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Ashburton, Devon

Part II: Ausewell Mine
(Wheal Hazel)

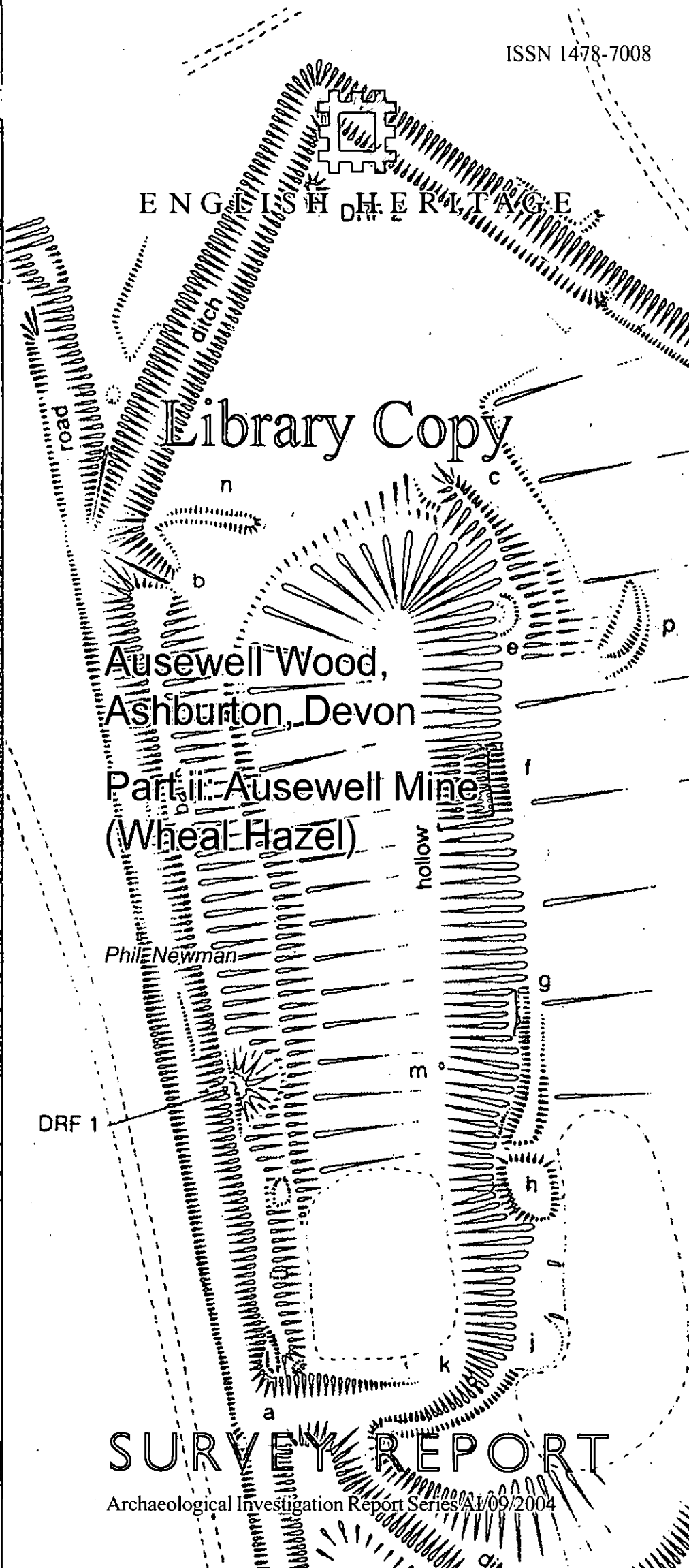
Phil Newman

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SURVEY REPORT

Archaeological Investigation Report Series AI/09/2004





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AUSEWELL WOOD, ASHBURTON, DEVON

PART II: AUSEWELL MINE (WHEAL HAZEL)

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INTRODUCTION and BACKGROUND

In 1998 the ore processing and smelting complex at Ausewell Wood, situated on south-east Dartmoor, was surveyed at large scale (1:500) by the RCHME investigation team from Exeter (RCHME 1998), commissioned by the Dartmoor National Park Authority (DNPA). The survey was to form a central component in an ongoing research programme promoted by the DNPA, which was to include investigations of the site by researchers from a number of disciplines. Among the outcomes of the first RCHME report was the recommendation that the extractive evidence located at Cleft Rock, 100m south of the blast furnace and believed to be a source of ore for it, should be surveyed in detail and that a geological evaluation of that area was also needed. The present report fulfils the first of these objectives and a separate report on the geology, to complement the field survey, has also been completed (Page 2004).

In the six years since part 1 of the survey, much additional research has taken place at Ausewell including a Gradiometer Survey of parts of the smelting area (Dean & Faxon 2000); excavations and quantitative slag analysis (Juleff forthcoming); geochemical analysis (Carey 2000) and a report cataloguing much of the available documentation for mining and smelting at Ausewell has been completed (Phillipotts 2003).

The present report represents completion of the programme of earthwork survey at Ausewell Wood, providing a large-scale plan with interpretation of the extractive elements of the site around Cleft Rock.



Figure 1. Ausewell Wood.
Location.

