/Manager's House was of contemporary construction, as well as its related outhouse, which is likely to have sited the outside toilet (or perhaps Sites 6 or 7 – see Figure 2), and probably a 'copper' or boiler housed in a wash house. It is likely that the brick chimney flue and (possibly later smaller fireplace) was for the 'copper'. The possible wash house building (Site 9) is shown as roofed on both the 1884 and 1907 OS maps (Buck 2008, Figures 6 & 7), whilst Site 8 is shown as unroofed. Figure 4 (*ibid*), the 1865 engraving, shows two chimneys on this site, possibly a washhouse chimney and a taller square corniced chimney adjacent. The roof, from this engraving appears to be mono-pitched (set against from the high boundary wall adjacent to the road).

Archaeological recording (2009-2010)

The site survey recording took place on 27/11/2009. Offset measurements were made from a baseline with a hand tape. This site had been photographed during previous site visits for general photographic recording of the Assay Office/Ingot Store/Manager's House (from the east looking west). Thus, Figure 8 (bottom left side) shows the site from the east on 3/4/2009. It could not be photographed earlier as the dense vegetation growth made photography ineffective. A mono-pitch roof with rotting timber and corrugated galvanised steel can be seen. Figure 9 (taken 14/7/2009) shows the site in more detail when the roof had been removed. Figure 19 shows the site after clearance of rubble and vegetation from the floor – permitting a detailed survey.

Figure 18 shows the site looking eastwards after clearance of the roof remnants, obscuring vegetation and rubble. The photograph was taken after a rain shower revealing floored and tiled surfaces. In addition, Figure 9 shows the masonry walls and doorway (west and south sides). Figure 19 is a hand measured survey plan (27/11/2009) of Sites 8 and 9 – with three elevations of the brick chimney flue (see A-C), as this site was to be removed and rebuilt. The remainder of the masonry walls were retained and possibly added to where the wall tops had been reduced. In terms of site analysis, the area in front of the steps (east end of survey area) appears to have always served as a yard area with a brick and tiled floor. However the c 1870s plan (Buck 2008, Figures 5 and 10), shows another small rectangular building near/around the chimney flue, which is not replicated on either the 1884 or 1907 OS maps (which only show the chimney). However, the possible building foundation trench (east and north wall) may be discernable at ground level. This feature appears to pre-date the open plan layout shown on the 1884 OS map.

The function of the tall brick chimney is not known (as shown on the 1865 engraving) however, it used the same brick flue as the probable site of the 'copper', but was higher.

Figure 18 Photograph (looking east) of Sites 8 & 9 (Outhouses) after roof removal and prior to major rebuilding and groundworks © CC HE Projects 18/11/2009

The west side of the brick chimney has a small brick lined fireplace. However, it is obvious that there was a larger opening – which perhaps held part of the 'copper' boiler, before it was partially infilled (on the north side).

On the north side of the survey area, the white brick and red brick appears to be a demarcation of function, divided by a single thickness brick wall. The red brick floor appears to be the appropriate dimensions for an outside toilet. There was a brick retaining wall built in front of a stone retaining wall (which varied in height from 1.25 to 1.33m).

The impacts of the repair works to this feature were major. Given the relative instability of the brick chimney breast, it was decided to remove it entirely, and rebuild in brick. A high proportion of the brick floor from the former site of the brick chimney breast westwards to the west masonry wall was removed, as a service pipe trench was brought under the roadside property wall (under the former site of the chimney breast),

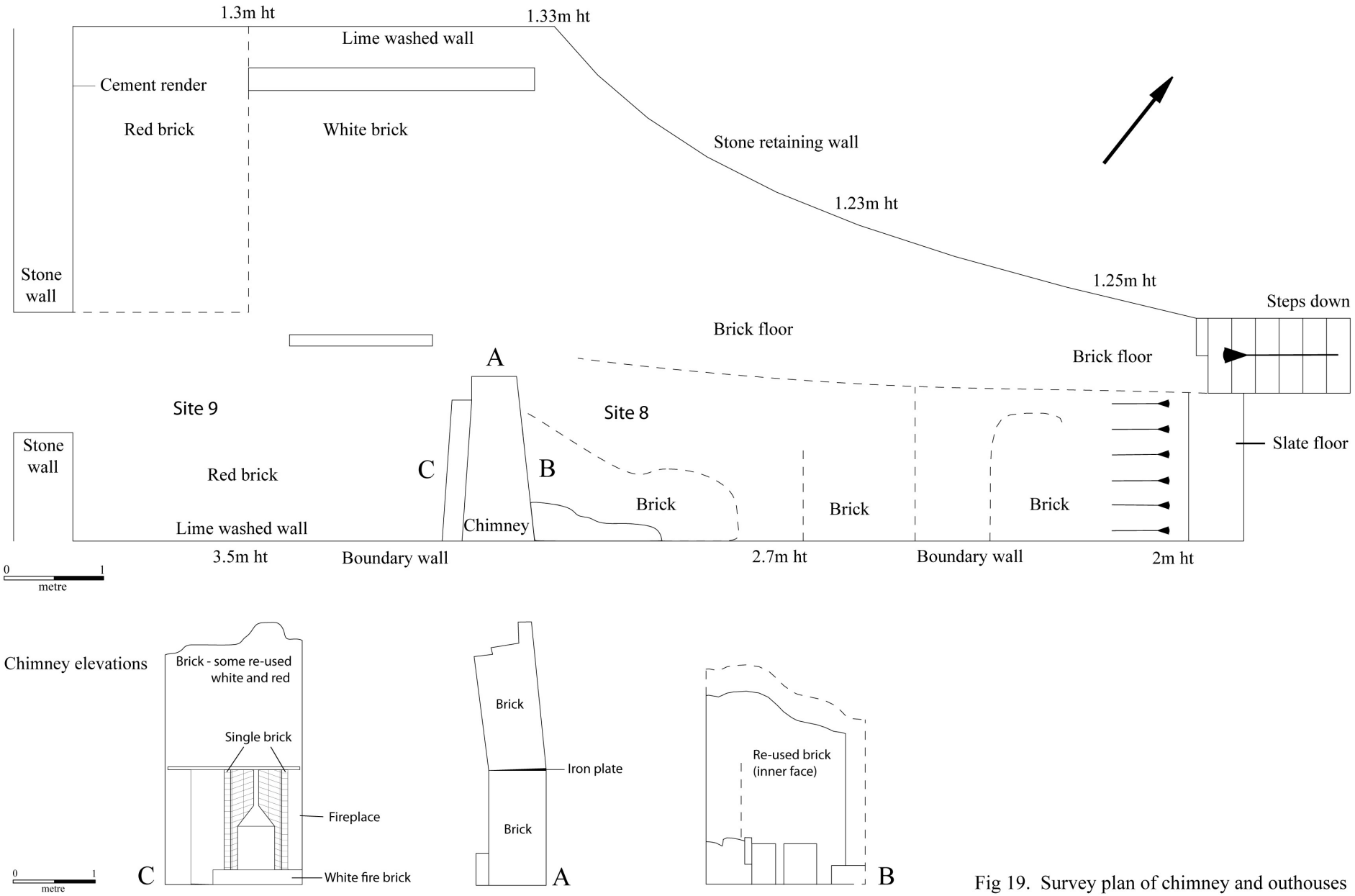


Fig 19. Survey plan of chimney and outhouses with plan and elevations of fireplace (sites 8 & 9).

across the former brick yard, and then westwards under the west masonry wall (December 2009). The final floor finish was concrete.

Figure 10 shows that the chimney breast was rebuilt with reclaimed period red brick using the dimensions of the original feature. It was extended up to a height (with both chimneys – one square, one round profile), that appears to be similar to the 1865 engraving of the building (Buck 2008, Figure 4). The roof was rebuilt as a mono-pitch (with corrugated sheeting to match the lower yard store re-roofing: Section 4.1), again reflecting the original arrangement (but the original covering would have been in slate). Figure 10 shows the new brick built east elevation – with two brick arched openings. The style and form of the original openings for this elevation have not been seen (or recorded), and this new form is pleasing to the eye, and retains character.

