LETTEREWE
Phase 1: Survey & Evaluation

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An archaeological survey and evaluation
on behalf of Letterewe Estate
carried out by

Glasgow University Archaeological Research Division
& Scottish Analytical Services for Art & Archaeology

SCOTTISH ANALYTICAL SERVICES FOR ART & ARCHAEOLOGY

Contents

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LETTEREWE PHASE 1:

SURVEY AND ARCHAEOLOGICAL RESEARCH

by

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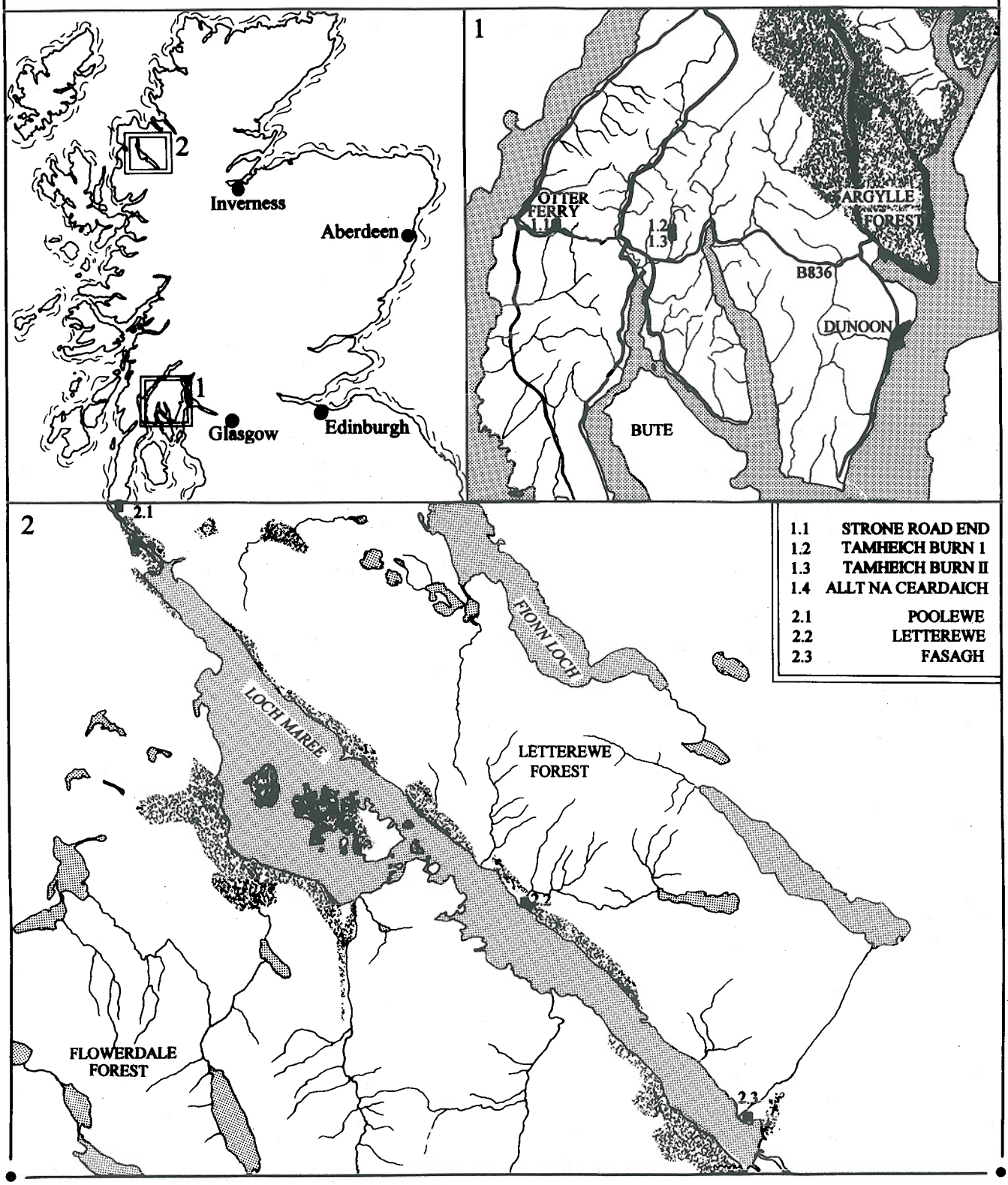
1999

Glasgow **U**niversity **A**rchaeological **R**esearch **D**ivision
Glasgow

BLOOMERIES RESEARCH PROJECT

Cowal And Loch Maree



1.0 *Executive Summary*

Survey and evaluation at Letterewe, Wester Ross have recorded a landscape which has undergone substantial changes from the early seventeenth century to the mid-nineteenth centuries. The results of a walkover and topographic survey indicate that the area of study had gone through a period of landscape transformation as part of an Improvement programme in the early nineteenth century. Those changes have in effect removed any evidence of association between the agricultural settlement pattern and the industrial exploitation of the site during the seventeenth century. Geophysical survey and trial evaluation at the earlier site on the banks of the Abhainn n/a Fùirneis (Furnace Burn) revealed the remains of a furnace and an associated charcoal storage bin, together with other structural features (including pits, walls and hearths in an adjacent field) and deposits of metallurgical waste. Analysis of the metallurgical waste suggests that the Letterewe furnace was most likely a charcoal-operated blast furnace, perhaps Scotland's earliest example. The evidence certainly indicates iron production at Letterewe in the early seventeenth century, possibly associated with Sir George Hay of Nethercliff. However, the scale and the duration of the activities may not have been long. The present state of the furnace suggests that it was abandoned after it became unusable at the end of a campaign gone wrong.

Figure 1:

Site location map.

2.0 *Introduction*

During May of 1998, Glasgow University Archaeological Research Division (GUARD) and Scottish Analytical Services for Art and Archaeology (SASAA) undertook a programme of survey and evaluation of the post-medieval iron working furnace at Letterewe, Loch Maree (NGR NG 9580 7075) and the surrounding landscape (Figure 1). This programme of work was undertaken on behalf of Mr P Van Vlissingen and Ms C Tisdall and followed on from work carried out in 1996 as part of the Scottish Bloomeries Project at both Letterewe and the nearby site of Fasagh. The assessment conducted was many-faceted, involving a desk-based assessment, walkover survey, topographic survey, geophysical survey, archaeological evaluation and archaeometallurgical study.

This project had several key aims, which had been developed to assess both the ironworking remains and the context for their operation. In consequence, the main goal of the project was to identify archaeological sites within the landscape and to incorporate them into a topographic map of the locality. This would allow a detailed impression of the relationship between the ironworks and the post-medieval industrialised landscape to be developed, and produce a clearer appreciation of elements of the landscape which were contemporary with the ironworks. The second, but equally important aim of the project was to target the

ironworks area in particular and establish a clearer understanding of the scale, methods and techniques of iron production employed at Letterewe during the seventeenth century. It was hoped that evidence would become apparent that would allow an estimation of the longevity of the smelting operation at Letterewe, something that is not made clear in the documentary histories of the site.

3.0 *Historical and Archaeological Background* —

Loch Maree has long been known as a prominent site in the early iron working industry of Scotland (Dixon 1886; Knox 1787; MacAdam 1887). Three main sites are known, at Poolewe (Red Smiddy), Fasagh and Letterewe. These have all been linked historically to Sir George Hay of Nethercliff, although evidence for this link is sparse and, as yet, archaeologically unproven. To these a number of earlier 'bloomery' sites have been noted around Loch Maree. These are known from Gharbaig, Talladale, Slattadale and Kinlochewe as well as a probable example at Tollie Bay. It is possible that Hay realised the potential for iron production in the area after seeing it in action at a bloomery works on the shores of Loch Maree.

The exact starting date for the production of iron in Loch Maree is still uncertain. The commission granted to Sir George Hay in December 1610 to manufacture iron and glass in Scotland for 31 years (Act Par Scot iv, 408; 515) would suggest a clear date, although later seventeenth century accounts and the MacRa genealogy would seem to imply a slightly earlier date (see MacPhail 1916; Lindsay 1977).

The early years of operation are not recorded in any clear documentary sources until March 1612 when, in an extraordinary letter between James VI and Sir George Hay, the ironworks are put into context (Reg Priv Coun xiv, 567). The letter makes clear that iron production has begun and been brought 'to some good perfectioune'. The letter also notes the introduction of 'strangers weill experimentid and skillfull in that arte' [iron making] to the works and the need to protect them from the Highlanders.

This letter is supported by a complaint by Sir George Hay to the Privy Council in 1613 against Lord Sinclair for interfering with the carriage of iron ore (Reg Priv Coun ix, 160). In this complaint, it is clear that Hay has identified a source of ore 'on the schoir and coast syde of Fyff besyde Dysart, and utheris pairtis thairabout' and has appointed workmen to 'wyn' [extract] the ore and vessels to transport it. This appears to suggest that the ore was mined in Fife before being shipped to Loch Maree, and is supported by a second complaint in January 1620 (Reg Priv Coun xii, 187) in which reference is made to an Englishman called Richard Bartoun who has been making 'provisioun of irne ure unto him (Sir George Hay) upoun the coast syde of Fyff' so that it might be 'schippit and careyit to his irne workis'.

The second complaint is interesting in relation to the chronology of the works in particular. MacPhail implies that the MacRa genealogy indicates that Hay stayed at Letterewe for several years before returning to the Lowlands before or during 1618 (1916, 226-7). This is also supported by Lindsay, who writes that "his [Hay's] regular attendance in Edinburgh from 1617 onwards testifies that he had left the Highlands" (1977, 51). Hay clearly retained an interest in the management of the works, which were still operating by 1620, if not later.

Although Hay's direct role in managing the iron works of Loch Maree would appear to have ceased in the early 1620s, a new venture in the area was clearly being planned as early as 1626. A series of patents and Acts of Privy Council appear throughout 1626, naming James Galloway and Nathaniel Edward as beneficiaries. This is followed in 1627 by an agreement which links the Earl of Seaforth to Galloway and Edward and, interestingly, Hay and his kinsman Lord Hay of Yester; this is the final reference to Hay in relation to the ironworks of Loch Maree.

The contents of the 1627 agreement have particular relevance for the understanding of the Loch Maree sites. The document describes the extent of the operations to be undertaken and, more critically, those already in existence:

"off all and haill o'r woodis and iroun work, forges and furnesis of in and upoun Lochew, Letterewe, Innerewe or withinn fyve mylles of any part of the same"

The mention of three locations is notable, as it suggests that iron was being produced contemporaneously at three distinct locations with the 1627 agreement. The name Letterewe is, of course, self explanatory, whereas Innerewe is the seventeenth century name for Poolewe (see Pont 1590; Blaeu 1654). The critical problem is the interpretation of Lochew. Lochewe is the original name of Loch Maree; used prior to the eighteenth century, it refers to two lochs (Loch Maree and the sea loch also known as Loch Ewe). The 1627 agreement would appear to utilise the name as that of an ironworks, which could be the original name of Fasagh. The confusion between names defining areas and names as specific indicators of place is problematic; however, it is likely that the ironworks would have been named after the areas of woodland in which they were located and which they utilised.

The agreement of 1627 appears to have been implemented by March 1629, as evidenced by a letter which informs the king that work had begun and was going well (Reg Priv Coun, 2nd series, iii, 151). After this, the references to the Loch Maree iron works tend to be "vague and contradictory" (Lindsay 1977, 52). In consequence, little is known about the functioning of the ironworks post-1628, which makes any chronology difficult to pin down. Although reference is made to 'Letter iu' in the late seventeenth century Wardlaw MS as the location of a forge and ironworks under Seaforth around 1634 (cf Lindsay 1977, 52; Mackay 1905, 270), no clear, unequivocal evidence is available to ascertain when the Letterewe site was finally abandoned as an iron works.

An interest in the historical and archaeological evidence for the iron workings on Loch Maree was late in developing. Although MacAdam (1887) and Dixon (1886) both visited sites and wrote about the subject in the 1880s, little new interest was stimulated on the Loch Maree sites until the following century. Following on from a series of papers by Lindsey (1975a; 1975b; 1977), Tabraham and Hume conducted a small trial excavation at Red Smiddy in 1978, which was finally published alongside Lewis's work at both Fasagh and Letterewe (Lewis 1984). They identified Red Smiddy as probably Scotland's earliest blast furnace, but were less sure regarding Letterewe, suggesting that it might represent a high bloomery which had been converted into a blast furnace.

It was another Scotland-wide study of iron working that next focused attention on the iron works of Loch Maree. The Scottish Bloomeries Project invested considerable time and effort in both the site of Fasagh and to a lesser degree Letterewe, as well as numerous other bloomery sites in the Highlands and Lowlands. At Fasagh, an initial season of evaluation led on to a main season of excavation and also a detailed topographic survey of the site and its environs (Atkinson & Photos-Jones 1995; 1997; Photos-Jones *et al* 1998). The main season of excavation revealed the site of Fasagh to represent a component of an integrated iron production industry based around Loch Maree.

The Scottish Bloomeries Project also undertook a survey of known and potential iron working sites in the Loch Maree area, together with a limited topographic survey of the site at Letterewe (Donnelly 1997; Lelong 1997). This, coupled with analysis of materials collected from Letterewe, has led to the project currently under discussion.

4.0 *The Surveys*

The archaeological assessment of the Letterewe area involved four main elements. The first of these was to carry out a walkover survey to identify sites which would be recorded in the topographic survey. The geophysical survey was utilised as a method of applying blanket coverage to an area deemed to have archaeological potential. Desk based assessment of aerial photographs of the Letterewe vicinity identified several possible anomalies near the furnace. Many of these were beyond the area that could feasibly be covered by geophysical survey during the time allotted, but several were identified in the western field, the area immediately adjacent to the furnace, and covering at least some proportion of it. Therefore, it was this area that was chosen for the geophysical coverage.

The topographic survey, which was carried out throughout the duration of the project, involved the accumulation of data on archaeological monuments as well as data on modern structures, field arrangements and many other aspects of landscape topography. Furthermore, as part of this survey, descriptive studies of the archaeological sites identified were undertaken. These archaeological sites ranged from the description of mundane features, such as old, collapsed field dykes, to the identification of structural remains, possibly dating to the period of industrial activity and representing either ancillary buildings, ore or charcoal stores or workers' settlements.

During the course of the assessment phase, a number of small archaeological evaluation trenches were opened. Some of these answered questions posed by the geophysical survey (trench 3), while others were opened to characterise remains identified during the walkover survey (trench 4). The two other trenches were chosen beforehand to investigate specific elements of the ironworks. Trench 2 was positioned over the furnace to allow a fuller understanding of the site and how it operated. The final trench (trench 1) was chosen to answer questions of site soil formation processes as well as to characterise possible upstanding remains.

4.1 *The Walkover Survey*

The initial phase of the assessment involved a walkover survey, the aim of which was to identify archaeological remains or clusters of features. Areas of dense undergrowth, such as bracken or thick stands of trees, were systematically covered by a team of surveyors maintaining a consistent degree of separation. This permitted a means of control in difficult areas over the recovery of obscured archaeological features.

Features identified were marked with flags, and written descriptions were compiled of each. These are included in the Site Gazetteer (section 11.1).

4.2 *The Geophysical Survey* (Figure 2)

4.2.1 *Introduction*

Geophysical survey was carried out as part of the project to evaluate the furnace site at Furnace on the shores of Loch Maree. The work was carried out in warm, dry weather over three days in May 1998.

4.2.2 *Aims and Objectives*

The aim of the survey was to reveal areas of metalworking relating to the furnace site, together with any evidence for ancillary activities. The objectives were to survey the area of the furnace; to survey the opposite bank of the river; to survey the flat area of the field to the west of the furnace, and to scan the environs of the furnace for areas of slag accumulation.

4.2.3 *Methodology*

The survey was undertaken using a Geoscan FM36 fluxgate gradiometer, taking readings in the 1 nT range at 1 m intervals across 20 m grid squares. The results were processed through Geoplot v2 and are presented as a shade plot. The grids were laid out tacheometrically using a total station, and the locations of the survey grids were incorporated within the overall landscape survey.

