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DOLAUCOTHI REVISITED

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Abstract: Roman interest in British metals is clearly attested by the Latin author Tacitus, writing in the later 1st century (Agricola 12):- "Britain produces gold and silver and other metals which are the rewards of victory." It is now generally accepted that the principal source of gold exploited by the Romans was at Dolaucothi in Dyfed, where ancient workings, running north-east to south-west along a mountain spur to the south of the Cothi, have been claimed to extend for over a kilometre. This paper seeks to draw attention to a hitherto-unsuspected early modern phase of mining, represented by a possible water-driven mill complex and associated processing wastes, which provides a cautionary counterbalance to simplistic interpretations of the surviving surface debris.

The mine workings at Dolaucothi have been a source of considerable interest for over two centuries. Antiquarian observers recorded the existence of underground galleries on Allt Ogofau as early as 1767, while their early 19th-century counterparts were well aware of an old watercourse or leat tapping the river Cothi well upstream from the site. Local tradition was already ascribing the visible workings to the Romans, a view readily encouraged by the discovery of Roman gold jewellery about the turn of the century and by the rather haphazard 'excavation' of a bath house to the north-west of the site in the 1830s. The workings were first systematically described by Bosanquet and Haverfield (1917), when the chance was taken to explore the line of the Cothi leat and one of the tanks along its course. The probable Roman date of the workings was further underlined in the 1930s by the discovery of several well-preserved wooden objects, including a fragment from the rim of a drainage wheel of well-known type, when miners broke into a series of underground stopes beneath the main Ogofau Pit (Davies 1936; Boon and Williams 1966). Further fieldwork in 1959 established the detailed line of the Cothi leat (Jones et al 1960).

The most detailed investigation of the site was undertaken in the late 1960s and early 1970s under the aegis of the Dolaucothi Research Committee of the National Museum of Wales. This involved two separate, though interrelated projects: the first combined surface survey and selective excavations to elucidate, in particular, the history of exploitation in the Roman period, directed primarily by G.D.B.Jones and P.R. Lewis; the second saw the exploration of the accessible underground galleries, most of them of late 19th and early 20th century date, by the then Department of Mineral Exploitation at University College, Cardiff. The archaeological aspect of these investigations still forms