4.6 Archaeological recording of the trench through the main Smelter floor

NGR: SX 43454 65069 to SX 43434 65060

Report Site No: Site 16

Project background

Following machine excavation of a service trench from west to east through the centre of the tin smelter floor in May 2010 by the owner, Devon County Council (Historic Environment) commissioned HE (Projects), to undertake archaeological survey and photographic recording of the excavated trench and to draw up representative sections before it was backfilled.

Archaeological recording (2009-2010)

The archaeological recording took place on 19/5/2010 using offset measurements (with a hand tape from a baseline), and detailed photography. A measured survey plan and sections of the Smelter House trench after excavation are reproduced in Appendix 2 (sections A to E), whilst analysis of samples of slag by the Mass Spectrometry technique is given in Appendix 3. Previous visits to the inside of the tin smelter had shown it to be full of cars and other items during the past 30 years. Some had been cleared from the east end to permit scaffolding to be erected for the roof repairs (Section 4.4). Prior to the (archaeologically unsupervised) excavation of the service trench, a 1.0 to 2.0m wide linear route from east to west had been cleared of stored items (see Figures 20 and 21).

Figure 2 (and Appendix 2) shows the route of the excavated trench across the former site of the two smelter ovens (Sites 17, 18 and 20). The trench is also likely to have removed the foundation or lower flue of a smelter Chimney (Site 17, attached to Site 18). Sites 11-13 were originally outside the main smelter building, but these would have been removed when the building was extended eastwards in the c 1870s. When the smelter went out of use (c 1890), at some point thereafter the smelter ovens and chimneys were removed (possibly when it was a Mount Edgecombe Estate workshop - Buck 2008, 22). However, Figure 2 shows that the lower part of each smelter oven, would have been below ground level (with steps down to enable the ash/burnt coke to be removed from each of the two smelter ash pits). Thus, there would have been large holes left in the floor when the smelters and chimneys were removed above ground level for re-use of the building. By 1977, a photograph of the smelter floor (looking east) by Frank Booker (*ibid*, Fig 13), shows a cleared flat floor, prior to its purchase by the previous owner, Eric Moss.

The narrow trench excavation (23.8m long within the smelter building, 9.5m across the former coal yard (outside and west of the smelter building) and 0.5 to 0.62m wide), is shown by a plan in Appendix 2. Five sections along the north trench side were drawn at selected locations along the length of the excavation (Sections A to E).

Figure 20 Photograph (looking west) of the excavated and partially infilled service trench across the former tin smelter floor © CC HE Projects 19/5/2010

Figure 21 Photograph (looking east) of the excavated and partially infilled service trench across the former tin smelter floor © CC HE Projects 19/5/2010

General views of the trench excavation are shown in Figures 20, 21 and 23 with detailed images of drawn sections C and E in Figures 22 and 24 respectively. Opportunities for recording were however confined as much of the trench was already infilled with a 4" plastic waste pipe on a bed of pea gravel with the result that part of the trench base was obscured for much of the archaeological recording.

The survey plan (referenced to Fig 2 and Appendix 2), and the sections/photographs are all indicative of three archaeological events. Firstly: the construction of the building itself in the late 1840s, secondly, the extension of the smelter eastwards (c 1870s), and the thirdly, infilling of the removed smelters (as shown on Figure 2).

The site of the original (1820s) lead smelter (near Weir Quay), lay on gently eastward sloping ground in the valley base up from the River Tamar. However, the 1849 Tin Smelter was sited further eastwards up the progressively steeper valley. Its site was built on essentially three levelled platforms; the reservoir pond and outbuildings (including Sites 8, 9 and 1 – the reservoir pond) formed the upper (east) section. The central section consisted of the main Smelter building (Site 16) and coal yard (Site 22). The western levelled platform was the lower yard section (including Sites 25, 26, 32 and 33), each western end supported by a tall vertical retaining wall. Each of the three levelled platforms would be cutting into natural ground at its eastern end, yet would have imported fill at its western end (some of this obviously from the excavated ground from the eastern part of each platform). However, given its industrial use and weight, the central smelter floor would have needed to be very robust and hard wearing, hence its construction with granite slabs (variable dimensions but approximately 0.2m thick). Unfortunately the floor was not cleared enough to allow recording of a plan of the various granite, brick and concrete areas.

Appendix 2 shows the trench route and sections (all on the north side). It appears the (c1870s) site plan of the smelter may not be entirely accurate (Buck 2008, Figure 5), upon which the location of the trench excavation has been transposed. Features which appear to have been cut by the trench do not show in the section elevation (ie Site 20 for example). The floor area of the 1865-1883 extension was partly obscured but from what was visible, it consisted of a combination of brick, concrete (possibly relating to its use as a Tamar Valley Jam factory), and some granite slabs. Section A shows a single layer of bricks overlying a thin sandy layer (0.03m depth), overlying a compact stone hardcore base (0.37m deep). This section was close to the east smelter extension. The rest of the section eastwards was mostly obscured by the pipe and its bedding material. Between Section A and B, the section (north side) revealed a line of bricks on edge – this may be related to the southern edge location of Smelter furnace Site 20 (see Figure 2 and Appendix 2). Section B may be located between two of the furnaces – hence why the floor consisted of granite stone slabs (0.38 x 0.1 x 0.8m). This overlay light brown compact earth and stone, the section being 0.5m deep (to pipe level).

Section C is perhaps the most interesting (see Figure 22). At this location the floor partly consists of concrete where granites are missing. However, this is probably due to the fact that the Smelter furnace (Site 18 and Site 17 - its related chimney), was formerly in this location. The below ground part of the furnaces would have been infilled with brick/masonry to allow the floor surface to be levelled for re-use. Appendix 2 (Section C) and Figure 22 shows the bricks and mortar, the stones and mortar and straight cut (marked by the scale pole). This section also marks the first point where the trench excavation was visible to its full depth (see Figure 22).

Given the limited width exposure of brick, it may be below ground remnants of the vertical chimney (Figure 2, Site 17) attached to the Smelter furnace (Site 18), or perhaps part of the side of the furnace itself still remaining in situ. The trench, after section C, bends to the north side of the wide opening in the Smelter west wall (see Figure 20). In section D granite slabs were recorded in the northern trench section and these rested on dumped infill comprising mixed black ash/earth, un-burnt coal, and burnt clinker slag waste.

Figure 22 Photograph (looking north) of Section C © CC HE Projects 19/5/2010

This is the first section that appears to show the use of imported clinker waste material (presumably from the nearby lead smelter/or perhaps a nearby mine) for hardcore, to build up the ground level on this west side (1.0m to the base of the trench). Some of this material was analysed by mass spectrometry (see Appendix 3), and related analysis of results.

Figure 23 is a photograph of the trench taken from its west end looking eastwards across the former smelter coal yard. Section E (and Figure 24) is typical of the fill layers seen in this part of the open trench. As one would expect the yard surface had been laid with medium sized flat granite stones, but much smaller than those in the interior, intermixed with stone cobbles. The section profile shows spread layers of black earth/coal dust and clinker intermixed with a tan coloured earth and stone. Again, the ground would have been made up using imported material brought in from elsewhere (in addition to that found on site).

To summarise the trench excavation results (and slag analysis), the hypothesis of the initial construction technique, has more or less been proved by analysis of the archaeological recording. The infilling of the smelter floor after the furnaces were removed can possibly be seen. The importation of 'hardcore' from outside the site utilised locally sourced (free) material, i.e. smelting waste etc from the nearby lead smelter. The original ground level was not plainly visible in any trench excavation section. However, the approximate datum ground level could be viewed as being similar to the fields south of the adjacent road (approximately 1.0m above road level). The tall vertical retaining wall west of the coal yard (Site 22 – indicative of the height differential between the west end of the middle levelled smelter platform and the east end of the lower yard platform), is 2.5m high; an indication of the large amounts of material that would have been imported to 'cut' and 'fill' the site.

The Mass Spectrometry analysis (Appendix 3), is from three samples: Sample A is clinker waste from Section C, Sample B is granular dust beneath/between the granite slabs) from between Sections C and D, and Sample C is from Section D (clinker slag). The slag appears to contain higher levels of tin than other elements. It probably originated from the nearby lead smelter which was mainly treating silver-rich lead ores.

