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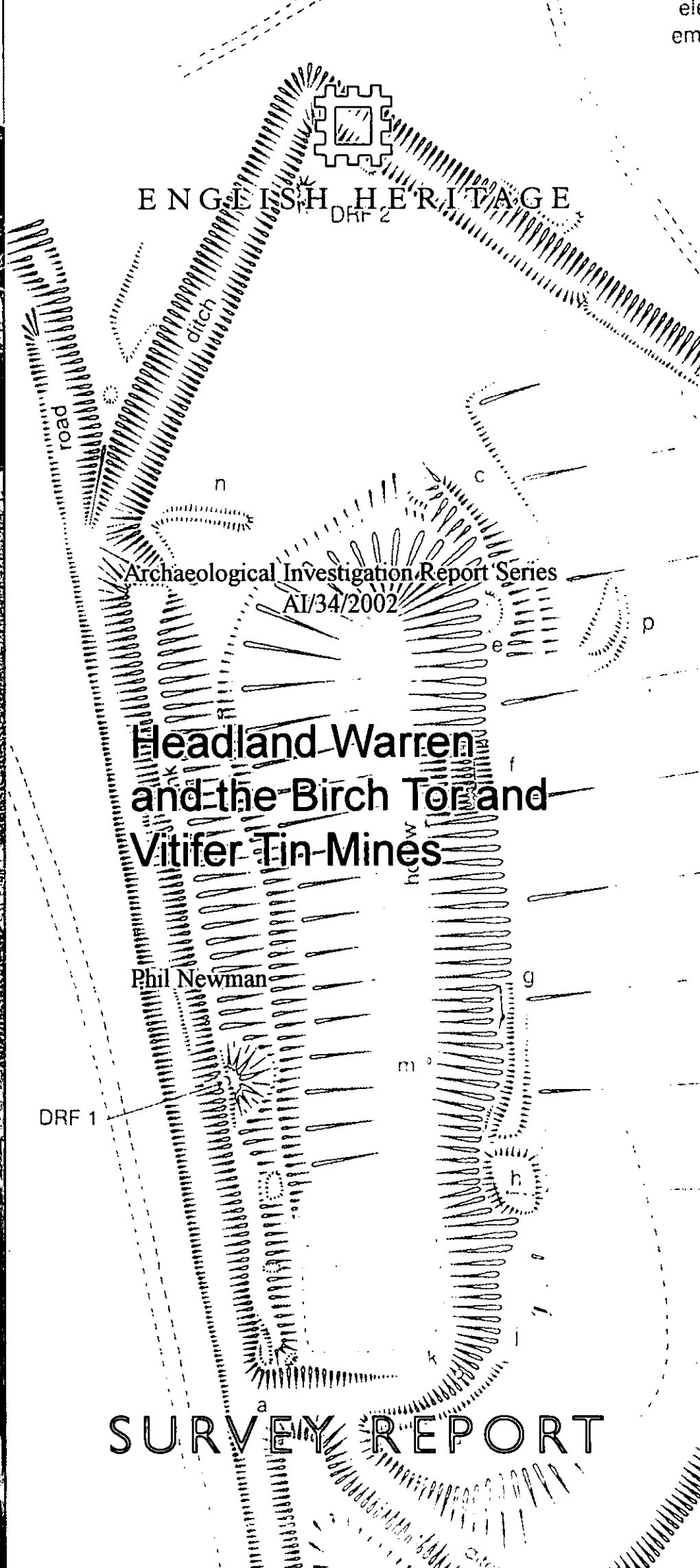
Archaeological Investigation Report Series
AI/34/2002

Headland Warren and the Birch Tor and Vitifer Tin Mines

Phil Newman

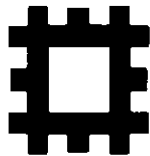
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SURVEY REPORT



Archaeological Investigation Report Series

AI/34/2002



ENGLISH HERITAGE

Headland Warren and the Birch Tor and
Vitifer Tin Mines

An archaeological survey by English Heritage

County:	Devon
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PART 1: INTRODUCTION AND PREHISTORY

Summary

The Birch Tor and Headland Warren area contains the most intensive remains of past human activity on Dartmoor. Prehistoric settlement and ritual sites have been overlaid and incorporated into a medieval field system which has itself later been partly effaced by post-medieval tinworks, a rabbit warren and 19th-century mining. This landscape therefore is a classic Dartmoor palimpsest, though unlike other such areas, the intensity and scale of the tinworks with their associated water systems, exploratory pits and structures have left what appears to be a predominantly industrial landscape where other forms and periods of activity have been under-recorded or overlooked. The following report combines data from three separate surveys by RCHME and EH to arrive at an interpretation of this highly complicated landscape. A breakdown of the various elements on the ground, including chronological information is attempted and presented in a graphical form.

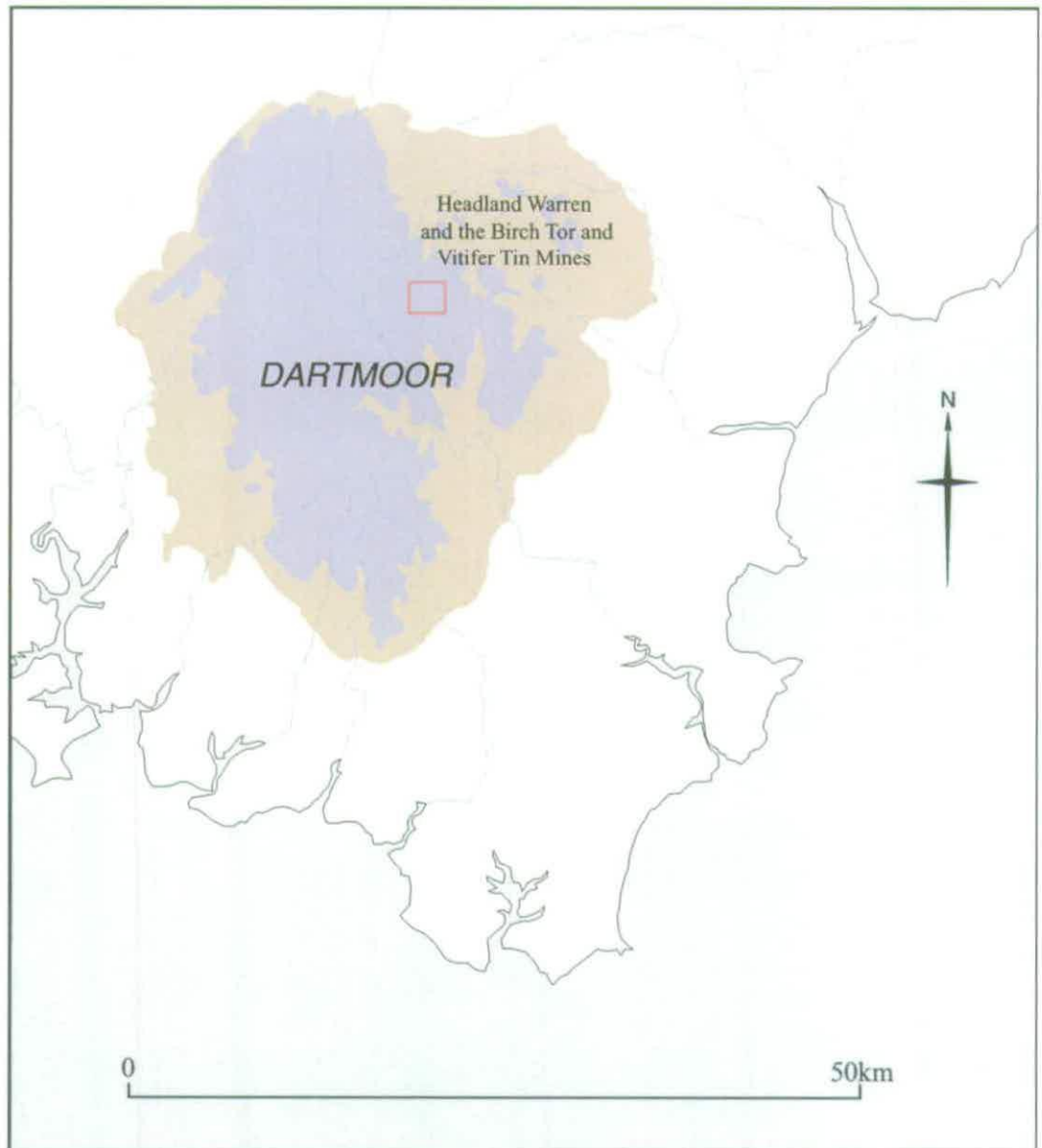


Fig. 1:1. Location map.