4.2.4 *Results*

4.2.4.1 *Scanning Report*

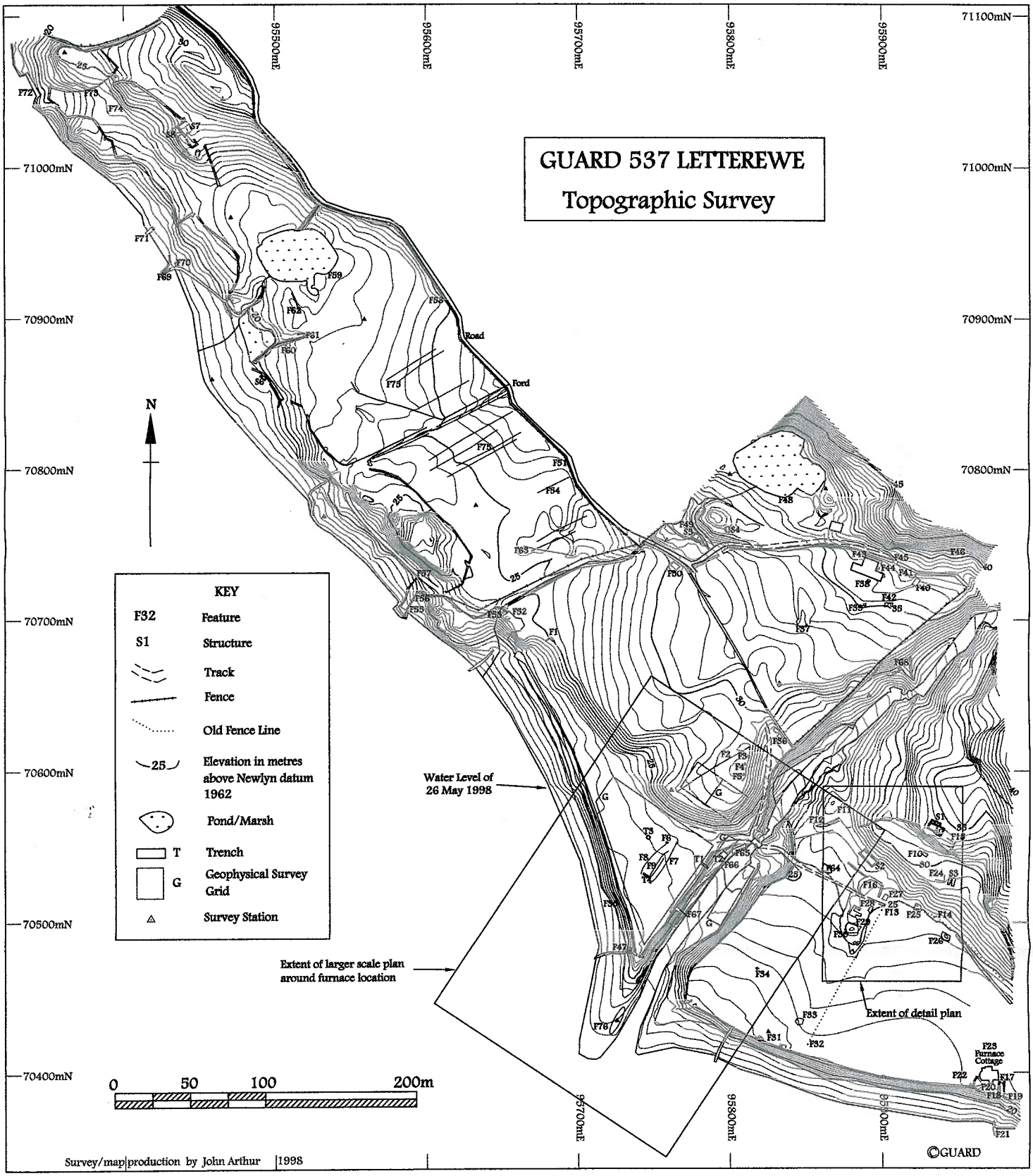
The scanning was conducted in a number of locations but concentrated largely upon the length of field wall which delineates the east edge of the adjacent field from the slope down to the river, below which the furnace stands. Other areas covered included the mound of material which had built up against the foundation of the bridge and the top of the nearer of the two bluffs overlooking the main field

Figure 2: Topographic survey plot.

Scanning along the wall and also along the slope indicated that little slag material had accumulated to the south-west of the furnace. There were occasional patches of higher readings consistent with the presence of slag, but their isolated positions and small extents suggested that they represented minor accumulations of material which might well represent later re-deposition of slag.

Scanning on top of the bluff indicated the potential for further investigation, leading to the addition of two grids in this area as part of the survey of the main field. The readings indicated that the area was magnetically active, although there was no indication of a particular concentration of high readings.

Scanning the footing of the bridge revealed that this was one area where slag and other metalworking debris had been dumped. The readings over the mound rose dramatically and in some instances rose beyond the ability of the machine to record the strength of the signal. It must be emphasised that this did not appear to be an effect of proximity to the bridge, which itself produced much lower readings. No part of the bridge was contained within the mound, nor were any of the supports.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F32 Feature
S1 Structure
Track
Fence
Old Fence Line
25 Elevation in metres above Newlyn datum 1962
Pond/Marsh
T Trench
G Geophysical Survey Grid
Survey Station
Water Level of 26 May 1998
Extent of larger scale plan around furnace location
Extent of detail plan
Road
Ford
F23 Furnace Cottage
0 50 100 200m
Survey/map production by John Arthur 1998
©GUARD

4.2.4.2 *The Furnace*

The area of the furnace was surveyed twice. The first survey covered two grids, one on either side of the field wall, measuring 20 m in length and roughly 7 m wide. Readings were taken at 1 m intervals. The furnace stands out clearly, while there are patches of high readings against the slope and also on the other side of the field wall in the main field. These may represent small dumps of slag material.

The furnace area was then re-surveyed at 0.5 m intervals to provide more detailed information. The higher resolution certainly increases the detail, showing the shape of the furnace much more clearly. The readings are entirely consistent with a major thermal event, but the greater resolution indicates that the furnace may have been a larger feature in the past, with the magnetic disturbance covering a far greater area than that of the upstanding remains. The slope also appears to have a considerable amount of magnetic material lying against it and it can be assumed that this probably represents slag material from the furnace which has been dumped here. In the area between the slope and the furnace, the flatter ground can be seen in the variation of the signals from the survey, but with some degree of magnetic variation in the readings which could mean that this area would repay further, intrusive investigation.

4.2.4.3 *The Opposite Bank*

An area of 20 m by up to 9 m was surveyed in the narrow channel between the river and the scarp of the next field. The intention was to look for metalworking activities on the opposite side of the river from the furnace. Readings were again taken at 1 m intervals.

The survey revealed three isolated patches of high readings and a possible linear feature. The latter anomaly is represented by a curving line of slightly higher readings, together with some blocks of substantially higher readings, running from the river bank out toward the scarp and then toward the river again. If this anomaly does accurately represent sub-surface conditions, then the two potential explanations are firstly that it might be a channel of the river, a point where the river temporarily shifted its course a little, or secondly that it represents an artificial channel such as a lade. The readings from it are not particularly high, but are positive against a general negative background. The anomaly does appear to be real, but it requires excavation to determine its cause.

There is a further linear anomaly apparent on the plots, running in a gentle curve across the plot on the opposite alignment to the anomaly described above. It runs across the line of that anomaly and either passes through or includes a patch of higher readings at their junction. Again, the nature of this anomaly can only be determined by excavation.

The patches of high readings may represent thermal events, consisting of high positive readings in a negative background. They are accompanied by strongly negative readings which raises the possibility that these represent thermal events. However, their limited extent makes it unlikely that they would represent remains of a smelting process. It is perhaps more likely that they represent ferrous material, possibly relating to the industrial processes on the opposite bank, rather than actual industrial activity.

4.2.4.4 *The Main Field*

For the main field, 15 grids were surveyed across the flat ground below the bluffs, including two on the summit of the nearer of the two bluffs. The survey was conducted at 1 m intervals, although one of the grids was re-surveyed at 0.5 m intervals in an attempt to provide greater definition to the results.

The grids closest to the furnace proved to be particularly active in magnetic terms. The readings were considerably jumbled, but with particular 'hot-spots' standing out. One of these, lying on the edge of the block of four grids closest to the furnace, was investigated by Trench 3 (see below). The series of linear features (F6 - F9), visible on the surface and picked out in the topographic survey, can be roughly made out in the geophysical data, but they do not explain the disturbance closer to the furnace. The readings were not consistent with a major thermal event such as the furnace, but rose to a level of between 100 and 200 nT; this range is consistent with minor thermal events such as fires. In the absence of excavation, it is difficult to explain the levels of disturbance, but it does suggest that this area of four blocks, an area of 1600 m², would repay further investigation.

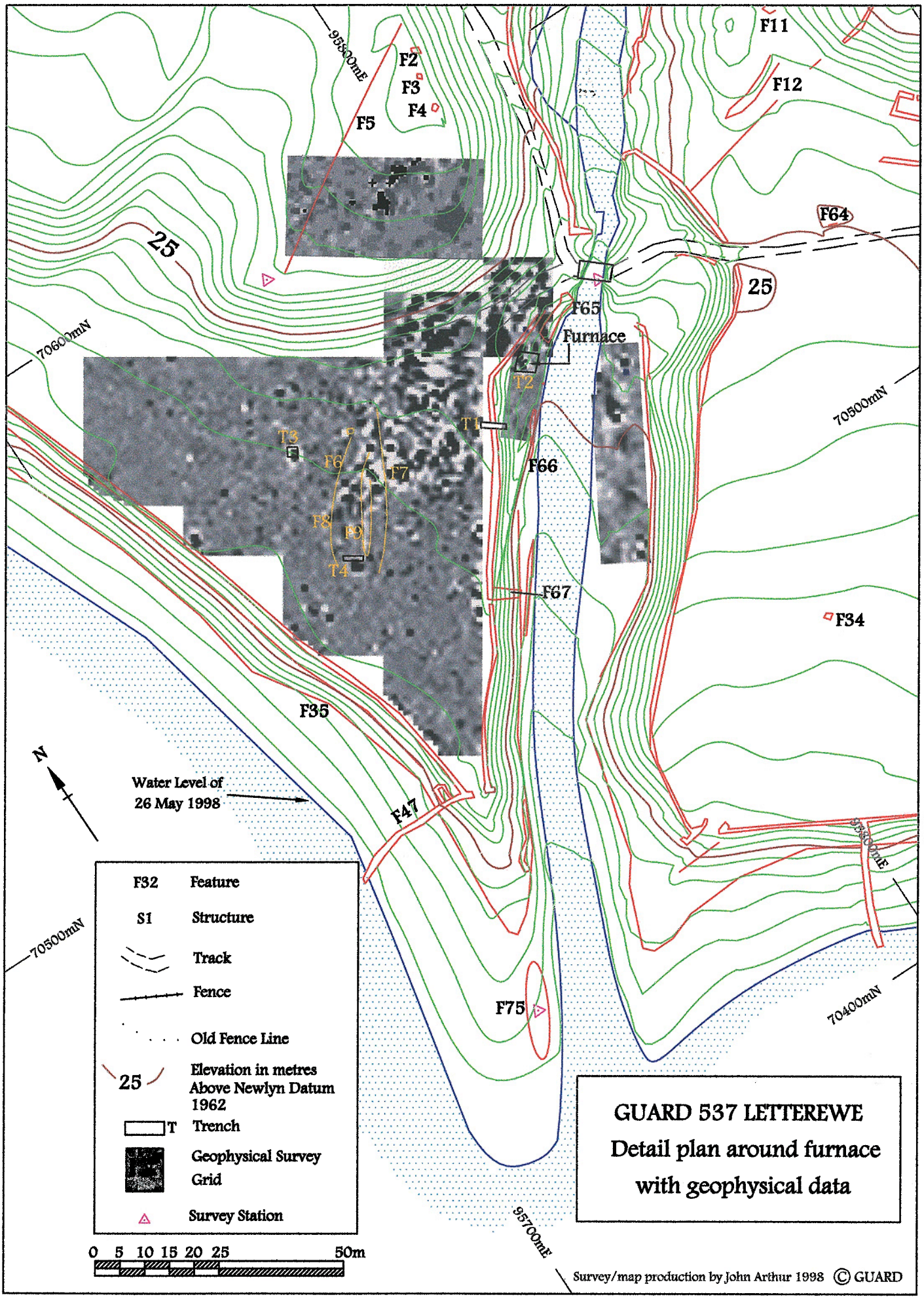
Figure 3:

Topographic/ Geophysics plot.

Processing the results produces suggestive patterns in the data, possibly indicating structural remains amongst high linear anomalies, but these can only be seen as tentative, as they are the result of processing. Because these latter plots are produced using heavily processed data, what they show is a long way from the original results and any patterns may be entirely a fortuitous result of the processing.

One of the grids in this block, that nearest the furnace, was re-surveyed at 0.5 m intervals in an attempt to derive greater detail about the nature of the anomalies in this area. This included one of the areas which had produced patterns suggestive of structures. In the new higher resolution data, processing again produced indications consistent with structural remains.

Beyond this block of four grids, the magnetic response was fairly quiet. There were patches of enhanced magnetic activity along the border of the survey area, adjacent to the furnace and relating to areas which had been noted in the scanning. This may indicate the result of dumping slag from the furnace. None of the readings suggested the likely remains of a bloomery or other iron-working site.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95900mE
70500mN
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70400mN
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F32 Feature
S1 Structure
Track
Fence
Old Fence Line
25 Elevation in metres Above Newlyn Datum 1962
T Trench
Geophysical Survey Grid
Survey Station
0 5 10 15 20 25 50m
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Detail plan around furnace
with geophysical data
Survey/map production by John Arthur 1998 © GUARD

The remainder of the flat part of the field was relatively quiet. However, there were patterns within the readings which might suggest structural remains. The most apparent and most likely of these is what appears as a large ovoid enclosure lying on a north/south alignment, north of the furnace. This may be nothing more than a random patterning in the data, but it certainly survives processing and may well represent sub-surface features.

The two grids on the summit of the nearer bluff yielded some indications of magnetic activity. The most obvious feature is on the eastern side of the plot and represents the wire around the base of a telegraph pole. Adjacent to this, however, is a patch of higher readings which may indicate human activity. None of the readings exceeds 100 nT and they are therefore unlikely to represent major thermal events, while the rather linear appearance of the anomalies suggests that they are not related to hearths. Indeed, the hints of linearity to the data could indicate a structure measuring 7 m long by about 4 m wide. However, in the absence of excavation, this can only be considered as a tentative suggestion.

4.2.5 *Conclusions*

The surveys were reasonably successful. The general picture to emerge is that other activities probably took place in the general vicinity of the furnace, but that the furnace itself is probably the only actual metalworking site in the area. The block of grids nearest the furnace would repay further investigation through excavation, and there is a possibility that structural remains would be encountered. Investigation of the large ovoid anomaly lying to the north of the first block of grids may produce evidence of earlier activities, although these may prove to have been simply agricultural in nature. Investigation on the opposite bank of the river would also be worthwhile, where there is a possibility of encountering features relating to metalworking.

The furnace survey will be tied to the trial excavation results more closely as a part of the final report. Again, further investigation would be advised for the flatter ground adjacent to the furnace along the river-bank.

4.3 *The Topographic Survey*

Following a thorough reconnaissance of the area, a total of 19 survey stations were established, forming two 'closed loop' traverses, with two of the stations being common to both loops. The survey stations were situated to provide maximum visibility of the topography and archaeological features. Both traverses were checked and computationally adjusted to produce a fixed easting, northing and elevation for each station. Having calculated the station co-ordinates, a detailed survey from each station could take

place. The survey was carried out using a Sokkia Set-5 total station electronic theodolite. The data were captured using a Psion data logger loaded with SDR-5 software, and were then processed using Leica LISCAD software, which essentially reduces the theodolite observations to a plane surface and generates a contour model. The data were then converted to .dxf format and imported into AutoCAD for final editing and map compilation. The topographic map produced shows a contour plot at 0.5 m intervals, as well as any significant archaeological features encountered during the survey.

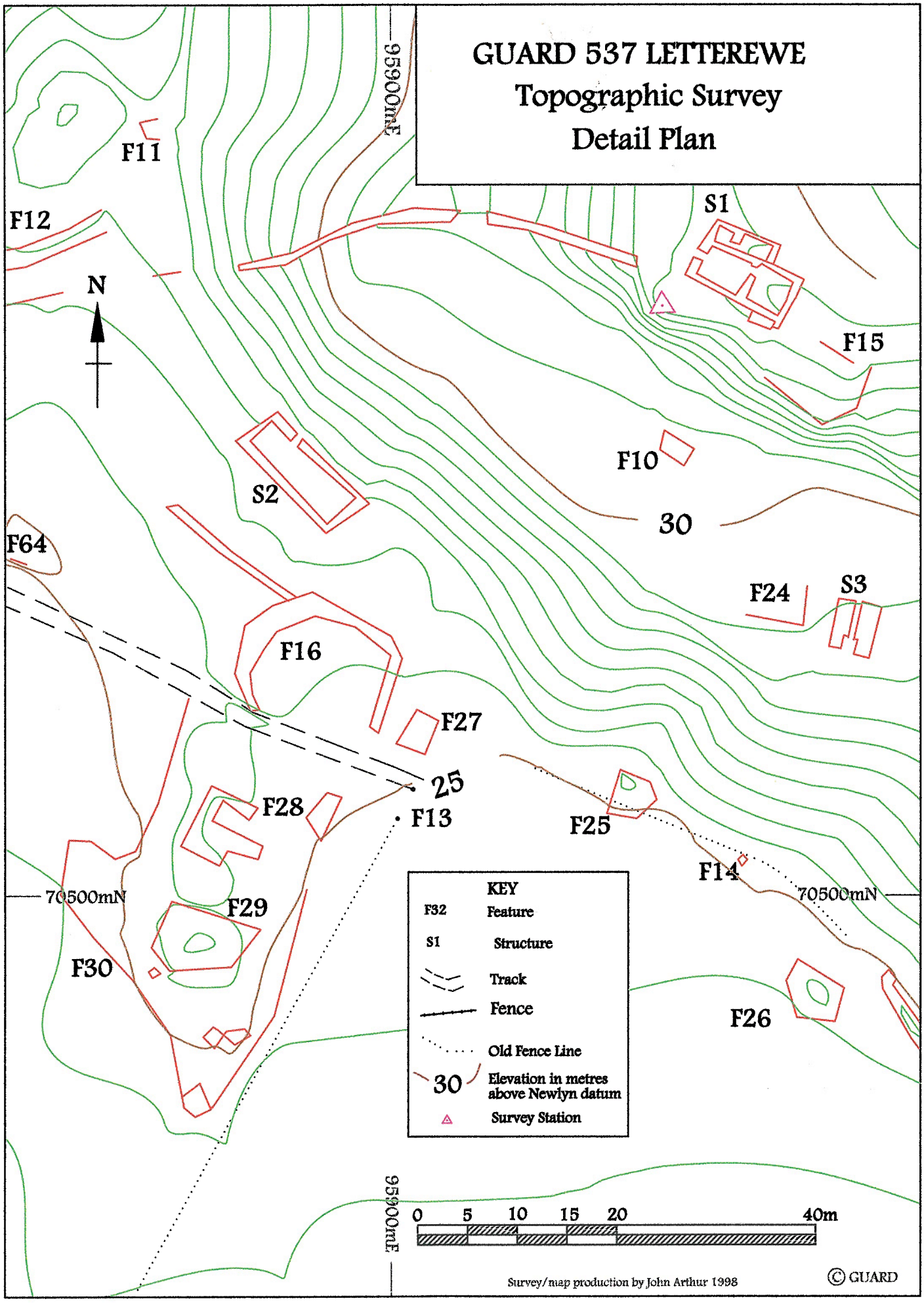
4.3.1 *Discussion of Results* (Figure 3)

The walkover survey and topographic survey results reveal a landscape which is dominated by the traces of agricultural use, including settlement sites, trackways, field boundaries and the remains of field systems (see appendix 11.1 for a full list of the sites). It is quite clear that the layout of the settlement pattern and the field system pattern has changed little since the Ordnance Survey (OS) surveyed the area in 1873. Of particular note is the group of structures located to the east of the Furnace Burn, three of which were noted as roofed at the time of the OS survey (Figure 4). In fact, the remains of a much higher number of buildings are visible on the ground, and these must pre-date the first edition survey. As such, they may indicate the location of the original settlement associated with the furnace at Letterewe; however, further work will be required to confirm this connection.

