

# PREHISTORIC AND ROMAN MINING IN THE PEAK DISTRICT: PRESENT KNOWLEDGE AND FUTURE RESEARCH.

John Barnatt

**Abstract:** The evidence for prehistoric and Roman mining in the Peak District is reviewed. Major advances in our knowledge of prehistoric mining in the area have been made with the recent confirmation of Bronze Age copper mining at Ecton. Our knowledge of Roman mining is still confined to indirect evidence, notably a number of inscribed lead pigs known to have derived from the region and to have been associated with Lutudarum. Ways of furthering our knowledge in the future are discussed, which include fieldwork strategies to investigate mining and smelting, and desirable changes in minerals-planning procedures to facilitate this.

## INTRODUCTION

Ten years ago the earliest known mining in the region was of Roman date, no prehistoric activity could be demonstrated. Recently, through work at Ecton in the Staffordshire part of Peak, we have now pushed known metal mining back by about 1500 years. Our understanding of local Roman mining has made little significant progress this century, the notable exception being through excavations at Carsington, which have highlighted the possibility that this was the Roman administrative centre for the orefield - Lutudarum. For both prehistoric and Roman mining studies there is still much to learn and serious obstacles to overcome before this is possible.

## METAL MINING IN PREHISTORY

In the last few years significant evidence has been found for prehistoric metal mining in the Peak District, although studies of this are still in their infancy. Copper was certainly being extracted and a case for lead mining can be made.

### Copper

Confirmation of Bronze Age mining at Ecton Hill in Staffordshire, a prominent hill between Warslow and Wetton, has recently been published in *Mining History* (Barnatt and Thomas 1998) and only a summary will be given here.

Ecton Hill is only the second Bronze Age mining site to be confirmed in England, the other being a short distance to the north-west at Alderley Edge in Cheshire (Garner *et al.* 1993; O'Brien 1996); here the results of recent excavations of prehistoric workings at Engine Vein are being prepared for publication (Simon Timberlake pers. comm.). To date, prehistoric copper mining sites are commoner and better known in Wales and Ireland where study over the last decade has done much to elucidate their character (Timberlake 1992; 1994; in press; Dutton and Fasham 1994; O'Brien 1995; 1996).

The possibility of prehistoric mining at Ecton Hill was first

brought to the general attention of modern researchers in the early 1990s when four hammer-stones were discovered on the 19th century hillock at the entrance to Dutchman Level (Guilbert 1994a; 1994b). In the mid 19th century Thomas Bateman had acquired 8-9 hammer-stones and a possible grinding stone from an unspecified context within the Ecton Mines, which are now in Sheffield City Museum (Pickin 1999), together with nine '*sharpened pieces of stags horn*' that unfortunately have now been lost.

In the 1940s Nellie Kirkham explored Stone Quarry Mine (the upper part of Dutchman Mine) and found *four large water-worn rounded stones* and, *a bone which might be slightly worn and have been used for scraping something*. All were found on a ledge in an underground working at 25-30m below surface (Kirkham 1945; 1958).

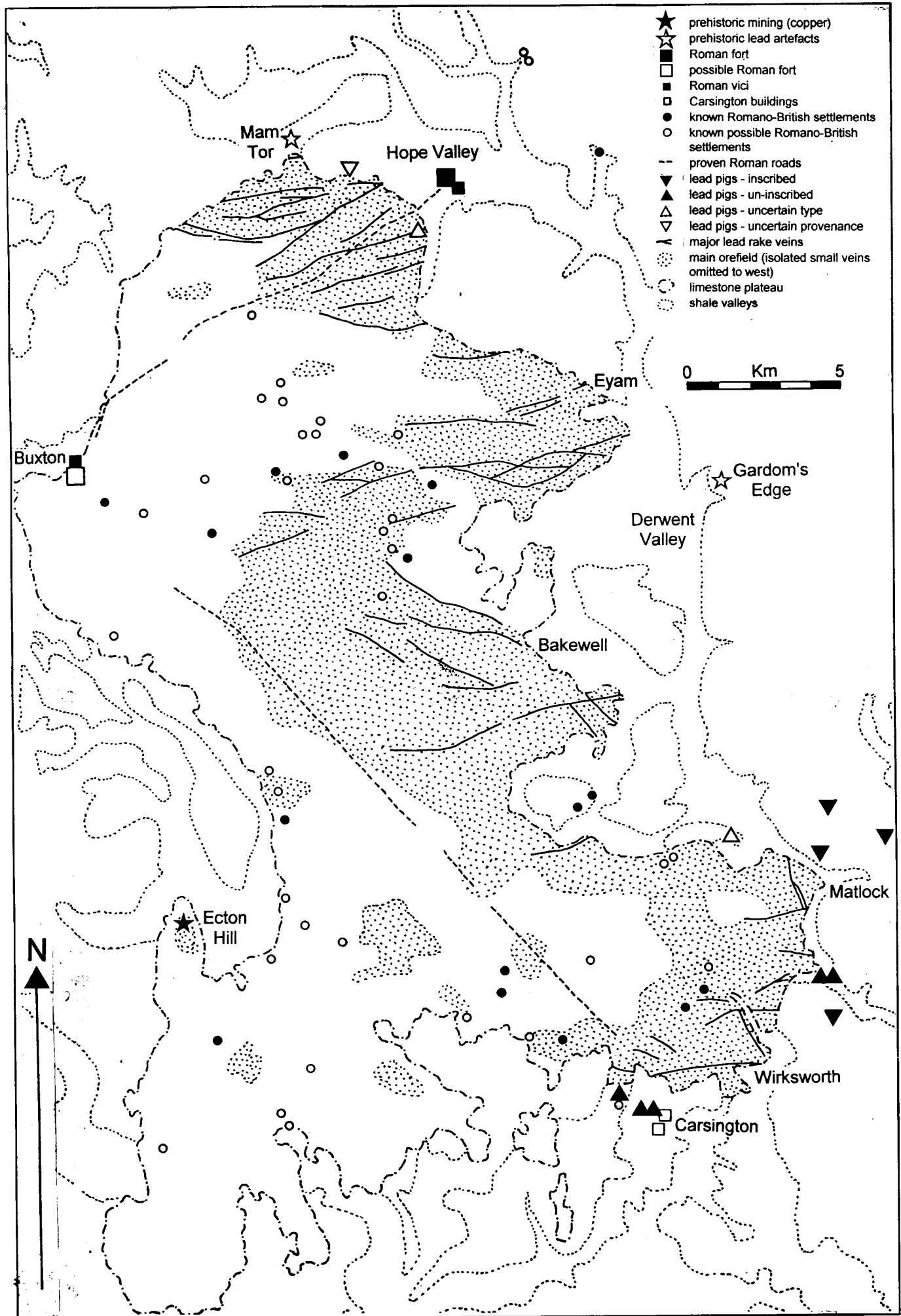
In 1994 systematic underground exploration and survey was started in an attempt to relocate the Kirkham discovery. It was eventually found that all routes to the working had run in, and digging through to this would be a serious undertaking. However, several significant finds were made elsewhere in Dutchman Mine. One unanticipated discovery was important evidence for the 17th century use of powder using continental methods (Barnatt *et al.* 1997), while a prehistoric antler tool and small area of finely-incised pickwork possibly made by such a tool were also found (Barnatt and Thomas 1998).

The antler tool was found by Bob Dearman and Garth Thomas after a difficult climb upwards for about 20m from Dutchman Level (now known to be of probable early 18th century date rather than later as previously stated) into small and unstable workings. The point of discovery was 11.5m below surface, but the tool may have fallen to here from now choked workings above and dislodged during later mining operations. The tool, made from an antler tine and clearly modified for hafting, may well have been primarily used to lever-out thinly bedded ore-bearing rock. Radiocarbon analysis produced a calibrated date of 1880-1630 BC (at a 95.5% confidence level that the tool dates from between the two stated dates).