HISTORY OF THE PROJECT

This report focuses on the area known as Headland Warren on central Dartmoor. A survey of this area was requested by the Dartmoor National Park archaeologist in 2000 and work commenced in September that year. Shortly after this the DNPA also requested some recording in the Golden Dagger area, in advance of forestry planting. No fieldwork was undertaken between February and August 2001 because of the Foot and Mouth epidemic. All this work was however completed in 2002. The area to the west of the Walla Brook, had already been surveyed by RCHME at level 2 in 1992, as had Challacombe to the south-east in 1990. The filling of the gap between these two was seen as a major opportunity to re-evaluate the whole area as a single piece of landscape, mainly because the post-medieval tinworking could not be properly understood when surveyed in arbitrary portions as it had been previously, and the combination of these three surveys would offer the first chance to evaluate the complete area. For that reason it was also decided to include the area to the north of the B3212, known as Bush Down with the 2002 survey to fill the final gap. It soon became apparent after commencing work at Headland Warren that although the post-medieval tin extraction was the dominant feature of the landscape, other previously overlooked elements also survive to a lesser degree, including a prehistoric enclosed settlement of 10 huts and a medieval settlement with two longhouses and associated field system, all unrecorded. Field evidence for the 18th-20th century rabbit warren was also far more extensive than had previously been imagined.

In the following report, for the prehistoric elements and the remains of the rabbit warren, only the field evidence contained within the Headland Warren boundary is described (Figs 1:2; 3:1). For the medieval period also, only the evidence within Headland Warren is described (Fig. 2:2), but it is placed within the context of adjoining areas in the discussion (Fig. 2:3). For the tinworking and later mining the entire area is presented as a single entity (Fig. 4:2; 4:9). This report is an overview and discussion of the landscape as a whole and detailed description and measurement is for the most part not included. However, for each individual feature or groups of features a separate NMR report has been created (appendix).

THE SURVEY AREA

The survey area is situated on central Dartmoor, approximately 2.5kms east of Postbridge. (SX 690 810) and covers approximately 9km². It is centred around the water divide of the rivers Teign and Dart which includes the head region of two tributaries of the River Teign, running to the north, Boveycombe and the East Bovey and four of the River Dart tributaries, Statts Brook, Walla Brook, Redwater Brook, and the West Webburn flowing to the south. The terrain is one of moderate to steep slopes rising from the river valley floors to the summits of Merripit Hill (449m OD) Hookney Tor (497m OD), Birch Tor (487m OD), Water Hill (489m OD) and Challacombe Down (460m OD). The area is divided between three parishes: The Forest of Dartmoor, west of the Walla Brook; Chagford, approximately north of the B3212 road; North Bovey to the east and Manaton to the south-east.

PREHISTORIC EVIDENCE

The Challacombe Stone Row

Probably the earliest extant evidence of human presence at Headland Warren is the Challacombe Stone Row. The row is sited south of the low dip on the crest of the ridge which runs between Challacombe and Birch Tor, oriented SSE-NNW, just to the east of the crest and running uphill to

the south. It is usually described as a triple alignment though it survives as such only in fragments. The overall length of the row is 141.7m and it has 57 extant stones, including the blocking stone. Near the northern end an additional 12 stones appear to be part of the monument partly creating a short section of a fourth row, and several hummocks may represent the positions of stones present though buried. The blocking stone at the south end comprises a flattish stone, set with its axis at approximately 90 degrees to the prevailing axis of the alignments. Previous writers (cf Worth 1967) have considered that the northern terminal of the row, together with any associated features, were removed when the large Chaw Gully tinwork cut across it, however there is a gap of 24m between the current north terminal and the tinwork. The monument was partly restored in the 19th century as reported by Worth (1967, 226, Pl. 47), who considered the restoration to have caused little damage, though believed the additional stones on the NW end and a blocking stone inserted across the rows 12m from the northern end were probably incorrectly placed.

Cairns

There are few cairns within the area and those which have been recorded are poor examples being small or disturbed. On the northern summit outcrop of Birch Tor, is a flat heavily robbed cairn, in which an apparently unrecorded excavation has taken place. A possible cairn sits on the northern end of the Soussons Common ridge consisting of a low, grassy mound, apparently undisturbed and a similar feature is located to the north of Headland Warren, but neither have been confirmed as being of prehistoric date.

2nd millennium settlements and field systems('reaves')

Although reaves are present in the adjacent area of Shapley Common, they are not numerous within the Headland Warren area. Poor survival is the probable reason for this rather than a lack of occupation here. Some survive however, including one, rather faint example running north – south along the crest of Soussons Common. A clearer example also running north – south crosses the Challacombe Cross to Widecombe road. On the northern ridge of Birch Tor a clear, serpentine reave running approximately east – west forms the terminal reave for a system of clear parallel reaves, oriented approximately NNE from the terminal. There is some sub-division and evidence of attached reave settlements, including some very fine hut circles. This system continues across the eastern end of Bush Down which was not recorded as part of the EH survey. However, it contains many apparently unrecorded components and would be a priority for further research in the area.

Non-reave settlement is present at Headland Warren though mostly on the east side of the Redwater valley. One settlement is located on the lower west side of Challacombe Down and has been bisected by the Challacombe boundary wall. Part of the settlement was recorded during the RCHME Challacombe survey. To the north, in the newly-mapped area, five huts and sections of enclosure wall have now been added.

A small sub-circular enclosure is sited near the stone row on the crest of the Challacombe ridge, and part overlaid by the later warren enclosure there. It has one clear hut circle which is curiously just outside the enclosed area.