However, from these results perhaps the lead smelter company also smelted some tin before the new tin smelter was built. Although tin ores would not knowingly be smelted with lead/silver ores, there may have been poly-metallic deposits in some of the lead ores that were being smelted. There was a market for this complex smelting as the lead smelter company was importing ores from around the world.

Figure 23 Photograph (looking east) of the excavated service trench across the former coal yard © CC HE Projects 19/5/2010

Figure 24 Photograph (looking north) of Section E © CC HE Projects 19/5/2010

5 References

5.1 Primary sources

Thomson, T., 2011, *Preliminary analytical report on multi-metallic slag from the Tamar Smelter site, Weir Quay, Devon* (Plymouth University 12/8/2011, Issue 1)

5.2 Publications

Booker, F., 1971, *The Industrial Archaeology of the Tamar Valley*, Newton Abbot

Buck, C., 1998, *Preliminary assessment of industrial sites of archaeological importance in the Tamar Valley*, CAU

Buck, C., 2008, *Weir Quay Smelters – Impact and Conservation Assessment*, HES (Projects)

Claughton, P.F., 1998, *The Tamar Smelting Works* (Mining History information web site)

Rippon, S, Claughton PF, and Smart C, 2009 *Mining in a medieval landscape: the royal silver mines of the Tamar Valley*, Exeter University Press

6 Project archive

The HE project number is **2012027.**

The project's documentary and photographic archive is housed at the offices of Historic Environment, Cornwall Council, Kennall Building, Old County Hall, Station Road, Truro, TR1 3AY. The contents of this archive are as listed below:

1. A project file (2012027) contains site records and notes, project correspondence and administration.

2. ***Site recording (Photographic):***

   Photographs (Black/White: **GBP**,) and Digital images are archived under the following index numbers:

   Black/White photographs:

   Site before/during/after works: GBP 2093/2-36; 2107/6-19; 2108/7-27; 2115/19; 2153/1-6; 2155/11-20

   Digital images:

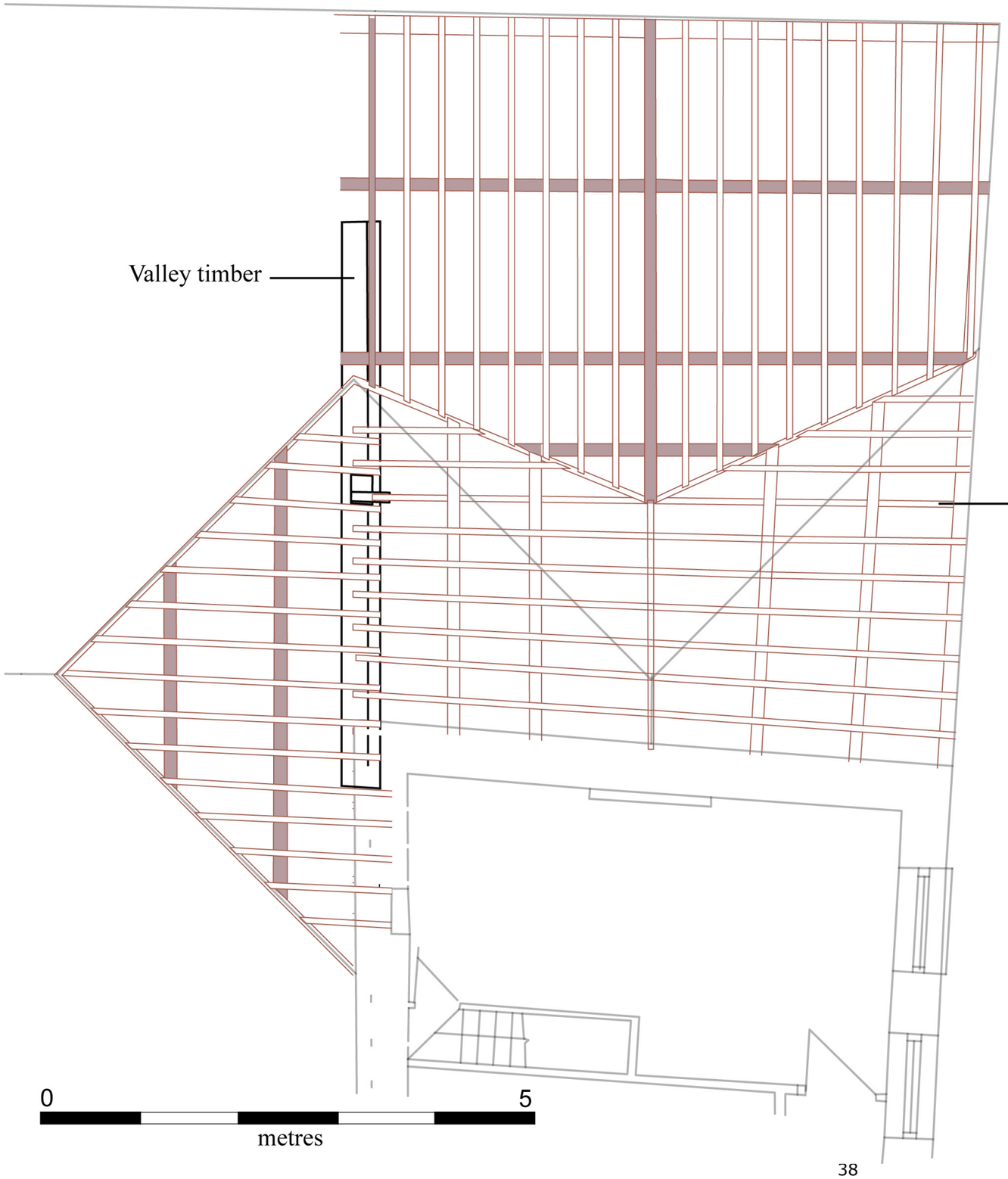
   R:/HE Images/Devon/Weir Quay WB 2012027

3. ***Site recording (Surveys):***

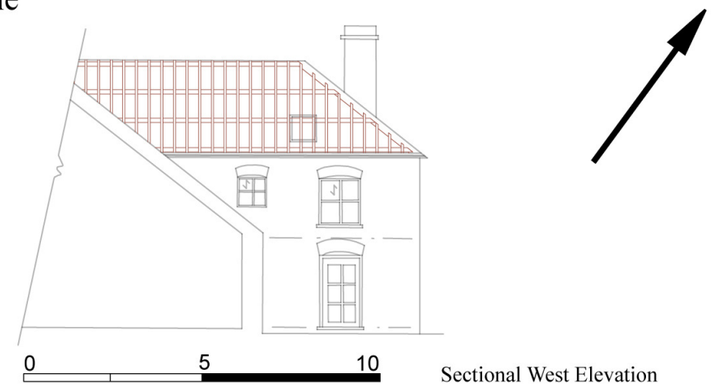
   Surveys: Drawn up pre-works measured surveys are in the project file as CAD files (R:/HE Images/Devon/Weir Quay WB 2012027).

4. This report text is held in digital form as: G:\TWE\Waste & Env\Strat Waste & Land\Historic Environment\Projects\Sites\Devon\Weir Quay WB 2012027\Report & Figs\ Union Smelter-Weir Quay report 2012027.doc