Figure 4: Topographic detail plot.

In general terms, the sub-rectangular nature of many of the field boundaries noted on the first edition OS map of the site is fairly typical of an Improvement period landscape in the Highlands, a feature which the RCAHMS have noted at Waternish on Skye in the recent past (1993). This would imply that the parcelling off and enclosing of fields was undertaken as part of a general programme of nineteenth century change and alteration at Letterewe. Interestingly, the area to the west of the main house reveals a more regular sub-division of rectilinear fields, probably undertaken because they were visible from the house. Although differences were noted in dyke construction within the survey area, there is a lack of supporting evidence to suggest phasing; however, some degree of phasing can probably b concluded.

In terms of communication links across the landscape, the existence of two piers in the survey area (one of which appears on the 1873 map) is testament to the importance of waterborne transport at Letterewe. The 1873 map also reveals three trackways or paths running from the main house in an easterly direction. Two of these tracks meet and intersect at the Furnace Burn, before extending beyond Furnace Cottage. The remains of both were recorded in the survey. The third path is more interesting, however; this path runs from the boathouse east toward the Furnace Burn, where it terminates. Closer inspection of this feature revealed it was probably built contemporaneously with the lochside field boundaries.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S1 Structure
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Old Fence Line
30 Elevation in metres above Newlyn datum
Survey Station
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Survey/map production by John Arthur 1998
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In terms of interpretation, although the east to west routes are undoubtedly related to landward access to Letterewe and beyond, and one of them may be the original seventeenth century route to the Western Isles which ran along the north of the loch, it is unclear why two trackways were necessary. The northernmost track may be related to access to the hill pasture, but this is by no means clear. The lochside track is of especial note, as it represents an element of the designed landscape around Letterewe. Its location, the fact that it terminates at the point where the Furnace Burn empties into the loch and the use of massive flat slabs in its construction all indicate that it was a walkway for the occupants of the main house. As such it would have permitted perambulation through the estate with clear views of the loch. This path undoubtedly dates from the re-ordering of the estate during the period of Improvement, probably in the early to mid-nineteenth century.

The re-ordering of the landscape at Letterewe during the nineteenth century has clearly disrupted the connection between the early seventeenth century iron works and its associated settlement pattern. However, the fact that the group of structures which includes Furnace Cottage and the structural remains to the north-west of it were known in 1873 as Furnes (OS 1873; Dixon 1886) implies that this may have been the original site of the ironworkers' settlement.

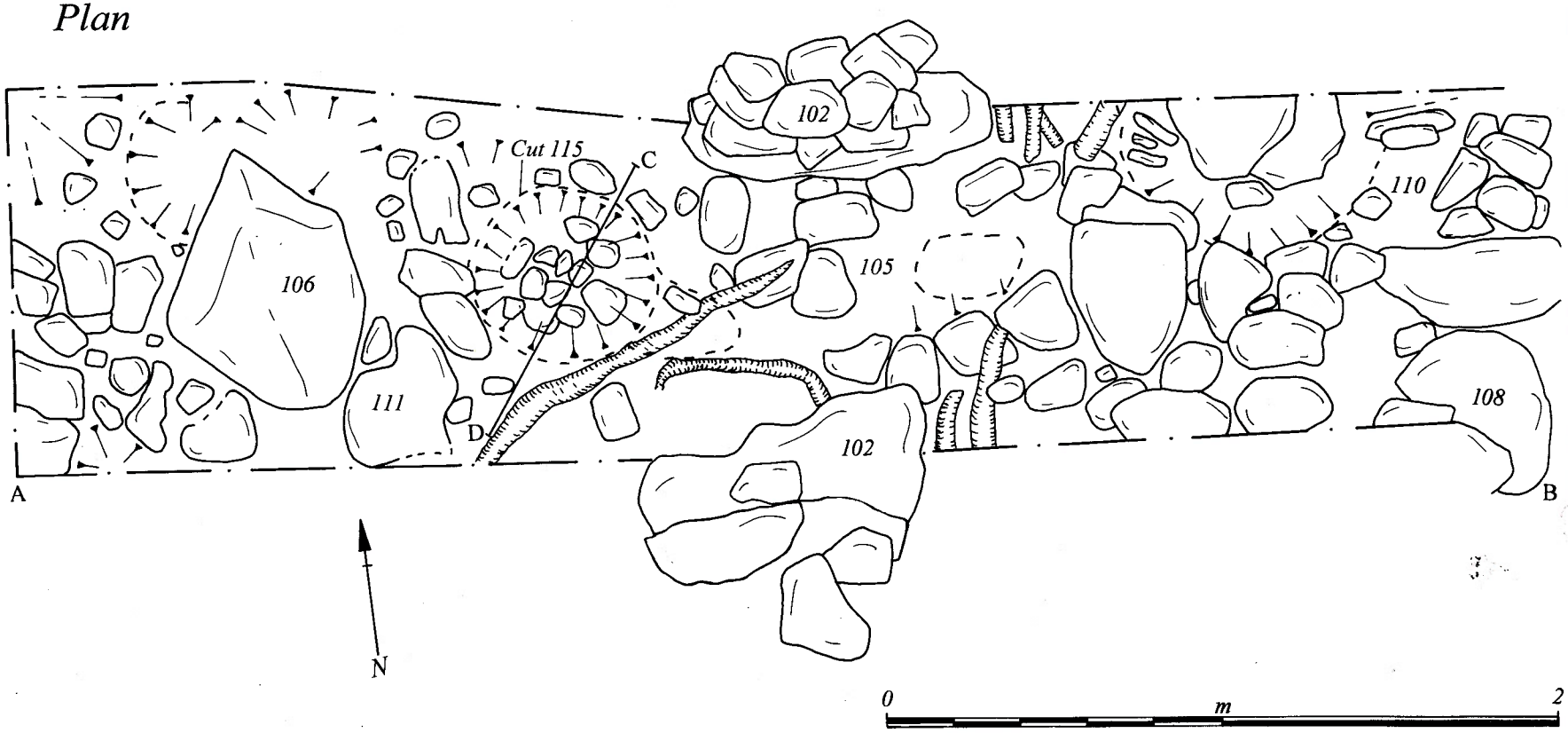
5.0 *The Archaeological Evaluation*

Archaeological investigations concentrated in the field immediately west of the *Abhainn n/a Fùirneis* (Furnace Burn). The area between the river and the field wall contains visible remains of the furnace as well as remains which could be confidently associated with it. The river bank is lined on the west by a narrow, flat terrace, bordered by a scarp rising sharply to the height of the western field. Many of the visible remains appear to have been set into this scarp, a situation frequently observed in high bloomeries or blast furnaces(Lewis 1984, 452). The eastern river bank area and the eastern field were not investigated in this manner, although archaeology relating to the furnace may survive in both these areas.

5.1 *Trench 1* (Figure 5 and Figure 6)

This initial trench was opened before the geophysical survey commenced, primarily to answer an obvious question regarding the level of soil build-up in the field to the west of the furnace. The trench also encompassed an area of possible walling which ran east/west from the field wall toward the river bank and was interpreted as perhaps relating to some form of construction, contemporary with the furnace activities. This impression was enhanced by the absence of slag in the area immediately to the north of this wall, again suggesting it represented structural remains.

TRENCH 1
Plan



The trench initially measured 4.5 m by 1 m and was orientated east/west. Two additional 0.5 m extensions were added to either end of the trench in order to answer specific archaeological problems encountered during the course of the excavation. However, the main problem encountered both here and in trench 2 was the complex and sturdy network of mature tree roots which cut across the trench and also delved into archaeological features, causing severe disruption.

5.1.1 *Sequence of Deposits* (Table 1)

The turf (101) was removed by spade; it averaged a depth of 0.12 m but reached a maximum of 0.22 m. The topsoil (107) consisted of a slightly clay-rich silt high in organic content and containing occasional cobbles and boulders related to field wall collapse and also very frequent tree roots. Charcoal was also very common, but only two pieces of slag were recovered from this layer, which represents the entire collection from the trench. The topsoil (107) was considerably thicker on the field side of the field wall, averaging 0.15 m in depth and reaching 0.25 m in places. On the steep, river bank side of the wall, the topsoil and turf together only averaged 0.05 m.

Figure 5: Trench 1 plan.

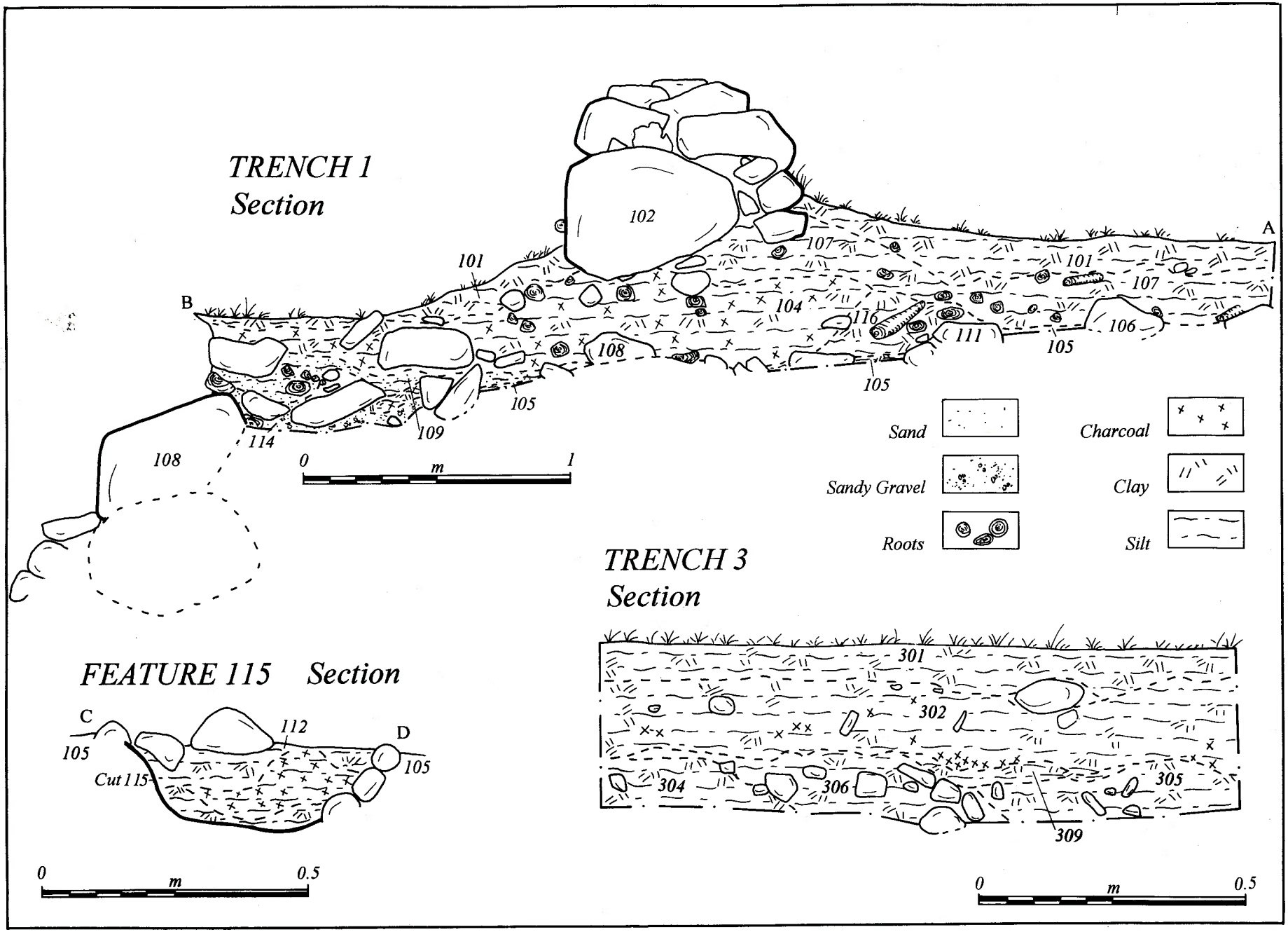
The field wall (102) was clearly shown to be a much later development than the main activity in trench 1. It rested on top of the layers associated with the deposition of charcoal. The wall had a base of large, sub-angular boulders, some as large as 0.7 m in length. On top of these, smaller cobbles and occasional pebbles created a well formed field wall 0.9 m wide and 0.75 m high. In places, large pieces of slag and furnace material were visible within this wall, but none were recovered from the portion of the wall excavated in trench 1. Below this a substantial banked deposit, extremely rich in charcoal, was found to run from directly over the possible structural walling observed running into the river bank. This deposit (103/104) ran for 2.6 m (east/west) and was 0.35 m thick in places, particularly where it had been protected underneath the current field wall (102). The deposit consisted of a dark grey to black mixture of silt clay and charcoal, with the latter material lying in lenses that consisted of approximately 80% charcoal and 20% silt. It would appear that the prime reason for this patterning was the intrusion of large tree roots mixing the deposit with topsoil and depositing organic material within it.

Context No	*Particle Size*	*Munsell*	*Colour*	*Type*	*Description*	*Slag*	*Charcoal*
101	silt/ clay	10YR 3/1	very dark grey	layer	turf line	?	occ
102	cobbles/ boulders	n/a	n/a	structure	field wall	-	-
103	silt/clay/ charcoal	10YR 3.5/1-7.5YR N2/0	dark grey to black	deposit	dump of charcoal rich material	no	v freq
104	silt/clay/ charcoal	10YR 3.5/ 1-7.5YR N2/0	dark grey to black	deposit	dump of material very rich in charcoal	no	v freq
105	silt (clayey)	10YR 4/4	dark yellowish brown	deposit	upper B horizon	no	no
106	cobbles/ boulders	10YR 5/6 (matrix)	yellowish brown	structure	possible stone surface	-	-
107	silt (clayey)	10YR 3/1	very dark grey	layer	topsoil	mod	freq
108	cobbles/ boulders	10YR 4/6 (matrix)	dark yellowish	structure brown	wall of charcoal storage bay	-	-
109	sand/silt	10YR 3/2	very dark grey brown	layer	soil build up prior to dumping of 104	no	no
110	silt/clay/ cobbles	10YR 3/1-3	very dark grey to dark brown	fill/ deposit	possible fill of structural area	no	freq
111	cobbles/ boulders	n/a	n/a	structure	walling set into 105	-	-
112	silt/clay/ cobbles	10YR 3/1	very dark grey	fill	fill of small pit/large post hole	no	freq
113	cobbles	n/a	n/a	structure	possible revetting	-	-
114	sand/gravel	10YR 6/6	yellowish brown	deposit	B horizon	no	occ
115	n/a	n/a	n/a	cut	cut of small feature 112	-	-
116	clay/silt	2.5YR 4.5/4 brown	light to mid olive	deposit	possible earth bank over 111	no	no

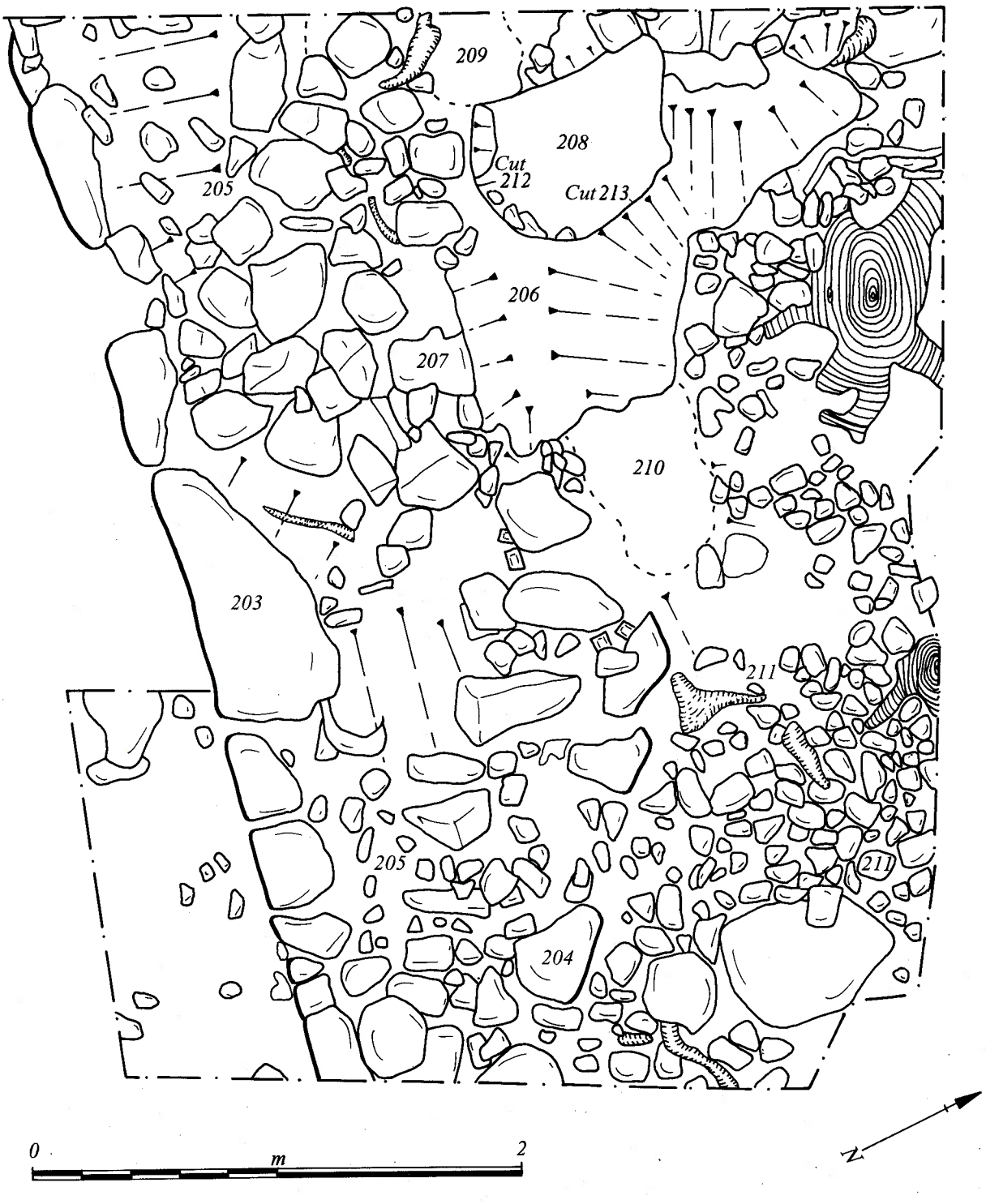
Table 1: Contexts Identified in Trench 1

Figure 6:

Trench 1 and Trench 3 - sections.