To the west of the Birch Tor main summit outcrop is a fine settlement of four conjoined enclosures and eleven huts, the only previous record of which comes from Crossing who mentioned them briefly in his guide to Dartmoor (Crossing 1912, 250). The settlement comprises four major elements covering a total area of 3.8ha. Some internal sub-division is also evident. The primary enclosure is sub-triangular (shield shaped) and has three huts, including two incorporated into the north-west wall. Additional enclosures and sub-division were added to the west and north sides as well as a

HEADLAND WARREN
Prehistoric evidence

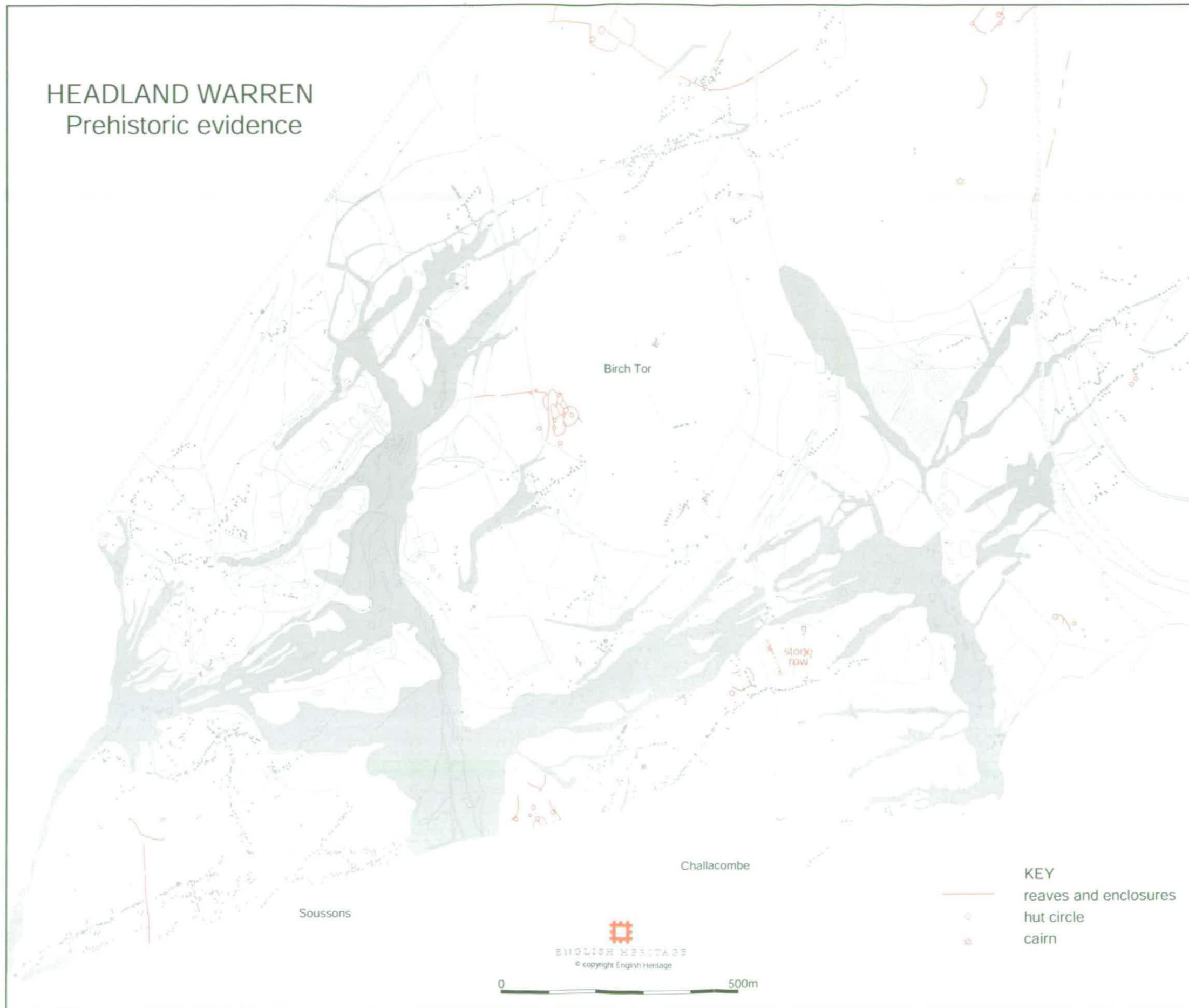


Fig. 1:2. Headland Warren survey. Interpretation highlighting prehistoric evidence.

large enclosure on the west which was later fossilised by medieval farmers. Of the eleven huts, several are fine examples with substantial stone walls visible.

DISCUSSION

Despite the massive upheavals to the landscape which occurred in the medieval and post-medieval period in the Headland Warren and Birch Tor area, prehistoric evidence is still well represented here, especially on the higher ground. However, settlement and land division were not on a very intensive scale which may be due to the altitude. This settlement on the slopes of Birch Tor for example, at approximately 450m above OD is among the higher altitude second-millennium settlements on Dartmoor.

PART 2: MEDIEVAL SETTLEMENT AND LAND USE

Summary

For the medieval period the survey has revealed remains of settlement and agriculture not previously recognised. A deserted settlement comprising two ruined longhouses and small enclosures is the focus of a field system which extends around the head of the Redwater valley and the slopes of Birch Tor. Evidence of enclosure has also been noted in the West Webburn Valley which could be part of the same farm or a separate holding, with its focus perhaps at the site of the later Headland Warren house.

INTRODUCTION

One of the outstanding surviving elements of the medieval agricultural landscape on Dartmoor is the shrunken settlement and associated field system at Challacombe, in the upper West Webburn valley. Here a cluster of deserted crofts containing ruined longhouses, surrounded by an extensive strip-field system, covering approximately 323ha, provides a rare and fascinating glimpse into medieval and later land use on Dartmoor

Challacombe has been considered to represent the upper limit of such land use in the Redwater and West Webburn valleys. Most previous writers have not mentioned the land north of the drystone wall which both defines the Manaton/North Bovey parish boundary and the northern edge of Challacombe. This implies that this wall may have been perceived to delineate the limit of enclosure and settlement for the medieval period within the valley, the lands beyond to the north not having been settled (ie Shorter 1938; Bonney 1971; Pattison 1999).

To the north of Challacombe today lies Headland Warren, an 18th-century creation, now disused, which exploited the marginal nature of the land there, made so by hundreds of years of tinworking. Massive open gullies and many hectares of dumping and pitworks had made this an area quite unsuited to agriculture, even before the onset of underground mining in the late 18th century.

However, the results of the English Heritage survey have demonstrated that much of the area known as Headland Warren was indeed colonised in medieval times and remains of a once extensive field system cover the slopes of the Redwater and West Webburn valleys. A small settlement also survives near the centre of the area which was undoubtedly associated with the fields. All that now remains is subtle earthworks, heavily disguised by vegetation and easily overlooked, being interlaced with later remains of tinworking and rabbit warrening. It seems likely that the settlement and the field system were abandoned long before the decline of Challacombe possibly because of the massive changes wrought on the landscape by the tinnners. Alternatively the location of the site at around 400m above OD, places it on the extremes of marginality which could suggest an earlier abandonment as part of a general desertion of the higher moors in the 15th century which came about as a result of a number of interrelated and frequently discussed factors.