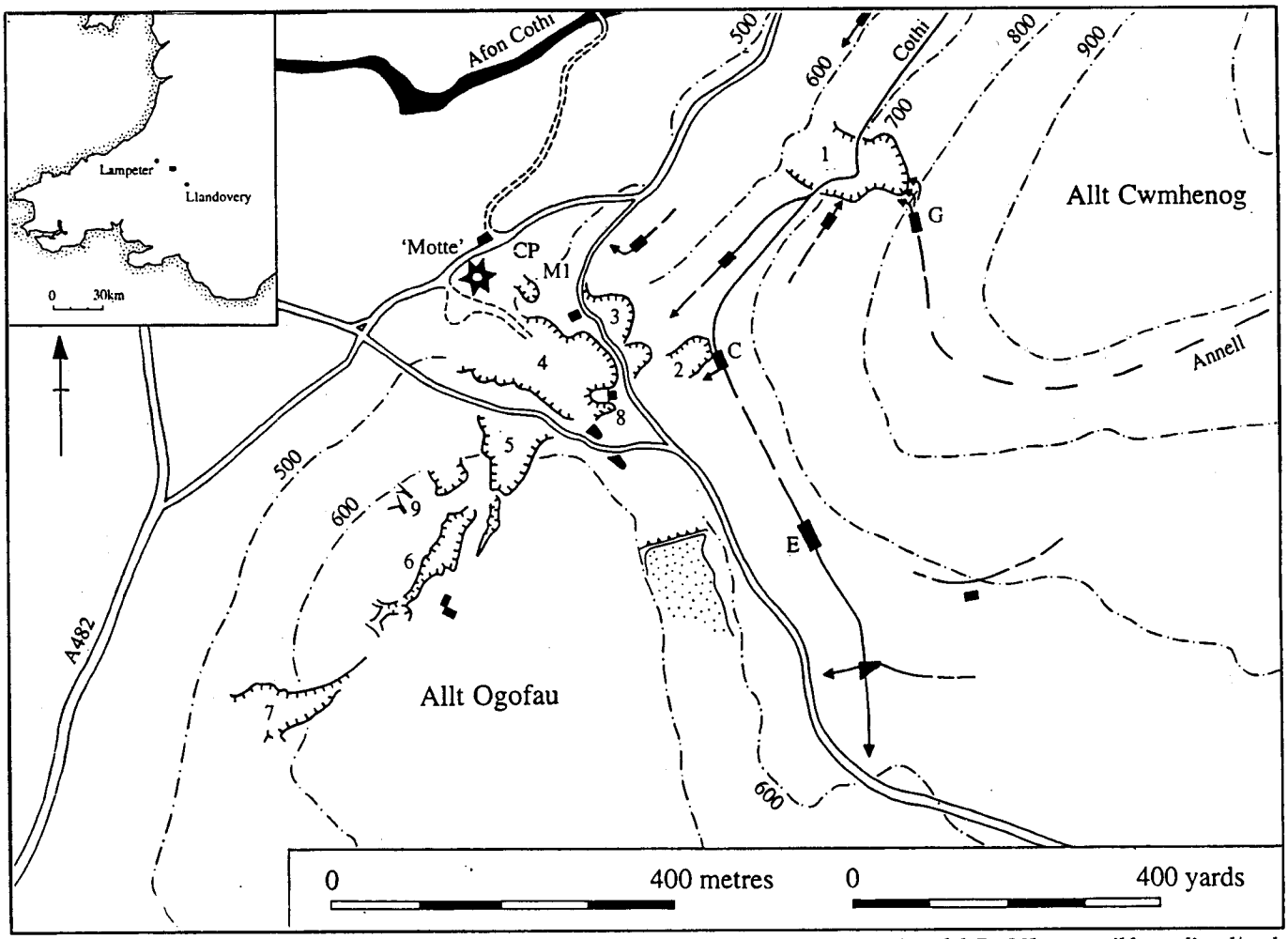

Fig. 1 Dolaucothi: location plan of pre-19th century workings. The main opencasts are numbered 1-7. M1 = possible medieval/early modern mill. CP = Carreg Pumsaint.

the basis of our overall understanding of the early exploitation at Dolaucothi, involving as it did a detailed survey of the principal surface workings, the examination of the Cothi leat and its associated features, the discovery of the so-called Annell leat, and the excavations within the newly-discovered fort under the village of Pumsaint (Lewis and Jones 1969; Jones and Lewis 1971; Lewis 1977; Jones and Little 1973; 1974).

The mining remains described by Lewis and Jones can be shown to run for over a kilometre, north-east to south-west, along the mountain spur to the south of the river Cothi (Fig. 1). They were clearly focused on the saddle now occupied by the main Ogofau Pit (no. 4), between Allt Cwmhenog on the north-east and Allt Ogofau on the south-west. This area is one of intense geological folding and thrusting, with the gold being found in association with iron pyrites in a matrix of either local black shale or quartz. The surviving surface features are best considered under three headings: the mine workings; the leat systems and related tanks and reservoirs; the ancillary processing and settlement areas (cf. Annels and Burnham 1986, 17-27).

(a) Mine Workings. These comprise a complex palimpsest of surface and underground features, the most prominent of which are the large opencast pits and trenches (nos 1-7) attesting to the successful exploitation of the ore bodies. By far the largest is the Ogofau Pit (no. 4), measuring 150m east-west by 100m north-south, and currently some 24m deep; drilling within the pit has, however, indicated a rubble infill up to 12.5m deep in places. Similar, if smaller, opencasts lay higher up the slopes of Allt Cwmhenog, including the so-called 'Roman' Pit (no. 3) and Mitchell Pit (no. 2), and on Allt Ogofau to the south-west, including what is now known as Niagara Pit (no. 5); beyond the latter, a series of trenches, some of which may have been affected by later collapses into underground galleries, extends over half a kilometre as far as Cwrt-y-Cilion farm (nos 6 and 7). Besides these conspicuous surface workings, less prominent traces of small-scale exploration and pitting on exposed outcrops survive in areas of peripheral or unsuccessful exploitation, on both Allt Cwmhenog and Allt Ogofau, but have never been surveyed in detail.

The early miners also followed the ore-bearing lodes underground, as is shown by various cavernous entrances and, more importantly, by the galleries or stopes beneath the Ogofau Pit and the two 60m long adits on the northern slopes of Allt Ogofau (no. 9). The galleries or stopes, from which the drainage wheel fragment came, extended to a depth of 45m below the modern surface and were discovered during tunnelling in 1935. The two adits, known today as Lower and Upper Roman, were clearly hand-driven, as the surviving pick and chisel marks on their carefully-dressed internal faces attest. Lower Roman, 2-3m high, is wider at the top than the bottom, while Upper Roman is some 2 x 2m square in section. Both seem to have been connected with a series of stopes beneath the Allt Ogofau workings. Unfortunately, neither can be closely dated.

Typologically there is nothing specific about the workings to indicate a Roman date, but the radiocarbon date from the drainage wheel fragment of 90 ± 70years BC (HAR 2809), must have implications, at least for the mining in and beneath the Ogofau Pit. Less certainty attaches to the suggestive fragment of Roman glass found 'stratified' in 1970 in the Mitchell Pit, since the full details have never been published. Unfortunately no comparable in situ finds are known from the remaining workings.

(b) Leat systems and related tanks and reservoirs. The extensive provision and use of water at Dolaucothi is one of its major features. Lewis and Jones identified some four separate leat systems, though only the Cothi has ever been fully published (Jones et al 1960). This tapped the river 11 kms upstream

