Mining History: The Bulletin of the Peak District Mines Historical Society. Volume 13, Number 1. Summer 1996.

THE OLDEST ARTEFACT OF LEAD IN THE PEAK: NEW EVIDENCE FROM MAM TOR

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Abstract. Reappraisal of a fragmentary axehead found in 1969 in an archaeological excavation on Mam Tor has led to recognition that it comprises lead rather than bronze. The postulated, socketed, form of this axehead is a type that was widely produced during the Late Bronze Age, *circa* 11th to 7th centuries BC; and this example would probably have been made some time before the earthworks of the great hillfort that still ring the summit of Mam Tor. Such lead axeheads are rare in Britain. They have been variously explained as votive objects, as ingots-cum-currency, or as part of some metalworkers' equipment, perhaps serving as trial-pieces, as core-boxes, or as models from which to manufacture bronze axes. If correctly interpreted, this fragment from Mam Tor can be regarded as the oldest artefact of lead yet recovered from a site in the Peak District; potentially also as the earliest indication of exploitation of the resources of lead in the White Peak.

Mam Tor sits at the heart of the Peak District, forming a localized eminence within a pronounced ridge of Namurian shales/sandstones, and lying close to the northern fringe of the limestone plateau known as the White Peak (Fig. 1). It is well known that this limestone is laced with lead-bearing veins of ore, and that, historically, the White Peak is one of Britain's premier lead-producing regions. Few who read about the Peak, and even fewer who frequent this landscape with an eye for evidence of past land-use, can be unaware that the top of Mam Tor is crowned by the earthworks of a prehistoric hillfort, indisputably the best example of its kind for many miles around. Archaeological excavations were conducted within the north-eastern sector of this 5-hectare hillfort during the 1960s, yielding plentiful evidence for intensive activity late in the Bronze Age, probably at some time in the 10th to 7th centuries BC (Coombs & Thompson 1979). Discoveries made in the course of more recent fieldwork (1989-93), itself concerned primarily with the repair of an eroding footpath across the hillfort, have gone some way towards demonstrating that this Late-Bronze-Age activity spread more widely over the hilltop (Guilbert & Vince 1996, 57). In the present state of knowledge, however, there can be no certainty that any hillfort-earthworks were constructed on Mam Tor during the Bronze Age. Indeed, by analogy with dated hillforts in other parts of southern Britain, it seems more likely that the earthworks seen today on Mam Tor were raised rather later in the final millennium BC, at least in their ultimate form with a substantial inturned corridor at each entrance, for these would appear to belong to the Iron-Age heyday of hillfort-building (cf. Cunliffe 1991, 333-40, 352-6). The best of the evidence for Late-Bronze-Age occupation on Mam Tor comes from sherds of characteristic pottery, though even this material offers some hints of an Earliest-Iron-Age element (Guilbert & Vince 1996, 49, 55). There is also an item of metalwork which has attracted much attention in the archaeological literature over the quarter-century since it was unearthed, when it was identified as a fragmentary socketed axehead. Largely artefacts of the Late Bronze Age, many such axeheads were made in Britain and abroad over a period of 500 years or so; in the case of that found on Mam Tor, the details of its form have suggested attribution to the very end of the Bronze Age, i.e. to the 7th century BC or thereabouts (Coombs & Thompson 1979, 44).

As an indirect consequence of an involvement in the recent fieldwork on Mam Tor (undertaken for the Trent & Peak Archaeological Trust, on behalf of the National Trust, who own the hill), the writer has sought to review various aspects of the results of the earlier archaeological work there. It is intended to publish the wider conclusions of this reappraisal elsewhere in due course, and there is just one aspect of the evidence that concerns us here - namely, the fragment of socketed axehead (actually three joining fragments, but here termed a 'fragment' for simplicity). The material of this object has previously been regarded as 'bronze', and this identification has seemed unremarkable as it is well known that such axes were usually manufactured from various copper-alloys. However, during discussion with staff in the Department of Archaeology & Ethnography at Sheffield City Museum (where the Mam Tor artefacts are housed), it was recognised that this axe-fragment has rather the appearance of lead-carbonate than of any alloy of copper. Consequently, the writer asked the advice of Dr B.P. Atkin (of the Department of Mineral Resources Engineering, University of Nottingham), who agreed to conduct analyses which could resolve the matter. Fuller details will appear elsewhere, and for present purposes it will suffice to explain that a combination of X-ray fluorescence spectrometry (Hodges 1976, 184-5; Bowman 1991, 187; or, for more detail, Bertin 1975, ch. 3) and emission spectrometry (Hodges 1976, 182-4; more specifically, inductively coupled plasma atomic emission spectrometry, and a rare instance of its use in the elemental analysis of archaeological material - Walton 1989; Bowman 1991, 183) has confirmed that the supposedly bronze axehead was actually made exclusively from lead. Indeed, the cutting of a small sample from one end of the fragment has revealed the certainty of this conclusion even to the naked eye, for it is evident that the pale colorations of its surface must arise from the corrosion-products of lead, contrasting markedly with the less-corroded, darker-grey core of the metal.

The interpretation of fragmentary artefacts is often hazardous, and it is next necessary to question whether this piece from Mam Tor has been correctly ascribed to a Late-Bronze-Age socketed axe. From an accumulation of observations, it can be stated at the outset that the best answer is 'very probably'. First, it should be pointed out that there is nothing among the assemblage of artefacts known to come from Mam Tor that need be regarded as later than prehistoric typologically - i.e. there are none that should be attributed to any Roman, medieval or later activity. Secondly, it is evident that the intrinsically-datable objects among the Mam Tor assemblage can be split into two groups: one, including a small collection of flintwork and a stone axehead, is indicative of Late-Neolithic or Early-Bronze-Age activity, and these items were probably made many centuries before any socketed axe; the other comprises the pottery, which, as already