THE WORK OF PREVIOUS RESEARCHERS

Little attention has been paid to the field archaeology in the Headland Warren and Birch Tor area other than investigations into the 19th-20th century mines (Broughton 1968; Greeves 1986) and historical examinations of the warren itself (Haynes 1970; Brewer 1986). The OS 25-inch 1st edition map of 1885 depicts only major features associated with the tin mines and warren, both of which were working at that date, and the double stone row. Two aerial photographic transcriptions of the area (RCHME 1986; Butler 1991) have both overlooked the medieval remains. Much

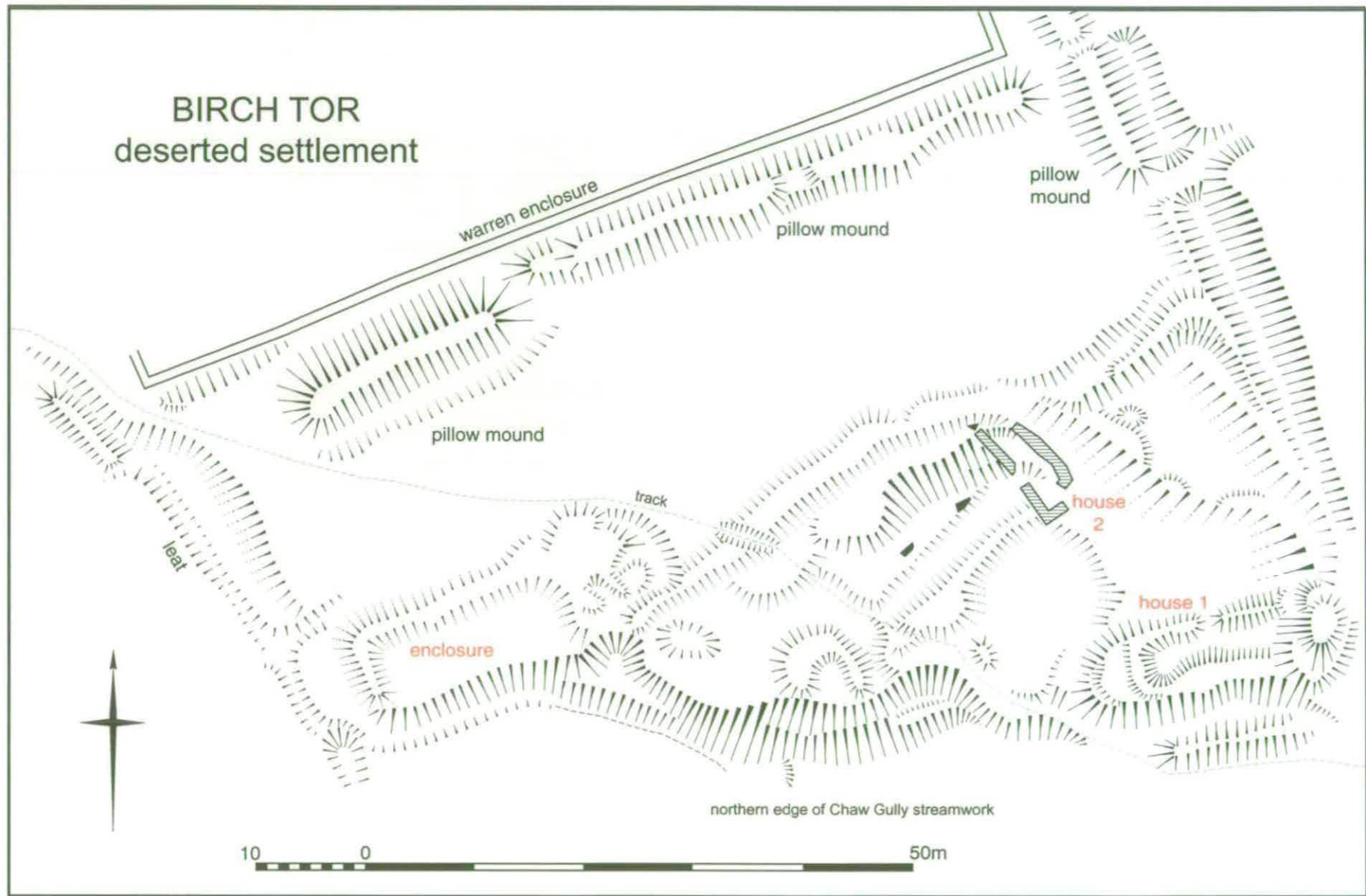


Fig. 2:1. EH 1:500 earthwork survey of the deserted settlement south of Birch Tor.

important research has taken place at neighbouring Challacombe to the south of Headland Warren, some of which is germane to this report (Shorter 1938; Bonney 1971; Pattison 1999).

FIELD EVIDENCE

The remains (centred SX 688 809) are contained within the valleys of the Redwater and West Webburn, including the east flank of Soussons Common and the south flanks of Birch Tor, all within North Bovey parish at an altitude between 360 and 480m above OD. Human activity has taken place here since prehistoric times, though probably not continuously. A triple stone row on the crest of Challacombe Common is probably the earliest surviving feature here, and together with several cairns in the area, is likely to date from the Early Bronze Age. Three small enclosed hut settlements from the Later Bronze Age demonstrate that the area certainly was habitable in the 2nd millennium BC.

The dominant feature of the landscape is the remains of tinworking, probably dating from medieval times right up to the 1930s (see below). The lower valleys have been widened and deepened by streaming activity and large, deep, open gullies extend up and across the hillsides. Hundreds of extractive pits pockmark the surface of the land and many kilometres of leats form a complex lattice over much of the ground. Shaftheads and their associated spoil heaps are the main evidence of deeper mining, from the 18th century onwards, but also associated with this period are ruins of many structures including wheelpits, processing areas and domestic buildings.

In the mid 18th century, during a probable hiatus of tinworking activity, a rabbit warren was established, hence the modern name of Headland Warren (see below). Rabbit warrens were often sited in areas considered unviable for either arable or conventional stock rearing and Headland Warren at the limits of marginality and with its despoiled ground would have been ideal. The warreners in many cases altered existing earthwork features to build their pillow mounds and enclosures, including parts of the medieval field system and disused tinnners' leats.

The settlement (Fig. 2:1)

The settlement (SX 6848 8076) consists of two ruined longhouses and associated small enclosures, adjacent to the north side of a large tin streamwork which extends east from the Redwater valley. The northern edge of the streamwork truncates the settlement which was probably larger before tinworking occurred. The building remains lie within a natural hollow, which although shallow probably offered effective shelter from the elements. Access to the settlement was via a sunken lane adjoining the hollowed area on the eastern side, running NNW, parallel to a later enclosure and pillow mounds.

The principal surviving dwelling is a substantial longhouse oriented approximately east-west, sited at the edge of the streamwork. The south and west sides of the building have been heavily earthed up with spoil and the whole feature has a maximum spread of 25m by 12m. Although little stonework from the walls is visible the outline is clear as an approximately rectangular hollow within the earth mound, having internal dimensions of 11m by 2.7m. A possible entrance is visible on the north side, centrally placed on the long wall. The structure is shrouded by perennial vegetation, and is completely covered by bracken in the summer months.

A second building stands 15m north of the first, oriented NNW-SSE nestling against the edge of the natural hollow within which the settlement is constructed. Parts of the drystone granite walls survive upstanding and there is a clear central entrance on the west side approached by a hollow path. The northern end of the structure is not visible but a minimal internal length would be 9m

while the width is 3m.

Part of a small enclosure survives just to the west of the houses, consisting of spread earth banks truncated on the south by the streamwork. The surviving area is approximately 0.16ha. The northern lip of the natural hollow is also defined by vestiges of a bank and together these two represent the remaining elements of the toft.

THE FIELD SYSTEM

Fleming and Ralph presented a morphology of field boundary types which were applicable to their area of interest at Holne Moor (Fleming & Ralph 1982, 105). Although some adaptation of this scheme has been necessary for research on other areas of Dartmoor (cf Newman 1992), this has remained a good basis from which to work. However, only four of Fleming and Ralph's eight types apply to Headland Warren and these are the hedge-banks, small and large, reaves, and drystone walls; stone-faced corn-ditches and wall banks have not been noted here. The lack of corn-ditches does not necessarily have any chronological implications as would be so if Fleming & Ralph's scheme were strictly adhered to.