5. EH OASIS No. cornwall2-122900



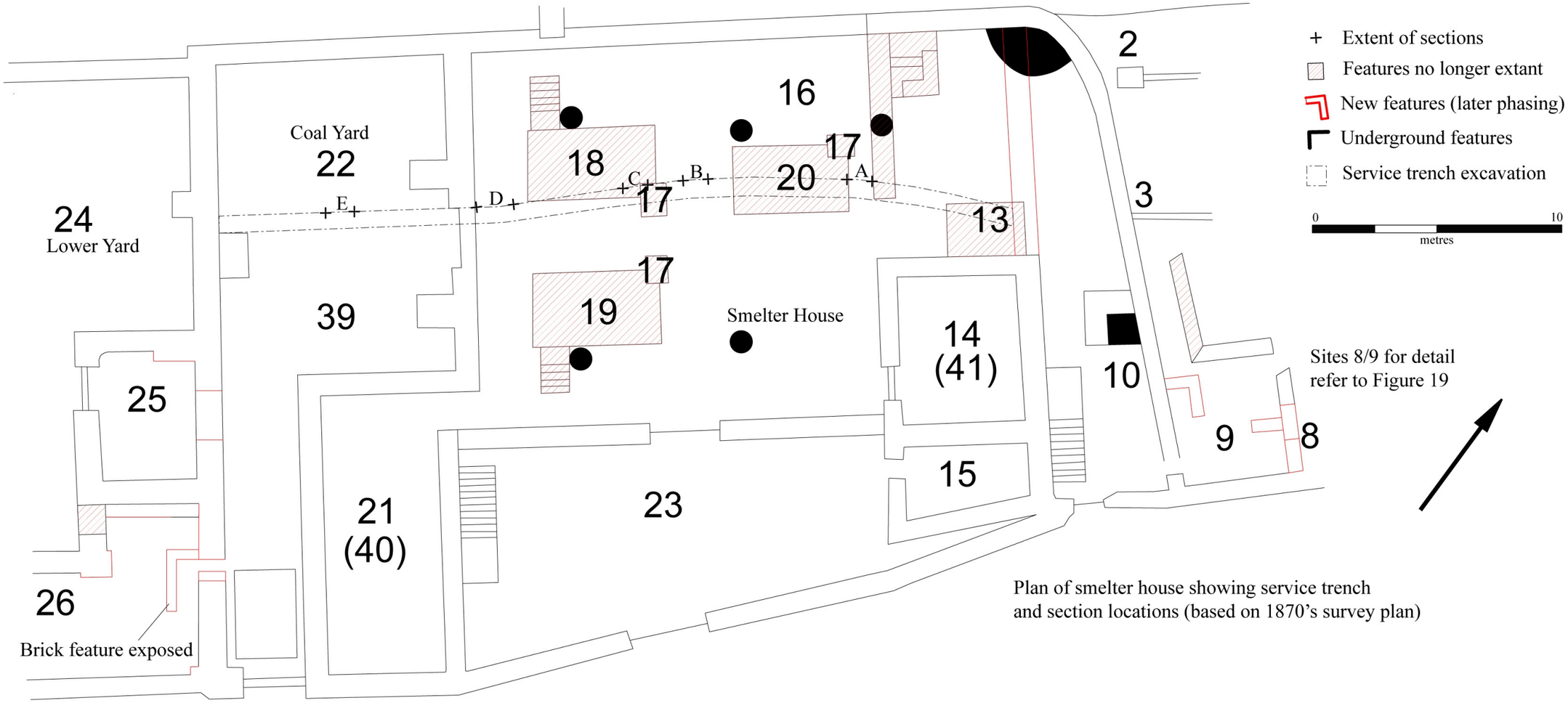
East Elevation



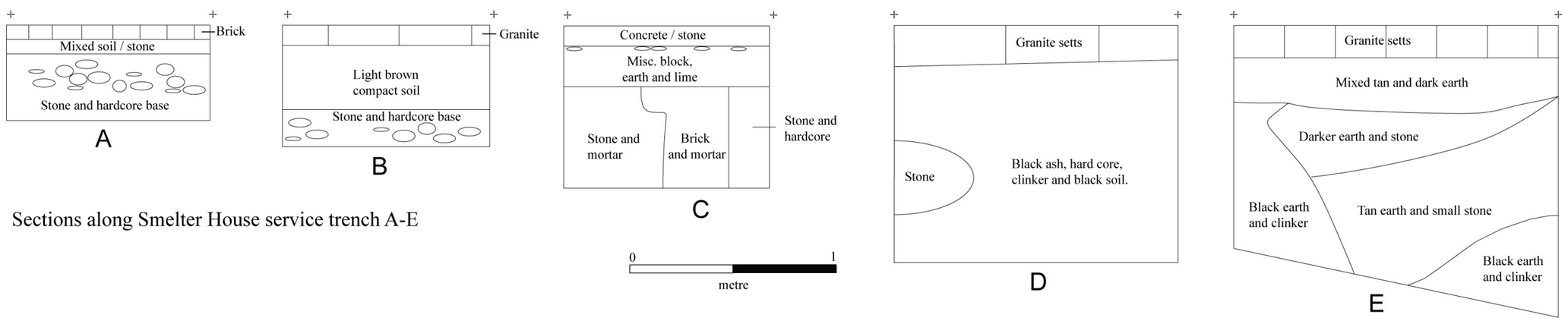
Sectional West Elevation

Retained structural roof timbers
(some timbers repaired and re-scarfed)

Appendix 1. Measured survey plan and elevations of the Smelter House roof timbers. (Rafters Purlins and A frame shown)



Plan of smelter house showing service trench
and section locations (based on 1870's survey plan)



Sections along Smelter House service trench A-E

Appendix 2. Measured survey plan and sections of the
Smelter House service trench after excavation

Appendix 3:

Preliminary Analytical Report on Multimetallic Slag from the Tamar Smelter site, Weir Quay, Devon.

Analytical Report: WDBC/AC/001
Issue date: 12.08.11
Issue No: 1

Prepared For:
Colin Buck
Senior Archaeologist
Historic Environment Service
Cornwall County Council

Work carried out by:
Tom L Thomson. BSc (hons). MSc. GEEIM.
Postgraduate Researcher, University of Plymouth

Tel: 07727948084
Email: tom.thomson@research.darkelement.co.uk

//Hard copies of this document should be considered uncontrolled//

Analytical Report: WDBC/AC/001	*Issue date: 12.08.11*

Customer Requirements.

Three samples of metallic slag materiel were analysed, originating from an archaeological investigation of a former smelting site at Weir Quay in the Tamar valley, Devon. The aim being to determine the composition of each sample with bias towards metallic composition.

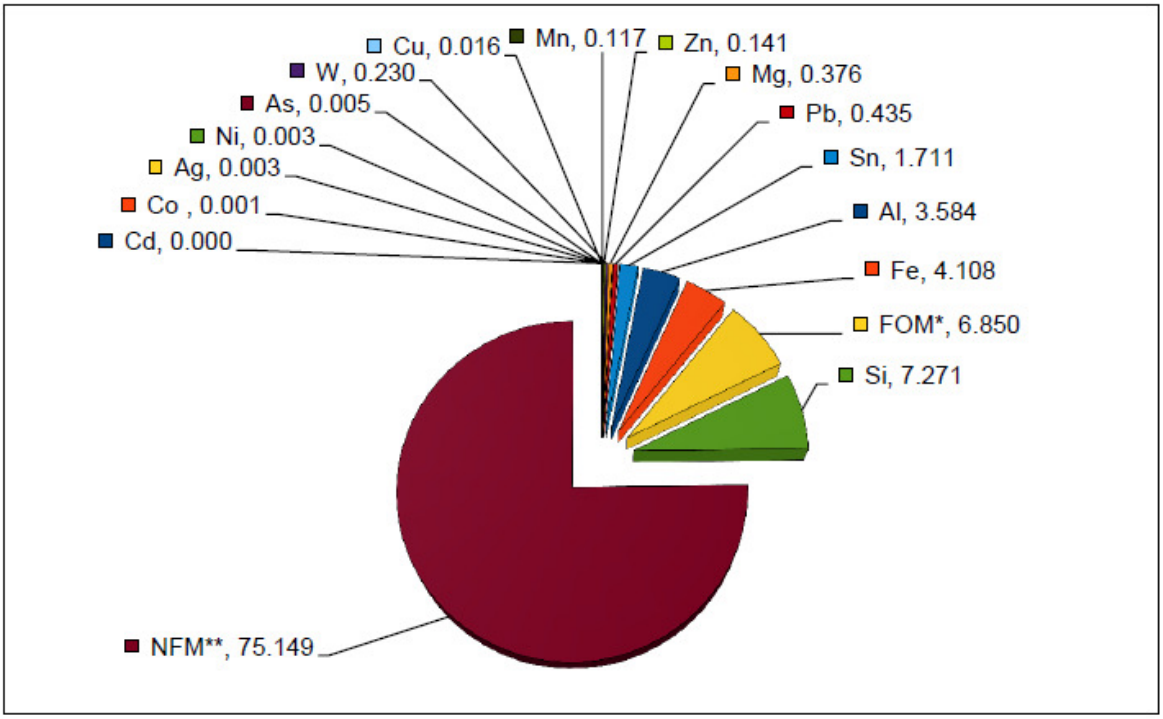
The analytical requirements were agreed after discussions with the client represented by Colin Buck of the Historic Environment Service, who requested an estimation of the ratio of elemental composition to determine the type of process that this slag originated from, the main candidates being the processing of sulphide ores for either tin or lead and silver.