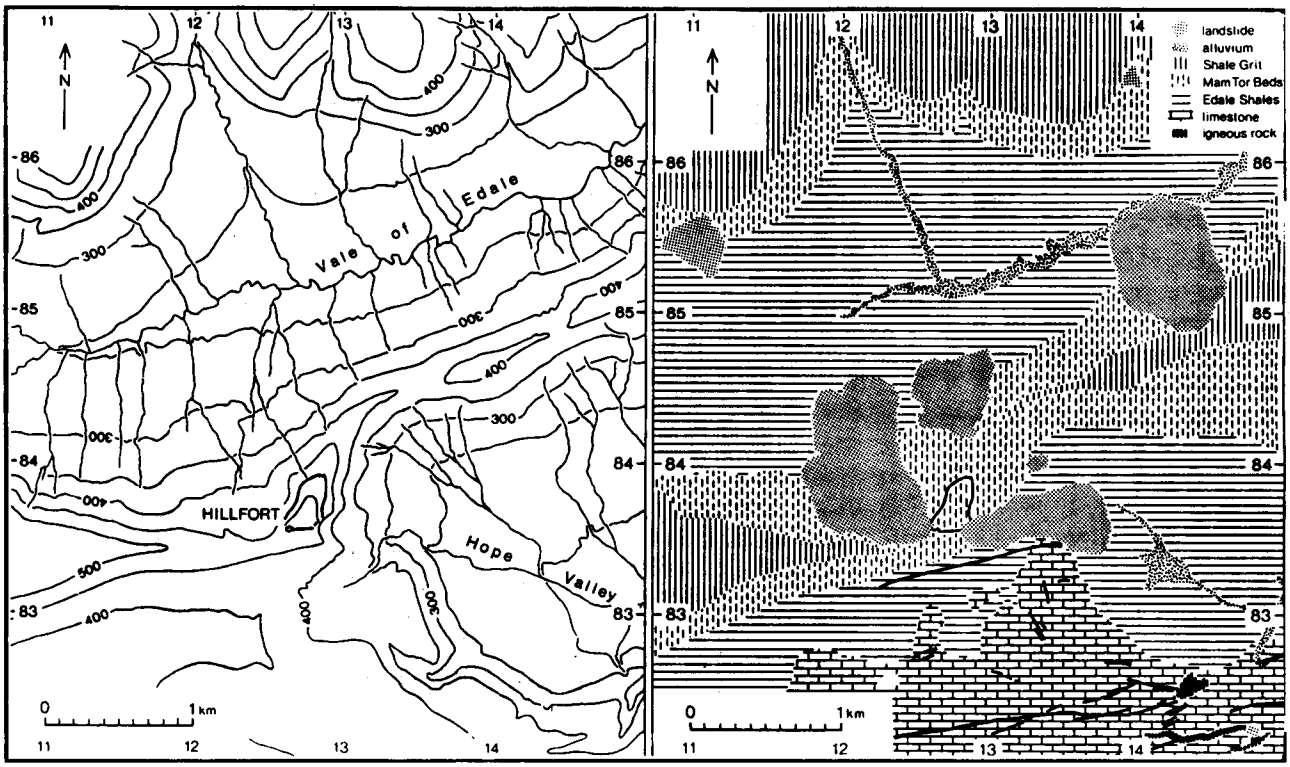

Fig. 1. Maps locating the hillfort on Mam Tor in relation to topography (left, showing water-courses and contours at 50m vertical interval, numbered in metres above Ordnance Datum) and geology (right, with mineral-veins as bold lines; omitting head and hill-peat). Scale 1:50,000. (Based upon Ordnance Survey and Geological Survey maps, Crown copyright.)

explained, is attributable to the Late Bronze Age or, at latest, the earliest years of the Iron Age. Thirdly, it is possible to fit the fragment from Mam Tor into the outline of a socketed axehead (Fig. 2). Finally, and crucially, it should be explained that socketed axeheads of lead are not unknown, bizarre as the concept may seem at first sight. In Britain, it is recognised that lead artefacts of any type are 'extremely rare in Bronze Age contexts' (Coombs 1992, 515), and socketed axeheads of lead are few and far-flung (Tylecote 1986, 92, Table 54). They are more plentiful, however, in the final phase of the Bronze Age in north-western France, or Armorica, where 'hoards of pure lead axes' are said to occur (*ibid.*, 92-3; Briard 1979, 207), as well as many made in a similar form but from copper-alloys that are often very rich in lead (Giot 1960, 158-61; Briard 1979, 207, citing a figure of up to 60% lead).

The difficulty of maintaining a cutting-edge on an axe of either pure lead or a heavily-leaded alloy must have rendered these 'implements' useless to the woodman or the woodworker. Similarly, such soft metal would hardly be suited to other practical purposes, like tillage, which has been suggested as one possible function for some so-called 'axes' of the Late Bronze Age (Champion *et al.* 1984, 279). This obvious lack of utility is reinforced by the observation that some of the Armorican examples were cast solid, without a socket for hafting though apparently indistinguishable outwardly (Giot 1960, 160; Briard 1979, 207; Tylecote 1986, 93), thus making them unusable even as weapons.

Various theories and hypotheses to explain the manufacture of such non-utilitarian axeheads have been put forward. One of the first ideas was to see a lead axe as a mere imitation, perhaps intended to accompany a burial (Evans in Denny 1866, 446). The fact that some found in Armorica are diminutive has led to the conjecture that they fulfilled an entirely symbolic role, within a votive or ritual context whose significance has long been lost (Evans 1881, 417; Giot 1960, 159; and see Tylecote 1986, 93).

Numerous others have reasoned that these as well as full-sized examples may have served as ingots or currency (e.g. Dunning 1959, 54; Giot 1960, 160; Harding 1974, 156; Briard 1979, 206-8; Coles & Harding 1979, 474; Megaw 1979, 337; Cunliffe 1991, 420; Parker Pearson 1993, 116, 124 - but see O'Connor 1980, 236), possibly even continuing in use into the Early Iron Age (Giot 1960, 161; Briard 1979, 206, 216; Cunliffe 1991, 420). On the other hand, it was once surmised that the high lead content of one such axe may have amounted to 'commercial fraud' (Crichton Mitchell & Crichton Mitchell 1935, 430 - but see Tylecote 1986, 93). Others have proposed that wholly-lead axeheads should be viewed as part of some bronze-founders' paraphernalia. In one such suggestion, they are seen as trial-pieces, intended to give the founder confidence for the final operation of casting in the more precious bronze (Denny 1866, 443; Clark 1905, 258). In another, they are thought to have been 'core-boxes', designed for making clay cores, subsequently to be used in forming the socket when casting bronze axeheads (Evans 1881, 444-5), though this obviously cannot account for examples lacking a socket. Another notion is to regard them as models (otherwise called 'patterns' or 'mould-formers') around which to fashion clay moulds, which in turn would be used for the production of real axeheads in bronze, either by employing bipartite piece-moulds or even by the investment, or lost-lead, method (Read 1897, 330; Clark 1905, 258-9; Burgess 1980, 277; Tylecote 1986, 74, 84, 89, 91-3), though this may seem an improbable explanation for those that were hoarded in numbers. The general technology of these processes is well understood (e.g. Hodges 1976, 70-2; Tylecote 1986, 74, 81-4, 89-93; 1987, 209-11, 224-6), and in any of the cases mentioned here - trial-piece, core-box, or model - the lead axehead would represent merely a stage in the bronze-worker's craft.