To date, underground workings accessible directly from surface in the vicinity of Dutchman Mine have been assessed and published (Barnatt and Thomas 1998), while the Post-Medieval workings reached by Salt's Level and Deep Ecton

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Adit have largely been surveyed and analysed in detail; a report is being prepared for publication. However, the workings associated with the main Ecton Pipe above Salt's Level, which are exceptionally difficult and dangerous to reach, have not yet been fully explored and may possibly contain evidence for prehistoric mining; much of the pipe workings so far examined down to Deep Ecton Adit level have few shot holes, except where minor reworking appears to have taken place, but there are no further positive indications of date and it is unclear if this is 17th century or earlier work. Underground explorations elsewhere on Ecton Hill, by Garth Thomas, sometimes accompanied by the author, have until recently been largely confined to readily accessible workings, as in Clayton, Chadwick, Good Hope and Waterbank Mines, and have failed to find positive indications of prehistoric mining. However, many of the near-surface workings most likely to be early in date are choked or not readily accessible.

Since the discovery of hammer-stones on the Dutchman tip a small number of further and as yet unpublished examples have been found at surface by Graeme Guilbert, John Pickin and Garth Thomas. Taking all the surface hammer-stone finds together, they largely fall into two groups, those of quartzite/ganister and those of sandstone/gritstone. All are river-worn cobbles, the latter certainly available in the River Manifold at the base of the hill and the former possibly so. None have been modified, in the sense that they are not artificially notched for hafting, but some show clear signs of use that cannot be explained as accidental damage. The findspots cluster in four locations on the hill (Table 1). Their distribution, together with a careful assessment of their potential points of origin, given that they may have been moved by later mining operations, clearly indicates two areas of prehistoric mining on the hill, although this does not preclude the possibility that it also took place elsewhere.

On the basis of current evidence a provisional assessment of the character of the prehistoric mining on Ecton Hill suggests it was small scale, as indicated by the relative paucity of hammer-stones recovered to date and by the nature of the mineralisation near surface. This appears to have largely comprised thin mineralised beds dipping steeply into the hill. The main pipe deposits do not seem to have become wider potentially more productive until at significant depth below surface. Much of the mining may well have taken place near surface as a series of open-casts and possibly in shallow

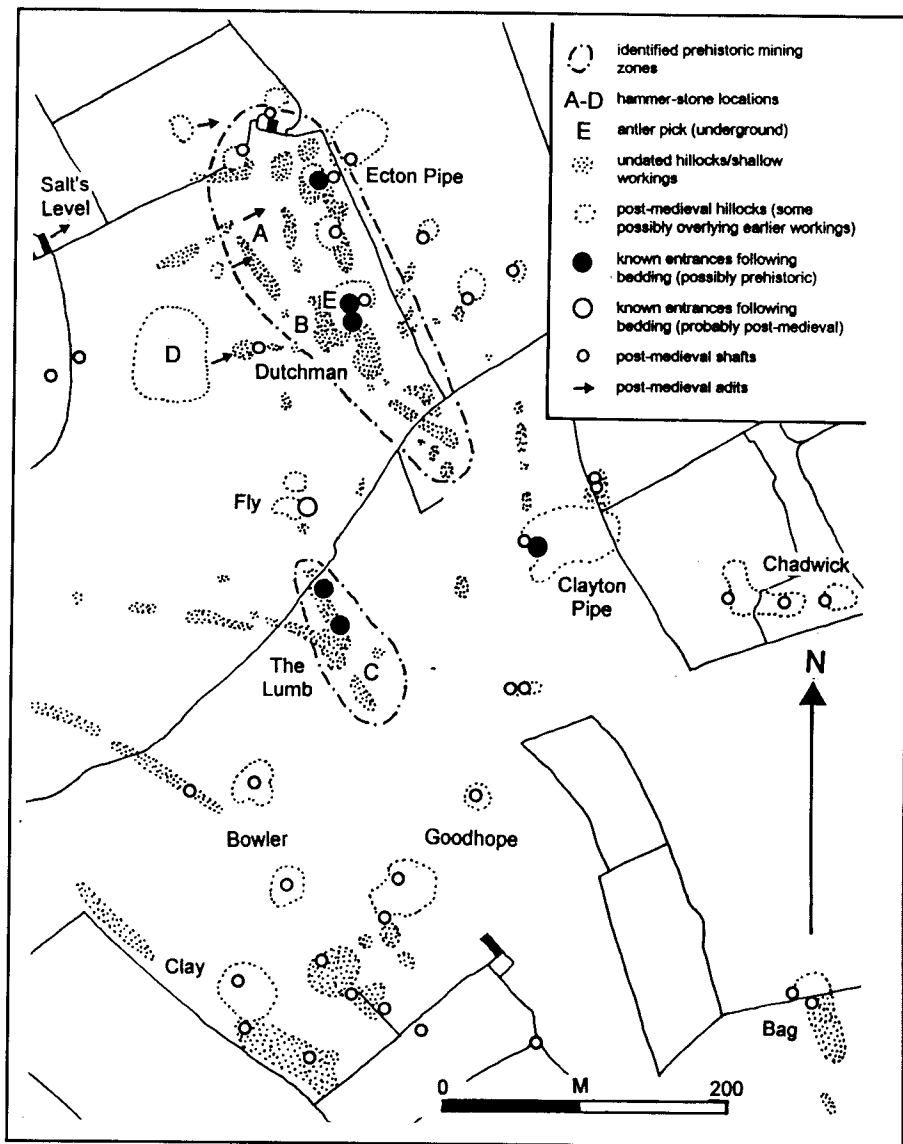


Fig. 2 The postulated extent of known prehistoric mining at Ecton.

underground galleries. No certain underground workings have been identified, although the distinctive pickwork at a depth of 8-10m is suggestive. The antler and Kirkham's artefacts, respectively at 11.5m and 25-30m below surface, are uncertainly interpreted; both could have derived from original contexts closer to surface. It remains unclear if prehistoric miners reached rich deposits in the main Ecton Pipe, which appears to have started widening significantly somewhere between c. 20 and 40m down. This said, the limited number of hammer-stones found suggests Ecton Hill is not a prehistoric mine on the exceptional scale of that discovered at the Great Orme near Llandudno (James 1990; Lewis 1990; 1994; Dutton and Fasham 1994).

#### Lead

Peak District lead was perhaps mined in later prehistory although the extraction and smelting sites are not known. The main indicator of this is the local discovery of two lead artefacts. At the Mam Tor hillfort, three fragments of a metal axe were found during the 1969 excavations (Coombs and Thompson 1979). These have recently been identified as lead (Guilbert 1996). The style of the axe indicates it probably dates to the 11th to 7th centuries BC, while detail suggests a potential 7th century date. Only a few other examples of lead axes are known in Britain, but they are found in greater numbers, sometimes in hoards, elsewhere in western Europe and particularly in Armorica. Their function is unclear, while

Fig. 1 (opposite page). The Peak District, showing the location of the Ecton Hill copper mines, prehistoric lead artefact findspots and the relationship of the main lead orefield to known Romano-British settlement sites and the Roman lead pig findspots.

Hammer-stone findspots	Likely Prehistoric points of origin	Observations
<b>A:</b> the hillocks downslope of the point of outcrop of the Ecton Pipe	Small surface opencasts in the immediate vicinity. or A short level of 19th century date accessed the upper parts of Ecton Pipe, which in turn were linked to the lower pipe workings and probably to the 'Stone Quarry' part of Dutchman Mine.	These hammer-stones may have been moved some distance, but may well come from the general vicinity of the Ecton Pipe and Dutchman Mine as the only link to mines elsewhere is via Goodhope/Dutchman Levels. It seems highly unlikely that Post-Medieval miners would have moved material from here up the workings associated with the upper Ecton Pipe and 'Stone Quarry Mine' as a much easier point of exit was provided by the Dutchman Adit entrance.
<b>B:</b> the hillocks immediately below 'Stone Quarry Mine' (part of Dutchman Mine).	Small surface opencasts in the immediate vicinity. or Dutchman Mine, which in turn was probably linked with the upper parts of Ecton Pipe.	These hammer-stones may have been moved some distance, but may well come from the general vicinity of the Dutchman Mine or Ecton Pipe - see A.
<b>C:</b> the hillocks (and small quarry) at the crest of 'The Lumb'.	Small surface opencasts and choked underground workings on 'The Lumb' which followed the mineralised bedding, which in this part of the hill dip less-steeply than elsewhere (although this may not be the case further underground).	These hammer-stones have almost certainly been found in the vicinity of their prehistoric contexts as any later workings here are very unlikely to have underground links with others elsewhere. It may be that much of the working at the Lumb is prehistoric, although this suggestion needs confirmation by excavation. However, while there is no documented Post-Medieval mining, it would be surprising if trial re-exploration did not take place at this time.
<b>D:</b> the Dutchman Level hillock.	Dutchman Mine - which includes those workings above the Level which linked to surface via 'Stone Quarry Mine' and which in turn may well have been linked with the upper part of the main Ecton Pipe. or Goodhope Mine and linked workings - while much of these mines at depth are clearly of Post-Medieval date, linked to Dutchman Level via Goodhope Level driven in the 19th century, there are near-surface workings at the present hilltop entrances to Goodhope Mine well to the south, at Bag Mine further south and at Fly Mine near The Lumb all linked underground.	These hammer-stones are certainly displaced and must have been removed from underground contexts in the 19th century. While it is possible that they originated in any of the mines listed, the most obvious point of origin is from Dutchman Mine, perhaps in similar contexts to that where the antler tool was discovered, or in the workings entered by Kirkham.

