

PREHISTORIC MINING AT ECTON, STAFFORDSHIRE: A DATED ANTLER TOOL AND ITS CONTEXT

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Abstract: Explorations at the Ecton copper mines have led to the discovery of an antler tool, at about 11.5m below surface, which has recently been radiocarbon dated to 1880-1630 cal. BC. The evidence for Bronze Age mining at Ecton Hill is reviewed and areas on the hilltop and northern spur crest are identified which probably contain prehistoric surface and underground workings.

INTRODUCTION

The importance of Ecton as a centre for post-medieval copper mining has long been recognised (Kirkham and Ford 1967; Robey and Porter 1972). However, it is only with the discovery of hammer stones in the early 1990s (Guilbert 1994a; 1994b) that a systematic search for prehistoric mining on the hill began. This paper documents this research and reports the most significant find to date, an antler tool which has been radiocarbon dated to the Earlier Bronze Age.

The study of the prehistoric component at the Ecton mines is part of a more general re-appraisal by the authors, with assistance from Jim Rieuwerts with the post-medieval documentary evidence. The first results, which concentrate on 17th century mining and the early use of gunpowder have already been published (Barnatt *et al.* 1997) and a detailed re-assessment of the accessible parts of Ecton Pipe, Deep Ecton Mine and Salts Level is in progress.

EXPLORATIONS ON ECTON HILL (GHT)

In 1994 exploration of Stone Quarry Mine was initiated in an attempt to locate a chamber at a depth of *c.* 25-30m where possible hammer stones and a worm bone were described by Nellie Kirkham in her unpublished notes and a letter detailing underground trips here in 1945 (Kirkham 1945; 1958; Timberlake 1992; Guilbert 1994b; Barnatt *et al.* 1997).

For convenience a numbering system (prefixed by 'E') has recently been devised for workings at Ecton Hill (Fig. 1, 2). In the light of evidence presented in the previous paper (Barnatt *et al.* 1997) we now refer to Stone Quarry Mine (E11-13) and associated workings (E10, E17) as Dutchman Mine. The descriptions of the workings here are a summary of those given in the aforementioned paper. They are presented in the sequence of exploration.

Three of the accessible entrances to Dutchman Mine lie close together (E11-13), at the crest of the northernmost spur of Ecton Hill at 320-323m OD (SK 09945824). One of these is a vertical drawing shaft (E12). This is currently very unstable at surface and is completely blocked with rubble *c.* 10.5m down, at a point where it intersects another of the entrances (E11). This is a relatively spacious working that follows the steeply dipping strata at about 45 to 65 degrees from horizontal, dropping to the ENE.

Another entrance (E13) lies *c.* 14m SSE from E11 and is very similar in character. This is accessible to a depth of *c.* 17.5m but here it is also blocked due to surface collapses.

The chamber as described by Nellie Kirkham was accessed by her via E13, but originally may well also have linked with E11. It would require a major undertaking to remove the rubble blockage which may be up to *c.* 15m deep. Therefore attention was turned to nearby accessible entrances along the crest of the spur in the hope of finding an underground connection with the lower workings of E11-13.

Two uncapped vertical shafts exist nearby. One of these, E8, lies about 90m NNW of E11-13, a short distance west of a shaft entrance (E7) leading to the main Ecton Pipe. The large entrance of E8, the ginging of which has collapsed, drops 9m into an adjacent near-vertical working (E9), capped near surface, which is presently blocked with rubble and animal carcasses at a depth of 20m from surface. A level or part-backfilled stope runs southwards in the direction of E11-13 but collapse or filling of a working in the roof has resulted in a total blockage *c.* 16m along.

The second shaft (E10) lies 50m NNW of E11-13, on the same line as E8/9. This was explored with the hope of locating a 'horizontal' level, shown on a stylised 1858 mine section (Kirkham and Ford 1967, plan 7), that linked E10 to E11-13. The small, ginged E10 shaft drops 3m on to a near-vertical working, the present base of which is blocked with rubble at a depth of *c.* 13-15m. No possible connections with E11-13 were found. However, the 1858 section shows it left E10 at around the same depth as the present blockage and entered E11-13 at about 26m, around the same depth as the 'hammer stones' chamber recorded by Kirkham (see Barnatt *et al.* 1997, fig. 3); this possible way on remains to be dug; there is only limited stacking space below ground and, before removing material to surface, the shaft ginging, which is supported on rotted timbers, would have to be stabilised. The working is also likely to be blocked at the E11-13 end as Kirkham found no way into this passage.