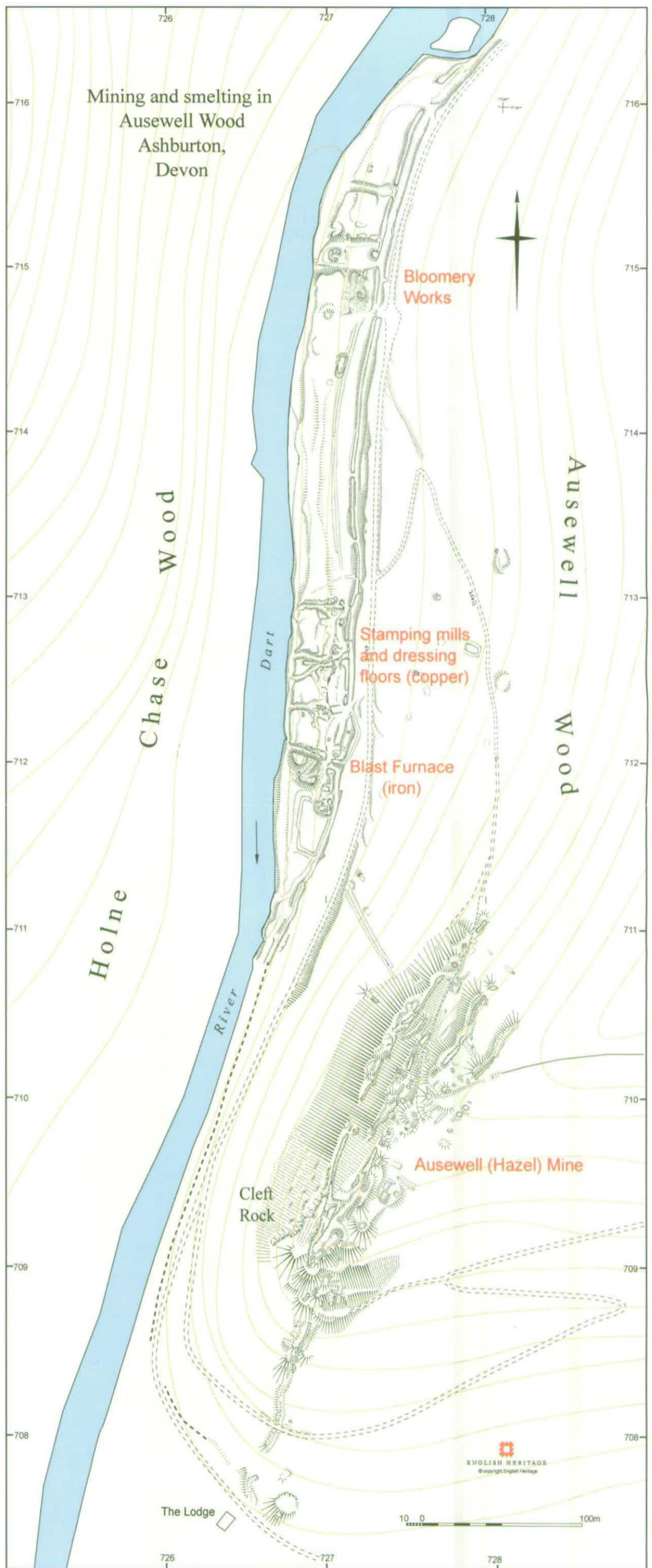


Figure 2. Ausewell Wood, mine and smelting works. Compiled from OS 1:2500 1905; RCHME 1998; EH 2004, using the best-fit method. Contours, derived from OS 1:10560 1964, are in feet and should be used only as a guide to topography. (note: The Lodge is as depicted on the OS 2nd edition 1905).

The survey was undertaken by staff from the EH Archaeological Investigation team at Exeter in January 2004.

DOCUMENTARY EVIDENCE

The earliest documented metallurgical activity at Ausewell Wood was the iron smelting, now believed to have commenced between 1582-98 (Phillpotts 2003) and certainly in existence by 1605, when depicted on a map of that date (Amery 1925). Fragmentary, documentation (Phillpotts 2003) has suggested that iron ore for the smelting may have been imported to this site from sources elsewhere, either local, or from as far away as South Brent, though where precisely is yet to be established. Also apparent from geological analysis is the fact that the Cleft Rock area has the wrong mineralisation to have ever been a source of hematite (K. Page pers comm). It now seems certain therefore that this mine did not provide material for the blast furnace period at Ausewell Wood and probably not the earlier bloomery phase either and it appears most likely that this was exclusively a copper mine.

The first surviving document to refer to the copper mine is Henric Kalmeter's journal dated 1724-5, in which he described work having taken place on several copper lodes for some time previously. He also mentions that the most recent lease for the mine included the provision of 100 men being employed (Brook 2001, 46-7; appendix i). In 1763 the lease was again for sale when it was claimed the mine had been unworked for some years (*Sherborne Mercury* 1863) and two years later Benjamin Donn's Map of Devon (published 1765 but probably completed by 1763) had the site marked as Hazel Copper Mine. In 1791 the lease passed to Christopher Gullet, a well-known mine agent and one time Jurate for Tavistock at the Stannary Parliament, though how successful were his efforts at Ausewell Mine is not known (Phillpotts 2003). Further activity is recorded in 1810-15 when Peregrine Palmer leased the sett though the mines were not being worked by him (Phillpotts 2003). In 1833 clearing of adits and removal of rubbish were among activities undertaken by the Bastard estate, who owned the site at that time, though the extent of any extraction which occurred or sale of ores is not reported. Re-opening of the mines was again mentioned in correspondence by the Bastards in the 1850s and 60s and between December 1859 to April 1860 the Wheal Hazel Mining Company, as it had become known, was purchasing timber from the Bastard Estate. The Old Hazel Mine sett was described in 1859 as '...in its time.. one of the most productive copper mines on the east of Dartmoor..' (*MJ* 28.5.1859) and 'the once-renowned old Ausewell Copper Mines' (*MJ* 12.2.1859), giving some indication to past success. The mine finally closed in July 1860 when the operators were forced to surrender their licence (Phillpotts 2003).

GEOLOGY

The geological makeup of the site is currently under review and will appear in a separate report (Page 2004).