**Table 1: The location of prehistoric hammer-stones on Ecton Hill.**

they certainly are too soft to be used as practical tools or weapons, various alternative suggestions have been made, including prestige or votive objects, trial casting pieces and core boxes for smelting (fully reviewed in Guilbert 1996). The proximity of the Mam Tor example to the orefield makes it tempting to suggest it is made from local lead, but the possibility that it is an imported piece cannot be discounted. The case for a local origin is perhaps strengthened by the recent discovery of a second lead object in the region. In the 1999 season of excavations above Gardom's Edge near Baslow (Barnatt *et al.* 1999), a decorated lead object was found which provisionally is being interpreted as one half of a torc; this cannot be confirmed until conservation and comparative studies are completed. The object had been purposefully deposited, together with charcoal and fragments of burnt bone, in a pit at the centre of a multiphased structure, with a circular timber house that was later replaced by stone banks/cairns which mirror its outline. Pottery from the site provisionally suggests a Later Bronze Age or Earlier Iron Age date, most probably in the first half of the first millennium BC.

The implication of these finds is that local ores could have been known and worked. However, assuming this to be the case, mining was probably small in scale and confined to surface workings. There was little use for lead in prehistory,

artefacts made of this metal are particularly rare in Britain. While lead is frequently found as a minor constituent in copper-alloys (bronze) commonly used for artefacts from the Later Bronze Age onwards, it may well be that this is explained as contamination from the copper ore source, as the two ores commonly occur together, rather than a purposeful addition.

## ROMAN LEAD MINING

For many years we have known the Romans worked lead-ores in the region and that lead and pewter were widely used in the Roman world. Locally found artefacts, sometimes found in Roman military sites and Romano-British settlements but often as stray finds, include numerous lead weights and spindle whorls as well as rarer finds such as brooches, a lamp holder and dice. However, little is known of the Peak District mining itself; no workings have been conclusively identified. Roman documentation, in association with several inscribed ingots or pigs originating in the Peak District, demonstrates that the mining industry was administered by the Romans from Lutudarum. In the earlier Roman period, from their arrival in the region in the late 70s AD, administration may well have been under military control, but the situation in the third and fourth centuries AD

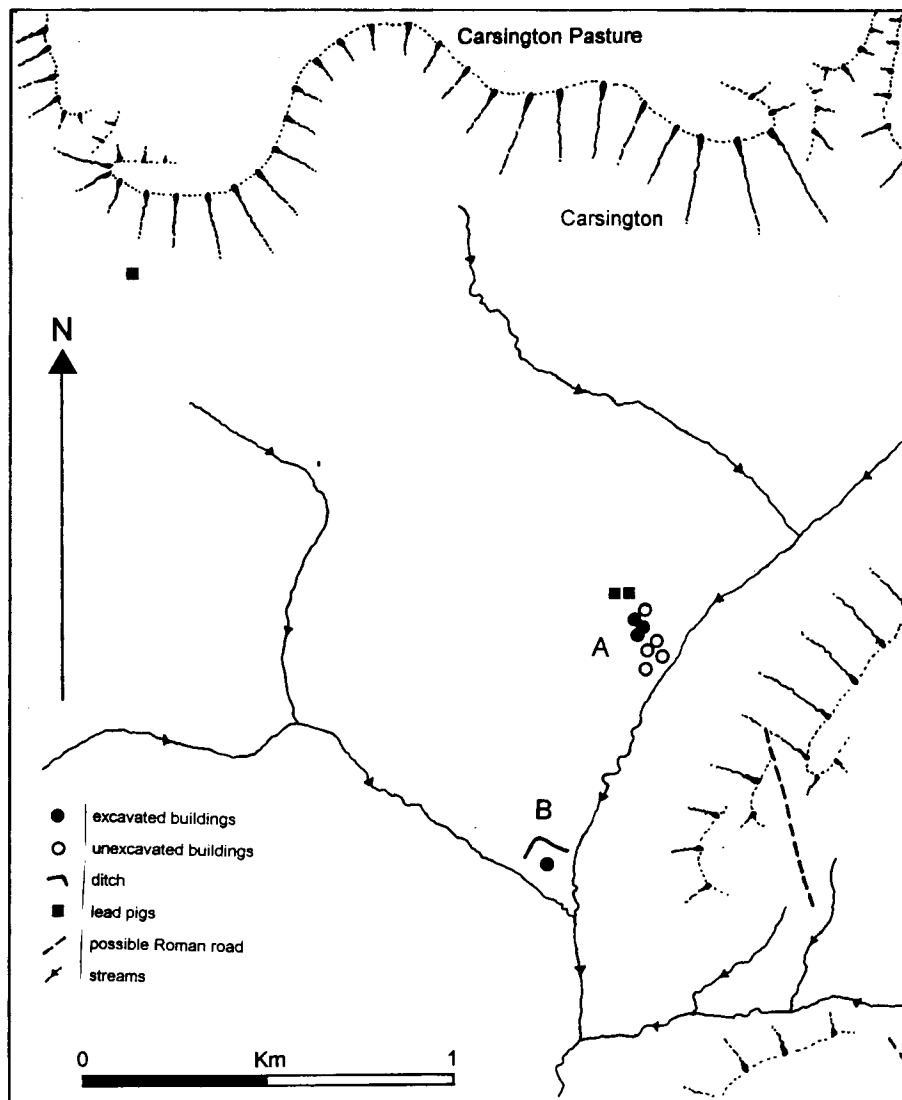


Fig. 3. Roman sites at Carsington.

is unclear. The lead pigs provide the best physical evidence for Roman mining within the orefield, but where they were smelted is not known; it could have been in relative proximity to the mines or elsewhere in the region. Smelting works may have existed but again these have not been identified. There are also some indicators of smelting/re-smelting of lead in the local rural Romano-British hamlets and farms of the Peak District. However, evidence found to date suggests this was small-scale and perhaps locally-orientated activity and it is uncertain if this had anything to do with pig production for external consumption.

#### Administering Lead Production: Lutudarum

The Roman administration of lead production within the Peak District is identified by inscriptions on lead pigs which correspond with an eighth-century gazetteer known as the Ravenna Cosmography, which lists Lutudarum alongside places in Cheshire and Derbyshire (Rivet and Smith 1981; Ling and Courtney 1981). However, there has long been debate as to whether Lutudarum was a specific place or the name given to the orefield as a whole (Haverfield 1907; Hart 1981; Branigan 1991; Dearne *et al.* 1995).

If Lutudarum was a place, it may have been south of the modern village of Carsington. This possibility was investigated in the late 1970s and early 1980s in advance of flooding by the reservoir under construction at that time. Here two sites were excavated. At site A unfortunately heavy ploughing had removed all but the last vestiges of features.

However, the postholes of a rectangular timber building of probable late first or early second century AD date, and the fragmentary remains of two or more later stone-footed rectangular buildings of probable late second century date, were recovered (Dearne *et al.* 1995). There were significant quantities of Roman artefacts of first to fourth century date. Concentrations of building materials in the ploughsoil indicate a further five or more stone-footed buildings probably once lay beyond the excavated area to east and south. An unknown number of timber buildings may also have existed here.