The medieval field boundaries at Headland Warren are discernible from their prehistoric precursors, because they lack stone in their construction. The majority were simply built by digging a ditch and piling the earth into a bank along the lip of the ditch; the ditch being on the outside of the area to be enclosed. The result was Fleming and Ralph's hedge-bank types. Prehistoric walls or 'reaves' were mostly constructed from stone and although often turf-covered today, giving the appearance of a bank, they rarely have a surviving ditch and usually have at least some vestiges of stone visible. Identification is sometimes complicated however, because some prehistoric boundaries were adapted as part of the medieval expansion. Although Fleming observed that some stone reaves were built on earth precursors, it seems very unlikely that an earth or turf-only bank of the prehistoric period would survive today as a perceivable earthwork feature on Dartmoor.

One revelation resulting from the survey is that tanners, probably operating after the abandonment of the medieval fields, sometimes adapted the ditches as water channels to divert water to their tinworks. Many of the hedge-banks were ideally suited to this purpose, often running for many hundreds of metres along and down the hillsides. If connected to other leats and rainwater run-off supplies, much effort could be avoided by not having to dig completely new leats. In the case of some of the steeper examples, the constant scouring by water has eroded and widened the ditch effacing the bank in the process so that all that remains is a gully.

Eighteenth and 19th-century rabbit warreners also adapted lengths of hedge-banks converting them into pillow mounds, probably because the soil had already been loosened and it was easier to dig. Several, in some cases very long, pillow mounds can be seen running along the courses of former field boundaries. Other pillow mounds were raised within fields which had once been cultivated taking advantage of the previously softened earth for the rabbits to burrow in.

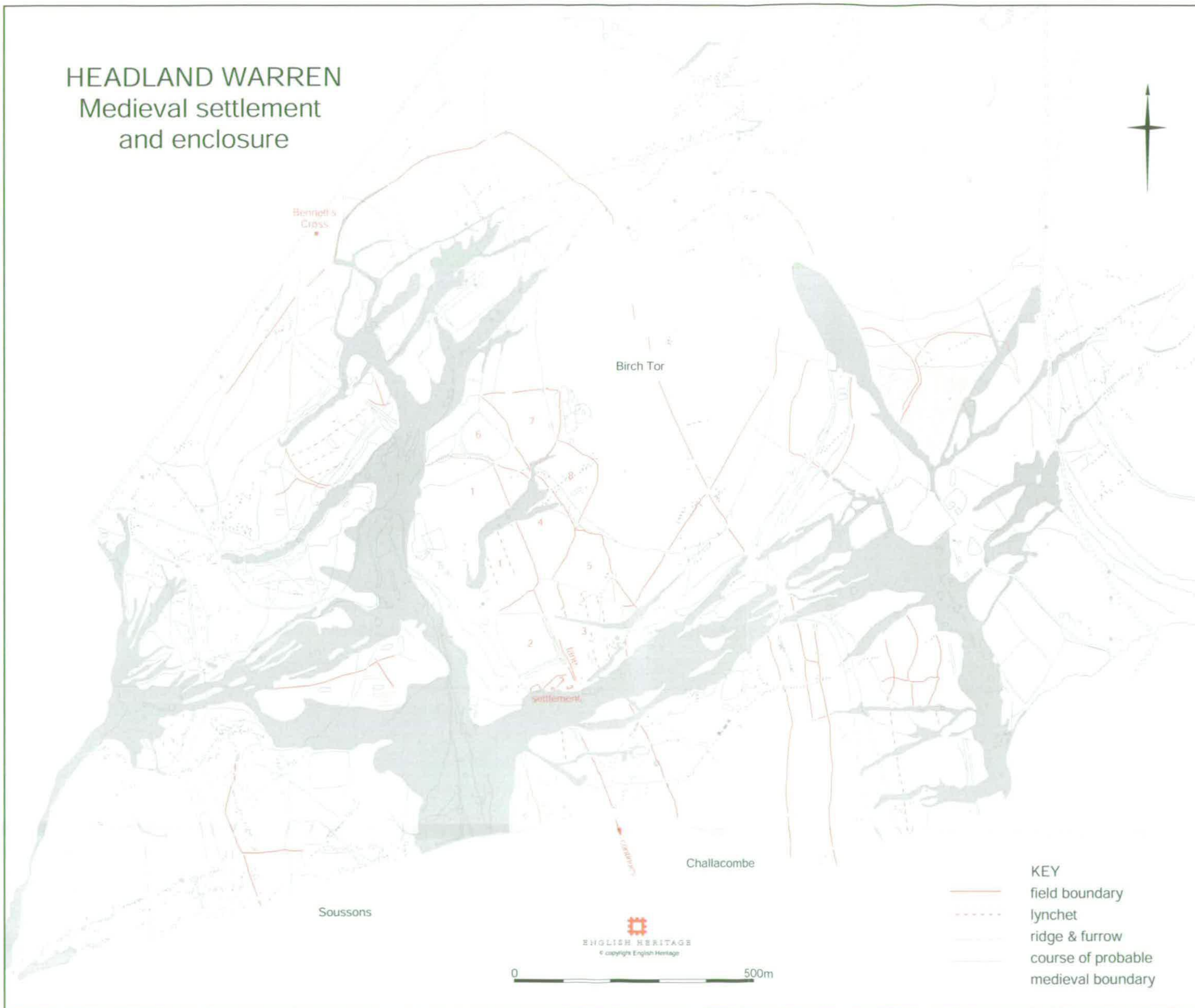
The Fields (Fig. 2:2)

Redwater valley

The main area of medieval fields is located on the south-west slope of Birch Tor on a large peninsula of land surrounded on three sides by tinworking. Apart from a single large openwork, called Garden Lode, and one smaller working which both transect it, the area is largely undisturbed by tinworks. This is the area closest to and immediately north of the deserted settlement. The prevailing axis of

HEADLAND WARREN

Medieval settlement and enclosure



- KEY
- field boundary
 - lynchet
 - ridge & furrow
 - course of probable medieval boundary

Fig. 2:2. Headland Warren survey. Interpretation, highlighting elements of the medieval settlement and field system.

this part of the system which includes the sunken lane from the settlement is NNW-SSE and within this some of the fields closer to the settlement appear to be subdivided into narrower strips, including some defined by faint lynchets.

On the northern sector of this part of the system the fields are more curving in form and appear to be later attachments or possibly outfield. It was during this probable later phase that part of a prehistoric enclosure was incorporated into the system (field 7).

Of the surviving fields in this cluster a likely relative chronology can be suggested for fields 1-8 (Fig. 2:2), but how this relates to other parts of the system to which it was once attached to the south and east, is not certain. This phasing confirms what might be expected: that the lower fields were established first and the larger, higher outfields represent later expansion.

South of the tinwork which transects the settlement and the field banks, the axis is continued by two banks, one with a substantial ditch, running down to and meeting the east to west Challacombe stone wall that marks the parish boundary. The western of the two banks continues south of the boundary wall (Fig. 2:3) and was recorded as part of the RCHME Challacombe survey (Pattison 1989).

At the head of the Redwater valley where tinworking disturbance is at its most intense, vestigial remains of hedge-banks reveal the position of more fields. Although now isolated from the fields to the south, these were probably once part of the main patchwork. A single curved hedge-bank running between two large tinworks is all that remains of the boundary of what was once a cultivated field where three faint lynchets run horizontally along the contour. The softened earth of this field rendered it highly suitable to construct pillow mounds at a later date and two survive within the field. At the western exterior of the field another bank which runs parallel with the hedge-bank for part of its course is suggestive of a droveway or moor lane, providing access to the commons from the lower fields.