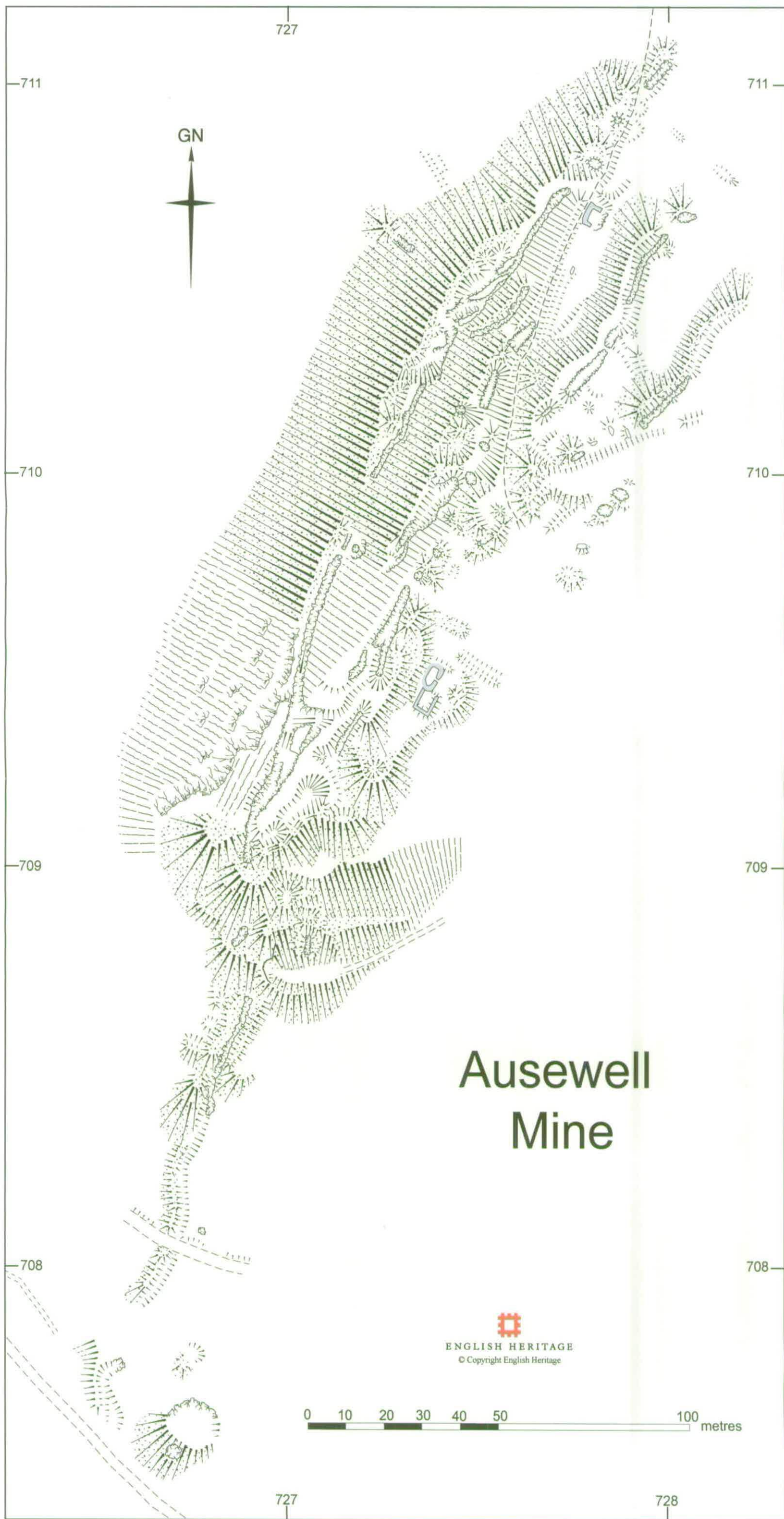


Figure 3. Ausewell Mine. EH 1:1000 earthwork survey.

LOCATION AND DESCRIPTION

The evidence for extraction is located around the Cleft Rock on the southern promontory within Ausewell Wood at a height of 130m above OD. This is an exposed, west facing outcrop with an almost sheer rockface that merges into the steep slopes of the hillside which in turn continue down to the level of the River Dart. The rock has earned its name because mining activity only a few metres to the east of the rockface has created a 10m-deep open gunnis, leaving only a thin wall of rock between the gunnis and the western face of the outcrop. However, the name Cleft Rock only occurs on maps after 1905 and may be a late appellation; it does not occur in literature prior to that date or in known documentation for the mine.

The extractive activity at surface reveals that at least four lodes were worked (A to E on Fig. 4) which run roughly parallel from NNE to SSW and appear to converge at the Cleft Rock precisely as described by Kalmeter in 1724 (see appendix). South of this point only one lode has been worked at surface, where a shallow gunnis (F) runs down the hill to within a few metres of the bottom, just above the floodplain behind the Lodge. Smaller sections of lode branching off the main lodes may account for a number of smaller detached gunnises between the larger examples. All of the gunnises have been cut into the country rock, to a depth of up to 14m in some cases, leaving deep narrow fissures of up to 80m long. For the convenience of description for this report the worked sections of the lodes are labelled A to E but this is not intended to imply any geological significance. From the surface the gunnises appear fairly unassuming, and in most cases barely noticeable even from close by, being notable for their depth rather than their width. Their significance therefore appears understated on the accompanying survey plans and their appearance and proportions are best gauged from the photographs (Figs 6, 7, 9 & 10).

THE OPENWORKS OR GUNNISES

Lode A (Figs 4-10)

The most impressive element of the site is the open gunnis which exploited the westernmost of the lodes (A). It extends for a total of 235m and includes the Cleft Rock section. There is a second deep section at the northern end of the worked lode, with intermittent sections between. An underground 'level' with two open shafts survive at the very far north of the working (S1 and S2).

The Cleft Rock (Figs 5-7, 9)

The largest of the worked areas on this lode and at the mine as a whole is the Cleft Rock, which consists of an open gunnis cut into solid rock and reaches a depth of 10m in places. The southernmost section is very narrow with as little as 1m between the parallel faces, which are slightly tilted where the miners have followed the underlie of the lode. As the gunnis curves slightly and progresses north a low slope on the east side has created a massive overhang (Fig. 7).