At some distance to the south, at site B, a better preserved building was excavated (Ling and Courtney 1981; Ling *et al.* 1990). This was a large stone-footed rectangular house which was probably built in the fourth century AD, with smaller wing added to one side which may have been a bath suite. There were at least two small 'outbuildings' placed on cobbled surfaces which may well have been earlier in date, associated with a house that had been demolished, as indicated by mosaic tesserae and window glass sealed under the later house. The character of the main fourth century building together with that of the large quantities of discarded artefacts which date from the mid second to the late fourth century AD, indicate the site was of relatively high status. The area surrounding the building was

investigated further shortly before the land was due to be flooded. It was found to be enclosed by a ditch on two sides, with streams defining two further sides; ditch recuts contained post-Roman pottery which suggested activity continued here into the fifth or possible sixth centuries AD (Taylor and Guilbert 1991; Graeme Guilbert pers. comm.).

The sites at Carsington are certainly atypical and probably represent something special. They are very different from the usual farms found in the region and are quasi-urban in character. They have more in common with the romanised civil settlements (*vici*) found outside forts, as for example at Navio in the Hope Valley. However, there is no identified fort at Carsington, previous postulations of this possibility are unsubstantiated (Hart 1981, 87; Wroe 1982, 55); this said, given the relatively regular spacing of forts along Roman military roads, one can be anticipated somewhere in the general area. Only one serious candidate is currently known; about 4km to the WSW of sites A/B, at Closes Farm, Kniveton, a rock-cut ditch has been found with high quality Roman artefacts of 1st century date (Dearne *et al.* 1995, 66). This has recently been investigated further by staff and students from Liverpool University, but no details are yet available.

The exact relationship of both the Carsington and Kniveton sites to Roman military roads is not yet clear. While the Roman road from Buxton heading towards Little Chester/Strutts Park near Derby, known as 'The Street', can be

1	Cromford Nether Moor	c. SK 3055.	Found in 1777 about 30cm below surface. Face inscribed; 'IMP.CAES.HADRIANI.AVG.MET.LVT (Haverfield 1907, 230)
2	Matlock Bank	c. SK 3061.	Found in 1783 just below the surface during agricultural improvement, close to a 'bole' of large flat stones. Face inscribed; 'L.ARVCONI.VERECVND.METAL.LVTVD' (Haverfield 1907, 231)
3	Matlock Moor	c. SK 3062.	Found in 1787. Inscribed; 'TI.CL.TR.LVT.BR.EX.ARG' (Haverfield 1907, 231)
4	Hexgrave Park	c. SK 6558.	Found in 1848. Face inscribed; 'C.IVL.PROTI.BRIT.LVT.EX.ARG' (Haverfield 1907, 231).
5	Portland Grange, Tansley Moor	c. SK 3261.	Found in 1894 at c. 0.6m depth during agricultural improvement, associated small hollows, with signs of burning, that were suggested to have been used for smelting. Face inscribed; 'PRVBRI.ABASCANTI. METALLI.LVTVDARES' (Haverfield 1907, 232)
6	Yeaveley	SK 185399	Two pigs found together while excavating drains in 1975. Both identically inscribed; on face - 'SOCIORVM LVTVD' ; on side - 'BRIT EXARG' (Dool and Hughes 1976)
7	Yeaveley	SK 185399	see 6.

#### Inscribed Pigs

1	Carsington	SK 251524	A worn pig of Roman shape found in 1894 when digging school foundations. The possibility that the face once had an inscription cannot be discounted (Cockerton 1953).
2	Carsington	SK 251524	see 1.
3	Carsington	SK 238533	Pig found by ploughing in 1946. Base inscribed 'CX' which is an approximation to its actual weight in libra (Cockerton 1953).
4	Cromford Churchyard	c. SK 299571	Two pigs dug up by the sexton (reported 1919), one inscribed 'XXX' the other 'XV' (Cockerton 1962).
5	Cromford Churchyard	c. SK 299571	see 4.

#### Un-inscribed Pigs

1	Oker Hill	c. SK 2761	Found in 1846 ' <i>near some ancient mineral works</i> ' and of ' <i>Roman shape</i> ' - no details known. Roman coins and ' <i>other antiquities, both of British and Roman origin</i> ' were found nearby. (Bateman 1848, 159; Haverfield 1907, 232).
2	Bradwell	SK 172813	A worn pig of Roman shape found in 1894 when digging school foundations. The possibility that the face once had an inscription cannot be discounted (Cockerton 1953).
3	Castleton	c. SK 15.83.?	An inscribed pig was reported in 1802 as from ' <i>near Castleton</i> ' with only the letters 'IMP' that could be read distinctly. It has been suggested that this reference is erroneous and the pig was found at Hints Common in Staffordshire and thus not identifiably originating in the Peak District (Haverfield 1907, 232-3).

Table 2: Lead Pigs found within or close to the Peak District

#### Uncertain Type or Provenance

traced to a point just north-west of Carsington Pasture, its course beyond here is uncertain. It has been suggested that the road passed down Carsington Pasture to run somewhere close to Site A (Wroe 1982; Dearne *et al.* 1995, 65; Willies 1995) and a broad, artificial-looking terrace on the route across the lower slopes below later mining hillocks may be its site (Andrew Chamberlain pers comm). Below the Pasture, closer to Site B, an excavation trench dug by the Hunter Archaeological Society found a raised 'hardcore' surface that suggested that the road line had been found (Dearne *et al.* 1995, 65). However, a second unpublished trench dug across the same earthwork in 1983 in advance of flooding, led to the conclusion that this was a Medieval cultivation headland, the 'hardcore' being a natural deposit that had been truncated to either side. Similarly, postulated Roman road earthworks south of Carsington around Warrington Knob (Wroe 1982, 64) have yet to be dated.

Given the uncertainty just noted, it remains unclear whether the excavated buildings at Site A functioned as a road station. Wherever the road went, a further possibility is that it was a centre for administering the lead industry and thus is perhaps Lutudarum. There are indications that lead processing took place here. Several pits associated with at least one of the excavated buildings had galena in their fills, a millstone was also found here that was suggested to have been used for milling ore. In addition, at several locations across the excavations splashed lead, lead-sheet offcuts, smelting slag and possibly part-smelted galena were found. Two lead pigs were subsequently found nearby which had been purposefully placed in a pit (Branigan *et al.* 1986). All this said, the signs of ore crushing and smelting activity appear to be relatively small in scale and could fit comfortably within a farming or other 'cottage-industry' context as a minor part of varied activities taking place. Similarly, site B was interpreted by its excavator as a farmstead, but one owned by someone with a

degree of wealth and standing. However, such arguments do not contradict sites A and B being equated with Lutudarum, for its main function would probably have been administration and supply rather than ore processing. The villa-like characteristics of site B may indicate its occupants had a significant role in this administration, as well as perhaps also being farmers.

While Carsington is currently the prime candidate for Lutudarum (assuming it is a specific place, or, if not, one of its main administrative centres), this is not proven and another site in the Matlock/Wirksworth area may yet remain undiscovered. Similarly, the possibility of a second centre that oversaw mining in the High Peak should be considered; the division of the orefield into High and Low Peak Liberties may be of greater antiquity than the Medieval period. It has been suggested that this northern centre was near Eyam (Makepeace 1998, 108). However, a location in the Hope Valley is an equally likely possibility. The Roman fort of Navio and its associated vicus (civil settlement) may have functioned in this way, but this currently is beyond proof.

### Lead Smelting: Pigs and Hearths

The most tangible evidence for local mining of lead in the Roman period is about 30 lead ingots or pigs, some found in or near the Peak District (Table 2). Others elsewhere but thought to originate here (Haverfield 1907; Cockerton 1953; 1959; 1962; Dool and Hughes 1976; Hart 1981; Branigan *et al* 1986). All have been casual finds except two from Carsington. These were found placed in a pit. Similar contexts may be postulated with all or the majority of the poorly-recorded pigs, perhaps buried after they had been stolen or for security in times of unrest. None have been found in direct association with a mine, although it is possible in up to three of the inadequately documented examples that they were associated with smelt sites (see below).