TRENCH 1
Section
102
101
107
A
B
104
116
111
106
105
108
109
114
0
m
1
Sand
Charcoal
Sandy Gravel
Clay
Roots
Silt
TRENCH 3
Section
301
302
304
306
305
309
0
m
0.5
FEATURE 115 Section
C
D
112
105
Cut 115
0
m
0.5

TRENCH 2
Plan



Deposit 103/104 covered a complex sequence of archaeological remains which remained largely unexcavated. At the west end of the trench, a surface of irregular stones was encountered (106). This appeared to be delineated on the east side by an apparent wall base (111) which lay partially under a low earth bank (116). The trench was expanded at this point in order to establish whether or not surface 106 represented a form of internal wall core. Expansion of the trench failed to prove this and it remains unclear whether this surface was a wall core or possibly an internal floor surface. The wall base and bank appeared to represent some form of structure, perhaps the back wall of the charcoal storage area, or an earlier field boundary. The wall consisted of sub-rectangular cobbles and boulders up to 0.35 m in length, set into the dark yellowish brown upper B horizon (105), a slightly silty clay. The bank which overlay the wall, mostly to the eastern side, consisted of a sterile light to mid olive brown clay/silt (116). This measured 0.6 m in width and had a maximum height of 0.25 m. The wall (111) was 0.4 m in width. There appears to have been little time between the creation of this bank and the deposition of layer 103/104, since there was no obvious intervening archaeological horizon.

Figure 7: Trench 2 plan.

Immediately inside the wall and bank, a small feature was identified (115). This measured 0.5 m in diameter and 0.25 m in depth and was broadly circular. It was filled with a very dark grey, slightly gravely, silty clay (112) with numerous charcoal inclusions and occasional cobbles. Many more cobbles appeared disturbed on or just in the top of the fill, which was heavily disrupted by tree roots. These were responsible for the charcoal inclusions which were localised around tree roots. It is possible that this feature represents a disturbed posthole, although this is currently unproven.

At the eastern end, the structural remains which had led to the siting of this particular trench proved to represent a wall (108) running perpendicular to the river bank. This was of large cobble and boulder construction, the stones being sub-angular to sub-rounded in form and measuring in excess of 0.6 m long. The wall appeared to be 0.8 m wide and survived in places to a height of 1.4 m. It remained unclear, within the confines of the narrow trench, whether the wall abutted the river bank directly or whether it turned northward and continued, parallel to it. Thus, the wall appeared to define an area of river bank and suggested some kind of bay or storage area related to the furnace.

Overlying the wall and putative interior, a very dark grey brown sandy silt was encountered (109). This contained no charcoal, ore or slag and its function was unclear. It is possible that it represents a period of inactivity which allowed this horizon to accumulate (to a depth of 0.13 m). During excavation, it was evident that this layer separated the walling and interior fill from the upper deposit 103/104. Within the northern third of the trench, a deposit was observed to fill the area demarcated by the walling (110). Similar to layer 103/104, this was a very dark grey to dark brown silt/clay with numerous cobbles and charcoal inclusions. Upon excavation it was revealed to be 0.7 m long (east/west) and 0.2 m deep. Finally, at the eastern end of the interior, an area of possible revetting was identified (113) which butted up against walling 108 and overlay a B horizon (114), richer in gravel than horizon 105.

5.1.2 *Discussion*

The primary focus of attention in trench 1 was the possible presence of a structure directly associated with the furnace activity. Excavation did in fact reveal a wall running from east to west into the bank below the current field wall, but did not prove beyond doubt the presence of a floor surface. A deposit rich in charcoal (110) did appear to fill the area defined by the wall as the possible interior. Below this, the surface of the putative interior did not appear to represent a form of laid flooring. The walling and the interior fill were sealed by horizon 109, the function of which is at present unclear. Overlying this, and thus also overlying the walling, was a dense deposit of large charcoal fragments (103/4), clearly representing unused fuel. Such deposits of fuel have been found at several bloomeries (eg Donnelly 1997; Money 1971) and blast furnace sites (Lewis 1984).

Underneath deposit 103/4, at the western end of the trench, a feature possibly representing a posthole, a linear structural feature and a possible stone surface were identified. If this trench did expose a fragment of a charcoal storage area, then the structure must have had a roof. Such a roof would either require a cruck-supporting wall or a series of postholes. The appearance of a surface outwith the linear structural element was initially confusing.

However, at Bonawe, the charcoal stores identified there posed similar problems and it was suggested that that structure may have had internal walling. These were identified as wall bases covered in collapsed turf, which would have constituted the bulk of the walling. At Letterewe, the identification of a thick deposit of charcoal fuel combined with structural remains of a storage facility would seem to support a similar interpretation. What is not known is the date of this feature, although it would seem improbable for this not to relate to the iron works. Radiocarbon dating will be required to confirm this supposition.

If the linear arrangement of bank and walling identified within trench 1 is not part of an ancillary structure or store, then it may be an old field boundary. The orientation of this boundary, where revealed in the exploratory trench, suggests a slightly different alignment running more to the west than the current field wall. This would allow space to exist to the east of this boundary for the entire furnace structure. Clearly, only further excavation can prove this theory, but it would appear that the boundary represented by walling 111 and bank 116 was at least contemporary with the considerable upstanding remains of the furnace and may even relate to the ordering of space around the main focus of this industrialised centre during the seventeenth century.

One intriguing aspect of trench 1 was the almost complete absence of slag. This is of particular note when considering its proximity to the slag dump of area 6, some 12 m to the south, the main slag dump in area 5 and the furnace only 15 m to the north. This absence of slag may suggest that post abandonment disturbance in this area has been slight. It further supports the theory that the charcoal-rich deposit identified within is part of a charcoal store.

5.2 *Trench 2* (Figure 7)

This was the main trench, designed to allow a detailed evaluation of the furnace with regard to its structural traits and origins, the reasons for its demise and its surviving archaeological viability. A trench 5 m (east/west) by 4 m (north/south) was selected, as it would encompass the majority of the upstanding remains, extending beyond an area of intense tree root disturbance. As it transpired, the tree roots played a prominent role in hindering the work in this area all the same.

5.2.1 *Sequence of Deposits* (Table 2)

Trench 2 possessed a similar turf and topsoil arrangement as the eastern half of trench 1; that is, it had a very patchy covering of grass and moss (201) overlying a thin layer of very dark grey, slightly clay-rich silt (202). Both these layers were riddled with a complex network of tree roots and included frequent fragments of furnace lining and other vitrified products. Within the narrow area opened outside the furnace wall, cobbles and boulders were also frequently encountered within the slightly deeper topsoil there. These most likely represent collapse from the furnace house.

Context No	*Particle Size*	*Munsell*	*Colour*	*Type*	*Description*	*Slag*	*Charcoal*
201	silt/clay	10YR 3/1	very dark grey	layer	turf line	?	occ
202	silt/clay	10YR 3/1	very dark grey	layer	topsoil	mod	freq
203	dressed boulders	10YR 5/2 (matrix)	grey brown	structure	exterior walling	-	-
204	dressed boulders	10YR 5/2 (matrix)	grey brown	structure	interior walling leading up to furnace	-	-
205	silt/clay/ cobbles	10YR 5/2 10YR 8/3 5YR 6/6	grey brown- - pale brown reddish yellow	deposit	mixed rubble fill of walling, with decayed sandstone	freq	occ
206	slag/iron	n/a	n/a	structure	furnace bowl	freq	-
207	sandstone	n/a	n/a	structure	fused sandstone blocks	occ	no
208	sand/silt	7.5YR 3/2	dark brown	fill	fill of channel	no	no
209	sandstone blocks	n/a	n/a	structure	dressed stone surface	-	-
210	coarse sand	5YR 4.5/3	reddish brown	deposit	fill of channel	occ	occ
211	cobbles/silt	10YR 4/2 (matrix)	dark grey brown	layer	disturbed cobbled flooring	mod	occ
212	n/a	n/a	n/a	non-context	initially thought to be furnace bowl	-	-
213	n/a	n/a	n/a	structure	arc of interior duct	-	-
214	sand	5YR 3/4 fragments	dark reddish brown	deposit	lower fill of 208, includes stones	no	no
215	sand	5YR 3/4	dark reddish brown	deposit	lower fill of 208	no	no
216	sandstone blocks	n/a	n/a	structure	interior wall of furnace bowl	-	-

Table 2: Contexts Identified in Trench 2

The surviving remains of the furnace occupied almost all of trench 2, and must extend further for several metres west and north (and probably to the south as well). The outer wall of the furnace block (203) consisted of roughly dressed sandstone boulders, ranging in size from 1 m by 0.6 m by 0.3 m down to 0.4 m by 0.3 m by 0.2 m. The inner wall (204) of both the blowing and tapping areas consisted of similar stonework, only slightly smaller in scale.

This contrasted with the fill of the wall (205), which consisted of irregular cobbles of various geological origin within a matrix of mixed, slightly silty and sandy clays. The sand in this matrix consisted of degraded sandstone and much of the mottling of the clay appeared to relate to the incorporation of degraded elements of construction. The clay varied in colour from reddish yellow, through pale brown to grey brown. This contrasted with the clay used as the matrix of the inner and outer walls, which was a uniform greyish brown. The outer wall survived for a length of at least 5.4 m; it converged with the inner wall, which ran for 2.8 m at an angle of 250°. The inner wall did not survive particularly well, whereas the outer wall survived to a height of 1.2 m and over four courses.

The furnace bowl had not survived particularly well; only around 30% was exposed intact. At least half had been lost and it remains unclear how much of the final quarter has survived, since this portion lay outside the confines of the trench. The furnace bowl consisted of a slag-like material. At the exposed level of the hearth floor this material was predominantly metallic. Given the time constraints for the excavation of this area, it was unclear whether the real base of furnace lay buried below. The upper portion of the bowl measured 1.8 m (north/south) by 1.4 m (east/west) at the bosh and survived to a height of 0.5 m. Originally the width of the bowl at the bosh must have been close to 2.5-3 m, with an internal area that was circular in plan and resembled the furnace from Glenkinglass (Lewis 1984, 451).

The furnace rested against the supporting stack, which consisted of completely and partially vitrified, small sandstone blocks (207). Their colour, which was redder than was usual for the sandstone from the site (predominantly yellow), probably relates to oxidation of iron due to the intense heat of the furnace when in operation. This is further testified to by the vitrification and fusion of these rocks.

The furnace did not appear to be directly supported by the internal wall of the furnace block (216). Instead it rested on an area of flat, rectangular slabs arranged as a corbelled layer over the top of this internal wall (209). These consisted of slabs of sandstone and granite measuring on average 0.3 m by 0.2 m by 0.08 m. These were only partially exposed, but it is assumed that they were a feature around the perimeter of the furnace bowl. They rested on a carefully constructed internal wall of dressed sandstone blocks measuring around 0.35 m by 0.15 m by 0.1 m (216). Over this risband joint, the furnace bosh had become fused to the stack's superstructure.

The area between the bowl and the internal wall consisted of a duct (213) filled with an upper layer of root penetrated, organic soil (208) and a lower horizon of coarse sand (210, 214, 215). This duct was 0.4 m high and 0.1-0.15 m wide at the top and 0.4 m wide at its lowest, exposed level. Originally the interior of this duct would have been filled with a coarse, reddish brown sand (210). At the surviving end of the furnace, where the duct survived well, a discrete patch of this sand was evident (210). This may have defined the maximum extent of the duct and thus also that of the furnace itself. The area of the duct below a rectangular hole at the back of the furnace bowl was chosen for investigation. Excavation here revealed the duct to have been filled with a dark brown silty sand with many inclusions of degraded furnace material (208). This lay over a pair of nearly identical deposits of dark reddish brown coarse sand, the upper of which contained many fragments of collapsed stonework (214) while the lower deposit was free of these fragments (215). The appearance of a duct filled with coarse sand and the method of support for the bowl has important implications for understanding the site and will be discussed below.

The north-east quarter of the trench, bounded on the south by the interior angled wall (204) and on the west by the furnace remains, consisted of a cobbled stone surface (211). This had suffered greatly from tree action. Indeed, the key area where the surface met the exterior of the furnace bowl is currently occupied by the stump of a recently felled tree. These cobbles were water-rolled and very rounded in appearance, with the occasional rectangular slab similar to (209). They sat in a matrix of a dark grey brown silty clay suggestive of a working surface. This internal area of cobbling was well defined for 1.4 m by 1.2 m, with a larger area of 2.4 m by 1.8 m possible if a portion still rich in cobbles but raised up on thick tree roots is included. The base of the bowl was also filled with these cobbles.

What was unclear here was whether these cobbles were artificially raised by the tree roots and are obscuring the hearth that would have fired the structure. There is also a high likelihood that this surface extends beyond the trench for a considerable distance, as several metres further up the river bank, patches of cobbling are clearly visible below the thin topsoil on the bank. They are unlikely to represent glacial deposits, as the river flows over exposed bedrock at this point.

5.2.2 *Discussion*

It was immediately apparent after the initial phases of excavation in this trench that the previous description of the site had incorrectly described an area of damage to the furnace as the furnace bowl (Donnelly 1997). Thus the dimensions given in the earlier work are incorrect.

Investigation of the site revealed it had been heavily disturbed, with the majority of the furnace bowl no longer in place. Furthermore, there is very little blast furnace slag in the immediate vicinity of the furnace, having being apparently removed about 25 m to the south and deposited in a heap (601). Given the disruption evident at Letterewe, it is difficult to entirely dismiss the notion that the remains represent a rebuilt or modified high bloomery, particularly since very little is known about high bloomeries in England or Scotland. High bloomeries came to prominence in Styria, Austria and followed a particular type of development of the central European tradition (Percy 1890). They are characterized by very tall shafts (up to 4-5 m high in the nineteenth century) and the capacity to make all types of iron, from wrought iron to steel and cast iron. Two criteria can be used to identify high bloomeries: a) a tall shaft and b) an iron-depleted slag which "stands" between bloomery and blast furnace (containing circa 15-20 % iron). A far more comprehensive phase of excavation would be required to resolve this main query. Among the small number of samples analysed, none matched the normal high bloomery slag composition.

Certain aspects of the site do suggest that the structure has either undergone repair or has been constructed in part from the remains of an earlier structure. Most notable was the rubble fill of mixed clay and sandstone block fragments that made up the wall's interior (205). It would be interesting to see if this matrix continues down to the foundation levels. This possibility would suggest an entire re-build in the vicinity of an earlier structure instead of the rubble fill relating to limited repair and renovation of the existing structure.

The channel between the south-western stone wall and the furnace wall is of note. It was partly filled with crushed and ground sandstone. Similar beds of sand were found inserted between the inner and outer walls for purposes of insulation at several early blast furnace sites (eg Poolewe, Glenkinglass). A dry furnace is a basic requirement for a heat-efficient process; therefore, moisture either rising from the ground or falling from above (as rain) needed to be eliminated. In the case of Letterewe, insulation may have been achieved by ensuring that air (presumably hot) circulated around the back of the furnace over a bed of sand, which kept it constantly dry.

5.3 *Trench 3* (Figure 6)

This small trench was opened over a very discrete anomaly identified during the geophysical survey. The anomaly consisted of a small area of high readings surrounded by a ring of very low readings. This area appeared to also possess very slight traces of archaeology, visible on the surface as a low upstanding mound. A trench measuring 2 m by 2 m was positioned over both the anomaly and the low mound.

5.3.1 *Sequence of Deposits* (Table 3)

The trench possessed an upper organic A horizon (turf line 301) from 0.08 m to 0.15 m in thickness, overlying the main topsoil horizon, which consisted of a very dark grey slightly clay-rich silt, high in organic content (302). This layer contained evidence of localised industrial activity in the form of frequent inclusions of small to large charcoal fragments and occasional pieces of slag. Modern pottery and glass were also present, as was a single flake of burnt flint.

Below the topsoil, an interrupted deposit of dark olive grey silt/clay (305 & 306) was encountered. This deposit was between 0.04 m and 0.10 m in thickness and covered the majority of the opened area. In places this had been cut into (possibly by plough scars) to reveal the upper B horizon (304). The dark olive grey silt/clay has been interpreted as a probable structural layer, possibly representing some form of floor level. It was littered with charcoal and slag, inclusions lacking in lower deposits. In one area, a linear feature of similar colour and particle size but with a sizeable proportion of cobbles (40%) was identified, running from north-west to south-east (303). Upon excavation, this was revealed to represent a constructional slot with cobbled packing derived from the lower deposits into which it was cut. This feature was 0.4 m wide and 0.12 m deep and extended across the trench for 1.4 m. Its cut was poorly defined and partially obscured by the cobbles, which merged into the silt/clay/cobble lower B horizon (307).