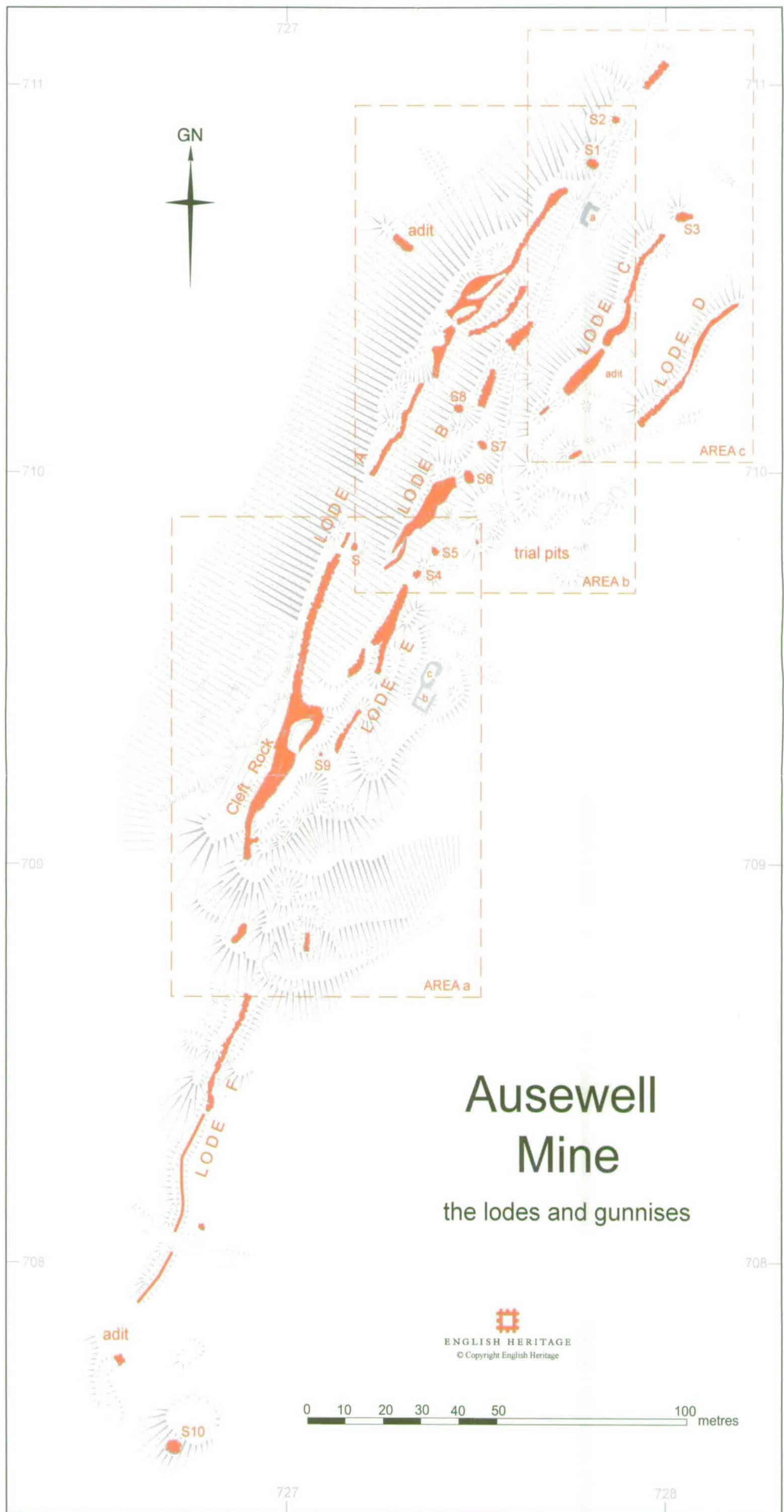


Figure 4. Interpretation plan, highlighting in red the evidence for the working of lodes.

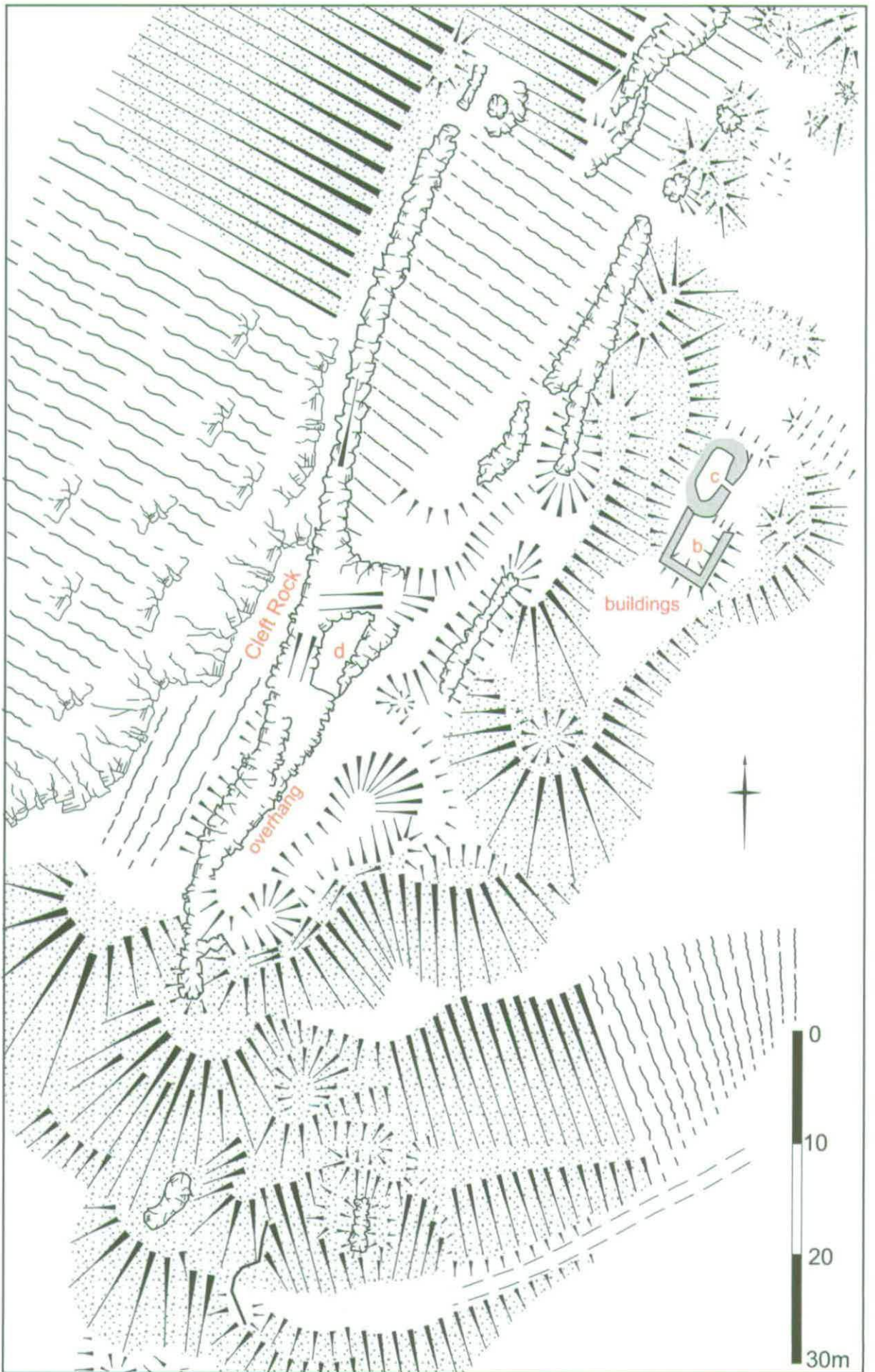


Figure 5. 1:500 scale earthwork plan of the Cleft Rock area (area A on Fig. 4).