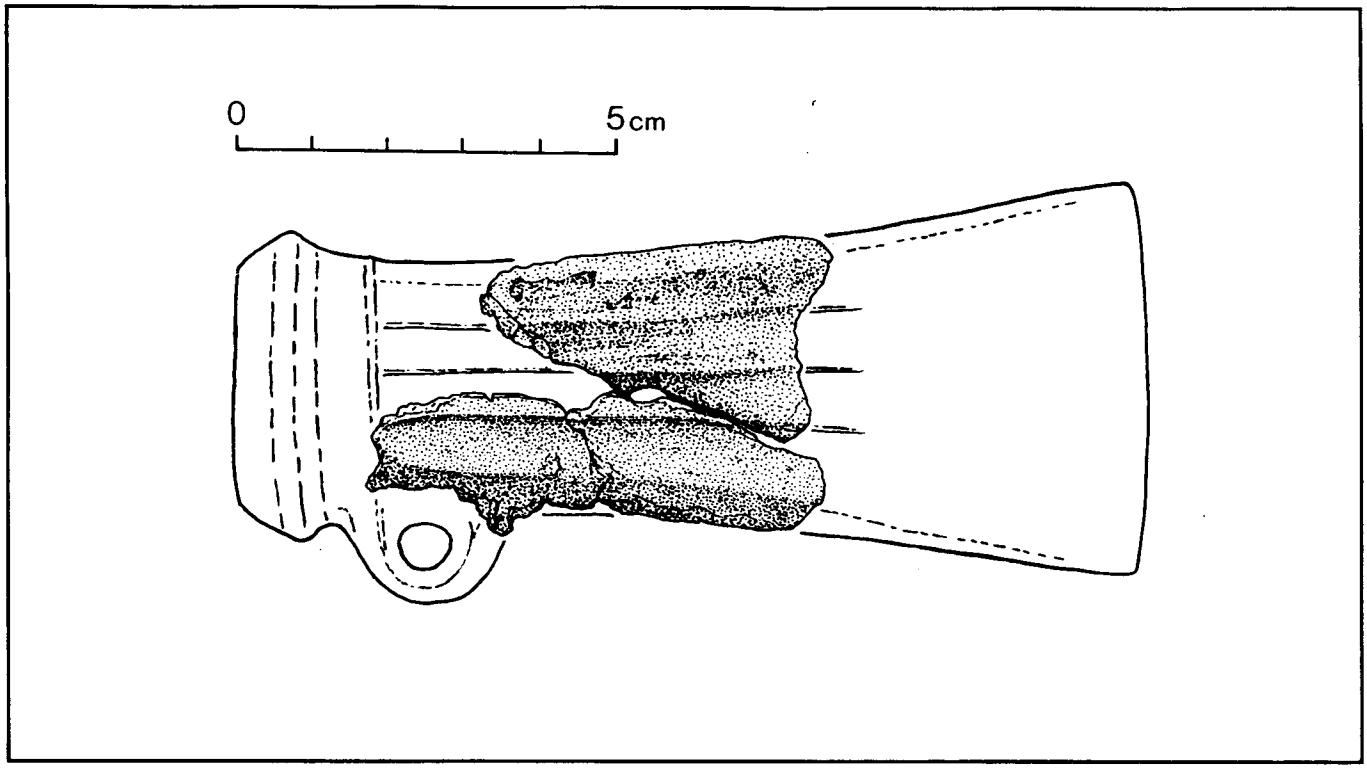

Fig. 2. The fragmentary lead axehead from Mam Tor, shown within the outline of a socketed axehead with side-loop and with three decorative ribs in low relief. This outline is based upon examples among a hoard of bronzes found at Sompting in Sussex (Curwen 1948), widely regarded as characteristic of metalwork produced in the final years of the Bronze Age in England, probably in the 7th century BC, and probably related to Armorican axes (Burgess 1968b, 28; 1969; 1974, 213-14; Coombs 1979, 263-4; Megaw 1979, 337; O'Connor 1980, 230, 234-6, 266-8, 272; Cunliffe 1991, 415, 451); though it must be said that too little survives of the Mam Tor example for certainty that it is of Sompting, rather than some earlier but still Late-Bronze-Age, form of socketed axe. Scale 1:1.

It may be pertinent to note in passing that there is other evidence suggestive of Late-Bronze-Age bronze-working on Mam Tor, notably a sherd of crucible. Moreover, given that it was already fragmentary when deposited where found, the Mam Tor axe-fragment may have been reduced to the status of scrap-metal by the time it reached that spot, perhaps ready for recycling by a founder operating on this site at the end of the Bronze Age or early in the Iron Age, and intending to use it either for another casting in lead or for alloying with copper. Be that as it may, this reappraisal of the Mam Tor fragment potentially carries important repercussions for our understanding of prehistoric activities on this hilltop, but these are issues which will be explored more fully in another place. Meantime, there is one implication of this material change to our knowledge of this object which gives purpose to the present essay, for it surely means that the Mam Tor axe-fragment constitutes the earliest instance yet known of an artefact of lead in the Peak District - indeed, such axeheads are reputed to be among the earliest recorded uses of lead in Britain (Tylecote 1986, 71-4).