Results and Method Used.

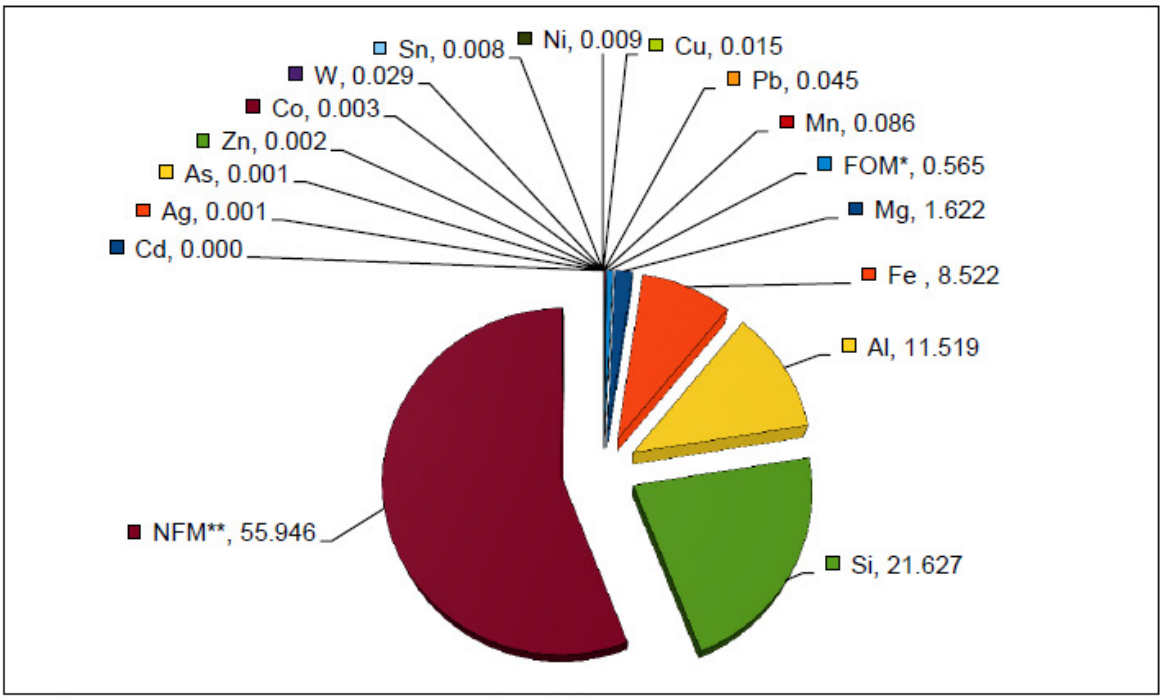
The samples were broken and ground to fine powder in a mill, designed to reduce to a minimal level any possibility of metallic contamination of the sample, this was then prepared by separating the fine fraction below 180 micron particle size by sieving and a precise quantity of this heated in graphite crucibles and fused with molten Lithium-metaborate at 900oC. The resulting melt was dissolved in dilute hydrochloric acid and the solution being analysed in triplicate using an induction coupled optical emission spectrometer.

The results for each sample are shown in figures 1-3 overleaf and the full data is attached in appendix 1.

Analytical Report: WDBC/AC/001	Issue date: 12.08.11

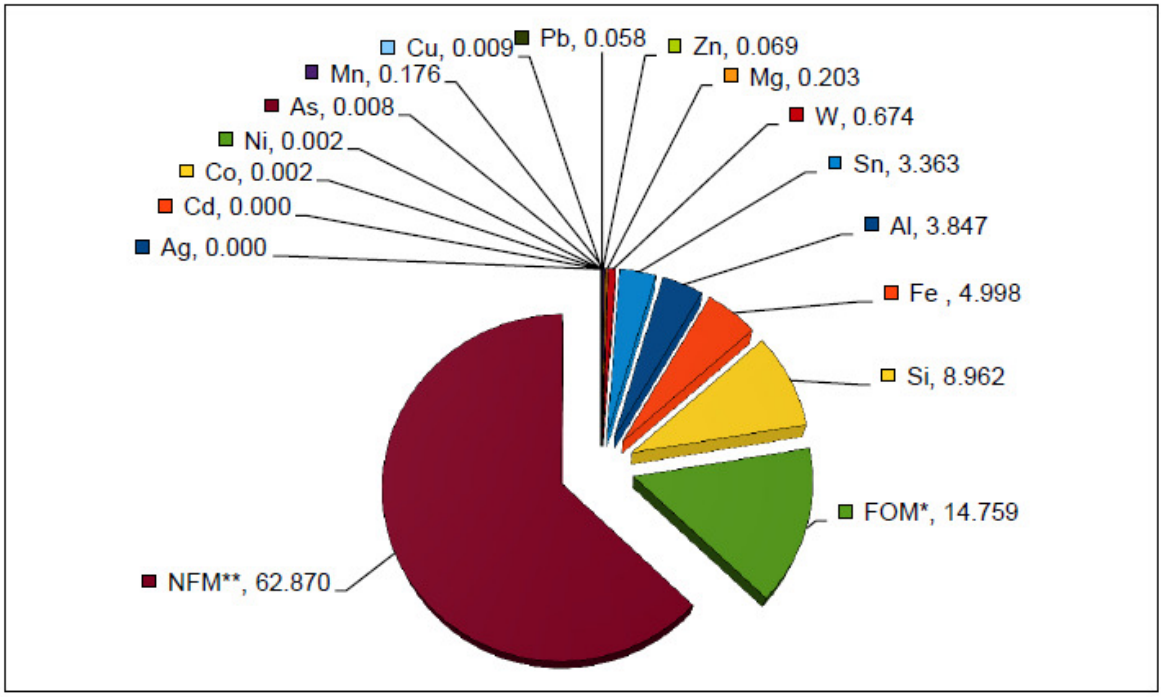


Sample A. Percentage concentration of each element over 0.00001%.
Note. FOM*: Fissile Organic Matter content. ** NFM: Non-fissile Matter content.



Sample B. Percentage concentration of each element over 0.00001%.
Note. FOM*: Fissile Organic Matter content. ** NFM: Non-fissile Matter content.

Analytical Report: WDBC/AC/001	Issue date: 12.08.11



Sample C. Percentage concentration of each element over 0.00001%.
Note. FOM*: Fissile Organic Matter content. ** NFM: Non-fissile Matter content.

Implications of results for supplied end use.

The analysis carried out was requested as a preliminary assessment of bulk content of the above multimetalic slags for the purposes of demining the process that produced these. The history of the sample site indicating that Sn or Pb-Ag sulfide ore smelt being the two most likely candidates. The results show that these slag materials are composed largely of fused ferrous Iron, Aluminum and Silicate matrices and none fissile matter which is likely composed of fully compacted and lattice bound larger fractions of the above, which has proved impossible to determine further. It is very unlikely due to the aggressive extraction method used that no more than a very small percentage of any metals present remains in this NFM however, and the data obtained can be considered representative of the proportions of the metallic elements under investigation.

From the samples under study it is clear that Sn is by far the larger fraction by volume of the material in two of the three samples (A and C), which strongly points to these originating from a Sn smelting process and not one to separate Ag or Pb. Although these elements are present it is at less than 0.5% in all samples and below 0.1% in sample A and C. Despite sample B having a very low percentage content

Analytical Report: WDBC/AC/001	*Issue date: 12.08.11*

of Sn at <0.01% it has no higher percentage of Pb or Ag, this sample therefore is anomalous to the group and may represent a different process being carried out on site or simply that the material is from a section of the process that has left very little of any of these elements behind. That this material was indeed the product of processing ores for Pb is possible but that such a process was efficient enough to leave such a low amount of Pb behind when in operation is highly unlikely even at a modern site let alone one that is historic in nature.