Figure 6. *The narrow southern entrance to the Cleft Rock looking south.*



Figure 7. *The interior of the Cleft Rock looking north towards the overhang.*

In the central section, the gunnis widens where once a narrow vein of ore branched off on the eastern side, just beyond the overhang. The working face on this branch continues underground for 4m to a point where ore has become worked out. The process of chasing this spur of ore within the widened area of the gunnis has also caused an island of unworked rock (d on Fig. 5), measuring 8.2m long by 3m thick at the widest end, to be left isolated from the main working faces. A small causeway of rock survives however connecting the southern tip of the island to the eastern rockface, not far below the original ground surface. This was left in place perhaps to offer stability for the large island of rock.

To the north of the island the working area narrows into a deep, slightly curving corridor with near vertical sides of up to 10m high (Fig. 9). This then becomes shallower as it meets the sloping western face of the Cleft Rock outcrop at an oblique angle. North of this point the working consists of a shallow, water-filled trench, probably no more than 2m deep. It ends abruptly where spoil from another gunnis has been thrown down the hillside from above, which may have covered any further evidence of the gunnis at this point.

Lode A, central and northern sections (Figs 8 & 10)

Evidence for this lode resumes a few metres to the north where a continuation of the gunnis has cut deeply into and runs along an approximately level course on the western slope, though partially hidden by vegetation. The parallel working faces are approximately 1.5m apart and, at the time of survey, the interior was flooded making access difficult at the southern end. As the gunnis proceeds northwards there are accumulations of spoil on the interior which have apparently been dumped from workings higher up the slope.



Figure 8. 1:500 scale earthwork plan showing gunnises at the northern end of lode A and lode B (area B on Fig. 4).



Figure 9. View of the northern end of the Cleft Rock interior looking north.



Figure 10. The northern deep section of the Lode A gunnis.

The continuity of the gunnis then starts to break up where a further two islands of rock exist, perhaps representing further fragmentation of the lode. There is also one small undeveloped stope at the base of the eastern rockface.

The final section of the gunnis consists of a deep and impressive excavated chasm, of between 1.5-2m wide, with vertical sides. The floor of the worked area slopes steeply down making the northern section particularly deep at approximately 17m.

At the lowest and most northerly point the open gunnis gives way to limited underground working. This consists of a short level which has a high hanging wall and 10m beyond the portal is an open shaft (S1). After another 13m interval there is a second open shaft (S2) beyond which the level continues and probably once broke surface at the short shallow section of open gunnis located 12m to the north. This point marks the termination of visible extractive activity on this lode. The shafts do not appear to have ever penetrated the ground any deeper than they do currently.

At several points within the worked sections of lode A there is evidence for the use of explosives in the form of shotholes. These semi-circular impressions are up to 30cm in length and the original diameter of the hole was about 25-30mm. The holes have been bored parallel with the strata of the rock rather than at 90° to the face which is suggestive of an early use of the technique, sometime after the 1690s when powder was first recorded in Cornish mines and probably therefore used in Devon.