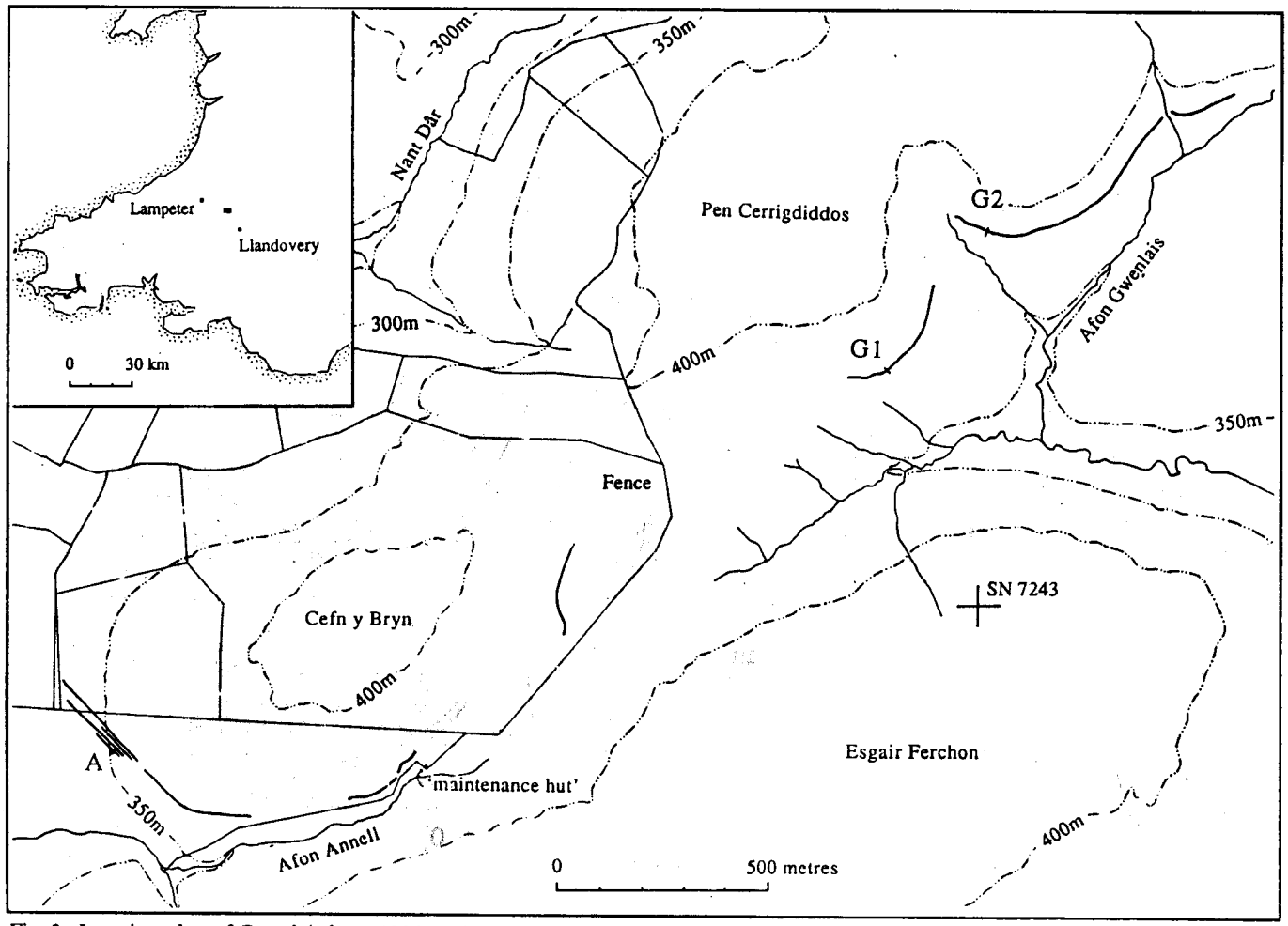

Fig. 2. Location plan of Gwenlais leat. 1990 sections marked G1 and G2.

and ran on a carefully-engineered gradient to the top of the Allt Cwmhenog workings, where it served at least two separate reservoirs (fig. 1, C and E). A second leat, discovered in 1969, apparently tapped the river Annell 7 kms upstream on the south flank of Allt Cwmhenog and ran at a higher level than the Cothi. Only a few isolated sections were identified along its course, much of which had been destroyed by recent afforestation. As reconstructed, it ran on a rather steep gradient to serve at least one tank (G) perched above the Allt Cwmhenog Pit (no. 1), from where a series of deep gullies dropped steeply away downhill; these provide the clearest proof for hushing.

Doubts have recently been expressed about the existence of the Annell leat in the absence of a definitive publication (Bick and Boon 1993), while the situation in its upper reaches has been complicated by the discovery of the Gwenlais leat (Fig. 2), apparently extending some 3 kms beyond its postulated source to tap the headwaters of the Gwenlais (Bick 1989). Sections across this in 1990 revealed evidence of a well-defined leat, rock-cut in places, with traces of a low bank on the downhill side (Burnham et al 1993). While the relationship, if any, between the two systems must remain uncertain for the present, pending further fieldwork, recent excavation across the predicted line of the Annell leat in the field south of Tank G has conclusively identified a watercourse at this point (Burnham and Burnham 1994).

Two lesser water supplies have also been postulated, one tapping a tributary of the river Cothi, the Nant Dâr, the other coming off the river itself further down than the main leat, but neither has been satisfactorily traced into the mine area. There are also a number of isolated tanks, especially I and J, on the edge of the main Ogofau Pit, which can probably be associated with exploitation by fire-setting and quenching; their source of water remains uncertain.

Although leat systems are common on mining sites of all periods, the Dolaucothi examples have traditionally been assigned to the Roman period, partly on the excavated evidence, partly by analogy with the evidence from the Roman mines in Spain, and partly because of what seems to be an eyewitness account of the large-scale use of water in Roman mining recorded by Pliny the Elder (Bird 1984). More importantly, however, two radiocarbon dates have recently been published from a peat horizon infilling a section across the upper reaches of the so-called Annell leat (Jones and Maude 1991). The peat itself produced a date of 775 ± 15 AD, while an alkali extract yielded a reading of 865 ± 20 AD (Grn 16553 and 16720), suggesting that by c.AD 800 the leat channel here was three-quarters infilled.