The most informative pigs are over 20 that are inscribed - 'LVT', 'LVTVD' or in one case from Tansley Moor 'LVTVDARES', all indicating an association with Lutudarum. These are thought to have been cast in the late first or second century AD (and possibly later), although only that from Cromford Nether Moor can be dated relatively precisely as it bears the name of Emperor Hadrian who reigned from 117 to 138 AD.

In 1983 two uninscribed pigs were discovered in a pit close to the excavated buildings at Site A, Carsington. These are the only examples in the region to have been recovered using archaeological techniques. Artefacts within the pit, which may be residual, indicated that these were of late Roman date, the pit having been dug in the fourth century AD at earliest, probably in its second half (Branigan *et al* 1986). Similar but undated pigs have been found elsewhere at Carsington, at Cromford Churchyard, and possibly at Bradwell and Oker Hill (Haverfield 1907; Cockerton 1953). These pigs, being uninscribed, beg the question - do they represent civilian exploitation of the lead mines, after the probable cessation of direct military control at the end of the second century AD? If the excavated buildings at Carsington do equate with Lutudarum, does this indicate it was a centre where Roman officialdom administered the leasing of the mines and/or smelting rights through to the late fourth century AD?

Alternatively, was it one of the main leasees who lived at Carsington's site B?

Inscribed pigs have been found outside the Peak District both in the East Midlands and at one site in southern England. There is a notable concentration of these around Brough on Humber, suggesting that Roman lead was transported to here, for shipping to other parts of Britain and probably continental Europe (Bartlett 1967; Dool and Hughes 1976; Hart 1981). To date, the four pigs found together at Pulborough in Sussex are the furthest certain examples from the point of origin, although some pigs from a Roman wreck at Ploumenac'h off Normandy are also thought to originate from the Peak District (Tylecote 1987; L'Hour 1987; Willies 1990).

Several of the pigs are inscribed 'EX ARG', including those found locally at Matlock Moor, Hexgrave Park and Yeaveley. This has previously been suggested to indicate they have had their silver content removed from the lead. However, with the notable exception of galena from Ball Eye mine on the Via Gellia west of Cromford, Peak District ores have very low silver levels (Ford and Rieuwerts 1983), which would have

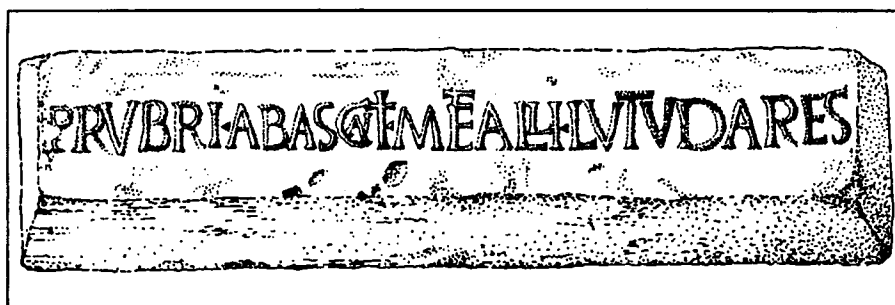


Fig. 4. The lead pig from Portland Grange on Tansley Moor.

made its extraction unviable. Rather, it may well be that the inscription signifies the lead had been smelted in an officially sanctioned 'smeltworks' or under the jurisdiction of the administration of Lutudarum.

The distribution of pigs in the Peak District, found not only around Matlock and Wirksworth but also in the Hope Valley, suggests the orefield may have been widely exploited in the Roman Period. However, it is unclear where the ores were smelted. There is currently no evidence that this took place in the immediate vicinity of the mines. It may be that smeltworks were placed to the east as the lead was to be transported to Brough on Humber, but it is far from clear whether this centred on the eastern gritstone uplands as with Medieval boles in order to take advantage of the winds here, or elsewhere. The pig found at Oker Hill was noted as being found near 'ancient mineral works', but it is unclear if these were of Roman date, whether they were smelting-related, or if they were situated on the hilltop; there are no obvious signs of smelting here today. Similarly, the pigs from Matlock Bank and Tansley Moor were noted as being found close to respectively a 'bole' of large flat stones and small hollows with signs of burning. These possible smelting sites are undated and may have no bearing on the context in which the pigs were deposited; the high locations at which the pigs were found may lie on transport routes eastwards rather than in proximity to smelt sites. Alternatively, lead smelting in the Roman period may have been settlement-based or valley-centred, the ores being smelted with the aid of hand-bellows rather than in true bole hearths.

One pertinent clue as to the character of lead smelting is

provided by many of the pigs themselves. It is common for them to have lateral laminations, as for example with several of the inscribed pigs and one of the fourth century excavated examples from Carsington. This may indicate that each pig was the product of several small-scale smelting episodes rather than a single casting as might be expected from a bole hearth.

At some distance from the orefield a small lead hearth in a settlement context has been excavated at Scarscliffe Park near Chesterfield (Lane 1973) and an insecurely dated hearth overlying Roman pottery kilns has been found at Duffield (Willies 1990). In the Peak District possible evidence for smelting in Romano-British settlements is provided by the presence of galena, sometimes part-smelted, splashed lead and lead slag. In the majority of cases it is unclear if the evidence represents primary smelting or re-smelting of lead. Similarly, in some cases the galena could be naturally placed rather than having been imported. The relatively poor quality of the current evidence is illustrated by the examples given below. At the two well-documented and relatively extensive excavations at Romano-British rural settlements, there have been no conclusive results. At Roystone Grange, near Ballidon, the main evidence for lead working was a hearth with *lead debris* overlying a house site but this could not be securely dated to the Roman period (Hodges and Wildgoose 1981:46; Hodges 1991:76-77). At Staden, near Buxton, excavations have found only occasional isolated pieces of smelted lead and galena in unsecure contexts but in loose association with artefacts and structures of Roman date, while Medieval lead re-smelting was demonstrated in one part of the site (Makepeace 1987; 1989; 1995). At Owslow Farm near Carsington, in the same vicinity as the lead pig found during ploughing in 1946, excavations in 1959 found Roman features and artefacts together with many pieces of galena that the excavator suggested were *more than could be reasonably expected to occur naturally* (Lomas 1960); this evidence is tentative as the general density of naturally occurring galena in the vicinity was not tested. Finally, one curious demonstration of the importance of galena to local people in the Roman period is provided by the placing of pieces of ore on the eyes of person buried at the settlement on Chee Tor near Blackwell (Lane unpublished; Bill Bevan pers comm.).

### The Lead Mines

Conclusive identification of Roman mines has always proved elusive; not a single case as yet exists. Several examples have been quoted in the past, but none have particularly convincing evidence.

Some parts of the orefield, such as Bonsall Moor and around Wensley, have many small mines that appear to have been dug using simple methods and may well be of some antiquity; Some of these are in proximity to Romano-British rural settlements. However, as yet no clear indications that any of the mines are as early in date as the Roman period have been found. Similarly, open-cast cuts into veins sometimes give the appearance of being ancient, as for example as has been suggested for workings near Elton (Hart 1981, 106), but this again remains to be substantiated. Proximity to Romano-British settlement is not in itself enough, as these are found throughout the limestone plateau (Hart 1981; Barnatt and Smith 1997; Makepeace 1998), including those areas where mineral veins are rare; all these settlements may well be primarily agricultural in character and the postulation that the farmers here also mined lead is speculative.

There are several instances where Roman artefacts have been

documented as found in the past associated with mines. Bronze brooches, pins and coins were found in the 1860s at Hardbeat Mine and Cowlica Rake at Elton, and a further brooch was found in 1861 '*in old mine on Elton Moor*' (Haverfield 1907, 257). 'Bronze pins' and coins were found '*in the 19th century at the Longstone Edge Mines*' (Haverfield 1907, 259). In Hilltop Mine at Hucklow wooden spades were found that were claimed to be Roman but there was no supporting evidence for this and such spades are known to have been used in more recent times (Haverfield 1907, 258); similarly, iron spades in a mine at Taddington were thought by some to be Roman (Haverfield 1907, 262). None of the above accounts give enough information to make it clear if the finds were made in sealed Roman contexts. In some cases it is not even known if the finds were made underground. Some may have been found at (or originally at) surface and have no direct association with Roman mining; they could for example be from pre-mining domestic contexts at sites that were only mined at a much later date.