90m WSW of E11-13, on the steep slope below, is an adit known as Dutchman Level (E17). This runs for 129m and passes directly underneath E11-13 at a depth of *c.* 32m from surface. Nellie Kirkham's account describes a 70-80 foot (20-25m) 'shaft' which was descended to Dutchman Level from the base of one of the Stone Quarry Mine entrance passages (E11), that was 'very tight, wet and slippery, with loose blocks poised in it on mud'. In November 1995 it was decided to try to locate this 'shaft' from

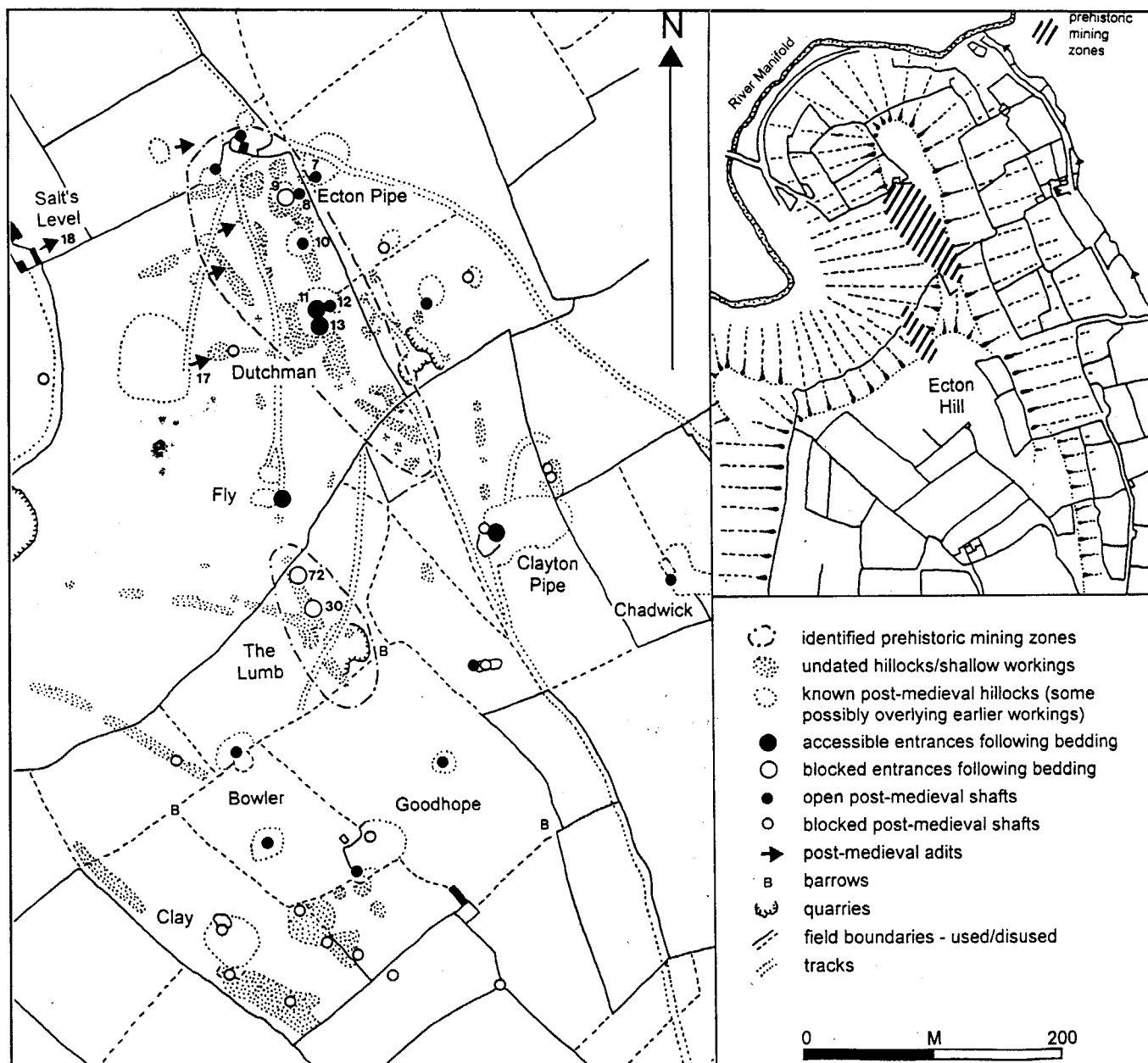


Fig. 1. The surface remains on the northern parts of Ecton Hill, identifying the zones of postulated prehistoric workings and later mines.