(c) Ancillary processing and settlement areas. While considerable work had been done on the mining and water supply systems, the related question of ore processing and settlement remained poorly known prior to the 1960s. Lewis and Jones could only list the Roman fort at Pumsaint, the bath-house south of the river, a possible motte north of the Ogofau Pit, various crushing stones and quantities of crushed quartz in the vicinity of Ogofau Lodge, and several stepped washing tables cut into the local shale, most notably in association with Tank C. Since then, our understanding of the fort at Pumsaint has increased greatly as a result of the 1989 excavations (Burnham and Burnham 1991a; 1992a), while the identification in 1982 of a possible water-driven mill complex (Austin and Burnham 1984), discussed in more detail below, has broadened our view of the processing aspects.

On the information available to them, Lewis and Jones devised a simple developmental model for the early exploitation at Dolaucothi, based upon the relationships between the opencasts, notoriously difficult to date on surface evidence alone, and the relative sequence of the leat systems and their associated features, the Roman dating of which seemed beyond doubt. Lewis and Jones' model can be summarised simply:

(i) limited pre-Roman exploitation;

(ii) the development of the Annell leat and the hushing tank(s) related to the Allt Cwmhenog Pit;

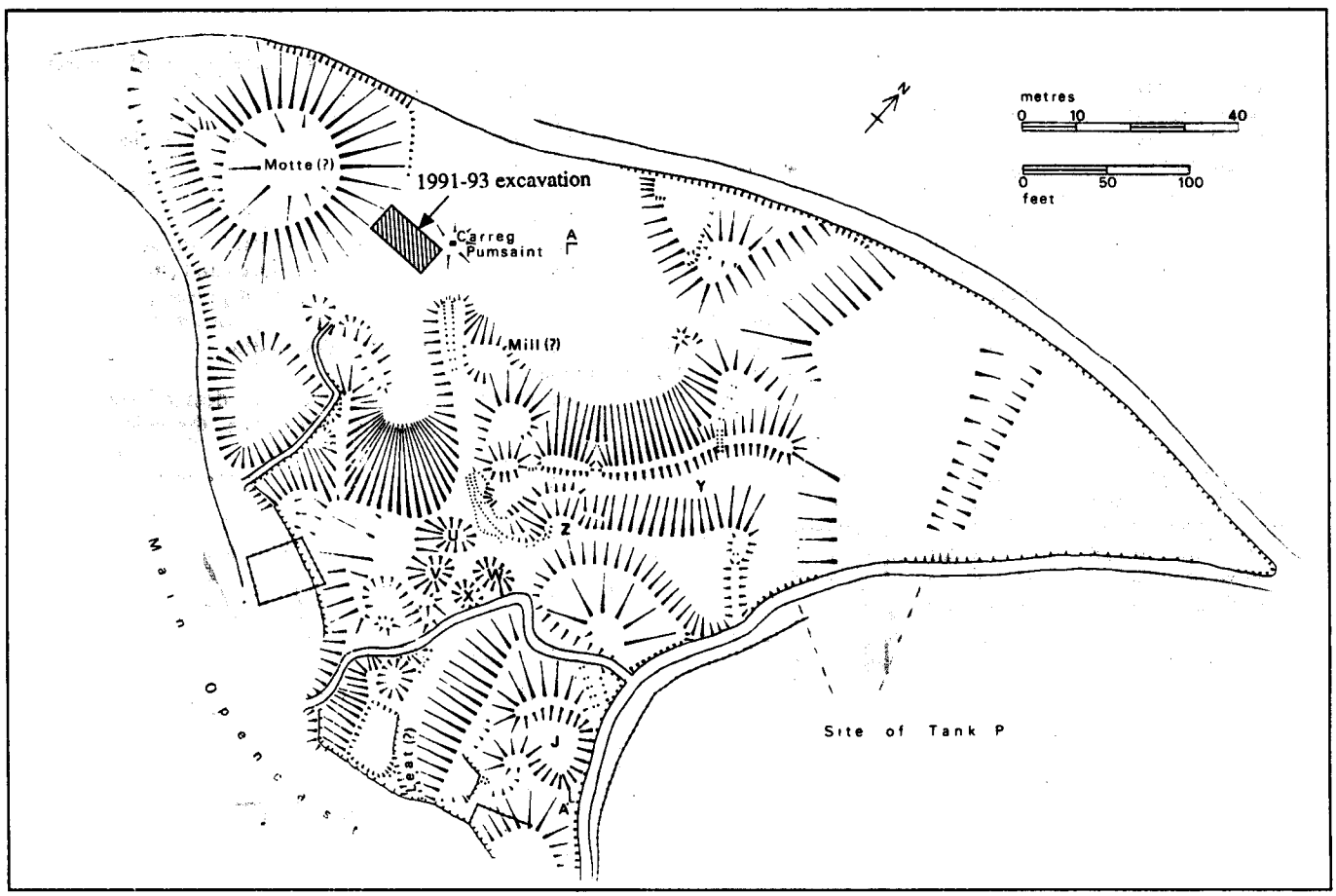

Fig. 3. Location plan of water-driven mill complex and the 1991-93 excavation site.

(iii) the development of the Cothi leat and its related tanks in connection with the exploitation of the main Ogofau Pit and the other opencasts on Allt Cwmhenog and, less certainly, on Allt Ogofau;
(iv) the exploitation of underground resources beneath the Ogofau Pit (the context for the drainage wheel) and the creation of at least two adits on Allt Ogofau in connection with stoping beneath the surface trenches.