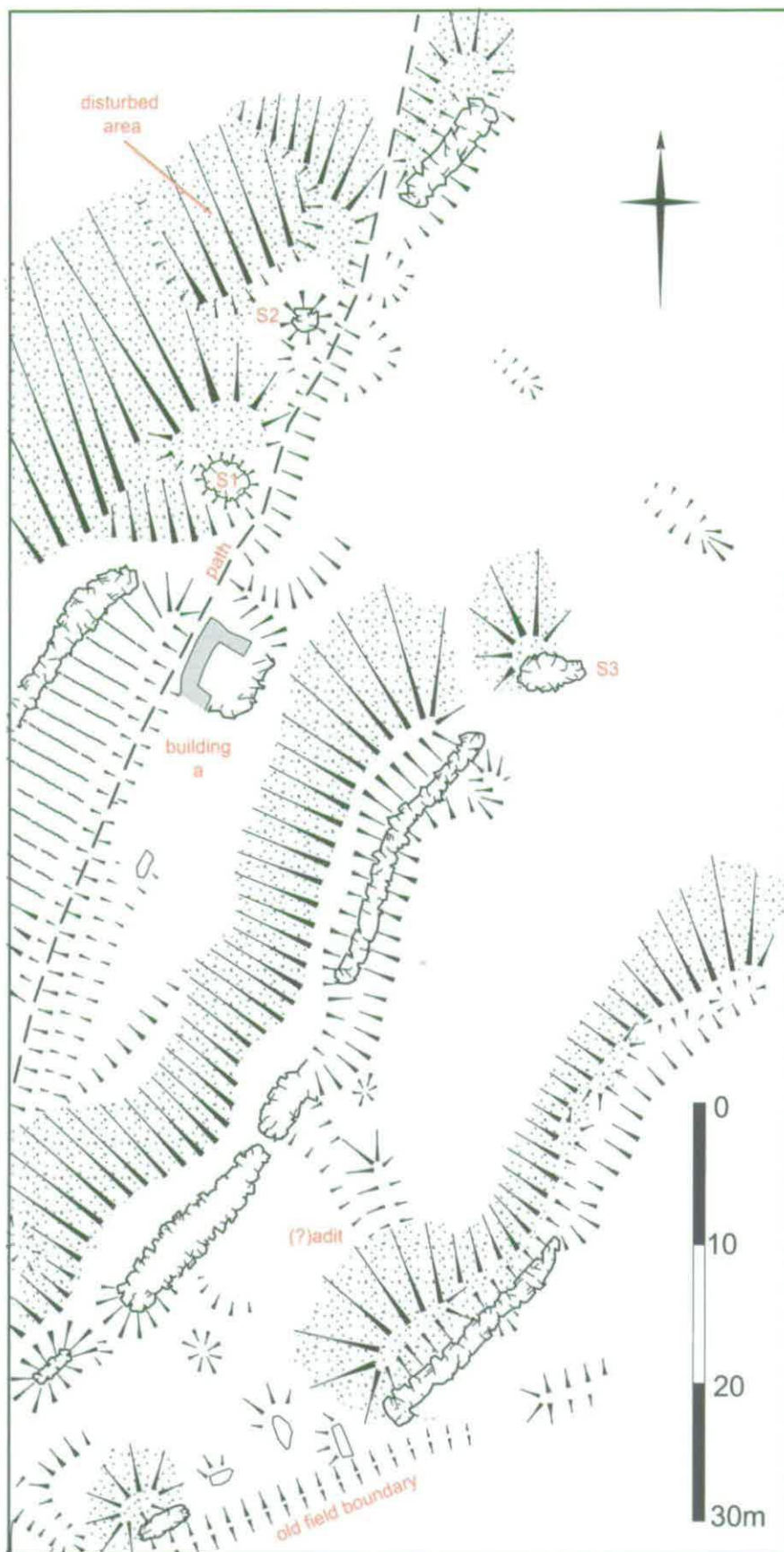


Figure 11. 1:500 earthwork plan showing gunnises over lodes C and D (area C on Fig. 4).

Adit

On the NW extremities of the spoil heap associated with the working of this lode (see below) is a partially blocked adit, set at 90° to the lode and approximately 10-12m vertically below the top edge of the gunnis. The portal is still visible though much material now fills the

entrance and a substantial rounded spoil heap extends 10m to the NW, suggesting this level penetrates the hillside for some depth, perhaps as far back as the gunnis over lode A.

Lode B (Figs 4 & 8)

This section of lode runs approximately parallel with the central section of lode A, and is 15m east up the slope. The working is traceable at surface for an overall distance of 75m and, like lode A, and consists of a series of intermittent narrow open gunnises together with three shafts (S6-8). The gunnises are not as deep as those of lode A, at 4-5m and a certain amount of backfilling is likely to have occurred.

Lode C (Figs 4 & 11)

A narrow gunnis with one detached shaft (S3) at the northern end represent the visible working of lode C, 30m up the slope of the north end of lode A. Surface evidence may be traced for a total of 65m though it is possible that the lode and the evidence of it being worked continues underground to the SW, possibly to meet lode B because an isolated rock-cut pit is sited between lode B and the end of lode C. A small level has been driven branching off the main gunnis of lode C on the west side about half way along but it is not certain how far this penetrates.

Lode D (Figs 4 & 11)

The westernmost of the parallel worked lodes is the shallowest, the gunnis having only penetrated the ground to 2m maximum. The gunnis has rock exposed along only part of its length. A moderate linear spoil heap on the western downslope side of the gunnis, has partially covered what may have been an adit opening. This consists of a 2m-wide gully emerging from under the spoil which may represent an early attempt at accessing this lode from underground.

Lode E (Figs 4 & 5)

This lode could have been a continuation of B judging by its position on the plan, although E is substantially higher up the slope and the two may not be associated. It is more likely that E once converged with A at the southern tip of the Cleft Rock section where a backfilled gunnis aligns with lode E and may be evidence of it extending south. There is a short section of underground working which follows on from the northern tip of the open gunnis on lode E and may connect to two shafts (S4 & S5) on the same alignment.

Lode F (Fig. 4)

A shallow, narrow gunnis runs down the slope from the foot of the Cleft Rock spoil heaps for 85m before fading out. The upper one third of the gunnis is cut from rock but as it progresses down hill it develops into a shallow trench. Spoil has been cast up onto both sides along the entire length. This evidence could represent exploitation of the southern tail end of the copper lodes at surface, or it is perhaps a prospecting trench, but it does not appear to have been very productive.

No shotholes have yet been noted in the gunnises of lodes B to F. However, this could be due to the more friable nature of the rock surrounding these lodes, especially at lodes C and D, negating the need for expensive explosives. It could also be due to the growth of mosses

and other clinging plants on the rock faces which have disguised the evidence and it is possible that shotholes may be found on closer inspection in the future.

Shafts

Several small openings in the ground above the lodes may be described as shafts though they do not appear to have functioned as such in that they do not show evidence for use for access or ventilation. Shafts 3-9 fall into this category. These shafts may be found on the alignment of the lodes where gunnises are not open. In most cases they are too close to the open sections to be useful for ventilation and could be explained by working of overhand stopes intermittently breaking the surface, or as exploratory diggings to find continuation of lodes beyond the sections already worked.

Spoil heaps

The large spoil heaps are all associated with the open gunnises. For the long sections of gunnis, north of the Cleft Rock, the material was clearly excavated from the working and dumped straight down the hillside to the west; no attempt at tramming or barrowing the spoil appears to have been made. It seems likely also that large lumps of material were broken up using hammers (spalling) and sorted at surface as was common practice at copper mines of the period (ie 18th & 19th century). This operation could have been performed on the level areas adjacent to the downslope sides of the gunnises and the waste from this process forms part of these dumps.

The Cleft Rock and lode E presented the miners with a slightly different problem in that the summit of the sheer outcrop was probably too dangerous a place to stand and tip spoil. All the spoil from these gunnises has been tipped down the steep slopes to the south forming rounded heaps. Establishing the precise chronology of this process is not really viable but it would appear that the slightly spread dumps in the vicinity of the two buildings contain the material from the gunnises of lode E, while those immediately east of the Cleft Rock may be the waste from the upper levels of the Cleft Rock gunnis. As this working developed and became deeper, spoil was transported along the base of the gunnis and tipped out the open southern end and down the slope to form the dumps immediately south of the Cleft Rock.