below and climb upwards in the hope of finding an alternative route into the 'hammer stone' chamber. Dutchman Level is presently dammed and gated, providing the water supply for the cottages below; exploration is only possible by passing down the adit in deep water in parts. Initial investigation located a partially blocked working to the side of the adit, that rose upwards directly underneath E11-13, just beyond a large flooded working in the floor that was crossed on a previously imported metal rail. Attempts at removing the blockage resulted in loud rumblings from above and subsequent collapse. The survey results suggest that this is the base of the drawing shaft (E12). Eventually the base of Kirkham's 'shaft' was located c. 2m before the flooded workings. This is a small body-sized hole in the roof leading upwards to steeply-sloping workings, mostly following the bedding. These are intersected by a series of short blind or blocked levels which appear to follow a fault. After ascending a total of c. 20m a short level was reached that is blocked with rubble at the end. This was the point of entry in 1945 from E11. Although the workings continued upwards a short distance there were no further ways on, a disappointing result in that no other obvious route to the elusive 'hammer stone' chamber was available without recourse to major excavation. During

preparation for abseil, the tip of an unusual looking object was noticed projecting from the rubble, which upon closer inspection proved to be the antler tool described below.

Encouraged by the discovery of this artefact a decision was made to search for other early workings in the vicinity. Those at The Lumb are completely choked a short distance from surface. Fly Mine and Goodhope Mine have no obviously early workings and contain extensive evidence for gunpowder work. One of the most likely sites is the main Ecton Pipe which had traditionally been thought to outcrop at what is now known after exploration to be a large vertical shaft (E7) sunk onto the hading pipe at depth. As E7 is capped at surface further exploration again involved the challenge of climbing upwards, this time from Salt's Level (E18) about 70m below surface. Exploration of the Ecton Pipe is ongoing and awaiting survey. It could be that if the pipe mineralisation came close to surface this was within the lower part of E8, from where it dropped steeply via workings that await exploration to a point c. 42m down shaft E7; below where it is known to continue down to river level and beyond.

The other major post-medieval working on Ecton Hill is the Clayton Pipe. The upper parts, which could have been worked at an earlier date, are vertical and dangerous to access; they have yet to be properly explored and evaluated. The majority of other mines on the hill are either capped (shown on Fig. 1 as open but not currently accessible due to a lack of entrance lids) or are blocked at surface.

None of the workings on Ecton Hill should be entered without the consent of the owner of the mineral rights, who at time of writing is Geoff Cox of Lees Farm, Back of Ecton. As noted above, Dutchman Level is dammed and used for the Ecton water supply; access is not normally allowed. Parts of the working rising from near the end of Dutchman Level, shafts E8, E10, and E12, and workings E9, E11 and E13, are highly unstable and unsupervised exploration is not recommended. There were serious rockfalls during exploration and survey. There is potential for further collapse in all the workings described. Inspection of the workings should not be contemplated without permission and the necessary knowledge and experience of the dangers of mine exploration.

PREHISTORIC MINING AT ECTON (JB)