These successive stages were seen as following a logical progression from prospecting, through opencast development, to underground stoping, all closely associated with a system of water supply designed for use in hushing, fire-setting and quenching, hydraulicing (?) and ore processing. Besides the obvious comparisons with the Roman mines in Spain, this sequence was further supported by a considerable body of datable material found in the immediate vicinity of the mines. This included (i) the drainage wheel fragment; (ii) the fragment of glass from the Mitchell Pit; (iii) the pottery from Melin y Milwyr discovered in 1973, which includes some 96 sherds of 1st to 4th century date, with a peak for both samian and coarse wares in the 2nd; (iv) the pottery found in association with the fort and the bath house, which seems to have survived throughout the 2nd century; (v) the well-known gold hoard and two late coin hoards.

Such evidence clearly demonstrates a marked Roman presence in the vicinity of the mines and some of it certainly indicates extensive Roman operations within the mine itself, not least the leat systems and the drainage wheel fragment, but whether it is sufficient to substantiate the view that most, if not all, the surviving surface evidence has preserved its essentially Roman characteristics, as has sometimes been claimed, must be open to question. In this context, indeed, one has to ask whether such an obviously well-worked site as Dolaucothi could have avoided the attention of later miners, not least the numerous entrepreneurs active throughout west Wales during the 15th to 17th centuries, and if it was so exploited, would we be able to recognise the fact? The answer is probably in the negative, principally because opencast pits and trenches are notoriously difficult to date on typological grounds alone, prior to the advent of powder. Furthermore, it must be remembered that mining by its nature can be a very self-destructive activity, whereby one phase of mining development can be radically transformed, or even entirely removed, by succeeding phases, and that such alterations, however large or small, are frequently difficult, if not impossible, to identify from the surface evidence without in situ dating material.

This problem was dramatically highlighted in 1982, when renewed survey by the Department of Archaeology at Lampeter investigated a sequence of hitherto unrecognised earthworks in the triangle of land north-east of the Ogofau Pit, immediately east of the so-called motte and terraced into the hillside overlooking the open area in which the Carreg Pumsaint or 'Five Saints Stone' stands (figs 1 and 3; Austin and Burnham 1984). The most prominent of the newly-discovered features was an elongated depression (tank Y), the outer edge of which had been reinforced with a bank, presumably to aid the retention of large quantities of water. Immediately above this lay a second levelled feature (tank/leat Z). Both would seem to have been supplied with water from their eastern ends, though the exact arrangement is obscured by a modern trackway and more recent mine workings. At their western ends, channels run away northwards onto a steeply-sloping ramp, the western edge of which is formed by a small horseshoe-shaped opencast probably of later date. At the base of this ramp, shrouded by a rhododendron bush at the foot of the slope, are very clear traces of a stone-lined channel, with the remains of a c 4.5 x 7m platform, apparently marking the position of a structure, terraced into the hillside to its east.

The suggested interpretation of these earthworks, based on comparative evidence from the medieval tin industry in Devon and Cornwall, was that they represented a water-powered crushing and processing mill related to gold extraction. The crushing machinery would have been driven by a waterwheel set alongside the mill and served with water from the tank complex on the hillside above (features Y and Z), while additional processing activities would have been carried out in the flat area beyond the mill. In the south-western tin mills, a series of vertical hammers was operated by a system of trip levers attached to the extended axle of the wheel. Such hammers dropped onto a mortar stone, the individual faces of which became characteristically indented. The occurrence of what is obviously one of these mortar stones in the nearby Carreg Pumsaint, so close to the presumed mill site, was a further important link in the chain of argument. Representations of such mills involving both dry and wet stamping are also well known from the pages of Agricola (1556).

The dating of this complex was obviously difficult without excavation, but a date somewhere between c 1200 and 1700 could be suggested, based on three strands of evidence: first, the identification of the Carreg Pumsaint as a characteristic medieval/early modern mortar stone; second, the absence of any evidence for the use of a trip-hammer technology during the Roman period (Hodges 1974, 190-6); and third, the possible relationship of the mill complex and its associated processing debris with the nearby mound traditionally identified as a motte. Such a dating would have significant implications, of course, opening up a hitherto-unrecognised phase of exploitation at Dolaucothi.

In order to test some of the ideas generated by this survey work, a small-scale trial excavation was undertaken in 1984, focused mainly on the base of the motte (fig. 3). A 10 by 2.5m trench was begun, but the increasing complexity of the stratigraphy made it clear that a larger-scale excavation would be necessary to elucidate the full site sequence (Austin and Burnham 1985). For various reasons this was not possible until 1991-93 (Burnham and Burnham 1991b; 1992b; 1993). When work was resumed, the original 1984 trench was extended towards the Cothi valley road, to examine an area totalling 12 x 5m. This had a number of clearly-defined objectives including:

(i) the recovery of a detailed sequence through the successive processing deposits indicated by the 1984 work, but over a wider area;
(ii) the examination of any related or underlying features and, in particular, of any motte ditch, if present;
(iii) the investigation of the structure of the so-called motte.