Other shafts (S10-11) and an adit

At the bottom of the slope at the very southern extremity of the site is an adit and a shaft, now fenced for safety. The adit, which is cut into rock is open and although narrow and partially blocked could probably be entered. There is no spoil associated with the adit, consequently it is unlikely to have penetrated the ground for any great distance, although it is possible that spoil from this source could have lain in the grounds of the Lodge and was dispersed when the buildings were enlarged.

The shaft (S11) is sited 25m south-east of the adit but they are unlikely to be connected. It is open and measures approximately 2.5m diameter. The depth is unknown though unlikely to be more than 10-15m. The lower section is currently flooded. The shaft is sited within what appears to be spoil from a level platform to the north of the shaft. The platform is an approximate circle of 12m diameter, the north arc of which is cut into rock, leaving a vertical



Figure 12. The ruined building (b) on the eastern side of the spoil heaps. The large tree is growing from the centre of the floor.



Figure 13. The western interior of building c, showing detail of the carefully constructed, battered wall.

face. It is uncertain whether this feature was associated with the shaft. It could have been constructed to house a whim, used to power winding equipment in the shaft, or it could be a charcoal burning platform, of which others are known in the vicinity (RCHME 1998). It is however substantially larger than other nearby examples.

Buildings

The remains of three ruined buildings survive amidst the mine workings.

Building a

Situated near the northern end of the site near two shafts, this small building sits in a flat-bottomed hollow cut into the slope adjacent to and on the east side of the path. Three walls survive upstanding; constructed from small blocks of killas, probably mine waste. The walls stand to a maximum height of 1.5m, they are 0.8m thick and the internal dimensions are 3m by 3.2m. The back wall does not appear to have any surviving masonry in place and may have consisted simply of a vertical cutting in the slope. The entrance is on the NE side, the opening being formed between the terminal of the wall and the unwallled back slope. The building probably had a slanting roof. The purpose of the building is not known but its crude construction and the fact that its position cut into the slope would have made it subject to dampness, suggest that it was not a shelter.

Building b (Fig. 12)

Sited on the eastern edge of the mine on a level position amid spoil heaps, are the remains of a well-built rectangular building, which measures approximately 5m long by 3m wide. The walls, constructed from killas, stand to a maximum height of 1.4m and would probably have supported a timber structure. Within the building is evidence of a dividing wall or perhaps edge of a raised area but a large tree now grows through one end of it.

Building c (Fig. 13)

Built against the north end of building b, though set further back into the slope, this structure is not rectangular but has an arced back wall, a straight front wall and well-rounded corners. The internal dimensions are 4.8m by 2.2m. The back(west) wall and north wall take the form of revetments built into the slope. All the walls are built from killas blocks laid on their long sides with the narrow end facing inwards. This together with the moderate batter of the wall faces has created a robust structure which has endured well with no sign of tumbled stone. It is likely that the upper section of the building as well as the roof would have been of timber construction. An entrance opening is centrally positioned on the east wall.

DISCUSSION AND CONCLUSION

DISCUSSION

The presence of so many open gunnises suggests that the copper ore was from the outset worked from above in an opencast fashion or 'open to grass' as the miners would have described it. Discovery of the ore could well have been originally due to a 'gozzan' or exposure of ore at surface which could have been exploited in this way. As to the possibility of the minor iron ores (chlorite, siderite, pyrite, arsenopyrite) found associated with the chalcopyrite having been smelted at the bloomery site, this will only be answered after full analysis of the slags is available, though on present knowledge it seems unlikely.

It has not been possible to establish the precise origins of copper mining in Ausewell Wood on the basis of archaeological remains or the known documentation but it is possible to offer some reasonably well-informed suggestions.

If there was once a highly visible gozzan near the Cleft Rock this may well have attracted the attention of the very earliest copper miners, perhaps even in prehistoric or Roman times. The lode could have been exploited to the limits of the available technology long before the 18th century AD when activity is first recorded here. But at this point, with no real evidence, such ideas have to remain in the realms of speculation.

Realistically, the most likely period for work commencing would be the late 17th century. The knowledge to mine copper to any depth was not widely available in England before the influx of German miners such as Hochstetter in 1565, who came on the invitation of the Crown to improve this country's mines. Even then copper mining in the South-West did not commence until the 1580s when Dutchman Ulrich Fosse started small scale mining in Cornwall. Copper mining still did not flourish in Britain, partly because of a monopoly over production by the Crown which only ceased in 1693 after an act of parliament. Apart from a very early reference of 1346 to a probably unsuccessful venture at North Molton (Dixon 1997), no specific documentary references for copper production in Devon have come to light from the medieval and early post-medieval periods and it is likely that few attempts were made to exploit this metal in the county at least until the 1690s; production in Cornwall certainly increased from this date. It is interesting that Richard Carew in his *History of Cornwall* (1602) writes several pages on the tin industry, yet considers copper mining to be of little significance. Similarly Tristram Risdon describing the period up to 1630 does not mention copper among the metals exploited in Devon, though by the time his book was updated and published in 1811, copper production exceeded that of tin and silver (Risdon 1811). Of the early Devon historians, the most relevant for Ausewell is Thomas Westcote who, also in 1630, specifically mentions iron mines at Ashburton and Brent, but although mentioning copper mines elsewhere in the county makes no reference to any in this area (Westcote 1845, 65).

The connection between Ausewell and the Welsh Copper Company of Neath, as mentioned by Kalmeter, is also intriguing. Neath was the earliest base for copper smelting, the first

smelting works being built in 1584 by the Company of Mines Royal but others followed, particularly towards the end of the 17th century and the early 18th century. The growth of these facilities was an important trigger in increasing the production of copper in the South West. The Welsh Copper Company is known to have existed from at least 1721 (Roberts 1957) and to have been prospecting at other mines in the vicinity at Buckfastleigh (Brook Index) and at least two Cornish mines mentioned by Kalmeter (Kalmeter 1724). The 'Welsh Company' is also mentioned by Kalmeter as working a lead mine on Black Down near Lydford, though this may have been a different company.