Several of the show mines at Matlock Bath have been claimed in the past to be of Roman date, but this may be nothing more than 19th century tourist hype (Flindall and Hayes 1976). However, the possibility that some of the pipe and rake workings here are Roman cannot be discounted. A strong case can be made that the Nestus pipe workings (including the Masson and Rutland show caves) had been extensively worked by the end of the 15th century (Barnatt and Rieuwerts 1998). While it most likely that these pipes were discovered and mined in the Medieval period, Roman exploitation cannot be entirely ruled out, although it must be stressed that there is no positive evidence to support such a suggestion. Similarly, workings at the nearby Coalpit Rake (Devonshire Cavern) have many examples of sooted roofs and walls within the narrow parallel vein workings near surface. Coal and coke have recently been found here in several places by Jim Rieuwerts and the author, which confirms fire-setting was used. However, while many of the workings here were undoubtedly mined before the introduction of powder in the late 17th century they remain undated; the use of coal rather than wood as the fuel source may well indicated medieval/early post-medieval rather than Roman working.

To date, there has been one postulated example of archaeological evidence for Roman (or possibly earlier) surface working, found during the extensive excavations at Roystone Grange near Ballidon (Hodges and Wildgoose 1981, 51-2; Hodges 1991, 80-1). Here an ancient field boundary was suggested to overlie the upcast from a backfilled open-cut into a scrin; the field bank was suggested to be of second century AD date. However, recent re-evaluation of the Roystone Grange field boundaries has led to the questioning this evidence (Chadwick and Evans in prep.). It is argued that the boundary feature was built in the Medieval period and that the stratigraphic evidence with regard to the lead working is at best ambiguous; it is concluded that the lead mining is of medieval or post-medieval date.

Recently, not far from the Peak District, conclusive evidence for Roman copper mining has been identified at Alderley Edge in Cheshire. Here a wide shaft of square-cut cross-section was sunk into the soft sandstone with a spacious level leading from the base into mineralised ground of Engine Vein; a Roman coin hoard was found part-way down the shaft and timbers at the base have produced radiocarbon dates for the Roman period (Simon Timberlake and Paul Deakin pers. comms.)

## FUTURE RESEARCH: PRIORITIES AND METHODS

The review given above illustrates that we know relatively little about early metal mining and smelting in the Peak District. Thus, research priorities are basic ones - finding the physical evidence for these activities and using this to assess their character. While in some cases new discoveries will undoubtedly be chance finds, there is scope for systematic research both at surface and underground. However, neither are free from significant problems.

The first step is to predict and identify locations where early mining and smelting are likely to have taken place. For each, assessment must be made as to what the nature of the evidence is likely to be in order to develop appropriate strategies for making significant discoveries. One major problem is the accurate dating of any early evidence, as extraction and smelting techniques are likely to have been similar from earliest times to the end of the Medieval period. As examples, when underground how do we identify diagnostic workings from evidence such as pickwork, while on surface how do we recognise early hillocks or processing areas amongst the plethora of later remains? Sometimes this may be possible by observation of what underlies or is cut by later features. However, for the most part, detailed chronological assessment will only be possible by finding stratified diagnostic artefacts or material that can be radiocarbon dated (bone, wood, charcoal and possibly soot).

### Copper Mining

It is likely that in a Peak District context the prehistoric mines at Ecton are an isolated occurrence. The prospects for finding further examples elsewhere in the region are not high. While copper is known to occur widely in small quantities, as for example around Matlock and at other locations near Ecton, it seems unlikely that these would have been easily discovered in prehistory. However, this possibility should not be discounted and a search for diagnostic artefacts such as hammer-stones should be made. At Ecton, further systematic research is needed to confirm the scale and character of the prehistoric mining here; this work is in the planning stage and hopefully will include detailed surface characterisation of the hillocks and opencast pits, through survey and trial excavation, and further underground exploration.

### Lead Mining

It may well be only a matter of time before direct evidence for Roman and perhaps prehistoric lead mining is found. This would fill the greatest gap in our current knowledge and is thus the first priority for future research. Most probably the Roman miners concentrated on the obvious outcrops of productive lead ore sites, comprising largely if not entirely of rake veins. Many of these could easily have been found, for example in daleside cliffs and similar exposures, and perhaps as lines of sinkholes along veins. Perhaps agricultural ploughing around settlements turned up fragments of galena and spar which indicated below-surface veins. Miners at this time may have known that veins could also be located by observing plant indicator species such as leadwort and more tenuous prospecting methods such as dowsing may also have been employed.

It may well be that much and perhaps all of the mining took place within relatively shallow opencasts, if only because this was probably the easiest and most cost-effective method of working. Deeper mines may not have been necessary while easily obtained galena was available. However, the possibility of mining down to local watertables, perhaps 50m or more below surface, cannot be discounted.

Near-surface pipe deposits may also have provided a rich source of lead at an early date. Recent examination of accessible near-surface pipe workings at mines such as Ball Eye Mine on the north side of the Via Gellia west of Cromford, Old Millclose near Wensley and Jug Holes above Snitterton have failed to find any clear indication of early mining; only at the Nestus pipes at Matlock Bath have distinctive workings been identified but here they are likely to be of Medieval date (Barnatt and Rieuwerts 1998, 64).

With the notable exception of the Nestus pipes, all known pre-gunpowder workings appear to have been mined using similar methods and tools for extraction; much of the detailed description given by Agricola in the sixteenth century (Hoover and Hoover 1950) would probably not be out of place in a Roman context. Commonly the only clues underground as to the presence of pre-powder workings (probably introduced in the 1660s - cf. Barnatt *et al.* 1997) is the absence of shotholes in conjunction with the presence of extensive pickwork scars. In addition, occasionally sooting is found that may result from fire-setting. Dating the pickwork scars may well be impossible. For example, the easily accessible open workings on Dirlow Rake, above Castleton, show fine examples of pickwork in their sides which are almost certainly of pre-powder date; there is place-name evidence indicating the mines further up the vein at Dirlow Rake Head existed by 1538 (Cameron 1959, 57). While this particularly large vein, easily found at the scrins in the side of Pin Dale, is a prime candidate for potential Roman discovery, we have no idea whether the pickwork is Roman or Medieval in date. Firesetting can potentially leave charcoal deposits suitable for radio-carbon dating, assuming wood rather than coal was used for fuel. However, suitable *in-situ* deposits have yet to be identified; these would need to be free from contamination from mine explorers using carbide lamps.

The main problem in discovering Roman and other early mining stems from the nature of the mineralisation (Ford and Rieuwerts 1983). The majority of ore-bearing veins are near-vertical. Thus, later miners have cut through and reworked the earlier workings, removing or at best modifying them. Similarly, Post-Medieval surface waste heaps overlie and mask earlier hillocks and associated evidence for mining. This situation has been compounded by extensive working of hillocks in the late 16<sup>th</sup>/early 17<sup>th</sup> centuries and again in the mid-late 18<sup>th</sup> and 19<sup>th</sup> centuries, as new technology allowed previously discarded grades of ore to be processed (Barnatt with Rieuwerts 1995; Rieuwerts 1998); presumably the remains left by ancient mining were damaged or removed at these times.

In the 20<sup>th</sup> century a large number of hillocks have again been re-processed and often removed for their gangue mineral content. Many others have been levelled by farmers and other land managers for agricultural purposes, despite the problems of stock poisoning that may result from hillock disturbance. While many of the most promising surface and near-surface locations for early mining, at the larger rakes, have already been reworked, often levelled and probably irrevocably damaged, there is still potential; perhaps our greatest hope of finding evidence for the Roman and other early mines will be careful observation of reworking as it happens. Archaeological evaluation work would also provide valuable information about all other periods of mining.