Although a great deal of analysis still remains to be done, the evidence so far

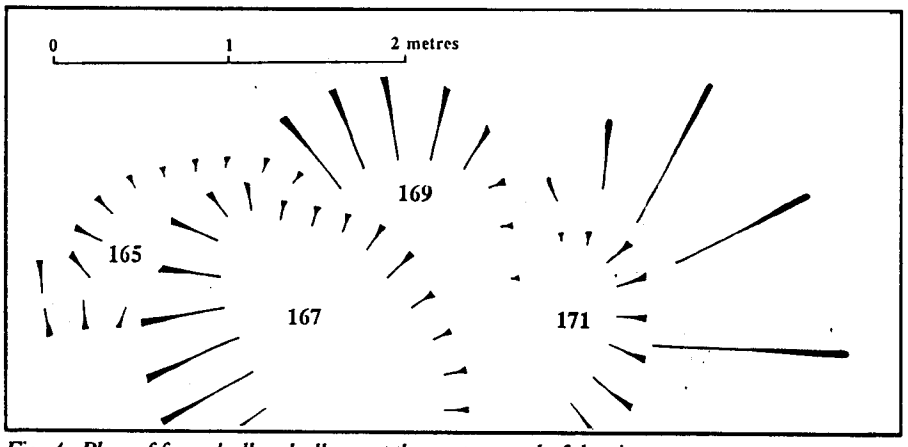

Fig. 4. Plan of four shallow hollows at the eastern end of the site.

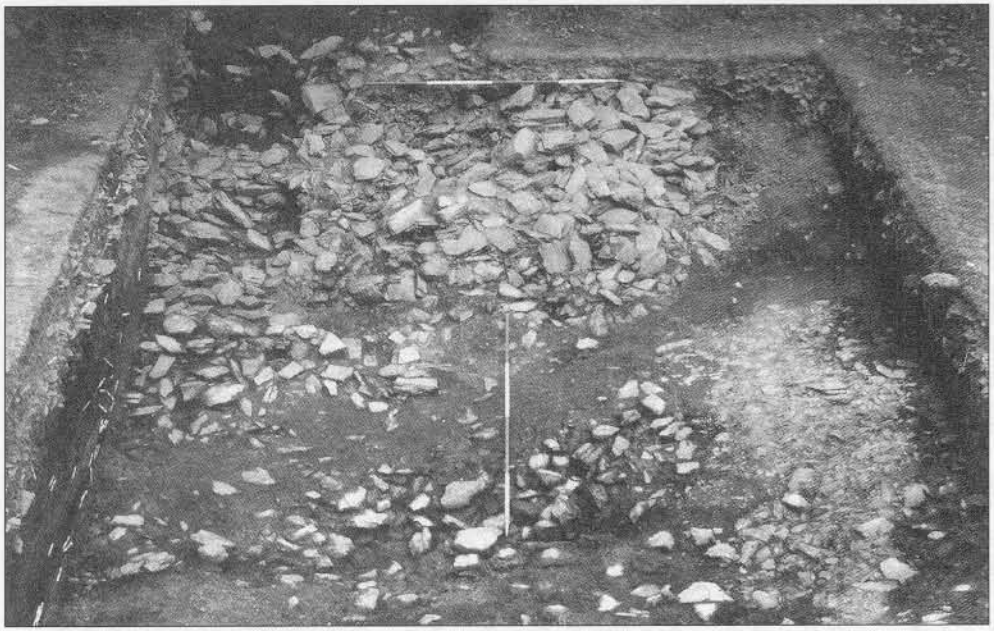

Plate 1. Detail of the built-up edge to the motte looking west [scale 2 m].

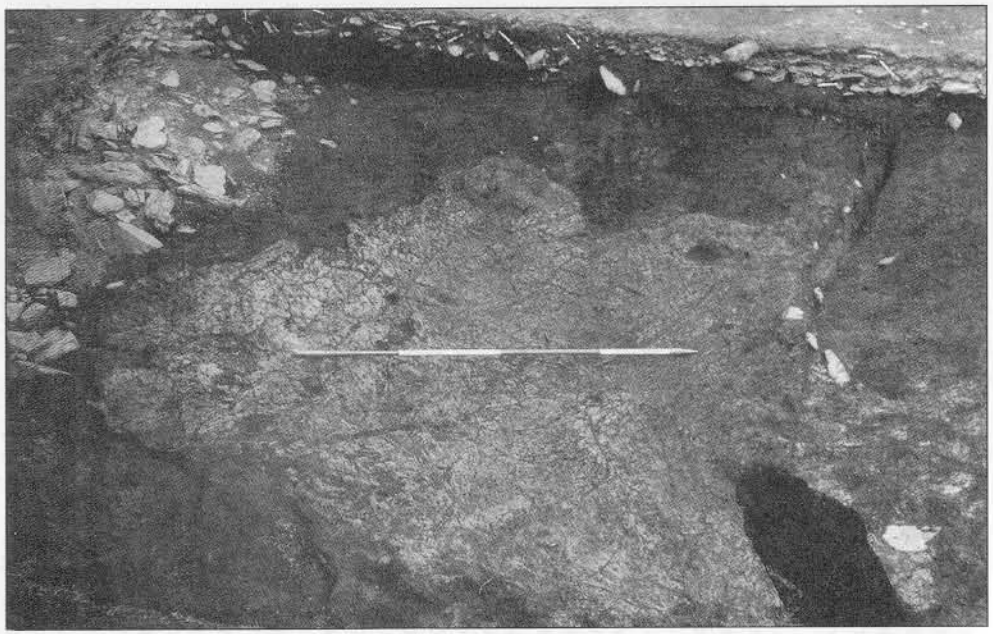

Plate 2. Detail of clay spread [77] looking north. [scale 2 m].