In general, comments upon early extraction and use of lead in the Peak District have made scant mention of prehistory. Thus, to cite a readily-accessible and widely-read work, Ford & Rieuwerts (1983, 15) observe only that 'before the Roman occupation . . . it seems likely, though not proven, that veins in the Peak District would be exploited'; like many other writers, they move swiftly on to adduce the celebrated Roman pigs. Some twenty of the known examples of these distinctive oblong ingots are inscribed as Lutudarensian (i.e. White Peak) in origin (Frere *et al.* 1990, 56-61); given also their distribution together with others uninscribed but found in Derbyshire (Dool & Hughes 1976, Fig. 1, to which can now be added two uninscribed pigs found near Carsington - Branigan *et al.* 1986), the evidence of the pigs leaves no room for doubt that Peak mines were productive and were exporting lead during the period of Roman dominance, the beginning of which is generally put in the AD 70s, perhaps the 80s, for this region (Hart 1981, 83; Branigan 1991, 57). However, it is said that 'lead was not of great significance in the pre-Roman period' in Britain (Cunliffe 1991, 460), because it is 'not a metal for which Iron Age technology had much use' (Manning 1979, 112-13). On the other hand, it is suggested that 'metals extracted in various parts' were among commodities traded to the Roman world beyond these shores from around the end of the 2nd century BC (Cunliffe 1991, 543-6), albeit with no place envisaged for products from the Peak in these Late-Iron-Age networks of exchange (*ibid.*, 180). The latter inference may seem appropriate to the paucity of exotic goods of Iron-Age type from the Peak (Hart 1981, 73-81); yet the example of the elaborate brooch found in Harborough Cave (Smith 1909, Fig. 4), though perhaps not an import and probably datable to some point in the 3rd century BC, surely bespeaks a considerable measure of refinement on the part of some who occupied or frequented this area in the Iron Age (and it is hardly credible that such a dressy fastener should have adorned the outfit of a transhumant shepherd - *pace* Hodges 1991, 69, 82). Furthermore, it has often been remarked that the economic benefits promised by the plentiful mineral resources, including lead, to be found in Britain provided one of the reasons why the Romans ventured to conquer this island in AD 43 (e.g. Haverfield & MacDonald 1924, 254-9; Richmond 1963, 9-13; Frere 1967, 4-5; Salway 1981, 72, 633-4; Webster 1980, 84; Todd 1981, 132-3; Hodges 1991, 71; though not all concur with this orthodoxy - Manning 1979, 113; Millett 1990, 41-2). If so, this would obviously have required some prior knowledge on their part, if not necessarily of the precise locations of those resources, then at least of an appreciable output from various regions before

they arrived on the scene (cf. Richmond 1963, 149; Lewis 1967, 3, 24; Bédoyère 1989, 53). Indeed, it is arguable that the actual locations of lead-bearing rocks, perhaps including those in the Peak District, must have been manifest beforehand if the Romans began working the lead-fields as early in their occupation of the relevant regions as has often been maintained (e.g. Haverfield 1905, 229; Cockerton 1959, 91-6; Richmond 1963, 149-51; Frere 1967, 283-6; Wacher 1978, 92; Manning 1979, 113-14; Todd 1981, 133; but see Richmond 1963, 152-3; Hart 1981, 106; Branigan 1991, 60). The problem for us at this remove lies, of course, in finding incontestable evidence of prehistoric extraction of minerals, not least lead, and it must be admitted immediately that this is wanting in the Peak District.

It has lately been postulated that a small lead-rake at Roystone, in the southern part of the White Peak, 'probably pre-dates the construction of walled enclosures in the second century' (Hodges 1991, 80-1; cf. Hodges & Wildgoose 1980, 51-2; 1981, 51-2). However, this remains to be substantiated, because at present it rests upon the typological dating of the double-orthostat walling of these enclosures, and, pending a full exposition of the evidence, their date must continue to be regarded as 'far from certain' (Hodges & Wildgoose 1981, 50; despite later assertions of a Romano-British context - Hodges 1991, 33, 79; Wildgoose 1991, 216, 224). The evidence of artefacts, as paraded so far, includes 'a solitary sherd of poorly-made Later Iron Age pottery' (if such it be, then itself a rarity in the Peak) 'found buried below the orthostat foundations' (Hodges 1991, 63, 80-1; cf. Hodges & Wildgoose 1980, 51-2; 1981, 50), as well as 'three sherds of early second century samian ware found within the rubble core' of another such wall (Hodges & Wildgoose 1980, 51; cf. Hodges & Wildgoose 1981, 50, stating 'two sherds'; Hodges 1991, 79, referring to 'three tiny abraded sherds' from a 'field bank'). Strictly speaking, these finds can provide nothing more than an earliest possible date for the building of the relevant wall or bank in each case. In other words, all of these sherds *could* have been many centuries old by the time of the lead-extraction at Roystone. Moreover, another possible instance of 'prehistoric or early Roman lead exploration' at Roystone seems to have been inferred solely from the results of geophysical survey (Hodges 1991, 81), so its interpretation and dating must be treated with the caution befitting all such superficial evidence.

Besides these dubious claims regarding Roystone, there is just the hint provided by hammer-stones from the site of the Ecton mines, which lie at the south-western edge of the White Peak and are principally connected with copper (Guilbert 1994a/b). It should perhaps be remarked that a prehistoric date for these implements cannot be regarded as certain in the present state of knowledge, because it seems that the use of stone hammers in historic times, especially for ore-crushing as opposed to mining, cannot be entirely ruled out (Craddock 1989, 187-8; 1995, 71-2, 157; Timberlake 1990, 21; Budd *et al.* 1992, 682). However, the putative recovery of some of the Ecton hammers from underground seems more in line with mining that crushing; while the fractured ends of even those found on the waste-heaps there matches with the criteria considered appropriate to mining-hammers, despite the absence of signs of hafting on these stones from Ecton (Craddock 1995, 39-40).

Beyond the Peak, radiocarbon-dating has made it feasible to declare that 'copper mining in the British Isles during the Bronze Age is no longer in doubt' (Dutton & Fasham 1994, 251-2; cf. Ambers 1990), but it would seem that there is yet no good evidence for lead-extraction from any part of pre-Roman Britain (Manning 1979, 112; Cunliffe 1991, 460; Timberlake 1994, 134; Coles & Minnitt 1995, 143; Craddock 1995, 57-8, 205-9), though the occurrence of hammer-stones has been noted at several lead-mining sites in Wales (Lewis 1967, 22; Pickin 1990, 41; Thorburn 1990, 44; Bick 1990, 75-6).