To the north of the tinwork which transects the northern edge of the field, the approximate axis of the hedge-bank is continued by a substantial tinner's leat which has an upcast bank that is above average in size and runs in a straight line north to meet another abandoned field boundary. There are also two tinner's reservoirs built into this leat. It seems likely that the leat adopted the course of a former field boundary although it has been too heavily altered to be certain.

Traces of fields are visible on the western slope of the valley, south of the massive Vitifer tinwork; an area known as Soussons Common. Although this area has been heavily disturbed by tinworking, including a wide streamwork which spreads up the valley side, evidence of at least one large field survives, together with several other banks. Some of the field banks on this slope have been adapted for use as leats.

At the eastern foot of the slope, as the ground begins to level out, in an area completely surrounded by tinworks, are patches of faint ridge and furrow oriented east-west up the hill. The visibility of these features is not great on the ground but they are very clear on aerial photographs (see Griffith 1986). This island of formerly cultivated ground has also later been adapted for rabbit farming and contains four pillow mounds.

West Webburn valley

The upper reaches of the West Webburn are still occupied by Headland Warren house which has origins in the 18th century or earlier and is inhabited to this day, though the warren became disused probably before the 1920s. Associated with the house are several stone-walled enclosures which certainly date from the period the warren was in use, possibly as early as the late 18th century when first recorded. The valley floor has been widened and deepened by streamworks, and openworks

extend across the valley at right angles, so the head of the valley is effectively quartered by tinworking disturbance. Nevertheless enough undisturbed ground remains for earlier activity to be visible.

On the steep west flank of the valley, a number of linear features which run approximately along the contour may be attributed to medieval agricultural activity. On the lower and middle slopes, fragments of lynchets may be traced as well as a discrete group of field boundaries which demonstrate the existence of at least three fields in this group though possibly four. The boundaries have a serpentine appearance and it is tempting to associate this with cultivation though no evidence of ridge and furrow survives here.

To the south, a faint, straight lynchet runs for approximately 250m north-south and meets the Challacombe wall. South of the wall the line of the lynchet survives as one of the later field banks which encloses the lynchet plots in Challacombe.

Nearer the summit a substantial hedge-bank extends along the contour to the south between the tinwork to the north and the Challacombe boundary. Although no direct association with any feature south of the boundary has been noted, its alignment and position suggest that it could be part of the same scheme as Challacombe where hedge-banks of this type define the outer limit of the outfield. Further west, along the summit itself, a similar though more faint bank runs on an approximately parallel course. The ditch is hard to define in places but where present is on the east side, suggesting this bank to be the outer boundary of enclosure on the west side of Challacombe Down. There is no trace of it south of the Challacombe wall. These two banks together leave a narrow unenclosed strip of land running the length of the hill, beyond the boundary wall, which is only 88m at its widest point. This 'avenue' incidentally, appears to respect the prehistoric stone row which runs coaxially between the two and the parallel alignment of the two banks is redolent of prehistoric parallel reaves. However, the eastern of the two boundaries is a substantial earth bank with a deep ditch and is certainly not a prehistoric reave while the summit boundary, although faint, contains no stone, has a slight ditch and is unlikely to have survived from prehistory.

At the head of the combe, north of the warren house, the stream is flanked on both sides by fields enclosed by hedge-banks. On the west side only one enclosure is detectable but parts of it have been effaced through adaptation by the tinnerns. Interestingly four pillow mounds are located within this enclosure, which judging by the siting of other such mounds within this warren, suggests this field may once have been cultivated.

On the eastern side of the West Webburn vestiges of two fields are visible, separated by what could be a droveway or moor lane, consisting of a sunken channel and providing access from the commons to the lower ground. Contained within these two fields is an area of ridge and furrow. The remains fit well with Fleming's description of 'narrow rig' (Fleming 1994, 101), running up the hillside rather than along, with furrow-to-furrow measurements of approximately 3 – 4m and contained within an earlier enclosure. Fleming suggests a 16th or 17th-century date for this evidence in most occurrences on Dartmoor (ibid. 109).

On the slopes and summit of Birch Tor is the evidence of hedgebanks which delineate what may be interpreted as a system of outfields though the slight and incomplete nature of the remains suggest this was an unfinished or short-lived phase of enclosure. The relatively stone-free and gently sloping ridge of Birch Tor would have made the process of enclosure fairly easily achieved but its altitude of 487m at the summit places it beyond the edge of what is normally considered viable land on Dartmoor, even in the middle ages. The clearest evidence for this outfield is an almost straight bank and ditch which runs up the south side of Birch Tor, towards the summit. At the lower levels the ditch is very well defined but as the bank gets higher, the ditch fades to nothing. The bank itself fades away completely near the southern outcrop of the tor but reappears near the

prehistoric barrow at the northern end of the ridge. From there it runs north-west but then changes direction to south-west at the head of the Redwater valley, defining the head of the coombe. The hedge-bank was later adapted by tanners as a water course, leaving parts of it now eroded away but interestingly it was still perceived as an outer boundary in the 18th century when it was utilised as the boundary of Headland Warren and boundary stones were spaced along part of it.

The southern portion of this outfield boundary, south of the tor, runs on a similar north-south axis to the two boundaries on the hill summit to the south, near the Challacombe outer wall, but any relationship which may have existed has been destroyed by later tinworking.

An additional element of the outfield is the straight hedge-bank which runs south-west to north-east across the southern part of Birch Tor, connecting the enclosures of the West Webburn valley and those on the east side of Redwater valley. Further vestiges of a bank which may be part of this scheme run north up the east side of the head of the West Webburn, then curve to the west before fading out.

CONCLUSION

This area was settled and farmed during the medieval period, despite being at an altitude which is notably higher than that normally considered to have been viable, even during the mildest climatic conditions of the Middle Ages. With the settlement at 380m above OD and fields which extend up to 487m, this must be among the highest, if not the highest, medieval settlements so far recorded on Dartmoor.

Chronology

The model for medieval colonisation and retraction from the uplands of Dartmoor, is one which is constantly under review though some facts are now available. Earlier excavators of medieval settlements on the moorland fringe believed them to have pre-Conquest origins (Beresford, 1979) but this idea has not been supported by more recent investigations; the pottery evidence alone suggests that none of these sites excavated on Dartmoor so far were permanently occupied before 1300 AD (Allan 1994), though this should not preclude the possibility of slightly earlier settlement. A combination of population pressure on the land during a period of favourable climatic conditions is the most likely reason for colonisation of these high slopes and the fact that cultivation terraces or lynchets survive amid the fields at Headland Warren confirms that arable cultivation was possible here for a time.

Desertion may have occurred by the mid 15th century, again following the examples of excavated sites. A number of factors may have contributed to this including climatic deterioration which remains among the most plausible explanation. Other factors may have been influential but the altitude of this settlement and its extreme marginality must have made it particularly vulnerable to change of any sort, not only climatic but also demographic and tenural.