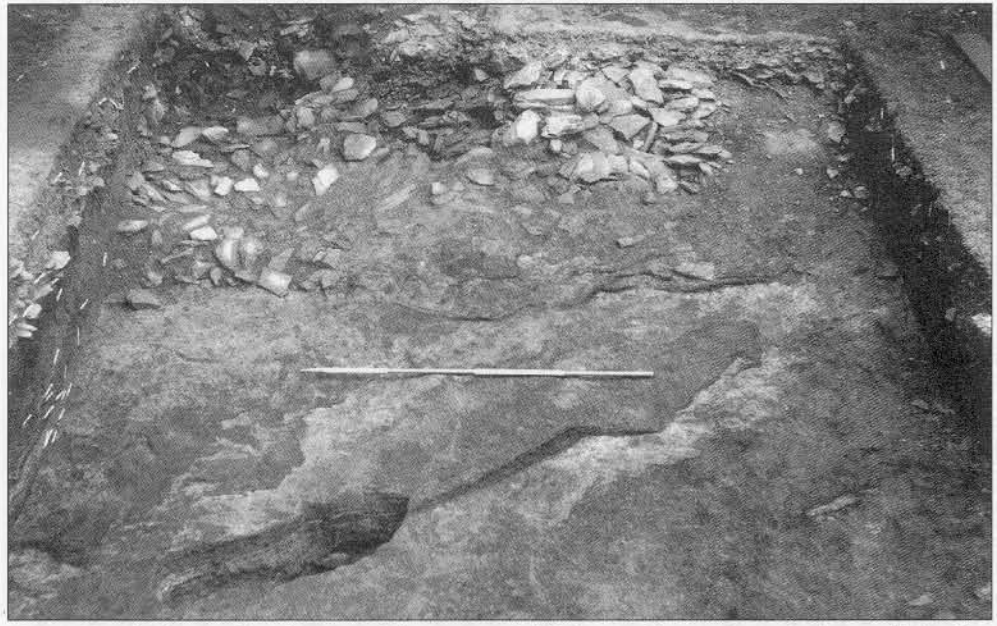

Plate 3. Detail of successive clay spreads interspersed with lenses of coarsely-crushed material looking west [scale 2 m].

Plate 4. Detail of clay spread [122] and of stratigraphic sequence in south section [scale 1 m].

suggests three main phases on the site:-

(i) The first phase involved extensive dumping right across the site, including the core of the mound [172] associated with the Carreg Pumsaint in the north-east corner, a dump of shale and sandy clay loam [151] across the eastern side of the trench, and the successive shale spreads (including 157 and 163) which merged together to form the basal core of the motte [49] which dominated the western end. In view of the increasing depth of the excavations, the exploration of the lowest of these successive deposits was confined to small-scale trenches, but at no point was the 'natural' encountered, which makes it impossible to gauge either their original depth or the underlying topography of the site. Given the nature of the dumping, however, which includes essentially barren material, it is possible to suggest that the open area beneath the mill complex began life as an opencast, the original profile of which has been largely infilled by later mining debris.

At the base of the motte slope and trending gently upwards from SSE to NNW in line with its presumed circumference, an apparently 'built-up' area was encountered (Plate 1). It comprised an extensively compacted upper surface [153] above a makeup of large angular shale fragments set in a solid matrix of shale chippings and sandy clay loam [155], very different in character from the structure of the mound to the west [49] where the shale and overlying frost shatter were very loose and fragile. Across the deepest part of the hollow, as far as the south section, it was clear that the makeup had been deliberately banked up to ensure an even gradient. From this edge and the associated makeup various pockets of charcoal were collected for radiocarbon dating in the absence of any other datable finds.

The interpretation of this feature presents a number of problems, not least because there is so little evidence to indicate either its source or its intended destination. One possibility, however, is that it was created at an early stage in the dumping process, serving perhaps as a convenient rampway onto the mound as it rose upwards, much like the barrow run on a modern spoil heap. Some such access up the mound's circumference would certainly have been necessary, given that the feature must have been raised by non-mechanical means.

The character of the stratigraphy associated with the so-called motte and the absence of any obvious structure in its makeup makes it highly likely that this feature is nothing more than a conical spoil heap constructed during a phase of exploitation which is as yet undated. To judge from the absence of a turf line between it and the overlying processing wastes it would seem probable that the creation of the heap and the dumping of the wastes were not separated by any significant length of time - it is even possible that the upper part of the mound continued to be built up while the wastes were being put in place.

Together these successive infills created a convenient hollow across the centre of the site, extending south beyond the edge of the excavation.

(ii) The second phase included considerable evidence for a period of processing activity in the immediate vicinity, comprising a series of shallow hollows [165; 167; 169; 171] cut into the shale and sandy clay loam [151] at the eastern end of the site, a somewhat later hollow [152] which replaced these latter in turn, and a complex sequence of interleaved fine clay slimes and coarsely-crushed quartz and shale horizons infilling the central hollow.

The uppermost hollow [152] lay immediately to the east of the ridge flanking the central hollow and south of the mound associated with the Carreg Pumsaint. It contained a complex sequence of fills, including a succession of thin, clay spreads [144 a-d], interspersed with intermittent bands of coarsely-crushed material, much like the sequence identified in the central hollow. At the bottom, these clays overlay a stone spread [145] which yielded a fragment of an upper stone from a rotary quern. The removal of this stone spread initially revealed a series of enigmatic contexts, the precise character of which was not immediately apparent. Excavation initially proceeded on the basis that they represented fills within the hollow, but this became less and less easy to sustain, at which point the various contexts were sketched and their full investigation was reserved for the final season.