If there was early mining of lead, then there should also be evidence for its contemporary usages. It is certainly true that lead was used extensively during the Roman period in Britain (e.g. Wacher 1978, 195-6; Manning 1979, 114; McWhirr 1982, 12-13; Bédoyère 1989, 48, 54, 111, 158, 180, 181, 186-7), and the Peak District can boast its share of examples. It will be sufficient here to note something of the variety of lead objects recovered from some of the more prolific sites of Roman or Romano-British occupation in the Peak area: e.g. dice, a lamp-holder, and a range of weights from Melandra fort (Conway 1906, 99-112); a neck-ring from Borough Hole, Wetton (Bateman 1861, 193, 200); numerous weights and whorls among other items from Carsington A (Dearne *et al.* 1995, 72-4, Fig. 16); a phallus from Carsington B (Ling *et al.* 1990, 38, Fig. 6.1); brooches, a seal, etc from Poole's Cavern, Buxton (Bramwell *et al.* 1983, 56, 61-5, Figs 3.5 and 6.17-21). The last-mentioned site is of particular interest in the context of the present discussion because its lead brooches have been interpreted as models for the manufacture of bronze brooches, one of several tell-tale signs of bronze-working inside this cave, probably in the 2nd century AD (Branigan & Bayley 1989, 46-9), and apparently involving the production of a distinctive, localized form of brooch (Dearne 1996). Hitherto, however, no lead artefact has been recognised from a site in the Peak District that is believed to have been occupied only during prehistory.

It may be argued that none of this evidence from the Peak District can definitely demonstrate the local manufacture of lead objects in such early times, though the brooch-models from Poole's Cavern come very close to establishing this for the 2nd century, much as the inscribed pigs found locally provide unambiguous proof of the contemporary processing of lead, axiomatically from local ores. Similarly, finds of 'splashes', 'spills', 'offcuts', 'scrap' and 'slag' of lead from such Romano-British sites as Carsington A (Dearne *et al.* 1995, 59, 73), Poole's Cavern (Branigan & Dearne 1991, 49-50), and the *vicus*, or civilian settlement, alongside *Navio* fort (Bishop *et al.* 1993, 62; Drage 1993, 88; Branigan & Dearne 1993, 128, Fig. 6.14) seem suggestive of manufacturing-processes; while discoveries of 'melted', 'molten', and 'fused' lead and 'burnt lead ore' made in opening certain Peak barrows in the mid-19th century could be held to reflect some usage of lead at a far earlier date, early in the Bronze Age (Bateman 1861, 64-5, 88, 113-15, 118, 141, 158).

Whether the locally-used artefacts, or even those that were produced locally, were actually composed of locally-derived lead is something that could only be proven by some means of sourcing their material, such as isotopic analysis (Stos-Gale 1989, 274-6; Hughes 1991, 112-14). Work has begun on characterizing galena from the Peak and other parts of Britain by this method (Rohl 1996), but its reliability has been subject to debate (see recent issues of *Archaeometry*), and it may be some time before it could achieve the provenancing of British lead artefacts satisfactorily. Nevertheless, it may seem perverse to suppose that anything other than White-Peak lead would have been used for local products (to many this would sound as absurd and superfluous as carrying coals to Newcastle, though it is not without parallels in other lands - Craddock 1995, 140-1, 217), and this sentiment will be equally apposite to the fragmentary axehead found on Mam Tor as to any of the other lead objects mentioned above. It may be noted, too, that the find-spot of this axehead lies within 600m of where a substantial lode of galena crops out at the eastern foot of Mam Tor (Fig. 1), and this was eventually to prove highly productive as

Odin Mine (Rieuwerts & Ford 1976). Even so, a local origin for this artefact must not be taken for granted, since at least one of the possible interpretations mooted above for such so-called axeheads - viz. as a standard measure of trade - could easily have involved their movement over considerable distances, maybe even between lead-bearing areas.

Considering these issues briefly in a somewhat wider perspective, it should not be forgotten that much of south-eastern England lacked the very resources required to manufacture some of the principal attributes of its archaeological record for much of the Bronze Age: namely, the bronze weapons, implements and ornaments. During the Late Bronze Age, it became common and widespread practice to alloy bronze with a considerable amount (up to 15-20%) of lead (Brown & Blin-Stoyle 1959; Burgess 1968a, 1, 29, 48, 53-6; 1968b, 1, 9, 13, 17; 1974, 207-8; Briard 1979, 195, 202, 222; Megaw 1979, 246, 305, 312; Northover 1980, 66-7; 1982, 63-7; 1988, 50-1; 1989, 226), a development to which the Armorican axeheads comprising alloys still richer in lead, and even perhaps the wholly-lead axeheads, could well have been related somehow (see p. 13 above). Consequently, this was the prime time in the prehistory of Britain for the consumption of lead. Notwithstanding the close connections that can be recognised between Late-Bronze-Age metalwork in southern England and adjacent parts of Europe (e.g. Burgess 1968b; 1974, 203-13, 221; O'Connor 1980), and with due allowance for suggestions that importation of copper and recycling of scrap-metal may have made considerable contributions to the resources available to British founders (Burgess 1974, 210; O'Connor 1980, 305-6; Northover 1980, 66-7; 1982, 50, 63; 1988, 51-2; 1989, 221-3), it yet seems reasonable to suppose that those responsible for manufacturing the profusion of these leaded bronzes in Britain, and especially in lowland England, during the early centuries of the final millennium BC would have made demands upon British sources of raw materials (cf. Coles & Harding 1979, 482; Burgess 1980, 276; O'Connor 1980, 300-6; Northover 1982, 67; 1988, 51); and necessarily so, because copper-ores at least are rare in those parts of Continental Europe nearest to Britain (Coles & Harding 1979, Fig. 3; Champion *et al.* 1984, Fig. 6.11; Tylecote 1987, Fig. 1.1). In this scenario, the communities of south-eastern England would have looked north and west to the neighbouring uplands to procure some of their supplies from others more self-sufficient. In which case, the White Peak, like the Mendips and parts of the Welsh Marches, would have lain in the front line for procurement, since these areas harbour the most south-easterly of the substantial deposits of lead and copper in the British Isles (Rohl 1996, Fig. 1; and see Tylecote 1986, 11-13, 54, Figs 7 and 22 - but note that Tylecote's maps are deficient in comparison with, say, Richardson 1974, Figs 8 and 10, though even this last omits Mendip lead, despite p. 107 therein). Archaeological evidence in support of such suppositions remains meagre, though it can be noted that at least one of the radiocarbon-dated copper-mines, at the Great Orme on the north coast of Wales (just possibly also Cwmystwyth in mid Wales), has yielded a result that appears likely to relate to Late-Bronze-Age mining, rather than to some earlier stage of the 2nd millennium BC (Dutton & Fasham 1994, 251, 258; Ambers 1990; Timberlake 1994, 137).