Within the putative interior of the structure (305 and 306), delineated by context (303), a small hearth or fire spot was identified, extending out from the southern baulk of the trench (309). This was represented by an upper layer rich in charcoal and fine silt, overlying a dark reddish grey, slightly silty clay, a fire-reddened layer 305/306. This feature measured 0.7 m by 0.5 m by 0.06 m in depth.

The B horizon consisted of a slag-free, dark brown, slightly silty clay (304), overlying a dark brown silt/clay/cobble layer cemented by iron enrichment (307). This lower layer represented the mineralisation of the C horizon.

5.3.2 *Discussion*

The material recovered from the topsoil in this trench suggests limited domestic activity coupled with the spreading of archaeometallurgical waste across the field through ploughing. Of more interest is the flake of burnt flint, as this hints at an earlier period of occupation, probably prehistoric.

Context No	*Particle Size*	*Munsell*	*Colour*	*Type*	*Description*	*Slag*	*Charcoal*
301	silt/clay	10YR 3/1	very dark grey	layer	turf line	?	occ
302	silt (clayey)	10YR 3/1	very dark grey	layer	topsoil	mod	freq
303	silt/clay/ cobbles	5Y 3/2	dark olive grey	structure	cobble filled construction slot	no	occ
304	clay (silty)	10YR 3/3	dark brown	deposit	upper B horizon	no	no
305	silt/clay	5Y 3/2	dark olive grey	deposit	clay spread, possibly structural	occ	freq
306	silt/clay	5Y 3/2	dark olive grey	deposit	clay spread, possibly structural	no	freq
307	silt/clay/ cobbles	10YR 3/3	dark brown	deposit	natural glacial deposit or lower B horizon	no	no
308	sand/clay	10YR 3/3	dark brown	layer	natural lens in 304		no no
309	silt/clay/ charcoal	5YR 3/2 (7.5YR 2/0)	dark reddish-grey/black	layer	small hearth, or fire spot	no	v freq

Table 3: Contexts Identified in Trench 3

The main archaeological remains within the trench consisted of the construction slot and putative interior. The staining and impregnation of the clay deposits 305 and 306 with materials associated with the period of smelting activity suggest that these features may be contemporary with the furnace (the layers immediately below these were slag- and charcoal-free). As such, this trench may represent the remains of a structure related to activities peripheral to the main smelting operations. The structure may not have been designed with permanence in mind.

The identification of a small hearth within an area which may represent the interior of a structure lends credibility to the argument that we may have identified part of the iron workers' camp. This feature was sampled in order to allow the confirmation of this deposit as being the cause of the geophysical anomaly. Furthermore, the charcoal may also prove suitable for archaeometric dating, which may prove or disprove that this structure and the furnace are contemporary. Finally, attempts will be made to identify the species used as fuel, which will provide interesting comparisons with the material used as fuel at an industrial level (see trench 1).

5.4 *Trench 4*

This trench was positioned in order to investigate a discrete geophysical anomally associated with clear, surviving structural remains suggestive of domestic rural habitation. A trench 4 m by 1 m, orientated east/west, was opened. This appeared to clip an area of linear banking and also included half of the discrete anomaly detected though geophysical prospection.

5.4.1 *Sequence of Deposits* (Table 4)

After a similar sequence to that in trench 3 of turf (401) and topsoil deposits (402), a deposit of brown silt was identified which gradually faded into a more orange brown sandy silt toward the west end of the trench. Due to the limitations imposed by the evaluation programme, it was decided to leave this deposit in place, possibly for future excavation to identify its origins (natural silting in a low-lying area or a deposit associated with agricultural or domestic activities).

Of more immediate relevance, a series of shallow pits were identified, cut into this deposit. These were clustered at the eastern end of the trench, one of them running southward into the baulk. The largest of these was identifiable for a length of 0.2 m and a width of 0.4 m before it disappeared into the baulk. This feature was 0.2 m deep and had a partially obscured, U-shaped cut (407). This was filled with a dark greyish brown silt containing little save for a few angular pebbles (408).

A very short distance to the east of pit 407, two intercutting features were detected (403 & 405). The upper of these was a shallow feature, 0.22 m by 0.2 m by 0.09 m deep, cut into the middle of the fill of the lower feature. This had a very dark grey, slightly sandy silt/clay fill with substantial quantities of charcoal and occasional pebbles (406). It is possible that this may represent the more organic upper fill of pit 403, as opposed to a separate feature. The lower of these, feature (403), measured 0.5 m in diameter at its top, reducing to 0.2 m in width at its base at a depth of 0.15 m. The fill was a dark greyish brown sand/silt with numerous pebbles and tree roots (404).

Context No	*Particle Size*	*Munsell*	*Colour*	*Type*	*Description*	*Slag*	*Charcoal*
401	silt/clay	10YR 3/1	very dark grey	layer	turf line	?	occ
402	silt (clayey)	10YR 3/1	very dark grey	layer	topsoil	mod	freq
403	n/a	n/a	n/a	cut	bowl shaped cut of small pit	-	-
404	sand/silt	10YR 3/2	dark greyish brown	fill	fill of 403	no	no
405	n/a	n/a	n/a	cut	cut of linear feature	-	-
406	sand/silt/ clay	10YR 3/1	very dark grey	fill	fill of 405	no	freq
407	n/a	n/a	n/a	cut	cut of pit	-	-
408	silt	2.5YR 3/2	dark greyish brown	fill	fill of 407	no	no

Table 4: Contexts Identified in Trench 4

5.4.2 *Discussion*

No apparent function can be discerned for these features, as it is not clear whether they represented structural elements or pits for the disposal of waste (in one case the extent of the feature is unknown). What is clear is that there is considerable archaeology surviving in the area in direct association with a visible upstanding monument suggestive of a structure, probably domestic.

Although no finds were recovered from the features identified, large quantities of nineteenth/twentieth century pottery and glass were recovered from the topsoil, along with archaeometallurgical waste products. The quantity of pottery is far greater than from the other three trenches, even added together, and this would appear to confirm the assumption that the contents of the trench represented an area of activity associated with waste from a domestic structure.

5.5 *Area 5*

It is at this location that the initial assessment of the *Abhainn n/a Fùirneis* identified substantial quantities of slag that were interpreted as the remains of a possible slag heap. It was observed that these remains were suffering from active erosion (Donnelly 1997). As such, material from this locality is likely to occur in lesser concentrations, further downstream. The area of slag identifiable on the surface is not great, perhaps only 4-5 m (east/west) by 7 m (north/south), but the local topography suggests that a considerably larger area may be masked by a subsequent build-up of soil against the field wall.

Geophysical prospection in the vicinity revealed extremely high levels of magnetic activity over a larger area than identified on the surface. This suggested that the slag deposit extends over a larger area than is identifiable as surface remains. Samples of slag from this location have been gathered by the current investigators on three separate occasions, twice in 1996 (August and October) and during the current season of investigation (see below for further discussion).

A short distance south of area 5, a small surviving portion of walling juts out from below the existing field wall and runs due south for 3 m (Donnelly 1997; Lelong 1997). This wall includes within its makeup fragments of slag. Consequently, it was built at some time after the initial phase of smelting activity at Letterewe. However, how long after is questionable, as elsewhere it has been proven that smelters frequently recycled waste products such as slag and the walling identified was clearly earlier than the standing field wall.

5.6 *Area 6*

A distance of about 25 m south of the furnace, there is another area rich in slag. This was identified during the initial survey phase (Donnelly 1997) and appeared to lie adjacent to an area free of slag but containing small yet significant quantities of ore. This material was collected in 1996 for analysis. Since then, no further ore has been noted in this area. It would appear that the area initially interpreted as the remains of the ore storage area was either a fortuitous occurrence or that erosion has been slow in revealing new ore deposits from below the field wall. Ore was recovered from the slag-rich area, although this was only in very small amounts.

The slag from this area differs from that found in area 5; it appears to relate to the operation of a blast furnace as opposed to a bloomery.

5.7 *Areas 7 and 8*

Either side of the mouth of the *Abhainn n/a Fùirneis*, deposits of slag were identified. These are located along the sides of the gravel spits which extend out into the loch. The quantities of slag discovered on these spits is not great, and it is unlikely that they represent the remains of considerable slag heaps that have been eroded. Slag held in the flow of the river in spate would have escaped to be deposited here, as the river lost its energy upon entering the body of the loch. Thus it would appear that this material indicates industrial processes occurring upriver.

In its physical appearance, the slag resembles material associated with glass working. Local traditions recount the involvement of Sir George Hay in this practice on the banks of Loch Maree, as he was known to have conducted similar operations at his main centre of activity in Fife. Much of the slag's distinctive appearance may relate to post-depositional factors such as submergence and transportation within a body of water, exposure on the spits and occasional (seasonal) inundation by the loch.

6.0 *Material Analyses: The Letterewe Industrial Waste as a Means of Characterising the Site*

The materials examination of the metallurgical remains from Letterewe Furnace was based on X-ray diffraction (XRD) and Scanning Electron Microscopy with energy dispersive XRF (SEM-EDAX) analysis of a select number of samples. Most samples, primarily slag, were chosen from different contexts but focusing on and around the furnace itself. The purpose of the analyses was to begin to address the crucial question as to whether Letterewe furnace was 'Scotland's earliest blast furnace' (Lewis 1984). The results of the analyses presented here can only be preliminary, given the complexity of the furnace materials and design, the poor state of its preservation and the limited level of excavation undertaken so far. Furthermore, given that chemically and mineralogically diverse types of metallurgical waste were found at different places within the site, piecing together all stages of Sir George Hay's metal-making activities at Letterewe will need to involve a longer term study.

The metallurgical waste examined here can be divided in the three groups:

(a) bloomery type slags forming a slag heap to the north of the site (area 5);

(b) blast furnace type slags, forming a slag heap to the south of the site (area 6), and

(c) industrial waste, the product of the reaction of metal and slag with the furnace interior.

Fragments of ore were also present at the site and have been treated below as a separate group (see Section 5.1).

All samples analysed optically and with the SEM were sectioned and mounted on metallographic resin. They were ground and polished with a series of diamond pastes, etched and subjected to hardness testing (the metallic ones).

6.1 *The Ores*

Samples of iron ore were found on the site, associated with the slag heap to the south (area 6). XRD analysis of a small sample showed that it was high grade hematite (see fig. LAX). In addition to hematite, other types of ore are thought to have been used at Letterewe (see discussion below).

6.2 *Group I: Bloomery Type Slags*

These samples derive from the slag heap (501 in area 5) to the north of the furnace, spreading over an area of *c* 4 by 4 square metres and sloping gently down to the stream. Indeed, part of the embankment was built with these slags. The majority are of the typical Highland bloomery (smelting) slag, purplish-black in colour, and either relatively light, amorphous and spongy in appearance or dense and with the characteristic ropy surface associated with tapped slags. Sample LA48 belongs to that group.

6.2.1 *Sample LA48*

Provenance: (501) slag heap

Description: purplish-black, dense slag

SEM-examination and Analysis

This section presents three mineralogically distinct phases (see OM photo below) which include a) dendrites of wustite (FeO), b) long, well-shaped needles of fayalite ($2FeO.SiO_2$) and an interstitial material (a glassy matrix), consisting of an alumina-silica rich phase with some manganese (10% MnO) and only 2% calcium (CaO). Analysis showed that both wustite and fayalite are rich in manganese with little phosphorus and sulphur present (see Table 5).

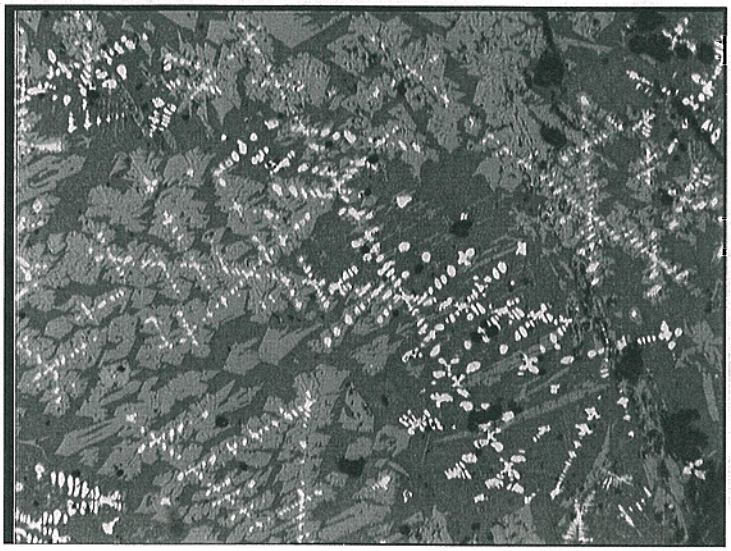


Plate 1:

LA48: Fine dendrites of wustite (white), criss-crossing fine, wedge-shaped lathes of fayalite, in a glassy matrix (x200).

6.3 *Group II: Blast Furnace Slags*

The samples belonging to this group are mainly associated with the slag heap to the south of the furnace (601 in area 6). They are glassy, with a green or black matte colour giving the appearance of severely weathered slag. In fact, this dull appearance can be seen both externally and on a freshly fractured surface. The results of the analyses on two samples are presented here. LA7A originates from trench 3, in the field to the west of the furnace, and presumably represents a scatter deriving from the main heap (601), while LA49A comes from the slag heap proper (601).

6.3.1 *Sample LA7A*

Provenance: (7/302)

Description: glassy and black on the exterior with evidence of fragments of charcoal trapped within. In section the sample looks grey or white and shows mild surface porosity.

SEM-examination and Analysis

The matrix is glassy, even at a micro level, showing little crystallinity. Metallic iron inclusions are scattered throughout the matrix; they are rich in phosphorus and silicon (see fig. LA7A below and Table 5 of analyses). The chemical composition is that of a calcium aluminium silicate with small amounts of magnesium, manganese and titanium. Iron content does not exceed 5% (FeO).

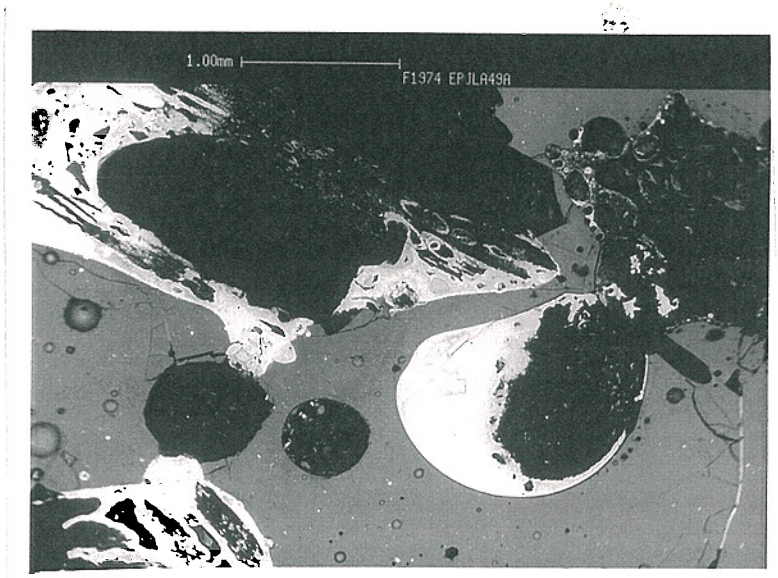


Plate 2:

LA7A: *SEM-BS image of LA7A at low magnification (bar: 1 mm); grey area is silicate matrix and bright white circular (or other) areas are metallic iron, rich in phosphorus; black areas are pores.*

6.3.2 *Sample LA49A*

Provenance: (601)

Description: large fragments of glassy slag, from the main slag heap (601). The original piece is cylindrical in section and 150 mm on its long axis by 40 mm on its short axis; large (0.5 mm) gas holes are noted on the surface. This sample resembles the "Poolewe type" of blast furnace slag.

SEM-examination and Analysis

Although the sample is glassy in appearance, it actually shows crystallinity on a micro level. Two phases can be seen: a light and a dark together with metallic, phosphorous-rich iron inclusions. The light phase contains all elements, while the dark phase consists of alumina, silica and calcium (but not potassium). Very little phosphorus is present within the glassy matrix.

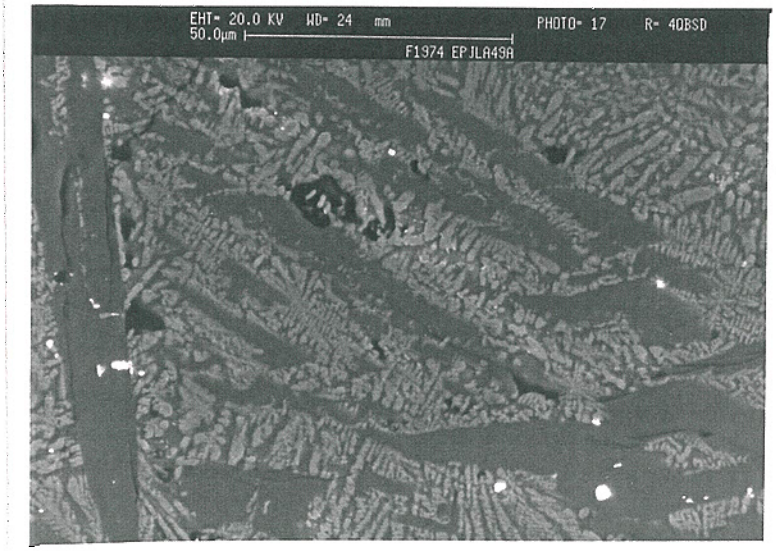


Plate 3:

LA49A: *SEM-BS image of sample LA49A (bar=50 microns). Dark phase is a calcium alumina-silicate, while the light phase represents the matrix. Small metallic inclusions are metallic iron with small amounts of silica and phosphorus.*

6.4 *Group III: Furnace Wall Industrial Waste*

These samples are neither metallurgical slag nor metal artefacts. They comprise both slag and metal and derive from the two extant walls of the furnace, the east/west-running wall (LA21, LA22, LA40) and the north/south-running wall (LA28, LA29, LA30). Strictly speaking they classify as furnace wall fragments but metallic iron, presumably from the contents of the furnace, has partially reacted with the furnace lining. The aim of the analyses was to establish the nature of this iron as a means of identifying the type of metal produced within the furnace.