When work was resumed, it rapidly became obvious that we were dealing with a series of at least four shallow, intercutting hollows [165; 167; 169; 171], each c.1.00 to 2.00m in diameter with their own distinctive fills (Fig. 4). To judge from the evidence, only the very bottom of these features had actually survived the cutting of the eastern hollow [152], so that it was not possible to estimate either their original depth nor the original topography at this eastern end of the site. All four contained distinctive spreads of medium to large shale fragments which appeared to have been dumped across their respective bases. Traces of what might have been a shallow gully feeding one of the hollows [165] were also noted leading south into the main section.

The exact character and function of these four hollows remains uncertain in the absence of any diagnostic finds, although it seems highly likely that they were in some way connected with nearby processing activities rather than being straightforward pits. Admittedly it might be possible to argue that their distinctive stone fills were simply the result of the extensive stone dumping which characterises the site as a whole, but this would be to ignore the fact that a similar layer [145] was recovered at the bottom of the main eastern hollow [152] and that this produced the fragment of a rotary quern. The repeated occurrence of such a stone layer might suggest that they had all been deliberately laid, perhaps to allow water to soak away from stockpiles of processed material which could then be recovered for further treatment at a later stage. The closeness of all the hollows to the site of the postulated mill might be suggestive in this respect, although it is by no means certain that they actually belong in the same stratigraphic horizon. Across the central part of the site, excavation revealed a highly complicated sequence of deposits, which proved extremely difficult to excavate, especially where successive layers of the same material had been laid one on top of the other. Considerable effort was therefore expended on establishing and recording the stratigraphy of the successive horizons and in tying them securely to the main south section. Despite their complexity, a coherent sequence emerged across the central north-west/south-east axis of the site, with fine clay slimes predominating on the south-western flank and coarsely-crushed quartz and shale on the north-east (Plates 2 to 4). These heavily interleaved deposits had accumulated to a depth of 0.75m inside the central hollow, which clearly extended beyond the south section.

The interpretation of these interleaved deposits can only be tentative at present, pending a detailed analysis of the samples by specialists in Cardiff and a full review of the relevant industrial literature, but it is already clear that the bulk of the material in the central hollow is derived from ore crushing and related processing activities. The coarsely-crushed lenses of quartz and shale are highly suggestive of material which has been mechanically pounded to a small fraction, before being processed and then dumped into the hollow from the north-eastern side. The clay slimes are most likely to be the residue from very finely-milled quartz which has been water sorted, prior to being allowed either to run down into the hollow or being dumped there in a semi-liquid state and left to settle. It remains unclear whether the clays were introduced from the north or south side of the hollow. Some of the clay lenses also contained charcoal fragments, which suggests a possible link with other stages in the processing technology described by Agricola (1556). The way in which the deposits are interleaved strongly suggests that miners were carrying out different activities in the immediate vicinity in fairly rapid succession, though it is

impossible to say whether we are dealing with weeks or months on the surviving evidence.

These processing horizons were overlain by a heavily iron-panned turf horizon [72] which extended right across the site as far as the visible shale matrix forming the core of the motte. At its eastern and western ends it merged with characteristically darker spreads of crushed material, but in the centre it merged into a deep loamy horizon much disturbed by root and animal action. To judge from the evidence, this turf horizon represents a considerable episode of stability on the site pre-dating all the later activity. Unfortunately nothing was found to help date this episode, but it would be tempting to see it as pre-dating the renewed interest in the site's mineral resources during the 19th century.

(iii) The third phase, which need not concern us in detail here, comprised a series of at least three separate road surfaces and other miscellaneous features postdating the turf horizon, which were clearly associated with 19th and 20th century finds.

Such evidence clearly adds considerably to our understanding of this part of the Dolaucothi complex, by confirming the presence of processing activity in the immediate vicinity and by rejecting the traditional interpretation of the mound as a 'motte'. Although the radiocarbon dates for the charcoal sealed beneath the processing wastes will be crucial as a terminus post quem for their dating, the close association of such wastes (including a quern fragment) with a nearby mill and a closely-datable processing technology, opens up the possibility of a hitherto-unrecognised phase of exploitation at the site which has to be accommodated within the traditional historical framework. It also raises other issues of relevance to the interpretations proposed by Lewis and Jones, including (i) which part of the surviving extractive features among the visible remains should be associated with the mill, (ii) how diagnostic is the evidence for a Roman or later dating for individual opencasts or trenches before the advent of powder, and (ii) how certain can we be of the traditional Roman dating for every part of the pre-19th C remains?

In support of this (or another) phase of mining we might recall that several sherds of 16th and 17th century date were also found alongside the Roman material from Melin y Milwyr, a fact which Lewis (1977) actually acknowledged as evidence of a possible later phase of activity on Allt Ogofau. A further suggestive feature is the presence of several pillow mounds, first identified during a student field class in 1983 and subsequently published by Gerrard (1989). These are clearly located in discrete areas of Allt Ogofau in between the known pits and trenches. None has been excavated, so their dating remains uncertain, but by analogy with comparable mounds in the Dartmoor tin industry, they may well belong with a phase of mining.

This is perhaps as far as one can go for the present. This work does not deny the importance of Roman mining at Dolaucothi, even on a large scale in relation to some of the known workings, it simply advises caution in the oversimplistic interpretation of a very complex site. Clearly answers to some of the questions posed by this paper will only come from interdisciplinary, collaborative research and excavation; it is somewhat ironic, therefore, that the National Trust's current conservation policies operate against the likelihood of such work and the chance to advance our understanding of a remarkable site.

ACKNOWLEDGEMENTS

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