Of course, these arguments stop a long way short of showing that the piece of a lead axe from Mam Tor is not an import, be it from some other part of upland Britain or even from the Continent. But considerations like those rehearsed above do encourage speculation that the deposits of lead and copper in the Peak District had the potential to be valued commodities during the Late Bronze Age, as also to some degree in the preceding and ensuing episodes of prehistory, especially in the case of copper.

Given that our lead axehead was found within the hillfort on Mam Tor, there is a further aspect of local prehistory which is germane to the matters under review, for a relationship between Peak hillforts and lead-mining has been inferred elsewhere. The possibility of such a link cannot be denied, but we may question whether it would be wise to go as far as Hodges (1991, 68-9) in deducing that 'competition for local lead needed for making bronze implements may have brought greater strife to the area [i.e. the White Peak] and led to the construction of communal fortifications' (i.e. hillforts, including that on Mam Tor) at the end of the 2nd millennium BC. Such an argument might carry more force if hillforts were thicker on the ground in and around the Peak District - they are actually quite thinly scattered here in comparison with some parts of Britain where the topography is similar (see gross distribution-maps in, for example, Forde-Johnston 1976, Figs 1, 2 and 18; Cunliffe 1991, Fig. 14.1; 1995, Fig. 35). It might also seem a more attractive proposition if the construction of any Peak hillfort could be placed convincingly before the Iron Age - aside from Mam Tor, the only hillfort-site in the region to have produced acceptable evidence, in the form of potsherds, for occupation at around the end of the Bronze Age is that at Ball Cross, above Bakewell (Stanley 1954, 93-4, 97-8, Fig. 3; Challis & Harding 1975, 51-2, Fig. 3), but, as at Mam Tor, the presence of this pottery does not prove that the Ball Cross hillfort existed then. And it might seem the more persuasive if early hillforts (i.e. built before or during the earliest part of the Iron Age, or the 8th/7th centuries BC) were shown to have been regularly, better still predominantly, located in the mineral-producing, better still lead-bearing, areas of the country - in fact, it is well known that excavated evidence has provided as many clues (albeit some no less tenuous) to early origins for hillforts on the downs of eastern and southern England as in the more metalliferous western and northern areas of Britain (Cunliffe 1991, 36-9, 313-16, 344-8; 1995, 29-31). Furthermore, Hodges's hypothesis of a local Late-Bronze-Age lead-rush resulting in 'the inception of large communities conscious of defence' does not sit happily alongside his own conclusion that the Peak landscape suffered a 'staggering depopulation' at that time, leaving the region 'virtually unoccupied' throughout the Iron Age (and see p. 12 above). In fairness, it should be noticed that Hodges is not alone in pondering the possibility of an equation between the building of some hillforts and the control of some mineral-resources, though others have been rather less emphatic in debating this notion in respect of parts of western Wales (Timberlake 1994, 137-8) and the Welsh Marches (Cunliffe 1995, 30).

For the moment, it can only be concluded that any inferences relating to, or arising from, the possibility of a lead industry in the Peak District during any period of prehistory must remain extremely tentative. None the less, it can at least be submitted that the new light shed upon the old find of a fragmentary axehead on Mam Tor has provided a small glimmer of the prospects for future research, not only regarding Mam Tor itself but also for all areas in and around the White Peak. Despite the obvious uncertainties inherent in much of this discussion, the possibility of prehistoric exploitation of the mineral-resources of the White Peak deserves to be borne in mind as much now as it did in Thomas Bateman's day (1848, 134-5), lest we overlook what could well have been a vital aspect of many centuries in the prehistory of this region.

ACKNOWLEDGEMENTS

In shaping various aspects of the content of this note, the writer has benefitted from conversations with, or information supplied by, numerous people, including Brian Atkin, John Barnatt, Bill

Brown, Tom Cobley, Paul Craddock, Peter Crew, Nick Debenham, Philip Dixon, Kate Fearn, Ron Firman, Daryl Garton, Julian Henderson, Howard Jones, Steve Malone, Jeffrey May, Julien Parsons, Alison Walster and Roger Wilson.

REFERENCES

Ambers, J., 1990 Radiocarbon, calibration and early mining: some British Museum radiocarbon dates for Welsh copper mines. In P. & S. Crew (eds) 1990, 59-63.

Bateman, T., 1848 *Vestiges of the Antiquities of Derbyshire...* (London).

Bateman, T., 1861 *Ten Years' Diggings in Celtic and Saxon Grave Hills, in the Counties of Derby, Stafford, and York, from 1848 to 1858* (London and Derby).

Bédoyère, G. de la, 1989 *The Finds of Roman Britain* (Batsford, London).

Bertin, E.P., 1975 *Principles and Practice of X-Ray Spectrometric Analysis* (2nd edn, Plenum Press, New York and London).

Bick, D., 1990 Observations on ancient mining in Wales. In P. & S. Crew (eds) 1990, 75-7.

Bishop, M.C., Dearne, M.J., Drinkwater, J.F., & Lloyd, J.A., 1993 Excavation and geophysical survey at Brough-on-Noe (*Navio*) 1980-3 and 1985. In M.J. Dearne (ed.) 1993, 37-63.

Bowman, S., (ed.) 1991 *Science and the Past* (British Museum, London).

Bramwell, D., Dalton, K., Drinkwater, J.F., Hassall, M., Lorimer, K.L., & Mackreth, D.F., 1983 Excavations at Poole's Cavern, Buxton: an interim report. *Derbyshire Archaeological Journal* 103, 47-74.

Branigan, K., 1991 Civilian development in a military zone: the Peak AD43-400. In R. Hodges & K. Smith (eds), *Recent Developments in the Archaeology of the Peak District*, 57-67 (Dept of Archaeology & Prehistory, University of Sheffield).

Branigan, K., & Bayley, J., 1989 The Romano-British metalwork from Poole's Cavern, Buxton. *Derbyshire Archaeological Journal* 109, 34-50.

Branigan, K., & Dearne, M.J., 1991 *A Gazetteer of Romano-British Cave Sites and Their Finds* (Dept of Archaeology & Prehistory, University of Sheffield).