A small number of the most important lead mining sites in the Peak District, with Post-Medieval and undated remains, have now been protected as Scheduled Ancient Monuments. In addition, in some cases mine sites can be protected

voluntarily through conservation agreement, through initiatives such as the Ministry of Agriculture, Fisheries and Food's Countryside Stewardship scheme and the National Park Authority's Farm Conservation Scheme. However, such schemes are often difficult to sustain if the owner of the mineral rights wishes to rework the mining site. A further limitation of such agreements is that they are for a fixed time period and long-term conservation is therefore not ensured. Currently, conservation schemes do not provide sufficient remuneration to make them financially competitive when set against the income that can be derived from mineral recovery.

Where conservation of near-surface workings, hillocks and associated mine features cannot be achieved, which is the preferred option, then appropriate mitigation strategies need to be put in place. Ideally minerals planning authorities should make it a condition of future extraction that archaeological watching briefs and trial excavations take place at the most promising locations. It is current practice that developers fund archaeological evaluations at threatened archaeological sites where development requires planning permission, through the implementation of Planning Policy Guidance Note 16: Archaeology and Planning. However, currently archaeological evaluation rarely happens at mine sites for a number of reasons. Hillock removal is usually allowed through a government General Permitted Development Order (planning permission is not therefore required) and there is thus no legislation that gives minerals planners the power to insist upon evaluation paid for by the minerals operator unless the General Permitted Development Order for a proposal is withdrawn. Minerals planning authorities have the power to do this and ask for the extraction proposal to be submitted for planning permission. However, if this is done then the mineral operator is entitled to compensation, to be paid by the relevant planning authority, the amount based on the estimated loss of the value of the mineral that would have been obtained by carrying out the proposed work; such compensation is potentially substantial and therefore it is often impractical to ask for a planning permission submission. In contrast, mining below the original ground surface does require planning permission, but here adequate archaeological evaluation is often difficult because of the extraction methods used and health and safety considerations when working at depth. Currently there is no legislation to prevent farmers levelling hillocks at will, provided the mineral is not removed from site.

From a research perspective the present situation is far from ideal, as evaluation would normally rely upon the goodwill of the mineral operator or farmer and significant funds would need to be found to carry out the work, which demands professional expertise. In some cases extraction or levelling methods would need to be modified to allow for the careful monitoring of remains, particularly at or near the original buried ground surface, and this again could have financial implications. The provision of funds by the developer/'improver' at the present time is a particularly difficult issue as conservation and research requirements need to be set against the uncertain viability of upland farming and the local mineral industry. Organisations such as the Peak District Mines Historical Society and other conservation societies could play a part by:

- Acting as advocate for the value and importance of archaeological evaluation work.
- Lobbying for change in the planning process to make evaluation a condition of the disturbance of surface remains at mine sites.
- Lobbying for necessary and fair funding structures to be

put in place that would make such work possible.

- Providing expertise that will help in the assessment of the findings.

If the General Permitted Development Order was rescinded (with regard to historic mine hillocks rather than stockpiles resulting from recent extraction) then mineral removal proposals would automatically be subject to planning permission and each case could be assessed individually according to its archaeological merit (amongst other planning criteria) without prohibitive compensation payments; thus, mine sites would be given the same protection through the planning process as other archaeological sites. However, the control of agricultural 'improvement' would involve a more radical re-appraisal of the planning process. It is debatable whether this is desirable, a more positive approach would be to provide attractive conservation funding to ensure survival of mine features.

The basic research priority for furthering our understanding of the early smelting of lead is to determine whether it took place entirely at a small scale in settlement contexts, or if larger 'industrially-organised' smelt sites also existed. To evaluate the latter possibility, in-depth fieldwork and research is badly needed. The obvious place to start is the many known 'hilltop' bole sites known in the region (Kiernan 1989; Barnatt with Rieuwerts and Roberts 1996). While the majority of these boles were undoubtedly used in the Medieval period, and this is sometimes confirmed by documentation or place-names, the possibility that some are also (or alternatively) earlier in date has never been investigated. Several sites for which there is no Medieval documentation have been located by the slags still present. What is badly needed is a programme of controlled archaeological excavation. At present bole sites in the Peak District have not been adequately investigated in this way; the only excavations to have taken place are at two sites which may well be atypical. One comprised a small hearth, with lead slag but no dateable artefacts, inserted into a prehistoric barrow on Beeley Moor (Radley 1969), the other was a low-lying site in Howden Clough, off the upper Derwent valley, where pieces of melted lead were found with medieval pottery, charcoal and burnt stones, all in a discrete deposit on a small natural platform; it may be this isolated site was used to recycle lead rather than smelt ore (Bevan in press). Future research will no doubt primarily inform us about Medieval smelting, but the possibility that it will also provide earlier data should not be discounted.

The smelting of lead in settlement contexts is also poorly understood; was this a common practice at all settlements on or near the orefield, used as a source of income to the farming communities here, or was occasional smelting or re-smelting of lead purely for internal consumption? Further information could be gained from multi-purpose excavations at settlement sites. To date there has been insufficient satisfactory excavation of Romano-British hamlets and farms in the Peak District. With the exception of Roystone Grange near Ballidon (Hodges and Wildgoose 1981) and Staden near Buxton (Makepeace 1983; 1987; 1989; 1995), previous excavations have comprised only small trenches and/or are not (or only inadequately) published. Examples are the sites at Chee Tor near Blackwell and Horsborough near Taddington. If the true context of 'domestic-scale' lead production is to be understood, large-scale and careful excavations will be necessary, to place any hearths or smelting debris against other activities that took place, assimilating these with evidence for the scale, detailed chronology, economy and character of settlement.

Furthering our knowledge of the location and character of Lutudarum may prove difficult. With the sites at Carsington now submerged under the reservoir nothing more can be done here. Finding evidence elsewhere may well rely on chance.