The question of how exactly, if at all, this settlement was affected by tinworking must also to be considered. Both the Redwater and West Webburn valleys have been massively disturbed by tinworking; the settlement has clearly been truncated by one of the workings and sections of the field system have been partly or completely destroyed. This scenario has been witnessed also at Beckamoore Combe on western Dartmoor where fields and one building have been cut through by streamworks (Newman 1994). However, it is probably unwise to assume that desertion was caused by tinworking for it is possible this site was abandoned before the tinworks were developed to the scale they eventually were. In the Meavy Valley, on south-west Dartmoor many farms, with origins

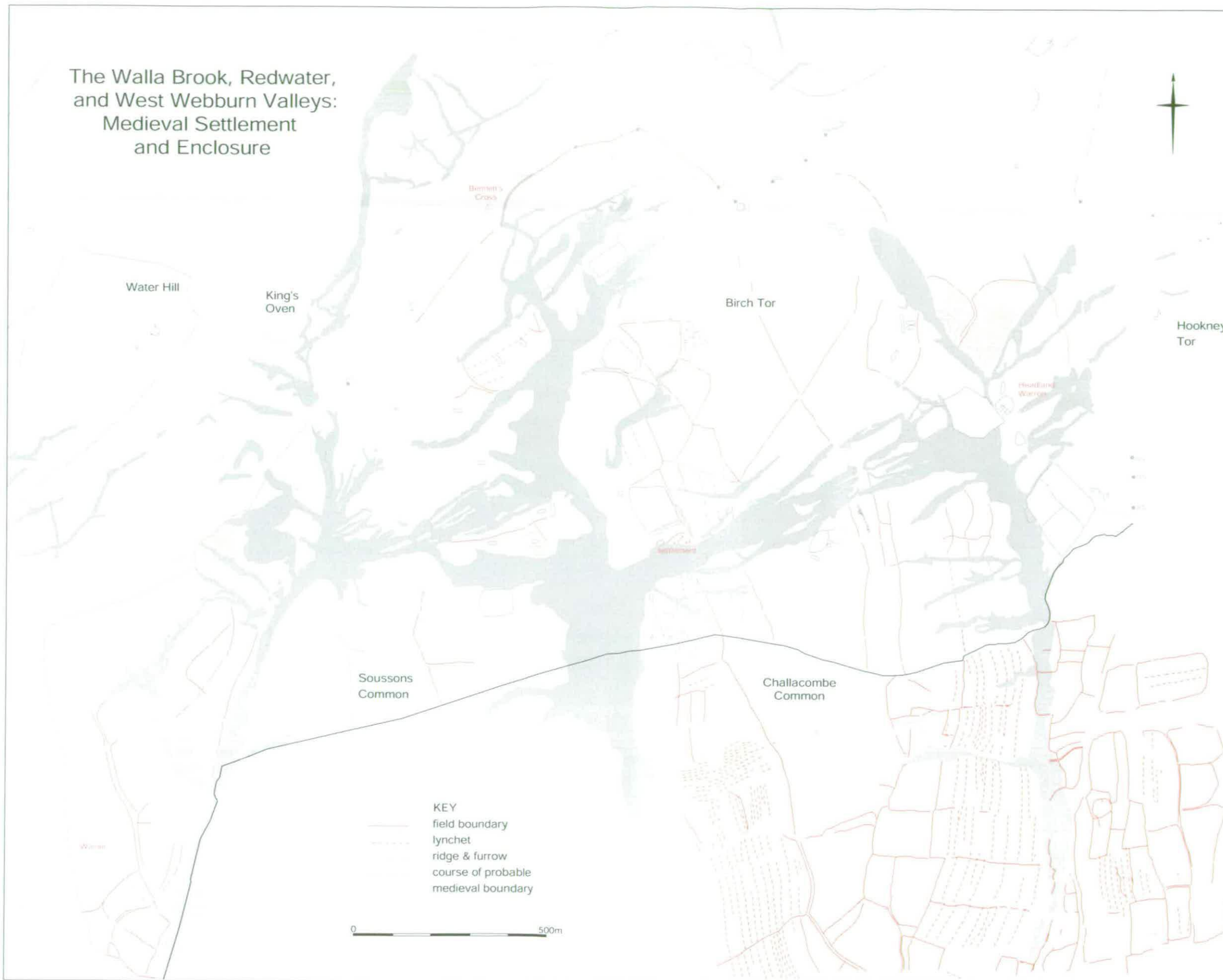


Fig. 2:3. Composite map showing medieval evidence (red) in the combined survey areas of Challacombe (part of), Headland Warren, and Statts Brook. Major tinworks, prehistoric features and components of the warren shown in grey (leats and tinpits omitted for clarity).

in the late 13th and early 14th centuries, survived episodes of disturbance caused by intensive tin extraction, remaining occupied into the 19th and, in some cases, 20th-centuries (Newman 1994). At Birch Tor the chronology of all these events has to remain uncertain because the settlement, its field system and all the pre-18th century tinworking is undocumented and parallels from elsewhere on Dartmoor are the only means of arriving at a rough chronological framework. The Dartmoor tin industry has an 800-year documented history; over much of that time changes in extractive techniques were slow and barely perceivable through field evidence. There is good reason to believe that streamworks would have preceded lode works within one valley but the period of transition may have been long. There is however, reasonable evidence that lode works became more significant between 1450 and 1750 (Newman 1986) and this is likely to be the period in which tinworking at Birch Tor took on the scale that we now witness there. There was a boom in production of tin on Dartmoor between 1450 and 1550 which reached a peak in 1524; output had slumped by 1600 with only one further small peak in 1700 (Worth 1953, 287).

It is possible therefore that, like excavated examples of deserted Dartmoor settlements, the settlement at Birch Tor was occupied sometime between c.1200 and c.1450. Colonisation occurred as a result of growing population on Dartmoor and in Devon, during a period of favourable climatic conditions. Desertion happened probably before the major onset of tinworking which intensified after c.1450, and was probably a result of a general pattern of withdrawal from the uplands.

The landscape setting (Fig. 2:3)

The drystone wall which divides Manaton and North Bovey parishes and the Challacombe and Headland Warren holdings was constructed using a wall-building tradition which on Dartmoor can usually be assigned to no earlier than the 18th century and it seems most probable that this robust wall was built when the warren was created by 1750. Before this time no physical barrier for the division of the two parishes existed or was needed at this point, although Pattison (1999) observed that the wall may partly overlie a prehistoric reave. When the farmed land was expanding therefore the Headland fields were a natural extension of the earlier occupied land of the Challacombe and Soussons field systems. At least one disused field boundary is common to both holdings and the lynchets of Headland share the same axis as those of Challacombe so when the Headland and Birch Tor fields were being actively farmed the agricultural landscape would probably have appeared seamless. It is only the likely earlier abandonment of the Headland area combined with the unusually long survival of strip field tenure at Challacombe, well into the 18th century, that make the two areas appear so different today.

Only one settlement has been identified on the ground, lying in the Redwater valley but there is room to speculate that others may have existed within the Redwater and West Webburn valleys or that the example noted may once have been larger. It is also just possible that the site now occupied by the Headland Warren house, has early origins as a settlement. It lies in a good position, moderately sheltered at the head of the coombe and facing south-east and with evidence of a moor lane to the north contemporary with the fields giving access to the commons, but any evidence of earlier settlement could have been engulfed by the 18th-century warren house. There is however, also evidence that the present house may predate the warren as traces of smoke blackening and certain architectural features have suggested a date possibly as early as 1600 (Mrs J. Sanders pers comm). Documentary research and building survey could help establish a date though the building has been much altered in modern times.

There is good evidence that parts of the field system were ploughed originally in horizontal strips in a way redolent of the much clearer evidence of neighbouring Challacombe. Enclosure of

these various elements may have come later, perhaps as a move from arable to pastoral use. Several of the hedge lines are coaxial with the lynchets and the contour and suggest a similar sequence to Challacombe. This may have been a gradual process which at Challacombe is believed (Fleming 1994) was not completed until about 1600.

Centuries of tinworking have had a dramatic effect on the remains at Headland Warren, altering vast areas of ground and destroying the evidence of what went before, and in some cases altering earlier remains for the diversion of water. It is perhaps this dominance of tinworking and mining remains, together with the clear upstanding evidence of the rabbit warren that has led to the medieval and earlier features here to appear less conspicuous in the past.