Antler Tools

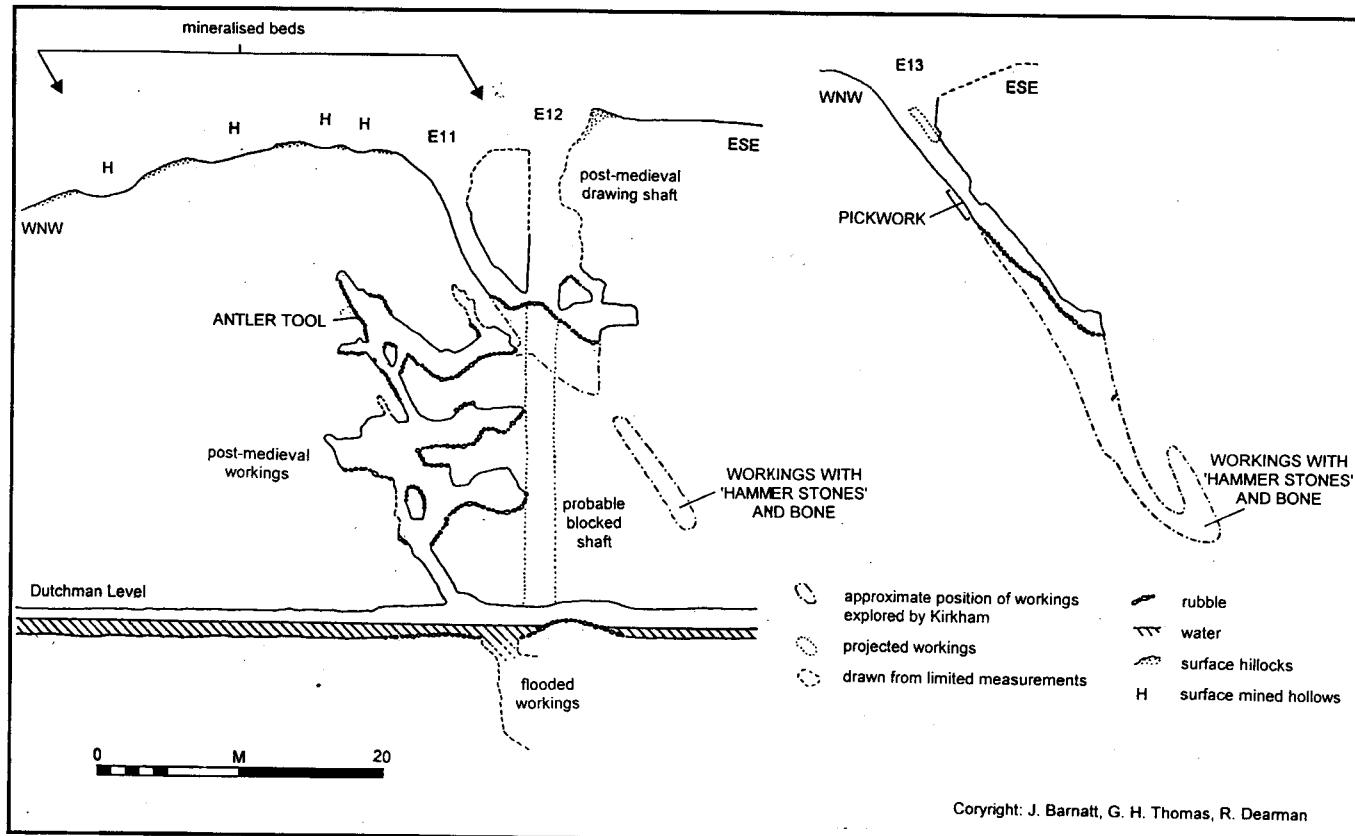
An antler tool was found about 11.5m below surface, amongst rubble and finely comminuted mineralised material/rock, on the floor of a steeply sloping working in Dutchman Mine (Fig. 1). While this part of the working has a solid roof, a choked passage that is above but to the side of where the antler tool was found may once have led upwards to surface. Thus, it is unclear if the artefact was in its original prehistoric context, or whether it had been disturbed by later miners and had perhaps fallen to its

present position at this time.

The tool comprises a 207mm long antler tine (Fig. 3), one end of which has been pared for hafting, while the other has use-scars. Up to 78mm of the butt end has been pared, creating a series of irregular, narrow but long facets, commonly with transverse scars. Examination of these under a microscope shows that they are consistent with shaping using a metal knife; however, no metal residues were identified to confirm the metalliferous composition of this blade (Mark Edmonds pers. comm.). Given the radiocarbon date of the antler tool it was presumably bronze. The paring has reduced the diameter of the tine from c. 25mm to 16mm along one axis. It is unclear if the antler tine was hafted at right-angles to its axis making it pick-like, or whether the haft was aligned with the tine to create a 'straight' levering tool. A hafted antler mining tool of uncertain date was recovered during post-medieval tin streaming in the Carnon Valley in Cornwall which is hafted at right-angles (Penhallurick 1986, 169). A 15th century brass in Newland Church in the Forest of Dean has a medieval miner holding what may be a similar example (Nicholl 1866, 67). The latter illustrates that such tools may have been used well into the historic period and thus that radiocarbon dating is essential before prehistoric mining can be demonstrated.

The point of the tine was naturally smooth but had a series of scratches created during use. While the majority run approximately longitudinally, others are transverse. There is no heavy wear at the end which would be consistent with the tool having been regularly used as a pick. The general impression the scars give is that the point of the tool has been pushed into fractures in the rock and then twisted to prise rocks from the walls or roof of the workings. This is consistent with experimental work on the effective use of antlers in the context of early metal mining (Timberlake 1990c).

Fig. 2. Elevations of parts of Dutchman Mine: the northern entrance workings (E11-12) and the bedding and fault workings above Dutchman Level, and the southern entrance workings (E13), including in both cases the approximate extent of the workings entered by Kirkham in 1945 that have now run-in.



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A sample taken from the antler tool has been radiocarbon dated. This has produced a date of 3445 \pm 35 BP (OxA-7466). Calibrated at 2 sigma (95.5% confidence), using the Oxcal computer programme and the 1986 bi-décal calibration curve, this gives a date of 1880-1670 cal. BC with a 93.8% probability that the sample falls within this range, together with a 1.6% probability that it falls between 1660-1630 cal. BC.