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## REFERENCES

- Barnatt, J., Bevan, W. and Edmonds, M. (1999) *A Prehistoric Landscape at Gardom's Edge, Derbyshire: Excavations 1999*. Bakewell: Peak District National Park Authority, Archaeology Service archives - unpublished interim report.
- Barnatt, J. with Rieuwerts J.H. 1995 *The Lead Mine Affected Landscape of the Peak District*. London: unpublished report for English Heritage.
- Barnatt, J. with Rieuwerts J.H. and Roberts, J. 1996 *The Lead Mine Related Landscape of the Peak District: Part 1 - Smelting Sites, Fuel Sources and Communications*. London: unpublished report for English Heritage.
- Barnatt, J. and Rieuwerts, J.H. 1998 The Upper Nestus Pipes: An ancient lead mine in the Peak District of Derbyshire. *Mining History* 13.5, 51-64.
- Barnatt, J., Rieuwerts, J.H. and Thomas, G. H. 1997 The early use of gunpowder in the Peak District: recent exploration and re-evaluation of the workings at Stone Quarry Mine and Dutchman Level, Ecton. *Mining History* 13.4, 24-43.
- Barnatt, J. and Smith, K. 1997 *The Peak District: Landscapes Through Time*. London: Batsford/English Heritage.
- Barnatt, J. and Thomas, G. H. 1998 Prehistoric mining at Ecton, Staffordshire: a dated antler tool and its context. *Mining History* 13.5, 72-78.
- Bartlett, J. E. 1967 A pig of lead from Broomfleet, East Yorkshire. *Derbyshire Archaeological Journal* 87, 67-68.
- Bateman, T. 1848 *Vestiges of the Antiquities of Derbyshire*. London.
- Bevan, B. in press Medieval lead: archaeological excavation and conservation of a lead working site, Howden Clough, Bradfield, South Yorkshire, 1997. *Transactions of the Hunter Archaeological Society*.
- Branigan, K. 1991 Civilian development in a military zone: the Peak AD43-400. In R. Hodges and K. Smith (eds.) *Recent Development in the Archaeology of the Peak District*, 57-67. Sheffield: Collis Publications (Sheffield Archaeological Monographs 2).
- Branigan, K., Housley, J. and C., Birss, R. and Hunt, C. 1986 Two Roman lead pigs from Carsington. *Derbyshire Archaeological Journal* 106, 5-17.
- Cameron, K. 1959 *The Place-Names of Derbyshire*. Cambridge: Cambridge University Press.
- Chadwick, A. and Evans, H. in prep. *Reading Roystone Rocks: Topographic survey and lithic analysis at Roystone Grange, Ballidon, Derbyshire, and its implications for previous interpretations of the region*.
- Cockerton, R. W. P. 1953 Note on a pig of lead from Carsington. *Derbyshire Archaeological Journal* 73, 110.
- Cockerton R. W. P. 1959 Roman pigs of lead from Derbyshire: Recent dating evidence from the Mendips. *Derbyshire Archaeological Journal* 79, 88-96.
- Cockerton R. W. P. 1962 Notes on Roman lead mining. *Derbyshire Archaeological Journal* 82, 106-07.
- Coombs, D. G. and Thompson, F. H. 1979 Excavations of the hillfort of Mam Tor, Derbyshire 1965-69. *Derbyshire Archaeological Journal* 99, 7-51.
- Dearne, M. J., Anderson, S. and Branigan, K. 1995 Excavations at Brough Field, Carsington, 1980. *Derbyshire Archaeological Journal* 115, 37-75.
- Dool, J. and Hughes, R. G. 1976 Two Roman pigs of lead from Derbyshire. *Derbyshire Archaeological Journal* 96, 15-16.
- Dutton, A. and Fasham, P. J. 1994 Prehistoric copper mining on the Great Orme, Llandudno, Gwynedd. *Proceedings of the Prehistoric Society* 60, 245-286.
- Garner, A., Prag, J. and Housley, R. 1993 The Alderley Edge shovel. *Current Archaeology* 137, 172-175.
- Flindall, R. and Hayes, A. 1976 *The Caverns and Mines of Matlock Bath: I The Nestus Mines: Rutland and Masson Caverns*. Hartington: Moorland.
- Ford, T. D. and Rieuwerts, J. H. (eds) 1983 *Lead Mining in the Peak District*, 3rd Edition. Bakewell: Peak Park Joint Planning Board.
- Guilbert, G. 1994a Hammer-stones from Ecton copper mine. *Bulletin of the Peak District Mines Historical Society* 12.3, 26-7.
- Guilbert, G. 1994b More on the Ecton hammer-stones. *Bulletin of the Peak District Mines Historical Society* 12.4, 14.
- Guilbert, G. 1996 The oldest artefact of lead in the Peak: new evidence from Mam Tor. *Mining History* 13.1, 12-18.
- Hart, C. R. 1981 *The North Derbyshire Archaeological Survey*. Chesterfield: The North Derbyshire Archaeological Trust.
- Haverfield, F. 1907 Romano-British remains. In W. Page (ed.) *The Victoria History of the Counties of England: Derbyshire*, Vol. 1. London: University of London.
- Hodges, R. 1991 *Wall to Wall History: The Story of Roystone Grange*. London: Duckworth.
- Hodges, R. and Wildgoose, M. 1981 Roman or native in the White Peak: the Roystone Grange project and its regional implications. *Derbyshire Archaeological Journal* 101, 42-57.
- Hoover, H. C. and Hoover, L. H. 1950 *Georgius Agricola, De Re Metallica, translated from the first Latin edition of 1556*. New York: Dover.
- James, D. 1990 Prehistoric copper mining on the Great Orme Head. In; Crew, P. and Crew, S. (eds) *Early Mining in the British Isles*, 1-4. Plas Tan y Bwlch: Snowdonia National Park Study Centre, Occasional Paper No. 1.
- Kierman, D. 1989 *The Derbyshire Lead Industry in the Sixteenth Century*. Chesterfield: Derbyshire Records Society, Volume XIV.
- Kirkham, N. 1945 *Unpublished notes describing explorations of Stone Quarry Mine in 1945*. Private collection, Eyam.
- Kirkham, N. 1958 *Unpublished letter to C. James, dated March 9. 1958*. Private collection, Eyam.
- Lane, H. C. 1973 *Report on the Excavations at Scarcliffe Park*. Chesterfield: Derwent Archaeological Society.
- L'Hour, Michel. 1987 *Un Site Sous-Marin sur La Cote de L'Armorique L'Epave Antique de Ploumanac'h*. Rev. Archéologique Ouest 4, 113-131.
- Lewis, A. 1990 Underground exploration of the Great Orme copper mines. In; Crew, P. and Crew, S. (eds) *Early Mining in the British Isles*, 5-10. Plas Tan y Bwlch: Snowdonia National Park Study Centre, Occ. Paper No. 1.
- Lewis, A. 1994 Bronze Age mines of the Great Orme. In: Ford, T. D. and Willies, L. (eds) *Mining Before Powder*. Bulletin of the Peak District Mines Historical Society 12.3/Historical Metallurgical Society Special Publication, 31-36.
- Ling, R. and Courtney, T. 1981 Excavations at Carsington, 1979-80. *Derbyshire Archaeological Journal* 101, 58-87.
- Ling, R., Hunt, C. O., Manning, H. W., Wild, F. and Wild J. P. 1990 Excavations at Carsington, 1983-84. *Derbyshire Archaeological Journal* 110, 30-55.
- Lomas, J. 1960 A Romano-British site at Owslow Farm, Carsington.

- Derbyshire Archaeological Journal* 80, 109-16.
- Makepeace G. A. 1983 A Romano-British settlement at Staden, near Buxton. *Derbyshire Archaeological Journal* 103, 75-85.
- Makepeace G. A. 1987 The Romano-British settlement at Staden, near Buxton, the 1983 excavations. *Derbyshire Archaeological Journal* 107, 24-34.
- Makepeace G. A. 1989 The Romano-British settlement at Staden, near Buxton, the 1984-5 and 1986 excavations. *Derbyshire Archaeological Journal* 109, 17-33.
- Makepeace G. A. 1995 The Romano-British settlement at Staden, near Buxton, the 1987-88 and 1989-90 excavations and final report. *Derbyshire Archaeological Journal* 115, 107-35.
- Makepeace G. A. 1998 Romano-British rural settlements in the Peak District and north-east Staffordshire. *Derbyshire Archaeological Journal* 118, 95-138.
- O'Brien, W. 1995 Ross Island and the origins of Irish-British metallurgy. In: Waddell, J. and Twohig S. (eds.) *Ireland in the Bronze Age*. Dublin: Stationary Office.
- O'Brien, W. 1996 *Bronze Age Copper Mining in Britain and Ireland*. Princes Risborough: Shire.
- Pickin, J. 1999 Stone Hammers from the Ecton Mines in the Bateman Collection, Sheffield. *Mining History* 14.2, 15-18.
- Radley, J. 1969 A triple cairn and a rectangular cairn of the Bronze Age on Beeley Moor. *Derbyshire Archaeological Journal* 89, 1-17.
- Rieuwerts, J. H. 1998 *Glossary of Derbyshire Lead Mining Terms*. Matlock Bath: Peak District Mines Historical Society.
- Rivet, A. L. F. and Smith, C. 1981 *The Place Names of Roman Britain* (3rd ed.). London.
- Taylor, C. and Guilbert, G. 1991 *Carsington Reservoir, Archaeological Excavations 1990*. Nottingham: Trent and Peak Archaeological Trust - unpublished interim report.
- Timberlake, S. 1992 Prehistoric copper mining in Britain. *Cornish Archaeology* 31, 15-34.
- Timberlake, S. 1994 Evidence for early mining in Wales. In: Ford, T. D. and Willies, L. (eds) *Mining Before Powder*. Bulletin of the Peak District Mines Historical Society 12.3/Historical Metallurgical Society Special Publication, 133-143.
- Timberlake, S. in press. Early metal mining research in the UK: the developments of the last 10 years. In: Craddock, P. T. and Lang, J. (eds) *Aspects of Early Mining and Metallurgy*. London: British Museum Press.
- Tylecote, R. F. 1987 Romano-British lead ingots off the coast of Brittany. *Bulletin of the Historical Metallurgy Society* 21.2, 110.
- Willies, L. 1990 Derbyshire lead smelting in the eighteenth and nineteenth centuries. *Bulletin of the Peak District Mines Historical Society* 11.1, 1-19.
- Willies, L. 1995 Roads, agricultural features and mines on Carsington Pasture. *Bulletin of the Peak District Mines Historical Society* 12.5, 19-23.
- Wroe, P. 1982 Roman roads in the Peak District. *Derbyshire Archaeological Journal* 102, 49-73.

John Barnatt - Archaeology Service