Branigan, K., & Dearne, M.J., 1993 Geophysical survey and excavation in the *vicus* of Brough-on-Noe (*Navio*) 1986. In M.J. Dearne (ed.) 1993, 99-130.

Branigan, K., Housley, J., & Housley, C., 1986 Two Roman lead pigs from Carsington. *Derbyshire Archaeological Journal* 106, 5-17.

Briard, J., 1979 *The Bronze Age in Barbarian Europe* (Routledge & Kegan Paul, London).

Brown, M.A., & Blin-Stoyle, A.E., 1959 A sample analysis of British Middle and Late Bronze Age material, using optical spectrometry. *Proceedings Prehistoric Society* 25, 188-208.

Budd, P., Gale, D., Pollard, A.M., Thomas, R.G., & Williams, P.A., 1992 The early development of metallurgy in the British Isles. *Antiquity* 66, 677-86.

Burgess, C., 1968a *Bronze Age Metalwork in Northern England c.1000 to 700 B.C.* (Oriel Press, Newcastle-upon-Tyne).

Burgess, C.B., 1968b The later Bronze Age in the British Isles and North-Western France. *Archaeological Journal* 125, 1-45.

Burgess, C.B., 1969 Some decorated socketed axes in Canon Greenwell's collection. *Yorkshire Archaeological Journal* 42 (1967-70), 267-72.

Burgess, C., 1974 The bronze age. In C. Renfrew (ed.), *British Prehistory - a New Outline*, 165-232 (Duckworth, London).

Burgess, C., 1980 *The Age of Stonehenge* (Dent, London).

Challis, A.J., & Harding, D.W., 1975 *Later Prehistory from the Trent to the Tyne* (British Archaeological Reports, British Series 20, Oxford).

Champion, T., Gamble, C., Shennan, S., & Whittle, A., 1984 *Prehistoric Europe* (Academic Press, London).

Clark, E.K., 1905 Report as Local Secretary for Yorkshire. *Proceedings Society Antiquaries London* 20, 258-64.

Cockerton, R.W.P., 1959 Roman pigs of lead from Derbyshire - recent dating evidence from the Mendips. *Derbyshire Archaeological Journal* 79, 88-96.

Coles, J.M., & Harding, A.F., 1979 *The Bronze Age in Europe - an Introduction to the Prehistory of Europe c.2000-700BC* (Methuen, London).

Coles, J., & Minnitt, S., 1995 *'Industrious and Fairly Civilized' - the Glastonbury Lake Village* (Somerset Levels Project and Somerset County Council).

Conway, R.S., 1906 Melandra Castle - report of the Manchester and District Branch of the Classical Association. Appended to *Derbyshire Archaeological Journal* 29 (1907).

Coombs, D., 1979 The Figheldean Down hoard, Wiltshire. In C. Burgess & D. Coombs (eds), *Bronze Age Hoards - Some Finds Old and New*, 253-68 (British Archaeological Reports, British Series 67, Oxford).

Coombs, D., 1992 Flag Fen platform and Fengate Power Station post alignment - the metalwork. *Antiquity* 66, 504-17.

Coombs, D.G., & Thompson, F.H., 1979 Excavation of the hill fort of Mam Tor, Derbyshire 1965-69. *Derbyshire Archaeological Journal* 99, 7-51.

Craddock, P.T., 1989 The scientific investigation of early mining and smelting. In J. Henderson (ed.) 1989, 178-212.

Craddock, P.T., 1995 *Early Metal Mining and Production* (Edinburgh University Press).

Crew, P., & Crew, S., (eds) 1990 *Early Mining in the British Isles* (Snowdonia National Park Study Centre, Maentwrog).

Crichton Mitchell, S.S., & Crichton Mitchell, M.E., 1935 The metallurgical analysis of three Bronze Age axes. *Proceedings Society Antiquaries Scotland* 69, 424-30.

Cunliffe, B., 1991 *Iron Age Communities in Britain* (3rd edn, Routledge, London).

Cunliffe, B., 1995 *Iron Age Britain* (Batsford, London).

Curwen, E.C., 1948 A bronze cauldron from Sompting, Sussex. *Antiquaries Journal* 28, 157-63.

Dearne, M.J., (ed.) 1993 *Navio - the Fort and Vicus at Brough-on-Noe, Derbyshire* (British Archaeological Reports, British Series 234, Oxford).

Dearne, M.J., 1996 Some observations on Romano-British brooch typology in the Peak District and adjacent areas. *Derbyshire Archaeological Journal* 116, 68-76.

Dearne, M.J., Anderson, S., & Branigan, K., 1995 Excavations at Brough Field, Carsington, 1980. *Derbyshire Archaeological Journal* 115, 37-75.

Denny, H., 1866 On the occurrence of a lead celt in Lincolnshire; with remarks on celts generally. *Proceedings Geological & Polytechnic Society West Riding Yorkshire* 4, 436-46.

Dool, J., & Hughes, R.G., 1976 Two Roman pigs of lead from Derbyshire. *Derbyshire Archaeological Journal* 96, 15-16.

Drage, C., 1993 Brough-on-Noe, Derbyshire: excavations in the *vicus* 1983-4. In M.J. Dearne (ed.) 1993, 65-97.

Dunning, G.C., 1959 The distribution of socketed axes of Breton type. *Ulster Journal Archaeology* 22, 53-5.

Dutton, A., & Fasham, P.J., 1994 Prehistoric copper mining on the Great Orme, Llandudno, Gwynedd. *Proceedings Prehistoric Society* 60, 245-86.

Evans, J., 1881 *The Ancient Bronze Implements, Weapons and Ornaments of Great Britain and Ireland* (New York and London).

Ford, T.D. & Rieuwerts, J.H., 1983 *Lead Mining in the Peak District* (Peak Park Joint Planning Board, Bakewell, and Peak District Mines Historical Society, Matlock Bath).

Forde-Johnson, J., 1976 *Hillforts of the Iron Age in England and Wales* (Liverpool University Press).

Frere, S., 1967 *Britannia - a History of Roman Britain* (Routledge & Kegan Paul, London).

Frere, S.S., Roxan, M., & Tomlin, R.S.O., (eds) 1990 *The Roman Inscriptions of Britain*, vol. II, *Instrumentum Domesticum*, fasc. 1 (Alan Sutton, Gloucester).

Giot, P.R., 1960 *Brittany* (Thames & Hudson, London).