6.4.1 *Sample LA21B*

Provenance: (feature 206) bottom of east/west-running wall, sample of metallic iron

SEM-examination and Analysis

The section consists of a silica-rich envelope surrounding a metal core. The metal core consists of large, equiaxial ferrite grains which include long carbide (or nitride?) needles. Some phosphorous is also present. Three hardness readings have been taken at various points within this uniform sample, ranging from 128 to 147 in the Vickers scale and with a 100 gr weight. The large grains formed under a slow cooling rate within the furnace. The slag inclusions within the metal are potassium-aluminium silicates. Other silica-rich inclusions include magnesium-potassium silicates or magnesium-calcium silicates.

In conclusion, the metal is not white or grey cast iron but wrought iron, albeit with carbide/nitride needles. The potassium-aluminium silicates and the potassium magnesium silicates suggest reaction of the furnace wall material (quartz and K-rich feldspars) with the magnesium/aluminium rich ore/slag.

6.4.2 *Sample LA28*

Provenance: feature 206

Description: on its the exterior, the sample appears uniformly glassy and at places porous. In section, it is made up of phases with different textures; it is mildly magnetic.

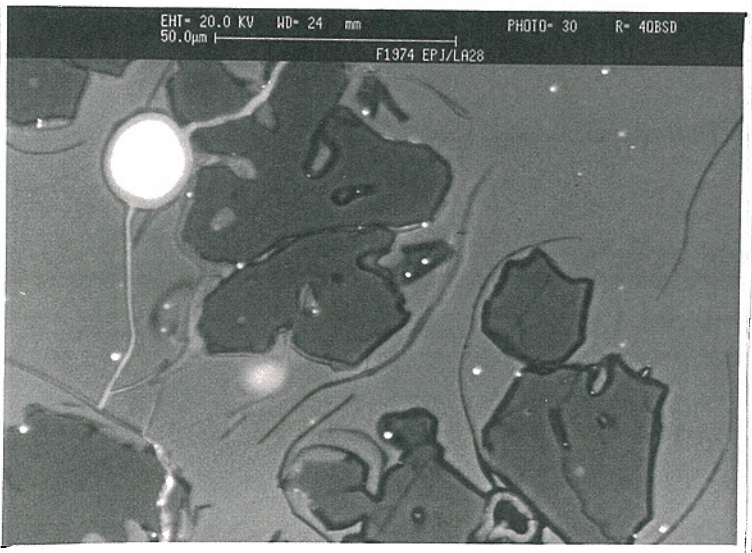
SEM-examination and Analysis

Two silicate phases are obvious: one consisting of potassium, aluminium silicate (dark in SEM-BS photos LA28.30 and LA28.32) and a surrounding glassy matrix (light phase) of potassium silicate, but with small amounts of sodium, magnesium, calcium, manganese and iron. The metallic inclusions are primarily iron with silicon and phosphorous. The presence of manganese sulphide inclusions is also noted (SEM-BS photo LA28.32) amidst inclusions of metallic iron. These are the product of the reaction between the manganese-rich bloomery slag used as ore and the sulphide (as marcasite) in the siderite ore.

XRD analysis: leucite ($KAlSi_2O_6$) has been clearly identified as the main phase within this sample.

Conclusions

The high K- content suggests that this is not a blast furnace slag but rather the product of the reaction of the wall material /lining with the slag contents of the furnace. Metallic iron inclusions are also present in the form of round prills rich in silicon and phosphorus. Smaller inclusions are Mn-S.



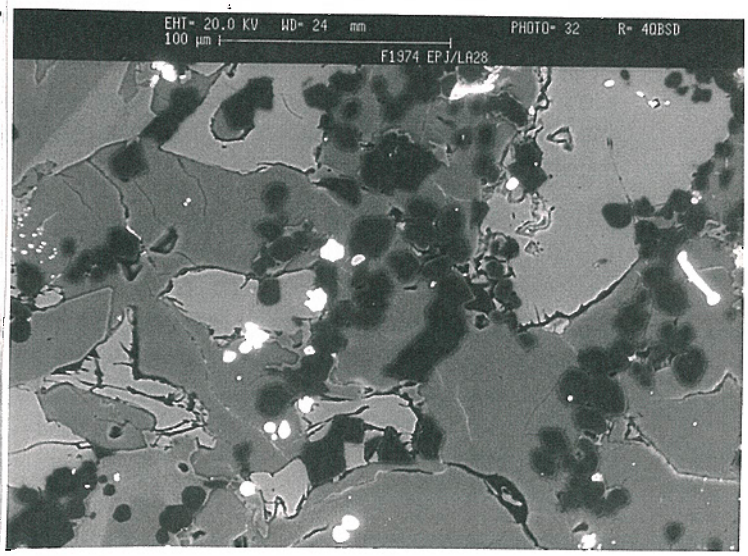


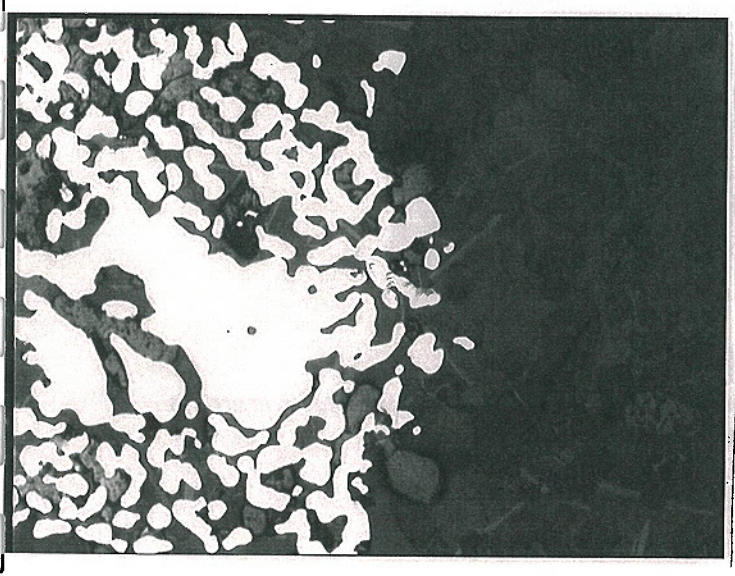
Plate 4 and Plate 5:

LA28.30 and LA28.32: *SEM-BS photos LA28.30 and LA28.32 (bar=50 microns and 100 microns respectively) showing a) leucite (dark grey grains), b) quartz (light grey) and c) a potassium-rich silicate matrix. Metallic iron and Mn-S inclusions are present (bright white).*

6.4.3 *Sample LA29*

Provenance: (feature 206) bottom of the north/south-running wall
LA29a: large grains of ferrite representing unconsolidated bloom (see OM photo below left, x50).

LA29b: unconsolidated bloom surrounded by an envelope of potassium-rich silicate matrix (see SEM-BS image below).



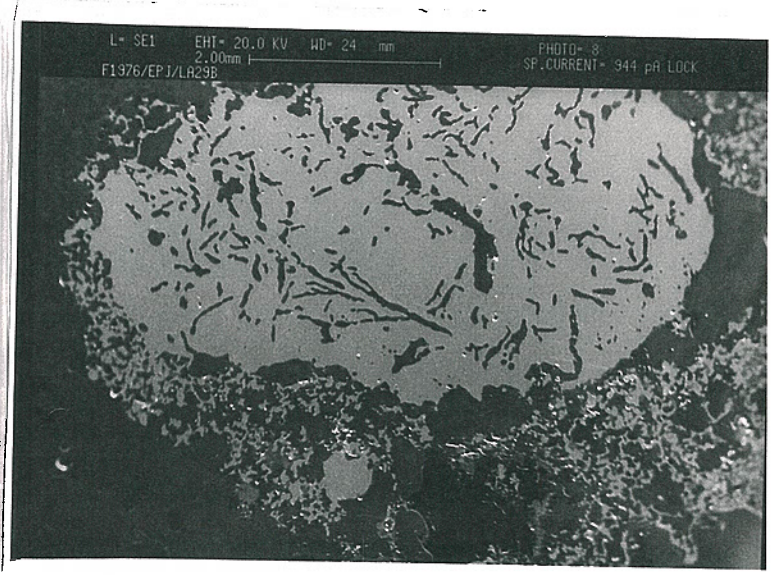


Plate 6 and Plate 7:

SEM-BS of LA29b (bar= 2 mm). 5 mm long iron inclusion within a larger section of unconsolidated "bloom" or wrought iron (light grey) surrounded by a potassium-rich silica matrix (dark grey); OM photograph of large grains of ferrite in LA29b representing unconsolidated bloom, x50.

6.4.4 *LA30*

Provenance: (feature 206) vitrified stone from mid-point of north/south wall of furnace.

Description: on the exterior, this sample has the appearance of vitrified stone; it is glassy (black) in places. The interior seems to be unaltered by heat.

SEM-examination and Analysis

Four mineralogically distinct phases were evident: a) quartz inclusions which appear to have been little modified by heat; b) potassium-feldspars (dark phase, SEM-BS photo LA30. 21); c) a metallic looking phase (bright white), perhaps FeO, and d) a fayalitic type phase ($2FeO.SiO_2$); see Table of Analyses. Area analysis clearly points to a quartz- and silicate-rich material of non glassy composition.

Conclusions

This is a sandstone, part of the building material of the furnace, which has been heated to a high temperature but not high enough to effect any changes in the shape of the quartz inclusions. The metallic-looking or perhaps purely metallic phase requires further investigation.

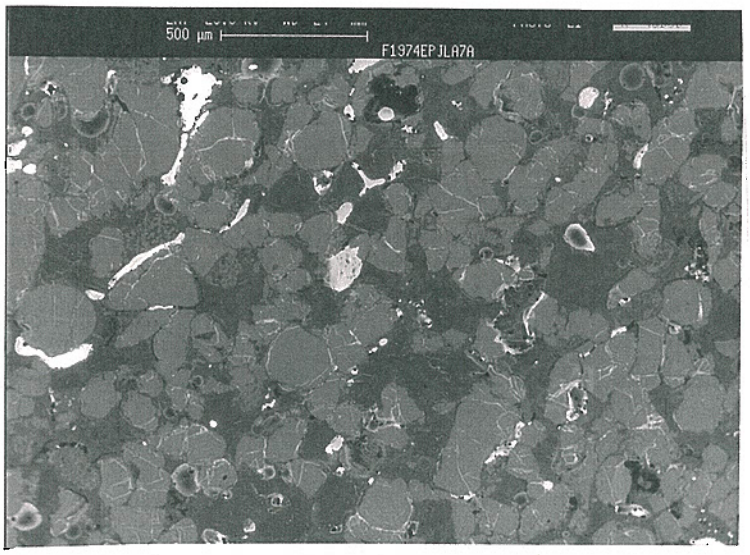


Plate 8:

LA30: *SEM-BS image of sample LA30 (bar=500 microns). Dark grey phase is a potassium feldspar, light grey is quartz.*

6.4.5 *Sample LA36*

Provenance: (feature 206), bottom of the hearth

Metallic iron: ferritic iron with small amounts of carbides and possibly phosphorous which explain increased hardness (see Table 1).

XRD analysis: the sample contains four phases, magnetite, hematite, wustite and goethite, most likely representing different stages of oxidation/weathering of originally metallic iron and/or wustite.

6.4.6 *Sample LA40b*

Provenance: (206) east/west wall near the top. This face is rock-hard and sparks when it is struck.

Description: slaggy grey and white on the surface. In section porous, with small pore size light and frothy.

Optical examination: the sample consists of two areas: a) a core of metallic iron with a non-crystalline ?silicate phase trapped within its interstices. The metal is not consolidated, reminiscent of a bloom; and b) a number of distinct non crystalline consisting of three shades of grey. All these phases are unusual and difficult to characterise without the SEM-EDAX.

6.5 *Materials Analyses: Discussion*

6.5.1 *The Ores*

Two types of ores have been used in the blast furnace at Letterewe: a) a hematite ore similar to that identified on site, and b) most likely a siderite ore or clay band ironstone known to contain phosphorous. Hematite ore is available locally, while siderite ores occur in many locations in Scotland (Hall and Photos-Jones, in press) in association with clay or the blackband ironstones.

The above is corroborated by documentary sources. It is known that Sir George Hay brought siderite ore from Fife to charge his furnaces (Reg. Priv. Coun., ix, 160; Reg. Priv. Coun., xii, 187). In general, it is difficult to separate the clay component from the siderite ore; therefore aluminium, magnesium, titanium and calcium, to mention a few of the elements present, would be carried into the slag and in the process make the ore self-fluxing. Apart from the above, marcasite (FeS) is also thought to be a common occurrence within the siderites. Presumably the bringing in of ore to Loch Maree ensured independence from local ore resources, namely the bog ore as well as locally occurring hematite. In conclusion, it is argued that both hematite as well as siderite were charged in the blast furnace at Letterewe.

A third type of 'ore' may have been available at Letterewe, namely the bloomery slags of earlier processes and those clearly identified with the northern slag heap, in area 6. This suggestion is put forward here on two grounds: a) the presence of high manganese content within the blast furnace slag, compatible with that in the bloomery slags, and b) the high iron content within the bloomery slag (up to 70% FeO), which made the slags a readily available source of iron. There were a number of bloomeries operating on both shores of Loch Maree.

6.5.2 *Metallurgical Waste and Their Metal*

Tylecote mentions (1986, 216) that among the early charcoal-operated furnaces, it was not only possible but common practice to add bloomery slag as a source of iron to the blast furnaces in combination with the ore. However, it was essential to add calcium to replace the iron from the slag and release it to the metal-forming calcium silicate phases. The blast furnace slag should contain only a small amount of iron (less than *c* 5%). Macadam's analyses suggested that the slag from Poolewe contained *c* 1-14% iron (Macadam 1887, 90), but Tylecote's analyses showed that the iron content was much higher, *c* 20% with 14% lime and *c* 50% silica. Our own analyses of Letterewe slag suggest iron contents not in excess of 5-6% FeO with *c* 10% CaO, c18% Al_2O_3 and *c* 50% SiO_2 (see Table 1).

Thus, on the basis of these preliminary results, it can be argued that the Letterewe furnace is indeed a blast furnace and not a high bloomery as previously suggested. Slag from the latter usually contains quantities of iron which fall half way between bloomery and blast furnace slag. The presence of the bloomery slag (of the conventional type) is interpreted here as feed rather than as product.

The analysis of round iron inclusions trapped within the slag clearly show silicon and phosphorus rich iron typical of pig iron. However, no clearly identifiable structures of grey or white cast iron were evident in the samples analysed, similar to those obtained from Poolewe (see OM photo below, with their characteristic graphite flakes). The addition of phosphorus would have made the metal run more freely and over a longer distance (ie retarding its cooling). Cannon could have been cast readily and directly from the tapping arch, but at Letterewe it is perhaps more likely that it would have been cast piecemeal.

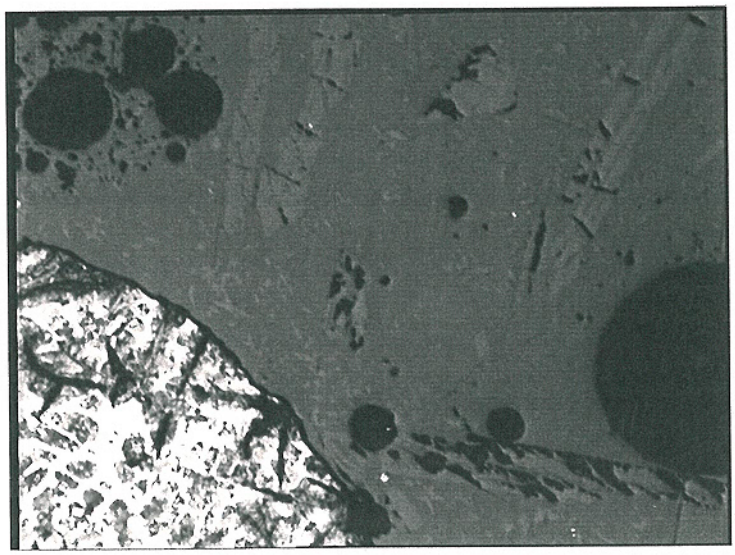


Plate 9:

OM photo of Poolewe blast furnace slag with characteristic magnesium silicate needles and a large inclusion of grey cast iron (bright phase in bottom left); the graphite (black) flakes are obvious and so is the pearlite (grey) phase within the metal.

6.5.3 *Furnace Building Materials and Reaction Products*

This group of so-called slag actually represents the product of reaction of the furnace wall/lining with the contents of the furnace, presumably both slag and metal, but primarily metal. Since this reaction is quite advanced, the boundaries between contents and container were blurred. When it became evident that the base of the furnace was metallic, it was thought that this metal would prove conclusively that pig iron, ie iron with a high percentage of carbon, was produced in the furnace. However, this was not proven to be the case. The iron was primarily ferrite, albeit with carbide needles and small amounts of phosphorous. It gives the appearance of unconsolidated bloom (see photo LA29a). Further research is required into this group of materials, which hold the key not simply to the process itself (pig iron production versus bloomery iron making) but to the nature and use of the furnace building materials as well.

The furnace wall/lining appears to be of the local sandstone which, when heated at high temperature, produces leucite, a potassium aluminium silicate. It is primarily this phase which envelopes the metallic iron recovered from the interior of the furnace. Because this group of materials represent intermediary products, neither waste proper (slag) nor metal but rather the advanced stages of an unwanted reaction between building materials and contents, the mechanism of its formation is not immediately obvious and requires further research. Although some reaction is always evident in the course of smelting, in this case the reaction has gone too far, the Mn–rich slag having severely eaten into the wall and ultimately rendering the furnace unusable.