There can be no certainty as to the extent of working of the gunnises at Ausewell, if any, before the introduction of explosives to west of England mines in about 1690. However, it is quite possible that miners armed with explosive technology after this date were expanding existing working areas both in depth and width. In that case the presence of shotholes at all levels need not be significant in dating the origins of the gunnises though they do provide a *terminus post quem* somewhere in the late 17th-century for the working faces where they are visible. All the shotholes so far recorded are within the lode-A gunnis and the majority of these are at lower levels. However, more examples will certainly be noted upon further investigation.

The shotholes are of a size (25-30mm dia) and type - lying parallel with the fracture lines of the rock - which probably dates them to the time of blasting with powder (as opposed to the more powerful explosives introduced in the 19th century), from the 1690s up to about 1860, the period for which activity at Ausewell is documented.

Nevertheless, the possibility that the gunnises were also exploited by firesetting must not be discounted. This technique was used in mines long before the introduction of powder but continued well into the 19th century at some mines because it was cheaper than the use of powder. It certainly would have made sense at Ausewell with its open gunnises, making the use of this technique much easier.

Kalmeter's reference to work occurring on several lodes appears to suggest that the site was being worked to its full potential even at this early date. It is also clear that the mine was well developed in 1724, already reaching '14 or 15 fathoms' (25.8m or 27.7m). However, despite this and the fact that underground mining at the site is also implied in documents of a later date (Phillpotts 2003), there is little evidence of work having reached this depth. All the spoil at the mine is associated with the open gunnises, either lying in parallel banks alongside or, in the case of the Cleft Rock section, it has been dumped down the hill directly out of the southern end of the gunnis. Although there are several open shafts, they do not appear to be associated with extensive underground workings, and have very little spoil associated. There are also no concentrations of spoil near or in the gunnises of a type which would suggest shafts had been sunk into the floors of these workings. Only two adits are visible in the vicinity of the mine and neither appear to be anything more than exploratory; the same could be said for another probable example sited near the copper dressing floors just above river level (RCHME 1998).

There is no trace of any pumping facility at the mine, such as an engine house, waterwheel pits, balance bob pits at the shaftheads or flatrod systems. Such equipment would certainly have been needed if underground working had penetrated to any depth using shafts, such as the 15 fathoms (27.7m) suggested by Kalmeter. At nearby Druid Copper Mine, 2km distant on the east side of Ausewell Hill, pumping was of a high priority from the very commencement of shaft sinking in 1852 (Newman 2003) and similar conditions must have been experienced by the Ausewell miners had they sunk shafts of any depth. It seems highly likely therefore that working of the lodes was restricted to the open gunnises. The two shafts and a short level on the northern end of Lode A appear to be the extent of underground working.

CONCLUSION

Work probably began in earnest at the Cleft Rock site in the early 18th century, though earlier working cannot be ruled out. The activity was restricted to copper extraction in open gunnises with powder being used in some areas to blast the rock, though firesetting may also have been employed. There then followed an intense period of working at the site and testimony from later years recalls the workings as having been very rich at this time. By the time of Kalmeter's visit in 1724 the mine was probably well developed. Sometime after this but before 1763 work ceased. A succession of fragmentary references between then and 1860, reveal that further attempts were made to revitalise the mine though they were mostly ineffective and no output is recorded for this period. The later attempts in the 1850s and 60s would certainly have been affected by the severe fall in the price of copper at that time and these miners would have found it extremely difficult to work the site profitably.

It would appear therefore that the great majority of the extractive evidence at Ausewell Mine dates from the period of intense working in the early-mid 18th century. Evidence of desultory working by later miners, is certainly also present though not easily singled out.

Dating the extractive elements of the mine may also help propose a date for the associated stamping and dressing mills beside the River Dart with a little more precision. The presence of four water-powered mills represents a major investment at a mine of this type. Although it was commonplace for mid-19th-century mining companies to invest heavily in surface equipment as a means of impressing shareholders, the remains at Ausewell appear to be earlier, judging by their condition. It is most likely that the stamping mills were constructed in the early period of prosperity leading up to 1724 when Kalmeter mentions the site of the stamps. Later, in 1791, Gullet's lease also mentions the erecting of stamping mills on the site of existing mills (Phillpotts 2003). The possibility of the early date in itself makes these mills interesting because, on current evidence, most stamping mills of this layout and type when used at Dartmoor tin mines are of late 18th - early 19th century date, yet here they may have been used at a copper mine of the 1720s.

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Appendix i

Extract from *The Kalmeter Journal. The Journal of a Visit to Cornwall, Devon and Somerset in 1724-5*. Translated and edited by Justin Brook (2001). Twelveheads Press.

In this forest and spur are several copper lodes, all of which course north-east and south-west, underlying north and appearing to unite at the end of the spur. They have all been worked a little in length but not particularly in depth, and not over 14 or 15 fathoms at the deepest. It is said that in olden times and in Queen Elizabeth's days they were worked for silver ore. It is known that a little further up, at the foot of the hill and close to where the stamps now are, there once stood a blast furnace, and there among the slags and in the cinders, as well as below the hearths, bits and ingots of copper were found. These excavations have been employed by various people and last by the Welsh Copper Company, which had a 21-year lease from Squire Ford of all the works and mines they could work or find in this forest or ground, on condition that they should pay him 31/2 years £400 a year, and that for the 1-7th of the ore he enjoyed as the owner of the land, as well as for 1-6th share he had in the work. They were also bound to keep a hundred men at work. After 31/2 years they were to pay to Squire Ford 1-7th of the ore raised and keep no less than twenty miners in these mines. But as the company shrank, and probably either from lack of money or a disagreement in the management, it reduced its efforts to carry on the work, and granted the mine in Ausewell Wood to a supervisor, Malakias Twain, who bound to himself from Christmas 1724 to keep a hundred men at work and to pay the company 20s. per ton for all the ore he could find. In addition the company reserved the right to buy the ore for £6 a ton, in case any other should bid £6. 5s a ton. Recently 170 tons were sold for £4.5s a ton, both cleaning and stamping ore together, 70 tons of the former and 100 of the latter, which ore was said to have been raised between December and May.

Appendix ii

Recommendations for further research

1. Further exploration of accessible underground areas.
2. Trial excavation at dressing floors to confirm the features to be for dressing of copper and attempt to find datable material.
3. Thorough photographic record of the gunnis interiors. (now completed by EH, April 2004)



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