Guilbert, G., 1994a Hammer-stones from the copper-mining site at Ecton, Staffordshire. *BullPDMHS* 12.3, 26-7.

Guilbert, G., 1994b More on the Ecton hammer-stones. *BullPDMHS* 12.4, 14.

Guilbert, G., & Vince, A., 1996 Petrology of some prehistoric pottery from Mam Tor. *Derbyshire Archaeological Journal* 116, 49-59.

Harding, D.W., 1974 *The Iron Age in Lowland Britain* (Routledge & Kegan Paul, London).

Hart, C.R., 1981 The North Derbyshire Archaeological Survey to A.D.1500 (Chesterfield).

Haverfield, F., 1905 Romano-British Derbyshire. In W. Page (ed.), *Victoria County History of Derbyshire*, vol. I, 191-263 (London).

Haverfield, F., & MacDonald, G., 1924 *The Roman Occupation of Britain* (Clarendon Press, Oxford).

Henderson, J., (ed.) 1989 *Scientific Analysis in Archaeology and its Interpretation* (Oxford University Committee for Archaeology, Monograph 19).

Hodges, H., 1976 *Artifacts - an Introduction to Early Materials and Technology* (John Baker, London).

Hodges, R., 1991 *Wall-to-Wall History - the Story of Roystone Grange* (Duckworth, London).

Hodges, R., & Wildgoose, M., 1980 Roman or native in the White Peak. In K. Branigan (ed.), *Rome and the Brigantes - the Impact of Rome on Northern England*, 48-53.

Hodges, R., & Wildgoose, M., 1981 Roman or native in the White Peak: the Roystone Grange project and its regional implications. *Derbyshire Archaeological Journal* 101, 42-57.

Hughes, M., 1991 Tracing to source. In S. Bowman (ed.) 1991, 99-116.

Lewis, W.J., 1967 *Lead Mining in Wales* (University of Wales Press, Cardiff).

Ling, R., Hunt, C.O,, Manning, W.H., Wild, F., & Wild, J.P., 1990 Excavations at Carsington, 1983-84. *Derbyshire Archaeological Journal* 110, 30-55.

Manning, W.H., 1979 The native and Roman contribution to the development of metal industries in Britain. In B.C. Burnham & H.B. Johnson (eds), *Invasion and Response - the Case of Roman Britain*, 111-21 (British Archaeological Reports, British Series 73, Oxford).

McWhirr, A., 1982 *Roman Crafts and Industries* (Shire Publications, Princes Risborough).

Megaw, J.V.S., 1979 The later bronze age (1,400bc-500BC). In J.V.S. Megaw & D.D.A. Simpson (eds), *Introduction to British Prehistory*, 242-343 (Leicester University Press).

Millett, M., 1990 *The Romanization of Britain - an Essay in Archaeological Interpretation* (Cambridge University Press).

Northover, J.P., 1980 Bronze in the British Bronze Age. In W.A. Oddy (ed.), *Aspects of Early Metallurgy*, 63-70 (British Museum, Occasional Paper 17, London).

Northover, J.P., 1982 The exploration of long-distance movement of bronze in Bronze and Early Iron Age Europe. *Bulletin Institute Archaeology London* 19, 45-72.

Northover, P., 1988 Alloy design in the Bronze Age. In J.E. Jones (ed.), *Aspects of Ancient Mining and Metallurgy* (Bangor).

Northover, J.P., 1989 Non-ferrous metallurgy in British archaeology. In J. Henderson (ed.) 1989, 213-36

O'Connor, B., 1980 *Cross-Channel Relations in the Later Bronze Age* (British Archaeological Reports, International Series 91, Oxford).

Parker Pearson, M., 1993. *Bronze Age Britain* (Batsford, London).

Pickin, J., 1990 Stone tools and early metal mining in England and Wales. In P. & S. Crew (eds) 1990, 39-42.

Read, C.H., 1897 Notes on two hoards of bronze implements from Grays Thurrock, Essex, and Southall, Middlesex. *Proceedings Society Antiquaries London* 16 (1895-7), 327-30.

Richardson, J.B., 1974 *Metal Mining* (Allen Lane, London).

Richmond, I.A., 1963 *Roman Britain* (Penguin Books, Harmondsworth).

Rieuwerts, J.H., & Ford, T.D., 1976 Odin Mine, Castleton, Derbyshire. *BullPDMHS* 6.4, 1-54.

Rohl, B.M., 1996 Lead isotope data from the Isotrace Laboratory, Oxford: *Archaeometry* data base 2, galena from Britain and Ireland. *Archaeometry* 38.1, 165-80.

Salway, P., 1981 *Roman Britain* (Clarendon Press, Oxford).

Smith, R.A., 1909 Harborough Cave, nr. Brassington - description of the finds. *Derbyshire Archaeological Journal* 31, 97-114.

Stanley, J., 1954 An Iron Age fort at Ball Cross Farm, Bakewell. *Derbyshire Archaeological Journal* 74, 85-99.

Stos-Gale, Z.A., 1989 Lead isotope studies of metals and the metal trade in the Bronze Age Mediterranean. In J. Henderson (ed.) 1989, 274-301.

Thorburn, J.A., 1990 Stone mining tools and the field evidence for early mining in mid-Wales. In P. & S. Crew (eds) 1990, 43-6.

Timberlake, S., 1990 Excavations at Parys Mountain and Nantyreira. In P. & S. Crew (eds) 1990, 15-21.

Timberlake, S., 1994 Archaeological and circumstantial evidence for early mining in Wales, *BullPDMHS* 12.3, 133-43.

Todd, M., 1981 *Roman Britain 55BC - AD400* (Fontana, Glasgow).

Tylecote, R.F., 1986 *The Prehistory of Metallurgy in the British Isles* (Institute of Metals, London).

Tylecote, R.F., 1987 The Early History of Metallurgy in Europe (Longman, London).

Wacher, J., 1978 *Roman Britain* (Dent, London).

Walton, S.J., 1989 The analysis of archaeological materials by ICP-AES. In M. Thompson & J.N. Walsh (eds), *Handbook of Inductively Coupled Plasma Spectrometry*, 232-7 (2nd edn, Blackie, Glasgow and London).

Webster, G., 1980 *The Roman Invasion of Britain* (Batsford, London).

Wildgoose, M., 1991 The drystone walls of Roystone Grange. *Archaeological Journal* 148, 205-40.

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