Other antler tools have been found at Ecton in the past. In Bateman's collection there were once apparently nine 'sharpened pieces of stag's horns', now lost, which were "found in an ancient copper mine at Ecton in June 1855"; unfortunately their exact provenance within the mines is unrecorded (Guilbert 1994b). These finds illustrate that 19th century miners were disturbing prehistoric deposits. Nellie Kirkham's unpublished letter and notes detailing an exploration of Dutchman Mine (1945; 1958), include an account of a now inaccessible working c. 25-30m below surface. She described this as a relatively large 'worked-out space' with a 'shelf' upon which were what may have been hammer stones, together with a 'bone which might be slightly worn and have been used for scraping something'. Whether this was bone or antler is unclear.

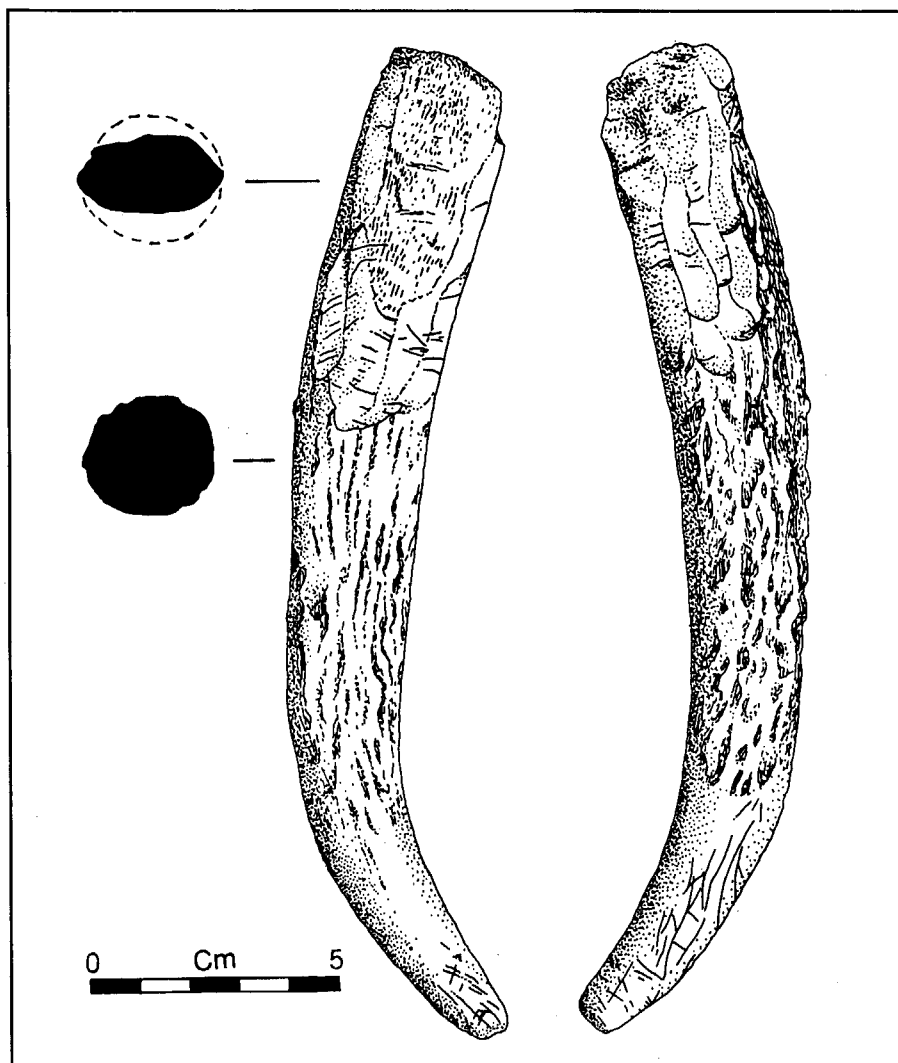


Fig. 3. The dated antler tool from Dutchman Mine, Ecton.

Hammer Stones

In 1994 Guilbert reported the discovery of four hammer stones on the large bare tip below Dutchman Level (Guilbert 1994a). As noted above Bateman had eight or possibly nine hammer stones in his collection, found somewhere at Ecton, now in Sheffield City Museum (Guilbert 1994b). None of these pebble hammer stones are notched but all have use-scars at the ends. The utilised pebbles are of quartzite/ganister and sandstone/gritstone, materials that do not occur naturally on the hill; the Bateman collection also has a dubious example in limestone. Kirkham (1945) described further possible hammer stones observed within Dutchman Mine, describing them as 'four large (largest 9-10" long) water-worn rounded stones, giving one the idea that they have been purposefully put there for use for crushing'. Recently a further eight hammer stones have been found on Ecton Hill (John Pickin pers. comm.). These have been recovered from the largely grass-covered waste hillocks in the vicinity of Ecton Pipe, Dutchman Mine and The Lumb (Fig. 1).