7.0 *General Discussion*

The work at Letterewe set out to address two different questions: one relating to the industrial activities focused around the furnace, the other to the settlement pattern as revealed by the series of structures, enclosures, drystone dykes, trackways and other features spread over the area between Letterewe House and Furnace Cottage.

The topographic survey was carried out with the aim of recording and interpreting the post-medieval settlement pattern. However, its relationship to the industrial activities was not straightforward, as much of the current landscape is the direct result of re-ordering during the nineteenth century. In the absence of any secure datable material and limited cartographic and documentary evidence, the history of landscape change, its association with the seventeenth century furnace remains and the inter-relationship between ironworks and settlement pattern remain somewhat clouded.

Some clues are clearly evident among the existing remains, notably the settlement locale to the east of the Furnace Burn, which was still occupied during the late nineteenth century and carried the name *Furnes*. Survey of the structures here noted a fairly large group of buildings and enclosures, which may directly relate to the earlier ironworks. Also of note here are the considerable number of trackways leading to and from the survey area which may, in part, be traces of earlier routes to the Western Isles, as well as cattle loanings and designed pathways through the estate and to the two quays noted along the shore. However, in the absence of more extensive excavation, it is difficult to deduce the relation of some of the remaining structures to the furnace.

Given the above, the bulk of this discussion will concentrate on the furnace and its immediate environs. Lewis (1984) suggested that Letterewe may have been 'Scotland's earliest blast furnace', possibly originating from the conversion of a high bloomery to a blast furnace. This hypothesis was the first to be tested by the limited scale excavation and post-excavation scientific analyses carried out at Letterewe.

The function of the furnace is dependent on the type of fuel, ore and fluxes charged within it and the metal that is intended for production. In the early industrial context of the sixteenth and seventeenth centuries, charcoal-operated blast furnaces were primarily set up to cast ordnance, that is cannon (and perhaps shot as well), either in piece moulds or as a whole within casting pits. According to Schubert, the first gun known to be manufactured of cast iron was at Newbridge in 1509 (1957, 164). In England it was the Crown which financed the building of blast furnaces, since cannons were needed for the wars against Scotland, a situation replicated in Scotland in the early seventeenth century, although by this time the Union of the Crowns had occurred and the exact destination and use of the ordnance is still unclear.

Tylecote (1986) lists a number of early charcoal-operated blast furnaces in England. These include the sixteenth century site at Panningridge, Sussex (Crossley 1975; the Bewl valley ironworks), the seventeenth century site at Allensford, Northumbria (Linsey and Hetherington 1978) and the eighteenth century site at Pippingford, Sussex (Crossley 1975). Although they differ in period and geographical location, all share some common characteristics which can also be seen in the charcoal-operated blast furnaces of Scotland, such as Poolewe, which operated in the seventeenth century, and Glenkinglass, which operated in the early eighteenth century.

The furnace design at Letterewe is similar to that at Chingley, Kent (Crossley 1975), although the latter was in a much better state of preservation. In many respects it also echoes other Scottish sites such as Glenkinglass and Poolewe in its structural design features. If Letterewe follows the design of Chingley, then the bellows should have been located to the north-east of the furnace. This assumes that, contrary to bloomery furnace construction, the hot zone is opposite the bellows rather than directly below and around it. Alternatively, if the furnace design follows Poolewe, the bellows would have been located to the south-east of the furnace. Both scenarios are possible; however, the lack of space to the south-east may support the former interpretation. Having said that, the nature of the tapering south-western wall at Letterewe has closer parallels with the similar wall at Poolewe (see Lewis 1984, 442; Illus 5). The apparent lack of space to the south-east may simply be a result of river erosion since abandonment.

There is currently no evidence for a form of water power scheme such as would have been required to power the furnace. The site's position in the landscape suggests that water power was intended, but the remains have yet to be identified. Judging by the narrow confines of the river and the evidence gathered regarding the site topography during the furnace's lifetime, it would seem extremely unlikely that the remains of water channels have been completely destroyed through river erosion, such as was the case at Glenkinglass (Lewis 1984, 446). It is quite possible that the remains do exist and are currently obscured by the extensive tree cover. Only excavation can confirm this to be the case, as geophysical methods of prospection have failed to identify any signs of a tailrace, launder or lade on the furnace side of the river, although the high magnetic anomalies spread across the north-eastern field may be obscuring this evidence.

The early charcoal-operated blast furnaces consisted of a hearth, in which the molten metal was collected, and a shaft. The general shape was that of two truncated pyramids set one on top of the other and meeting at the bosh, the place of the widest cross section of the furnace. Although there is clear suggestion for a bosh at Letterewe, the furnace wall tapers outward, and it is not easy to make out the shaft or furnace hearth because of the advanced state of reaction of the walls with the contents.

Because a blast furnace campaign lasted for a prescribed duration of time (around 2-3 months) as opposed to continuous working as in the case of the bloomery, there was continuous need for a frequent relining of the shaft. Tylecote (1986) has argued, 'It was for this reason that a separate shaft or stack and a separate hearth were built up from the bottom to meet the shaft at the bosh.' The lack of evidence for a shaft at Letterewe may well give support to Tylecote's assertion. The height of the shaft would have been directly related to the method by which the furnace was loaded. Most early blast furnaces were built against a natural bank to take advantage of the natural elevation, as was the furnace at Letterewe.

Rather than a high bloomery, the furnace at Letterewe appears to have been a charcoal-operated blast furnace, possibly 'Scotland's first' (Lewis 1984). The possibility for an earlier high bloomery on the same site cannot be eliminated, but it is important to corroborate the suggestion by both furnace design and the presence of high bloomery slag. Bloomery slag as well as hematite and siderite ore were mixed as charge. The siderite ore was most likely self-fluxing, providing the necessary lime for the formation of a fluid slag. Charcoal was available in the storage area directly to the south of the furnace. Clear evidence for large grey or white cast iron inclusions trapped within the slag was not forthcoming, but the iron did contain silicon and phosphorus. Whatever metal was evident was part of the reaction of the furnace wall with its contents and was primarily ferritic. More detailed examination of sandstone wall fragments and metal is required.

As has been noted above, the absolute date for the establishment, running and conclusion of the Letterewe works still remains vague, particularly for its concluding phase. Although the McRa genealogy suggests Sir George Hay kept a colony of Englishmen at Letterewe, making iron and casting cannon before 1610 (MacPhail 1916, 62; Lindsay 1977, 50), no clear and unequivocal date placing operations at Letterewe appears until 1627 (Reg. Priv. Coun., 2nd series, iii, 151). Similarly, the date of closure of the Letterewe venture is also obscured in the documentary record. In essence, there is a fundamental lack of dating for the site, although it has been assumed that the Letterewe furnace is the earliest of the Loch Maree sites, based on the fact that Hay stayed there during his time in Wester Ross.

In order to resolve this question it may be possible to obtain radiocarbon dates from charcoal recovered during the excavation. The lack of charcoal from the furnace itself would necessitate dating material from trench 1, which has been interpreted as a charcoal storage bin and should reflect the final charcoal burn in association with the ironworks, and thereby give a reasonable range of dates for the final firing of the furnace.

It is quite clear that the Letterewe furnace did work, as the blast furnace slag testifies. However, the duration of its working does not appear to have been long, judging from the quantity of slag available. It appears, although this needs to be verified, that the quantities of bloomery slag (the raw material) are larger than the waste product itself. Documentary records clearly state that Sir George Hay obtained the monopoly for casting cannon and producing ordnance at Letterewe. The preliminary analytical results suggest that the intention and the capital may have been in place but the outcome of this endeavour never rose to the original expectations. This may also explain why Sir George Hay left the Highlands after a relatively short stay.

8.0 *Conclusion*

The survey and evaluation of Letterewe offered an interesting insight into the domestic and industrial development of the estate during the period from 1600 to the present. The results recovered so far should be interpreted as work in progress, rather than a complete understanding of the estate through time. Many aspects of the transformation of the estate, from iron working centre to nineteenth century country estate, have only been touched upon here, although with a further period of concentrated study a fuller history of the agricultural and industrial past could be achieved.

9.0 *Acknowledgements*

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11.0 *Appendices*

11.1 *Gazetteer of Sites*

Map Label	*Description of Feature or Structure*
S1	Listed in first edition Ordinance Survey series as a sheep fank. Today it is manifest as a rectangular enclosure with 2 possible entrances at either end of the structure and a partition dividing the main structure. A possible doorway between each side of the structure suggests access between the two sides. Two extensions, neither of which appear to have entrances, are attached to the north side of the structure.
S2	A rectangular structure with one definite entrance identifiable in the north-eastern drystone wall. The walls remain only as low banks partly obscured by vegetation.
S3	A raised rectangular structure oriented north/south with a well defined drain or groove dividing the structure equally, also running north/south. At the southern end of the structure are two abutments which are lower and taper to the south.
S4	Drystone oval structure partially built into the side of a natural knoll. The structure is only one to two courses high and much dilapidated.
S5	A drystone structure which is much dilapidated and partially covered with vegetation. The structure appears to run into the revetment F54.
S6	A small structure abutting a drystone dyke only surviving to a maximum of three courses high and much dilapidated.
S7	This structure includes a natural rock outcrop and boulders in its design. The structure may have been a sheep fank. It is much dilapidated and disturbed by livestock.
S8	A discrete drystone structure built onto the south-west corner of structure 18 with no clear entrance visible.
F1	L-shaped structure identified as low lumps in improved pasture, completely covered with grass but containing stones.
F2	Linear depression running south-west/north-east with a width of 1 m and depth of 0.1-0.2 m.
F3-F5	Rectangular drystone structures partially obscured by grass. Possibly forming part of single complex. Stones in the structure measuring between 0.3 and 0.7 m
F6	Sub-rectangular grass-covered depression, 0.2 m depth.
F7-F8	Low curvilinear banks, approximately 0.5 m wide and 0.1-0.2 m high.
F9	Linear bank and ditch within area enclosed by F7 andF8.
F10	Sunken rectangular feature.
F11	Rectangular arrangement of boulders with approximate dimensions of 0.7 m by 0.5 m.
F12	Curvilinear stone-lined ditch with stones of approximately 0.3 by 0.5 m.
F13	Gateposts forming a gateway through a deer fence which has been removed.

Map Label	*Description of Feature or Structure*
F14	Line of previous field boundary demarcated by old iron fence posts which in turn follow line of a collapsed drystone dyke, visible as a discontinuous line of scattered boulders partially obscured by grass.
F15	Short length of drystone dyke approximately 0.4 m wide and comprising stones of approximately 0.3 m by 0.3 m which may be associated with S1.
F16	Curvilinear bank enclosing a semi-circular area. The bank, having been disturbed by later activity, is composed of discontinuous stone rubble obscured by grass.
F17	Drystone revetment on west side of path in the garden of Furnace Cottage. The feature is either relatively recent or is a rebuild of an earlier feature.
F18	Drystone facade of septic tank for Furnace Cottage.
F19	Revetment separating shore from cottage garden level.
F20	A pair of low revetments in the garden of Furnace Cottage, both entirely grassed over.
F21	Small jetty composed of boulders approximately 1 m by 1 m in size. Much of the jetty is obscured by deposition of beach gravel.
F22-F23	Deer-fence posts but no other fence remains.
F24	L-shaped platform on natural plateau area, raised above surrounding ground level on southern and eastern edges.
F25-F28	Discrete piles of stones with no discernible structure which may be field clearance cairns.
F29-F30	Sub-rectangular stone settings with stone settings discernible on their exterior but obscured by a jumble of stones within.
F31	A pair of rectangular stone settings similar to F3-F5 and pile of stones on the north side of the drystone field perimeter which is too large to represent tumble from the dyke but with no discernible structure.
F32	Fence post which would have linked a deer fence to F13.
F33	A pile of stones which may be the disturbed remains of two separate stone settings.
F34	Sub-rectangular stone setting obscured by grass.
F35	Revetment and walkway which run parallel with the high water line. The walkway is approximately 1.5 m wide. The revetment is much dilapidated and only remains a coherent structure in discontinuous sections with large stones of up to1 m by 1 m used.
F36	Rectangular drystone structures, only one course in height and containing a jumble of stones within.
F37	Remains of a stone structure and loose stones largely obscured by pasture growth.
F38	A square, raised, and grass covered mound with a flat top, approximately 0.5 m above surrounding level.

Map Label	*Description of Feature or Structure*
F39	A stone setting comprising three large boulders and several smaller stones.
F40	A platform of drystone blocks with a modern concrete platform laid on top.
F41	A pile of stones with no coherent structure abutting drystone dyke which may be a field clearance cairn.
F42	A U-shaped arrangement of drystone blocks, approximately 0.3 m high surrounding a modern concrete drain cover. Presumably a modern feature associated with the nearby abandoned cottage.
F43	Drystone revetment, approximately 0.5 m high ,forming the northern edge of a path behind abandoned cottage.
F44	Small, single-course drystone setting by abandoned cottage.
F45	Entranceway in drystone dyke.
F46	Drystone revetment, approximately 0.5 m high to consolidate a path across the hillside.
F47	Semi-circular drystone structure abutting drystone dyke.
F48	Marsh with artificial pond created by excavation and creation of a stone/earth dam.
F49	Drystone revetment obscured by grass and collapse which shores up a track way immediately to the north.
F50	A sunken rectangular feature, approximately 0.75 m deep with a raised mound on its southern side. Stone facing is present within the feature but is obscured by grass.
F51	Drystone revetment providing foundations for the road immediately to the north.
F52	Drystone revetment in south-west corner of field separating pasture from woodland.
F53	Drystone revetment consolidating east side of drainage ditch.
F54	Low bank, approximately 1 m wide running south-west/north-east and entirely covered by grass.
F55	Substantial jetty of drystone construction extending onto natural rocky promontory. The outer wall is constructed with massive boulders with maximum dimensions of 1-2 m. The interior of the jetty is filled with smaller rocks.
F56	Drystone revetment extending from the north-east corner of jetty, providing support to the area leading down to the jetty and walkway-F57.
F57	Remains of a walkway, approximately 1.5-2 m wide, demarcated on either side by tree stumps which once would have formed a tree lined pathway. The path forms a small terrace across the natural slope.
F58	Drystone revetment consolidating road immediately to the north.
F59	Artificial pond, excavated material forming perimeter banks. Possibly an attempt to improve drainage combined with increased amenity value as a duck flighting pond.
F60	Sub-rectangular drystone setting with discernible stone facing around its perimeter and a jumble of stones within.

Map Label	*Description of Feature or Structure*
F61	Possible culvert or stone-lined terminal of drainage ditch with walling extending along the west side of the ditch.
F62	Drystone revetment separating uneven ground to the south from pasture to the north.
F63	Drainage ditch, approximately 0.3 m wide and 0.1 m deep, almost entirely obscured by pasture growth.
F64	Short length of drystone walling only one course high and approximately 0.3 m wide.
F65	Slag heap immediately upstream from furnace on same side of burn.
F66	Sampled section of slag heap eroding out at river's edge.
F67	Slag heap on slope leading down to the burn's edge.
F68	Square stone setting adjoining drystone dyke.
F69	Drystone jetty of substantial size with similar construction to F55.
F70	Circular drystone structure which looks like a modern hearth but with no signs of burning.
F71	A jetty comprising only one layer of drystone blocks forming the perimeter.
F72	Enormous drystone facade/revetment for protection against wave action comprising boulders of up to 1 by 2 m. The structure reaches a height of 3 m in places.
F73	Drystone revetment containing small drystone blocks in a dilapidated condition.
F74	Drystone revetment in a similar condition as F73.
F75	Possible rig and furrow.
F76	Scatter of slag deposited within gravely spit at mouth of burn.