Use of Data.

All reasonable endeavors to ensure the accuracy of the work performed and any information given have been taken , however no warranty, express or implied is given to the information contained in this report beyond normal academic quality checks for publication of data and its use and should only be used for risk assessment purposes in view of the site conditions and valid interpretation of the results regarding the end use such.

Appendix 1. – Full data.

	Percentage by volume content for Sample A	Percentage by volume content for Sample B	Percentage by volume content for Sample C
Ag	0.002633	0.000652	0.000000
Al	3.584396	11.51932	3.846994
As	0.004574	0.000859	0.007930
Cd	0.000000	0.000000	0.000000
Co	0.001114	0.002505	0.001573
Cu	0.015922	0.014587	0.009133
Fe	4.107760	8.522270	4.997947
Mg	0.376151	1.622467	0.202720
Mn	0.117285	0.085814	0.176222
Ni	0.003498	0.009355	0.001587
Pb	0.434669	0.044802	0.057625
Si	7.270750	21.62658	8.962155
Sn	1.711499	0.008490	3.362941
W	0.230399	0.029402	0.673668
Zn	0.141254	0.002057	0.068612
NFM	82.00000	56.51100	62.87000
FOM	6.849765	0.565345	14.75920

Figure 4. Rresults for each sample - full data in percentage content by volume.

	Mg Kg^{-1} Concentration content for Sample A	Mg Kg^{-1} Concentration content for Sample B	Mg Kg^{-1} Concentration content for Sample C
Ag	26.333509	4.248588	0.000000
Al	35843.957253	106982.520422	38469.936413
As	45.737574	18.155822	79.298218
Cd	0.000000	0.000000	0.000000
Co	11.137478	26.466638	15.728696
Cu	159.221368	137.186758	91.327929
Fe	41077.595360	80276.655815	49979.471976
Mg	3761.507429	14966.802762	2027.199517
Mn	1172.850967	807.376180	1762.219869
Ni	34.982137	87.277599	15.868420
Pb	4346.690704	481.927893	576.249239
Si	72707.495667	198486.358004	89621.548443
Sn	17114.990441	104.805548	33629.411595
W	2303.985113	297.958403	6736.683161
Zn	1412.544186	21.805170	686.117303

Figure 5. Rresults for each sample - full data in milligrams per kilogram concentrations.

Appendix 4:

Historic Environment (Projects), Cornwall Council

Project Design for archaeological recording before/during/after works to the Union Tin Smelter, Weir Quay, Devon

Client: Devon County Council (Archaeological Officer)

Client contact: Bill Horner

Client tel: 01392 382494

Client email: bill.horner@devon.gov.uk

1 Project Background

In 1998 Listed Building Consent (No. 1299), was granted for conversion of some of the lower yard store buildings (No recording conditions were made). A subsequent application was granted for alterations to the outbuildings (Sites 32 and 33), with an archaeological recording condition attached. In 2007 Listed Building Consent (No's. 11150 & 11159), was granted for a change of use of the Count House to residential and substantial rebuilding works (Site 41). A PPG16 (para 30) archaeological recording condition was attached.

In 2009 Listed Building Consent (No. 12626) was granted to the site owners for the conversion of additional former stores (Sites 26 and 25) to a workshop and washhouse together with maintenance/repair works to the main smelter roof (Site 16) and Boveway roofs (Site 40). A PPG16 (para 30) archaeological recording condition was also attached. Concise descriptions and photographs were submitted to the WDBC Conservation Officer and his approval gained, prior to works commencing. Archaeological recording in advance of the works was a planning condition.

An archaeological impact and conservation assessment of Weir Quay (extant Union Smelter building and the remains of the Tamar Lead Smelter) was produced in November 2008 by CCC (HES).

Weir Quay lies within a constituent part of the Tamar Valley Mining Area of the Cornwall and West Devon Mining World Heritage Site (Site A10), and the Tamar Valley AONB. The Union Smelter building is protected as a Grade II Listed Building (SX46NW/2/26), and is within the Weir Quay/Bere Ferrers Conservation Area. The River Tamar is part of the Plymouth Sound and Estuary Special Area of Conservation

HES (Projects) has been asked by the client (email request sent on 30/3/09), to liaise with the site owner to undertake site recording following existing clearance works to Site 26 and before clearance works are carried out at Sites 25 and 36 (Buck 2009). In addition, recording is required at the north eastern corner of the main smelter roof prior to substantial repair works to the main beams and valleys etc. It is necessary to produce a project design for this archaeological recording, which will include the twin elements of fieldwork (Level 2 recording) and production of a report detailing site surveys and watching brief recording.

1.1 Project extent

The Union Smelter is sited at the northern end of the road leading down to Weir Quay at SX 43443 65662 (see Fig 1).

1.2 Previous archaeological work

A detailed impact and conservation assessment of the Union Smelter (part of a larger study area including the Lead Smelter to the south west) has been undertaken by CCC (HES) (Buck 2008).

1.3 Brief site history of the Union Tin Smelting Works

Tin ores from Tamar Consols and other local mines were smelted at these works. Built in the late 1840s by PN Johnson (a metallurgist as well as mining engineer) to specialise in the smelting of tin ores from other ore constituents. The deep water berth at Weir Quay, was deepened to take vessels of 400 tons, bringing South Wales coal, and ore from Spain, France, Wales and N. Ireland. In 1850 the new Pattinson de-silvering process was introduced at the lead smelting works, enabling much smaller amounts of silver to be extracted from lead ores. In 1852 the Tamar Smelting Works were sold by the mine, and closed in c1860. The Union Smelting Works were built in 1849 and operated until c1896. The smelting house was re-used as a jam factory (the troughs which had held the refining furnaces made excellent coppers for boiling Tamar Valley fruit - Buck 1998, 56). A more detailed history of the site is given in Buck (2008, Section 4.2).

2 Project aims and objectives

The purpose of the photographic and archaeological recording is:

- To ensure that any features that were previously unknown or obscured during a recent field survey (Buck 2008), and are likely to be impacted by works that have existing Listed Building Consent, are recorded (Level 2 survey) and photographed before the new works take place.
- To produce recommendations for interim recording at the Union Smelter during conversion works, for the approval of Bill Horner (Devon County Historic Environment Service), in order to minimise adverse impact upon the archaeological resource.
- To ensure that (through ongoing negotiation with Mr Moss), following clearance of part of the Union Smelter north east corner floor, a condition and descriptive survey (EH Level 2) of the roof structure is undertaken, prior to any works being undertaken to parts of the roof structure of the main smelter.
- To ensure that photographic evidence of the roof structure is taken before and after works, to record the nature and extent of the existing archaeological resource, and a record of the repair works.
- To ensure that any other site excavation works are mitigated by ongoing negotiation with Mr Moss. These will be undertaken in such a way as to allow adequate archaeological recording of remains affected by the works.
- To ensure that there is an agreed appropriate communication strategy for progress and any other issues etc with DCC (Archaeology – Bill Horner), throughout the duration of the archaeological recording element of the project.
- To record sites, features, deposits and artefacts affected by or uncovered by the works for Devon's Historic Environment Record.
- To disseminate the results of the project appropriately by production of an archaeological and arrange for the deposition of the project archive.

3 Working methods

All archaeological recording work will be undertaken according to the Institute of Field Archaeologists *Standards and Guidance for Archaeological Investigation and Recording.* Staff will follow the IFA *Code of Conduct* and *Code of Approved Practice for the Regulation of Contractual Arrangements in Archaeology.*

The principal factor in effective project delivery will be the employment of key project staff who are expert in the management and recording of the industrial heritage. Cornwall Historic Environment Service project staff are able to draw upon a substantial track record in undertaking similar work throughout Cornwall, as well as a detailed knowledge of the project area and adjacent sites.

3.1 Fieldwork: archaeological consultancy/recording before/after site works for existing

LBC works: Yard area: (Buck 2009, Sites 25, 26 and 33 – See Fig 2)

1. Devon Historic Environment Service (DHES - Bill Horner) has agreed with the impact assessment recommendations (Buck 2008, Section 7), that site consultancy/recording should be undertaken to record archaeological features affected by existing Listed Building Consents (2007?).
2. Archaeological recording in the form of Level 2 measured surveys (as appropriate), will be undertaken for those features not already identified during the impact assessment fieldwork (ie covered or obscured), where they are likely to be impacted/revealed by existing LBC works.
3. Archaeological recording in the form of photography (as appropriate), will be undertaken before any (previously unknown) archaeological sites are revealed and are to be affected by existing LBC works, and after works are finished.