While hammer stones are known from most prehistoric mining contexts in Britain, they are also known to have been employed in much later mines elsewhere, even recently in Uganda (Worthington and Craddock 1996). However, the radiocarbon date for the Ecton antler tool adds weight to the hammer stones from here being prehistoric.

Pickwork

Pickwork is not common in the accessible workings on the top of Ecton Hill, but one notable exception is a small area of unusual

pickwork c. 8-10m down the Dutchman Mine's southern entrance passage (E13) (Fig. 2). It comprises many short and narrow pickmarks, closely spaced, cut into rotted mineralised material on a ledge to the side of the working. This pickwork may be consistent with having been produced with an antler or bone tool, although this suggestion currently cannot be substantiated.

The Extent and Character of the Ecton Mines in Prehistory

Taking the strands of evidence together the general location of prehistoric mines at Ecton can be tentatively identified. These concentrate on and below the crest of the hill at The Lumb and on top of the ridge-like spur that runs north from this to Dutchman Mine and the main Ecton Pipe beyond. Here, amongst the hillocks and shafts of post-medieval mines, there are series of small workings mostly trending roughly north-west/south-east (Fig. 1) comprising small open-cast pits and trenches with upcast. Some of these are likely to be prehistoric, although others are probably post-medieval trials. In the absence of excavation, it is impossible to distinguish between the two likely possibilities in individual cases. In some of the pits and trenches the steeply dipping bedding here may also have been mined to a significant depth in prehistory (see below).

The hammer stones found recently by John Pickin are associated with these workings and it is possible they derive from prehistoric waste hillocks, or they were in later hillocks derived from prehistoric workings in their immediate vicinity. Similarly, the pickwork in Dutchman Mine is possibly direct evidence for

prehistoric mining here. The dated antler tool and the possible hammer stones and 'bone' tool described by Kirkham were found in workings directly below and were either in prehistoric galleries or had dropped from workings above when these were disturbed by later miners. The hammer stones reported by Guilbert were from a 19th century waste heap below Dutchman Level, which leads into the downward continuation of the Dutchman workings. However, in this case waste material on the hillock could also derive from Fly, Goodhope and Bag Mines as these are connected to Dutchman Level by a branch level. Thus, the possibility that the hammer stones came from these mines cannot be discounted (Robey and Porter 1972; Barnatt *et al.* 1997). This said, the accessible parts of the near-surface workings at Goodhope Mine have no indications of early work, while there is evidence that most or all have been created using powder. Fly Mine has shotholes from the entrance downwards; any earlier workings, if present, must have been superficial. The near-surface workings at Bag Mine are inaccessible.

The limestones of Ecton Hill are extensively folded and faulted (Critchley 1979). The predominant form of mineralisation at and near surface in the vicinity of the Ecton Pipe, Dutchman Mine and The Lumb appears to have comprised thin mineralised deposits in the bedding planes of the steeply dipping limestone bedrock (cf. Barnatt *et al.* 1997). Where exposed in Dutchman Mine the beds dip to the ENE at between 45 and 60 degrees from horizontal; to the north the beds in workings E10 and E8/9 are progressively more steeply inclined, while at The Lumb to the south they are closer to horizontal. Running westwards from these areas of mineralised beds, and further south, there are a series of east-west faults, visible at surface as lines of small hillocks and hollows, and seen underground in the workings above Dutchman Level; these seem to have been equally poor in mineral. The main Ecton Pipe, a huge 'pipe' deposit exploited at depth in the 18th century appears to have no significant surface expression, but pipe-like deposits seem to have first occurred in working E8/9 at about 9m below surface that only increased in size at greater depth (cf. Barnatt *et al.* 1997). Little mineral is apparent today in any of these upper workings, but where found malachite and calcite predominate, but with some azurite and other blue-green copper minerals, chalcopyrite, limonite and barytes. At depth the copper mineralisation exploited in post-medieval times was predominantly chalcopyrite. Many other minerals have been found in small quantities (Sarjeant 1956; Critchley 1979).

The limestone rock in which the mineralisation occurs is commonly thinly bedded, has interleaved thin beds of shale and is easily broken. Thus, there may well not have been the need to employ firesetting for extraction in prehistory. The dated antler tool would be ideally suited for prising beds apart. That firesetting need not have been used may well explain the relative paucity of hammer stones on site when compared with sites such as Copa Hill, Cwmystwyth. At Ecton their use may have been restricted to ore preparation on site once the ore and rock had been removed from the working face, rather than being used in conjunction with firesetting as elsewhere. However this suggestion must remain speculative until excavations take place that establish the context of the hammer stones and the presence or absence of charcoal deposits in the waste heaps.