11.2 *Photographic Record*

Film No 1 Colour Slide

No	*Area*	*Feature No*	*Subject*	*From*	*Date*
1-5	2	n/a	position from which samples taken	n/a	19/5/98
6	2	n/a	group shot of samples	n/a	19/5/98
7-9	n/a	n/a	herd crossing bridge and in field	n/a	19/5/98
10	1	104, 106, 111	charcoal rich deposit behind walling 111	west	19/5/98
11	2	206, 213	furnace interior duct pre-excavation	east-north-east	20/5/98
12	2	206, 212	damage to furnace pre-excavation	north-east	20/5/98
13-14	1	104, 108, 110	wall and interior fill, portrait & landscape	east	20/5/98
15	3	303-5	interior of trench and cobble slot 303	east	21/5/98
16-17	1	106, 111-2, 115	wall 111 and feature after removal of 104	west	22/5/98
18-19	1	108, 110	wall 108 and interior fill 110	west & above	22/5/98
20	1	101-3, 108-9	dump 103/4, lower horizon 109, wall 108	north	22/5/98
21-22	4	n/a	pre-excavation shots	east	22/5/98
23-24	1	112, 115	feature 115, pre-excavation	above & south	22/5/98
25	1	112, 115	feature 115, half excavation in plan	north-west	22/5/98

Film No 1 Colour Slide (cont)

No	*Area*	*Feature No*	*Subject*	*From*	*Date*
26	1	112, 115	feature 115, half excavation in section	north-west	22/5/98
27	3	303-5, 307	section of slot through deposits	north-west	22/5/98
28	3	303-5, 307	plan of slot through deposits	north-west	22/5/98
29	4	403-4	small feature half excavation	north-east	25/5/98
30-31	4	407-8	pit half excavation	west	25/5/98
32	1	110, 113	interior fill and possible revetting	south & above	25/5/98
33-34	1	108, 110	half excavation of interior fill (in section)	east	25/5/98
35	1	108, 110	half excavation of interior fill (in plan)	south & above	25/5/98

Film No 2 Colour Slide (incorrectly believed to be monochromatic when loaded)

No	*Area*	*Feature No*	*Subject*	*From*	*Date*
1	1	101, 102	field wall prior to turf removal	west	19/5/98
2	1	101, 102	river bank area pre-excavation	east	19/5/98
3	1	104, 106, 111	charcoal rich deposit behind walling 111	west	19/5/98
4	2	206, 213	furnace interior duct pre-excavation	east-north-east	20/5/98
5	2	206, 212	damage to furnace pre-excavation	north-east	20/5/98
6	1	102, 104, 111	filed wall, wall and charcoal rich deposit	north & above	20/5/98
7	1	101-3, 108-9	dump 103/4, lower horizon 109, wall 108	north	22/5/98
8-9	1	104, 108, 110	wall and interior fill, portrait & landscape	east	20/5/98
10-11	1	104, 108, 110	wall and interior fill, (wide angle)	east	20/5/98
12	3	303-5	interior of trench and cobble slot 303	east	21/5/98
13-14	1	106, 111-2, 115	wall 111 and feature after removal of 104	west	22/5/98
15-16	1	108, 110	wall 108 and interior fill 110	west & above	22/5/98
17	1	101-3, 108-9	dump 103/4, lower horizon 109, wall 108	north	22/5/98
18-19	4	n/a	pre-excavation shots	east	22/5/98
20-21	1	112, 115	feature 115, pre-excavation	above & south	22/5/98
22	1	112, 115	feature 115, half excavation in plan	north-west	22/5/98
23	1	112, 115	feature 115, half excavation in section	north-west	22/5/98
24	3	303-5, 307	section of slot through deposits	north-west	22/5/98
25	3	303-5, 307	plan of slot through deposits	north-west	22/5/98
26	4	403-4	small feature half excavation	north-east	25/5/98
27	4	407-8	pit half excavation	west	25/5/98
28	1	110, 113	interior fill and possible revetting	south & above	25/5/98
29	1	108, 110	half excavation of interior fill (in section)	east	25/5/98
30	1	108, 110	half excavation of interior fill (in plan)	south & above	25/5/98
31	1	108, 110	half excavation of interior fill (in section)	east	25/5/98
32	1	108, 110	half ex of interior fill and walling (in plan)	south & above	25/5/98
33-34	3	301-2, 306, 309	north facing section showing small hearth	north	26/5/98
35	3	306, 309	close up of hearth	north	26/5/98
36-37	3	301-2, 306, 309	drawn area of north facing section	north	26/5/98

Film No 3 Colour Slide Wide Angle

No	*Area*	*Feature No*	*Subject*	*From*	*Date*
1	n/a	n/a	voided shot	n/a	19/5/98
2	1	101, 102	field wall prior to turf removal	west	19/5/98
3	1	101, 102	river bank area pre-excavation	east	19/5/98
4	n/a	n/a	herd in field	n/a	19/5/98
5	1	104, 106, 111	charcoal rich deposit behind walling 111	west	19/5/98
6	2	many	pre-excavation shot of furnace	north-east	20/5/98

Film No 3 Colour Slide Wide Angle (cont)

No	*Area*	*Feature No*	*Subject*	*From*	*Date*
7-8	2	201, 203	pre-excavation shot of furnace block and south wall		south
	20/5/98				
9	2	206, 212	area of damage to furnace interior		20/5/98
10-11	n/a	n/a	Iain and the cows	n/a	20/5/98
12	n/a	n/a	Iain doing geophysics	east	20/5/98
13	1	102, 104, 111	filed wall, wall and charcoal rich deposit	north & above	20/5/98
14	1	101-3, 108-9	dump 103/4, lower horizon 109, wall 108	north	22/5/98
11	2	206, 213	furnace interior duct pre-excavation	east-north-east	20/5/98
12	2	206, 212	damage to furnace pre-excavation	north-east	20/5/98
13-14	1	104, 108, 110	wall and interior fill, portrait & landscape	east	20/5/98
15-16	1	104, 108, 110	wall and interior fill, portrait & landscape	east	20/5/98
17	3	303-5	interior of trench and cobble slot 303	east	21/5/98
18-19	1	106, 111-2, 115	wall 111 and feature after removal of 104	west	22/5/98
20	1	108, 110	wall 108 and interior fill 110	west & above	22/5/98
21	1	101-3, 108-9	dump 103/4, lower horizon 109, wall 108	north	22/5/98
22	1	112, 115	feature 115, pre-excavation	above & south	22/5/98
23	1	112, 115	feature 115, half excavation in plan	north-west	22/5/98
24-25	3	303-5, 307	plan and section of slot through deposits	north-west	22/5/98
26	n/a	n/a	'burial ground of the smiths', Kinlochewe	south-east	24/5/98
27	n/a	n/a	detail of structure at 'the burial ground of the smiths', Kinlochewe	south-east	24/5/98
28-29	n/a	n/a	modern clearance cairns near the cemetery	south & east	24/5/98
30	n/a	n/a	smiths place name on point	east	24/5/98
31-32	n/a	n/a	Rob at the slag dyke, South Erradale	n/a	
33	n/a	n/a	detail of slag	n/a	
34	n/a	n/a	John and the slag dyke	n/a	
35-36	n/a	n/a	JA & RS at bog ore source, South Erradale	n/a	
37-38	1	108, 110, 113	interior fill and possible revetting	south & above	25/5/98

Film No 4 Colour Slide

No	*Area*	*Feature No*	*Subject*	*From*	*Date*
1	1	108, 110	half-excavation of interior and walling	south & above	25/5/98
2-4	3	301-2, 306, 309	half excavation of small hearth in section	north	26/5/98
5-6	1	115	full excavation of feature 115	south & above	26/5/98
7	1	115	full excavation of feature 115	east & above	26/5/98
8	1	104/112	area of charcoal and tree root disturbance	north & above	26/5/98
9	1	110	full excavation of putative store interior	east & above	26/5/98
10	1	108, 110	as above plus walling	south & above	26/5/98
11	1	108, 110	as above, in section	east	26/5/98
12	2	many	pre-excavation of furnace and south wall	south	26/5/98
13	2	many	pre-excavation of furnace and interior	east	26/5/98
14	2	many	pre-excavation of furnace area	north	26/5/98
15-16	1	n/a	Mike planning trench 1	north-east	26/5/98
17	2	n/a	John & Effie in discussion of furnace	west	27/5/98
18	2	n/a	John planning trench 2	south	28/5/98
19	2	many	John planning and furnace structure	west	28/5/98
20-22	2	many	main pre-excavation shots of furnace area	west & above	29/5/98
23	2	many	detail of walling and rubble core	east & above	29/5/98
24-25	2	many	detail of interior and furnace bowl	east & above	29/5/98
26	1	many	shot of trench 1 from tree east of trench 2	north east	29/5/98
27-28	2	203-5, 211	detail of converging interior and exterior walls and interior cobbling	east & above	29/5/98

Film No 4 Colour Slide (cont)

No	*Area*	*Feature No*	*Subject*	*From*	*Date*
29-30	2	203	detail of south walling	south & above	29/5/98
31	2	203, 211	detail of south wall and cobbled interior	south & above	29/5/98
32	2	206	detail of furnace bowl area	south & above	29/5/98
33	1	many	shot of trench 1 from tree south of trench 2	north-east	29/5/98
34	2	203, 205	detail of south wall	south & above	29/5/98
35	2	203	detail of south wall (west half)	south	29/5/98
36	2	203	detail of south wall (west half)	south	29/5/98
37	2	n/a	John finishing plan		29/5/98

Film No 5 Colour Slide Wide Angle

No	*Area*	*Feature No*	*Subject*	*From*	*Date*
1	1	108, 110	half-excavation of interior and wall	east	25/5/98
2	1	108, 110	half excavation of interior and wall in plan	south & above	
3-4	3	301-2, 306, 309	half excavation of small hearth in section	north	26/5/98
5-6	1	115	full excavation of feature 115	south & above	26/5/98
7	1	115	full excavation of feature 115	east & above	26/5/98
8	1	115	full excavation of feature 115	north & above	26/5/98
9	1	108, 110	full excavation of store interior and wall	south & above	26/5/98
10	1	108, 110	as above, in section	east	26/5/98
11	2	many	pre-excavation of furnace and south wall	south	26/5/98
12	2	many	pre-excavation of furnace and interior	east	26/5/98
13	2	many	pre-excavation of furnace area	north	26/5/98
14	n/a	n/a	voided		27/5/98
15	2	n/a	John planning trench 2	south-east	28/5/98
16	n/a	n/a	voided		29/5/98
17-19	2	many	main pre-excavation shots of furnace area	west & above	29/5/98
20-22	2	many	detail of interior furnace area	east & above	29/5/98
23	1	many	shot of trench 1 from tree east of trench 2	north east	29/5/98
24-26	2	many	detail of interior and furnace bowl	east & above	29/5/98
27	2	203	detail of south walling	south	29/5/98
28	2	203-205	detail of converging walls (portrait)	west & above	29/5/98
29	2	203-205	detail of converging walls (landscape)	west & above	29/5/98
30-31	2	206, 211	detail of cobbled interior and furnace	north-east	29/5/98
32-33	2	210, 211	cobbled interior and sand area (top right)	north	29/5/98
34-35	2	206, 208	detail of damage to bowl and interior duct	north-east	29/5/98

Film No 6 Colour Slide (incorrectly believed to be monochromatic when loaded)

No	*Area*	*Feature No*	*Subject*	*From*	*Date*
1	1	n/a	voided	n/a	25/5/98
2-3	1	115	full excavation of feature 115	south & above	26/5/98
4-5	1	115	full excavation of feature 115	east & above	26/5/98
6	1	104/112	area of charcoal and tree root disturbance	north & above	26/5/98
7	1	110	full excavation of putative store interior	north & above	26/5/98
8	1	108, 110	as above plus walling	south & above	26/5/98
9	1	108, 110	as above, in section	east	26/5/98
10	2	many	pre-excavation of furnace and south wall	south	26/5/98
11	2	many	pre-excavation of furnace and interior	east	26/5/98
12	2	many	pre-excavation of furnace area	north	26/5/98
13	n/a	n/a	voided	n/a	26/5/98

Film No 6 Colour Slide (incorrectly believed to be monochromatic when loaded)

No	*Area*	*Feature No*	*Subject*	*From*	*Date*
14-16	2	many	main pre-excavation shots of furnace area	west & above	29/5/98
17	2	many	detail of walling and rubble core	east & above	29/5/98
18-19	2	many	detail of interior and furnace bowl	east & above	29/5/98
20-21	2	203-5, 211	detail of converging interior and exterior walls and interior cobbling	east & above	29/5/98
22	2	203-205	detail of south walling	south & above	29/5/98
23-24	2	203, 211	detail of south wall and cobbled interior	south & above	29/5/98
25	2	206	detail of furnace bowl area	south & above	29/5/98
26	2	203, 205	detail of south wall	south & above	29/5/98
27	2	203	detail of south wall (west half)	south	29/5/98
28	2	203	detail of south wall (west half)	south	29/5/98
29	2	203-205	detail of converging walls (portrait)	west & above	29/5/98
30	2	203-205	detail of converging walls (landscape)	west & above	29/5/98
31-32	2	206, 211	detail of cobbled interior and furnace	north-east	29/5/98
33-34	2	210, 211	cobbled interior and sand area (top right)	north	29/5/98
35-36	2	206, 208	detail of damage to bowl and interior duct	north-east	29/5/98
37-38	1	104, 111, 116	charcoal dump 104 over bank 116 and wall 111	north	29/5/98

Film No 7 Colour Slide

No	*Area*	*Feature No*	*Subject*	*From*	*Date*
1	2	203-205	detail of converging walls (portrait)	west & above	29/5/98
2-3	2	206, 211	detail of cobbled interior and furnace	north-east	29/5/98
4-5	2	206, 208	detail of damage to bowl and interior duct	north-east	29/5/98
6-7	1	104, 111, 116	charcoal dump 104 over bank 116 and wall 111 (wide angle)	north	29/5/98
8	1	104, 111, 116	as above but normal lens of central area	north	29/5/98
9-10	1	104, 111, 116	as above, but from opposite side	south	29/5/98
11	1	104, 111, 116	as above, but wide angle	south	29/5/98
12	2	206, 212, 214	interior walling and damaged furnace	north-east	29/5/98
13	2	206, 212, 214	floor of interior duct	north-west	29/5/98
14	2	208, 210, 214-5	deposits within damaged interior duct	east	29/5/98
15-16	1	103/4, 108-9	main section (east half)	north	29/5/98
17	1	103/4, 108-9	wide angle of main section (east half)	north	29/5/98
18	2	206, 216	interior walling and duct floor	north-east	29/5/98
19	2	206, 216	damage to bowl and duct floor	south-west	29/5/98
20	2	n/a	Effie recording	west	29/5/98
21	2	n/a	Mike recording	west	29/5/98
22	2	n/a	Mike & Effie recording	west	29/5/98
23	2	n/a	Mike & Effie recording	north	29/5/98
24-25	n/a	n/a	Stag in woods near site	east	30/5/98
26-28	n/a	n/a	Stag in woods near site	south-east	30/5/98
29	n/a	n/a	Rob in Loch Maree	north	30/5/98
30-31	2	many	final shots from tree top	east & above	30/5/98
32-37	n/a	n/a	final shots of team crossing loch	n/a	30/5/98

Film No 8 Monochromatic

No	*Area*	*Feature No*	*Subject*	*From*	*Date*
1	1	many	south facing section (west half)	south	29/5/98
2-3	1	many	north facing section (west half)	north	29/5/98
4	1	many	main view of trench (west half)	west	29/5/98
5	1	many	main view of trench (centre)	west	29/5/98
6	2	206, 212, 214	interior walling and damaged furnace	north-east	29/5/98
7	2	206, 212, 214	floor of interior duct	north-west	29/5/98
8	2	208, 210, 214-5	deposits within damaged interior duct	east	29/5/98
9-10	1	103/4, 108-9	main section (east half)	north	29/5/98
11	1	103/4, 108-9	wide angle of main section (east half)	north	29/5/98
12	2	206, 216	interior walling and duct floor	north-east	29/5/98
13	2	206, 216	damage to bowl and duct floor	south-west	29/5/98
14	n/a	n/a	Stag in woods near site	east	30/5/98
15-17	n/a	n/a	Rob in Loch Maree	north	30/5/98
18-22	2	many	final shots from tree top	south & above	30/5/98
23-24	2	many	final shots possible blowing arch area	east & above	30/5/98
25-26	2	many	final shots possible blowing arch area	east & above	30/5/98
27-31	2	many	final shots from tree top	east & above	30/5/98

11.3 *Sample List*

No	*Area*	*Context No*	*Type*	*Size*	*Description*
11	1	104	deposit	small	individual charcoal fragments for species identification
12	1	104	deposit	large	charcoal rich dump of material overlying store area
13	1	112	fill	large	fill of possible posthole, probable pit
14	4	404	fill	small	fill of small pit
15	4	406	fill	small	fill of small pit
16	4	408	fill	small	fill of small feature
17	3	302	layer	large	mixed topsoil and industrial debris
18	3	305	layer	medium	sample of possible interior working surface
19	3	309	layer	medium	50% sample of hearth deposit
20	1	110	deposit	large	fill of interior of possible charcoal store
21	1	n/a	n/a	n/a	sample not taken
22	2	202	layer	large	upper Ao horizon with high slag and furnace content

11.4 *Small Finds List*

No	*Area*	*Context*	*No of pieces*	*Material*	*Description*
1	1	104	1	iron	
2	1	107	2	slag	
3	5	501	1	slag	
4	1	107	4+	pot & ore	
5	7	701	5+	brick & slag	
6	6	601	10+	slag & tile	
7	3	302	10+	various	
8	5	502	3+	slag	
9	9	901	5	slag	
10	8	801	10+	glassy slag	
11	7	701	20+	glassy slag	
12	7	701	5+	nails	
13	7	701	1	slag	
14					
15					

11.4 *Small Finds List (cont)*

No	*Area*	*Context*	*No of pieces*	*Material*	*Description*
16					
17	2	215	1 bag	furnace floor	
18	2	206	3+		
19					
20					
21					
22					
23					
24					
25					
26					
27					
28	2	206	2	vitrified material	
29	2	206	5+	vitrified material	
30	2	206	2	vitrified material	
31	2	206	5	vitrified stone	
32	2	206	5+		
33			1	vitrified stone	
34			2	vitrified stone	
35	2	206	1		
36	2	206	1	cast iron?	
37	2	214	2	furnace wall	
38	2	209	1	vitrified stone	
39	2	206	5+		
40	2	206	5+	furnace wall	
41	2	206	1	furnace wall	
42	2	206	2	furnace wall	
43	2	206	3	furnace wall	
44	2	206	1	1	
45					
46	2		1		
47			1	iron nail	
48	5	501	5+	slag	
49	56	601	2		

11.5 *Drawing Record*

Drawing	*Sheet*	*Trench*	*Features*	*Scale*	*Details*
1	1	1	103-6	1:20	pre-excavation of trench 1
2	1	3	303-5	1:20	trench 3 after initial cleanback
3	2	1	105-14	1:20	trench 1 after removal of deposit 103/104
4	1	4		1:20	pre-excavation of trench 4
5	3	3	303-7	1:20	post-excavation overlay of slot in trench 3
6	4	4	403-6	1:10	west facing section of feature 406 in trench 4
7	4	4	407-8	1:10	quarter section of pit in trench 4
8	5	4	403-8	1:20	post-excavation of trench 4
9	4	1	103/4, 108-10	1:10	section/profile across east end of trench 1
10	4	1	112, 115	1:10	north-west facing section across feature 115
11	4	3	303-7	1:10	north-west facing section in slot in trench 3
12	4	3	301-4, 306, 309	1:10	north facing baulk of trench 3
13	6	1	110, 112, 115	1:20	final post excavation overlay in trench 1
14	1	2	203-13	1:20	pre-excavation of trench 2
15	7	1	101-14	1:10	north facing main section in trench 1
16	1	2	208, 214-6	1:10	section through duct fill