3.2 Fieldwork: archaeological consultancy/recording before/after site works for existing

LBC works: Main Smelter roof: (Buck 2009, Site 16 – See Fig 2)

1. Devon Historic Environment Service (DHES - Bill Horner), has produced a brief, requesting recommendations for interim recording at the Union Smelter north east corner roof during repair works, in order to record the existing features before works and to minimise adverse impact upon the archaeological resource.
2. Devon Historic Environment Service (DHES - Bill Horner) has agreed with the impact assessment recommendations (Buck 2008, Section 7), that site consultancy/recording should be undertaken to record archaeological features that may be affected by existing Listed Building Consents (2008?), for repair and rebuilding works to the main Smelter building roof (north east corner).
3. Archaeological recording in the form of Level 2 measured surveys (tape measured as appropriate and where possible given Health & Safety constraints), will be undertaken for those features not already identified during the impact assessment fieldwork (ie covered or obscured), where they are likely to be impacted/revealed by existing LBC works.
4. Archaeological recording in the form of photography (as appropriate), will be undertaken before any (previously unknown) archaeological sites are revealed and are to be affected by existing LBC works, and after works are finished.
5. DHES has recommended an overall Monitoring Brief (liaison with site contractors/owner and periodic site visits), to ensure that the construction works, vehicle movements, tree felling etc. do not cause unintentional damage and to record any unforeseen impacts upon known archaeology.

6. If archaeological deposits of a regional or national importance are uncovered, contingency should be allowed within the works programme to review options to ensure their preservation in situ. In the event that significant remains cannot be preserved in situ, strategies for their relocation or detailed recording will be agreed with the Devon County Archaeologist.
7. The chosen site archaeologist will adhere to Health and Safety Policies (see below), under the direction of the designated Site Safety Officer.

3.3 Site liaison

- The site archaeologist will regularly liaise with Bill Horner (DHES), and the World Heritage Site Advice Team (Phil Markham), during the appropriate monitoring points as described below.

3.4 Site recording (general)

- Site drawings (plans, sections, locations of finds) will be made by pencil (4H) on drafting film; all plans will be linked to the Ordnance Survey landline map; all drawings will include standard information: site details, personnel, date, scale, north-point.
- The site archaeologist will undertake recording in line with recommendations given by IFA. Sections and plans will be drawn on site at appropriate scales which will adequately record structures or features at appropriate levels of detail, and appropriate sections reproduced in the archive report at either 1:50 or 1:100 to adequately demonstrate revealed archaeological features.
- All features and finds will be accurately located by means of a National Grid reference.
- All archaeological contexts will be described using a standard format and linked to a continuous numbering sequence.
- A location plan will be made which will allow site detail to be accurately placed within the context of the Ordnance Survey Landline mapping.
- The archaeological watching brief report will detail (and if appropriate summarise) all forms of archaeological recording that has been undertaken at the mine site.

3.5 Treatment of finds

- It is recognised that fieldwork may produce artefactual material.
- It will be important to agree the arrangements for deposition of any finds prior to the start of the project, and ensure that transfer agreements are arranged and signed.
- An allowance has been made for discussions with landowners for the deposition of archaeological finds in an appropriate museum have been included in the cost tender.
- All significant finds in stratified contexts will be plotted on a scaled base plan and described.
- All finds will be collected in sealable plastic bags which will be labelled immediately with the context number or other identifier.
- Plymouth City Museum is the designated museum. Their guidelines should be followed and accession numbers for finds and archives for each project should be obtained at the start of the project. Unless otherwise agreed, mining-related artefacts and small finds to be removed from site will be deposited at the Plymouth City Museum, pending detailed discussions over their final place of deposition or loan to other local smaller museums and interpretation centres (for example Morwellham and Tavistock) etc.

3.6 Photographic recording

To include:

- Black and white scaled photography using either a 35mm camera or medium format camera using fine grain archive quality film (400ASA).
- Provision will be made for a range of lighting conditions and the photographic equipment will be available to the historic building recording personnel listed in the WSI.
- Each shot will be carefully composed, focused and lit appropriately with a flash gun if necessary.

The photo record will comprise:

- general views
- examples of structural and architectural detail.

Methodology for the archive standard photography is set out as follows:

- Photographs of details should be taken with lenses of appropriate focal length.
- Difficulties of back-lighting should be dealt with where necessary by balancing the lighting by the use of flash.
- A range of appropriate photographic scales should be used and a metric scale included in all archive recording photographs, except where health and safety considerations make this impractical.
- Selected prints will be scanned into the archive reports.
- Black and white photographs will be archived to HER standards and incorporated into the HES photo database.
- Supporting colour photographs will be taken with a high resolution digital camera (3MP or higher), to illustrate the report and for possible presentation purposes. This will be archived electronically onto each report CD.
- Care will be taken that each shot is focused and that with delayed shutter action that camera shake does not occur. Each shot will be of appropriate quality and used for reports and/or power-point presentation.
- Digital colour photographs will be stored according to the Historic Environment Service's guidelines. Copies of the images will be provided to the client.
- The archaeological record will include a plan showing the location of the photographs reproduced in the report.

4.0 Post Fieldwork

Following completion of the fieldwork stage the results of the archaeological recording will be combined into a single concise report:

4.1 Archaeological recording report

The site report will summarise the results of the archaeological monitoring and watching brief, photographic recording and any archaeological recording treated as part of this project, and will include the following components:

- Summary
- Project background
- Aims and objectives
- Recording Methodology
- Results of archaeological recording

- Conclusions
- References
- Project archive index
- Supporting illustrations (Appendices): location map, historic maps, site excavation plans, elevations/sections, - photographs (incl Project brief/Project Design).

A draft archaeological report containing the project results, as outlined above, will be produced and circulated to the DHES Advice Team for comment within three months of completion of the project.

4.2 Final report format

- A paper copy and a digital (PDF) copy of the report, illustrations and any other files will be held in the Cornwall HER.
- One paper copy of the report, and a CD containing an electronic copy of the report and the digital photographic archive will be produced for the client. Two paper copies of the report will be sent to Bill Horner (DHES).
- Two paper copies of the report will be distributed to local Devon archives (Westcountry Studies Library – Exeter and Plymouth), one to Cornwall and national archaeological record centres.

5.0 Finds archiving

Following review with the HES Project Manager the results from the fieldwork will be collated into an archive following the Society of Museum Archaeologists Guidelines. This will involve washing and cataloguing relevant finds, the indexing and cross-referencing of photographs, drawings and relevant context records.

- All finds and samples, etc will be stored in a proper manner (being clearly labelled and marked and stored according to DHES and IFA guidelines).
- Following any necessary cleaning, stabilisation and recording, artefacts or small finds will be deposited at an appropriate location.
- All paper and photographic records will be ordered, catalogued and stored in an appropriate manner (according to HES guidelines). It is expected that the depository site for these records will be the Devon County Record Office, Exeter.
- An EH OASIS entry (on-line) will be prepared at this stage of the project summarising the site impacts for each mine and referring to each archaeological watching brief report.

5.1 Cornwall HES archive deposition

An index to the site archive will be created and the archive contents prepared for long term storage, in accordance with HES standards (which will follow Society of Museum Archaeologists Guidelines). Archiving will comprise the following:

- All correspondence relating to the project, the WSI, a single paper copy of the report together with an electronic copy on CD will be stored in an archive standard (acid-free) documentation box.
- The drawn archive will be stored in A2 plastic wallets.
- Photographic material will be stored in archive standard negative holders and archive print holders within an archive standard box.
- All black and white photographs are to be archived using captioned labels, appropriate record forms and location plans. Other photographic records to be supplied with written captions and subject to appropriate batch archiving to be held in safe archival storage.