As noted above, prehistoric miners were exploiting a number of thin deposits of copper exposed at surface which dipped steeply into the hill. They may also have found richer concentrations of ore underground but this is presently uncertain. While the general area of early trenching can be identified, some of these surface workings may well have been created or reworked more recently

and there are certainly post-medieval underground workings and surface hillocks. Only excavation will resolve exactly where intact prehistoric workings survive, although the available evidence suggests the zones shown in Fig. 1 are correctly identified; the majority of post-medieval hillocks can be demonstrated as to be derived exclusively from mines directly below rather than elsewhere on the hill (Barnatt *et al.* 1997). Later reworking is particularly evident at the Dutchman Mine at the ENE side of the outcrop of the mineralised beds, where shafts were sunk to intercept these at depth (Barnatt *et al.* 1997). In contrast, the trench at the Lumb may be relatively intact. Here drifts (one at E72, three conjoined at E30) can be followed a short distance into the hill before they become fully choked. There is no documented post-medieval mining here, although trial work may have taken place.

Uncontrolled digging into surface hillocks and/or removal of mining artefacts will deplete the archaeological resource and hinder future research. Only careful archaeological investigation has the potential for unravelling the details of prehistoric mining at Ecton.

The depth to which the prehistoric miners descended is a matter for debate. Some parts of the accessible workings at Dutchman Mine (in E10, E11-13) and nearby (in E8/9) have no post-medieval shot holes but cannot be dated by this, their absence probably reflecting only the easily broken nature of the rock. In other cases the lack of shotholes may indicate that the workings here date to before the introduction of powder in the second half of the 17th century. Notable in this respect are the E9 working and the uppermost part of the workings rising from Dutchman Level where an antler tool has been found. The former is at least 20m deep, while the antler was about 11.5m below surface. By implication, the entrances at E11 and/or E13 must be equally early, although there is evidence in both that they have been enlarged from the 17th century onwards (cf. Barnatt *et al.* 1997). The more northern of the two (E11) is known to be directly linked with the working which contained the antler, while E13 has the small area of fine pickwork of probable early date at c. 8-10m depth. Kirkham's 'hammer stones' and bone were found at c. 25-30m depth, in a working which appears to have originally been linked with both entrances. There is known potential for workings to have been even deeper in the main pipe. The E9 working is currently blocked at 20m but what is presumably its downward continuation can be entered again, via shaft E7 from a depth of about 42m. Workings upwards from this dangerous and difficult to reach spot await exploration. Going down the main pipe from here to river level, the workings are again difficult to access and have only been cursorily inspected to date. They have occasional shot holes, but it is unclear if these represent initial exploration or subsequent widening of the pipe to extract less-rich deposits at the edges (Barnatt *et al.* 1997). All this said, while the character of all the workings just discussed indicate prehistoric mining could have taken place at depth, this remains unsubstantiated.

Further copper mines with surface mineralisation exist on Ecton Hill (Fig. 1) where there is no known evidence at present for prehistoric exploitation, but this possibility should not be discounted. The main examples are Clayton Pipe and Chadwick Mine to the south-east and Bowler, Goodhope and Clay mines to the south (and Bag and Waterbank Mine still further south). However, 18th and 19th century accounts of the mineralisation suggest that as one goes south on the hill the amount of lead increased and copper decreased, particularly near surface. Clayton Pipe, the nearest of these mines to the identified prehistoric workings, was described as a lead mine in the 17th century and it

was not until the 18th century that it started being described as a copper mine (Barnatt *et al.* 1997).

Prehistoric Barrows on Ecton Hill

Several barrows are known on Ecton Hill (Barnatt 1996, sites 11.1-11.4), including a possible small, mutilated, stony example on the summit of The Lumb above the postulated mines; while it is not obviously a mine hillock, this possibility cannot be discounted. To the south-west a larger mound, until recently surmounted by a field wall junction, is again not obviously a mine hillock and is probably a barrow, perhaps with undisturbed deposits. To the south-east a recently identified ploughed-down mound may also be a small barrow.