- All paper and photographic records will be ordered, catalogued and stored in an appropriate manner (according to HES guidelines). It is expected that the ultimate repository site for the records will be the Cornwall Record Office, and in the interim they will be held at Cornwall's Historic Environment Service and in archival storage at Pound and Co, Penryn.

6 Project staff

The Historic Environment Service (Projects) has accumulated unparalleled experience in industrial archaeology, having been involved in this aspect of archaeology for the last twenty years (see the HES CV) and the specific personnel CV summary bellow). The project will be managed and carried out by an HES Senior Archaeologist with proven experience in industrial archaeology; this staff member will also carry out the historic buildings consultancy and historic buildings recording. The project manager will:

- Undertake the archaeological site recording project.
- Discuss and agree the detailed objectives and programme of each stage of the project with DHES and the clients, including arrangements for health and safety.
- Monitor progress and results for each stage.
- Edit the project report.

Key personnel within the project will be:

Colin Buck, DipCert, Senior Archaeologist. cbuck@cornwall.gov.uk

Specialist in conservation works to Cornish mining landscapes, archaeological assessments and watching brief recording since 1993. Involved in numerous projects including conservation works to many engine houses and other structural conservation works, shaft safety works and mine site access improvements, particularly in the east of Cornwall. Other projects include archaeological Impact Assessments, Conservation Management Plans and Historic Building Consultancies for the Mineral Tramways Project, East Cornwall Regeneration Project, Tamar Valley Mining Heritage Project and Caradon Hill Area Heritage Project. Involved in the preparation of policies for the Cornish Mining World Heritage Site Bid's Management Plan. Produced over 80 archaeological assessments and watching brief reports over the last fourteen years for Cornwall Archaeological Unit (now Historic Environment Service). cbuck@cornwall.gov.uk

A fuller CV for Colin Buck (Senior Archaeologist/HBC) can be provided upon request.

7 General arrangements

Timetable

The programme of works within the smelter site is ongoing. Works are currently focussed on conversion of the former yard buildings (Buck 2009, Sites 25, 26 and 33 – See Fig 2). Repair and rebuilding works are due to start in May 2009 to the former 'Count House' building at the west end of the site (Buck 2009, Sites 14, 15 and 41 – See Fig 2), and to the north east end of the main smelter roof (Buck 2009, Site 16 – See Fig 2), where there are structural repairs necessary and re-roofing. HES will require at least two weeks notice before commencement of work, in order to allow the allocation of field staff time and arrange other logistics.

Monitoring and Signing Off Condition

- Monitoring of the project will be carried out by Bill Horner (DCC) and the CHES WHS Advice Officer (Phil Markham), who should be informed 1 week in advance of the intention to start the field recording.

- The site archaeologist will liaise with Bill Horner (DCC) and the CHES WHS Advice Officer (Phil Markham) to discuss the programme, progress of work, and agree site meetings as required.

Monitoring points during the project will include:

- Approval of the WSI by Bill Horner (DHES)
- Completion of fieldwork
- Completion and distribution of archive report
- Deposition of the archive

Professional standards

The historic building and archaeological recording will be carried out to the standards of the Institute of Field Archaeologists and all work and advice will be carried out in line with the IFA Code of Conduct and Code of Approved Practice for the Regulation of Contractual Arrangements in Field Archaeology.

The Historic Environment Service is a Registered as an Archaeological Organisation with the Institute of Field Archaeologists.

As part of Planning, Transportation and Estates, Cornwall County Council, the HES has certification in BS9001 (Quality Management), BS14001 (Environmental Management), OHSAS18001 (Health, Safety and Welfare), Investors in People and Charter Mark.

Professional publications

The consultancy and archaeological recording work will be informed by the practice and philosophy contained in the following publications (copies of which are held in the HES library and regularly used for Reference):

Buck, C., 1998, *Preliminary assessment of industrial sites of archaeological importance*, CAU report

Buck, C., 2008, *Weir Quay Smelters, Devon – Impact and Conservation Assessment*, HES report

Thorpe, S. (2005), *World Heritage Site Management Plan,* HES/CCC Truro

Websites

http://www.stastier.co.uk A particularly useful website by the manufacturers of St. Astier brand lime products detailing methodologies for their application.

http://www.cornishlime.com The website of the Cornish Lime Company

http://www.matchingbrick.co.uk A useful website for those seeking matching brick for the repair of historic structures

Copyright

Copyright of all material gathered as a result of the project will be reserved to Cornwall County Council. Existing copyrights of external sources will be acknowledged where appropriate.

Compliance and Variations

Minor variations to this WSI will be discussed in liaison with the client, Bill Horner (DHES) and the WHS Planning Advice Officer (Phil Markham). Major variations may require detailed agreement from the Local Planning Authority.

Contract

The HES projects team is part of the Historic Environment (Projects), within Environment and Heritage, Cornwall Council. If accepted, the contract for this work will be between the client and Cornwall Council.

The views and recommendations expressed will be those of the Historic Environment (Projects) team and will be presented in good faith on the basis of professional judgement and on information currently available.

Health and safety

- The Service follows the County Council's *Statement of Safety Policy*. For more specific policy and guidelines the Unit uses the manual *Health and Safety in Field Archaeology* (2002) endorsed by the Standing Conference of Archaeological Unit Managers and also the Council for British Archaeology's Handbook No. 6 *Safety in Archaeological Field Work* (1989).
- The archaeological consultant will adhere to the Health and Safety Statement of the Principal Contractors.
- Prior to carrying out on-site work HES will carry out a Risk Assessment.

Insurance

As part of Cornwall County Council, HES is covered by Public Liability and Employers Liability Insurance.

This project design has been prepared by Colin Buck, Senior Archaeologist, CCC HES (Projects), archaeological consultant to the TVMHP.

Colin Buck

Senior Archaeologist

24/4/2009

Historic Environment (Projects)

Environment and Heritage

Cornwall Council

Kennal Building, Old County Hall,

Station Road, Truro, Cornwall. TR1 3AY Tel: 01872 323603, cbuck@cornwall.gov.uk

Appendix 5:
Tabulated site numbers (reference to Figure 2 and Appendix 2)

Site No.	Name/description	NGR (SX)	Survival
1	Reservoir pond	43465 65079	Extant
2	Tank	43456 65077	Unknown
3	Watercourse	43460 65073	Unknown
4	Pond	43453 65074	Extant
5	Water course	43475 65078	Unknown
6	Outhouse	43476 65073	Removed
7	Outhouse	43475 65071	Removed
8	Outhouse	43470 65066	Removed
9	Outhouse	43467 65065	Partially removed
10	Covered tank	43460 65067	Extant
11	Outhouse	43449 65071	Removed
12	Outhouse	43449 65070	Removed
13	Shed	43451 65068	Removed
14	Store for Manufactured Tin	43454 65063	Extant
15	Assay Office	43458 65056	Extant
16	Smelting House	43447 65061	Extant
17	Chimneys (3)	43448 65066 43442 65063 43443 65060	Removed
18	Reverberatory Furnace	43440 65062	Removed
19	Reverberatory Furnace	43442 65058	Removed
20	(Refining) Furnace	43446 65065	Removed
21	Store for Un-Manufactured Tin	43438 65046	Extant
22	Coal Store (Yard)	43432 65057	Extant
23	Yard	43449 65050	Extant
24	Yard	43408 65038	Extant
25	Stores	43427 65045	Extant walls
26	Stores	43425 65035	Extant walls
27	Cemented Tank	43409 65048	Possibly buried

Site No.	Name/description	NGR (SX)	Survival
28	Cemented Tank	43399 65043	Possibly buried
29	Cemented Tank	43392 65039	Possibly buried
30	Tank	43390 65045	Unknown
31	Garden shed (Packing shed ?)	43442 65082	Extant walls
32	Stores	43402 65022	Extant
33	Stores	43413 65029	Extant walls
34	Unknown feature	43400 65025	Unknown
35	Chimneys	43379 65043 43422 65041	Removed
36	Weighing machine	43436 65040	Removed
37	Iron columns supporting Smelting House roof		Extant
38	Flue in later feature		Extant
39	Hollowed buttresses	43434 65061 43436 65057	Extant
40	Office rooms above Site 21 (Boveway)	43438 65046	Extant
41	Manager's/Family accommodation (above Sites 14/15)	43455 65062	Extant