In 1848, and again in 1849, Samuel Carrington dug trenches in a barrow 'on a hill near the celebrated Ecton Mine called Hanging Bank, Ecton Hill' (Bateman 1861, 111, 147). From the description given, and the lack of mention of walls crossing the mound (which estate maps show were already present by the early 19th century), this is likely to be a large barrow on the ridgetop a little to the south-west of the three sites shown on Fig. 1. Several burials and grave goods were found, including diagnostic Later Neolithic or more probably Earlier Bronze Age artefacts. One cremation in an 'urn' was accompanied by two unburnt antler tines. A further tine was found elsewhere in the mound. The south-west side of the barrow 'had been disturbed by miners, who, finding lead in the tumulus, had concluded it to be the site of an ancient bloomery or smelting place'. While it is tempting to see the antler tines as further examples of copper mining tools, antler tines are recorded at several Peak District barrows, the others well away from prehistoric mines, and they may well have been used in the construction of the barrow or for other purposes.

A second, smaller, earthen barrow was dug by Carrington in 1851, described as 'upon Hang Bank about 300 yards east of that previously examined' (Bateman 1861, 176). This is less certainly identified with mounds on the ground. Until the recent discovery of the south-eastern mound, it was postulated that the excavations had taken place at the mound on The Lumb (Barnatt 1996, site 11.1). However, the south-eastern mound, which may be earthen, fits better with Carrington's description of it being to the east. The only finds were burnt bones and two flints.

While these barrows may be contemporary with the prehistoric mining at Ecton, equally they could precede this by up to several hundred years. Hilltop barrows are common in the Peak District and the barrows on Ecton Hill do not stand out as being unusual in their density or contents.

ECTON AND PREHISTORIC MINING IN BRITAIN (JB)

Much work on prehistoric mining in Britain has taken place in the last two decades and reviews have been presented (O'Brien *et al.* 1990; Ambers 1990; Timberlake 1994; in press; O'Brien 1996; Jenkins and Timberlake 1997). Much of the evidence comes from northern and central Wales, and from south-western Ireland. Ecton is now the second proven example in England. The other is Alderley Edge in Cheshire, about 30km to the north-west, at which recent excavations have uncovered an undisturbed Earlier Bronze Age working on Engine Vein (Simon Timberlake *pers. comm.*).

The radiocarbon result of the Ecton antler tool is consistent with the majority of dated mines. Of those dated so far, the majority indicate mining in the first half of the second millennium BC.

These include the mines in central Wales at Copa Hill at Cwmystwyth (Timberlake and Switsur 1988; Timberlake 1990b) Nantyreira (Timberlake 1990a; 1995), Llancynfelin (Timberlake 1995), and Parys Mountain (Timberlake 1990a) and in south-west Ireland at Mount Gabriel (Brindley and Lanting 1990). A timber shovel from the Alderley Edge mines has produced an almost identical date to that from Ecton (Garner *et al.* 1993). Significantly earlier mines have been investigated at Ross Island in south-west Ireland (O'Brien 1995). Only the extensive mines at the Great Orme have so far provided evidence for substantive working continuing through the Later Bronze Age (Dutton and Fasham 1994).

The majority of the identified mines are relatively small and are little more than short drifts. However, larger workings include those at the Copa Hill and Ross Island. At the Great Orme the extensive prehistoric workings reach a depth of about 27m (James 1990; Lewis 1990; Lewis 1994). It is not yet clear where Ecton fits within this scale continuum.

ACKNOWLEDGEMENTS

Many thanks to Geoff Cox for his permission and encouragement in investigating the Ecton mines. Garth Haddon Thomas, mainly with Bob Dearman, undertook the technically difficult exploration which led to the evaluation of all the 'vertical' underground workings described here. John Barnatt, Jim Chilcote, Richard Griffiths, Dan Hibberts, Tim Pendleton, Jim Rieuwerts, Mike Salt and John Scaife also helped with underground exploration. The surveys of Dutchman Level and workings E11-13 were undertaken by Garth Haddon Thomas and John Barnatt, with the invaluable assistance of Tony Green and Dave Leaning who provided total station survey of the surface remains and a station within Dutchman Level. The underground surveys of E8/9/10 and the workings rising from Dutchman Level were undertaken by Garth Haddon Thomas and Bob Dearman with some assistance from John Barnatt. Graeme Guilbert provided information on his discoveries and on the Nellie Kirkham letter prior to his publication. Doug Nash kindly found and copied notes and sketch plans from Nellie Kirkham's archive. John Pickin generously agreed to our reference to his recently discovered hammer stones. Mark Edmonds arranged for the antler tool to be examined at the Department of Archaeology and Prehistory, Sheffield University. Simon Timberlake provided extensive comment and comparative information. Further comment and advice on the research were provided by Roger Doonan, Graeme Guilbert, John Pickin and Jim Rieuwerts.

The Peak District National Park Authority gave a grant which helped with the costs of exploration, survey and radiocarbon dating. Further funds for the dating were provided by the Peak District Mines Historical Society. This analysis was undertaken by the Oxford University Radiocarbon Accelerator Unit.

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