PART 3: THE WARREN

Summary

Discussion of Headland Warren by previous writers has been severely hampered through a lack of accurate field data, leading in some cases to spurious conclusions. The EH survey has provided an accurate plan of all extant archaeological features within the warren and has revealed that evidence relating to rabbit warrening is more numerous than previously believed. The evidence is evaluated in the light of what is known of warrening techniques used on Dartmoor and elsewhere.

HISTORY

The warrens of Dartmoor are not a subject which has attracted a great deal of attention from past researchers, either historical or archaeological. The seminal paper on the subject is R.G. Haynes' *Vermin Traps and Rabbit Warrens on Dartmoor* (1970) which is essentially only a discussion of the vermin traps; individual warrens were described only briefly in the gazetteer and not in great detail. Summary short articles have discussed various aspects of warrening on Dartmoor (ie Brewer 1986, 22-3), but little serious research has been undertaken on what would no doubt be a rewarding focus for a study. Few individual Dartmoor warrens have been the subject of fieldwork, the notable exception being Beardown Warren (Probert 1989, 229-233), and although several have been surveyed in detail as part of wider landscape studies by the RCHME (latterly English Heritage) and those of the Plym valley mapped and discussed by Robertson (1992), a general analysis is still needed.

The lack of detailed field data is manifest at Headland Warren where some of that which has been written in the past has been misguided as a result. One debate has hinged on the six small, sub-rectangular stone-walled enclosures which lie within the bounds of the warren, known locally as 'Jan Reynolds Playing Cards'. Haynes asserted that these enclosures were used for rearing and containing the rabbits. This, he claimed, explained the lack of pillow mounds or 'buries' at Headland. Brewer (1986) and Hemery (1983) have both dismissed this idea assuming that the rabbits utilized areas of tinworking waste for burrowing and that the enclosures were used to grow fodder crops; this theory was followed by Butler (1991, 27) but all three writers have reinforced the myth that there are very few pillow mounds at Headland where in fact 37 have now been recorded. However, the debate between Brewer and Haynes prompted a series of useful correspondence in the letters page of *Dartmoor Magazine* in the 1980s, from people who remembered the warren in the early 20th century, and this has helped shed light on some aspects of working practices at that time.

The Headland area was certainly occupied for some sort of agricultural activity, for many years prior to the development of a warren as there is evidence of field systems and a deserted settlement within the bounds of the warren (see above). In 1754 'Head Warren' is mentioned in the bounds of a tin sett (Brown 2001), being the earliest documentation for the warren. On the 1780 Land Tax Assessment William Roberts appears as Warrener, though 10 years later, on a map of Viscount Courtenay's lands, Robert Mead is tenant of Headland Warren (DRO Survey 1508/V5). In 1797 the Rev. John Swete passed through what he called 'Mead's Warren' while he was apparently lost in the area (Gray ed. 1999). The tenancy of Headland after 1800 has been recorded by Hemery (1983) who reports that after William, it was held by two further generations of the Roberts family in the first half of the 19th century followed by the Hannafords and finally Jim Collins. Warrening activity ceased probably around 1920, though the house has remained occupied. The warren house was for a time used as a hostelry selling beer, cider and meat to the miners working in the area in the 1830s (Crossing 1909, 250).

Since early times and for the entire recorded history of Headland Warren the area within its

boundaries was worked for tin (see below). This factor combined with the high altitude and unreliable weather rendered the area unviable for most agricultural uses. Such a location was ideal for rabbit farming.

LOCATION

Headland Warren occupies a spread of land at the head of the three River Dart tributaries of Walla Brook, Redwater Brook and the West Webburn, south of the B3212 road and south-west of the Warren House Inn. The terrain is one of moderate to steep slopes rising from the river valley floors to the summits of Hookney Tor (497m AOD), Birch Tor (487m AOD), and Challacombe Down (460m AOD). The area is wholly located within North Bovey parish and the total area of the warren is 246ha.

To the west the Walla Brook forms a natural boundary while to the south a drystone wall extends from the Walla Brook and east-west along the Manaton and North Bovey parish boundary to a point close to Firth Bridge. From there the boundary is defined by a series of inscribed stones delineating the east, north and north-west sides of the warren.

FIELD EVIDENCE

The warren house and dog pit (Plate 3:1)

The warren house, which is still occupied, lies at the head of the West Webburn, located on a level shelf, just east of the stream. The granite and thatch building which survives there today has been much altered but was originally that built for the warren in the mid-18th century, though the site itself and possibly the current house could have much earlier origins as a dwelling (see above p. 12). Attached to the rear eastern side of the house is a small stone enclosure which has a stone chamber built into one corner. This is traditionally described as a dog pit or kennel which accommodated working dogs used at the warren. Other examples may be seen at Ditsworthy Warren in the Plym Valley.

The warren boundary and boundary stones (numbers follow Brewer 1986)

The boundary of the warren was clearly defined on a map of 1790, and all features described then may still be traced: The southern boundary is a stout drystone wall, approximately 1.5m high, extending west to east between Walla Brook and Grims Lake, which separates Headland Warren from the lands of Soussons and Challacombe to the south; it has been well maintained up to the present day. The course of this wall coincides with the parish boundary Manaton and North Bovey which is certainly much older than Headland Warren and probably Challacombe. It has been observed that part of the wall follows the course of a prehistoric reave (Pattison 1998), but the wall itself is likely to have been constructed when the warren was founded in the 18th century. To the west, the waters of the Walla Brook form a boundary which runs approximately north to south. Where the Walla Brook becomes rather meagre at the northern end, a stone wall has been built parallel to it, augmenting the boundary, possibly in times of drought. To the north and east there is no barrier, artificial or natural, to prevent rabbits from straying, though the limits of the warren are marked by a series of boundary stones (below). It may not have been considered necessary to prevent the migration of rabbits to the north and east where immediately neighbouring lands were not enclosed or farmed. Whereas to the west, the lands of New House were farmed (though later to become a rabbit warren also; Greeves & Stanbrook 2001, 16), as were Soussons (described also as a

'Warren' on the 1883 OS map) and Challacombe to the south. In the 18th century, when Headland Warren was founded, Challacombe was still subject to an intensive agricultural regime, possibly including some arable, focussed around the Challacombe settlement (Pattison 1998).

Boundary stones are present on all sides of the warren where natural or artificial barriers are lacking. A total of 15 have been recorded, including a recumbent stone noted by Brewer; the re-used Bennett's Cross (3), a medieval waymarker; and the slightly more elaborate stone beside the road inscribed with the words 'Waren Bounds' (11), marking the eastern extremity. Brewer (1986) noted a further stone built into the Soussons boundary wall, but that has not been recorded as part of the present survey. The average height of the stones is 0.6m and each is inscribed with the letters 'WB'. On the eastern limits of the warren, the three boundary stones depicted on the 1790 map appear to be beside a track. This would have been an early track, preceding the current road which was not built until 1874 (Gill 1970), although it is likely to have followed the course of the older route in part. A short length of what appears to be a hollow way runs parallel with the line of the stones (13 and 14) and was probably a surviving component of this earlier track, which forms part of the warren boundary.

The boundary stones to the north of Birch Tor are sited on an abandoned medieval field boundary, which was also later adapted for use by the tanners as a water course. The field boundary represents the outer limit of medieval enclosure in the Redwater valley and possibly the limit of land associated with the Redwater settlement. Its adoption and reuse as a boundary for the warren suggests that it was still recognised as a land boundary in the late 18th century.

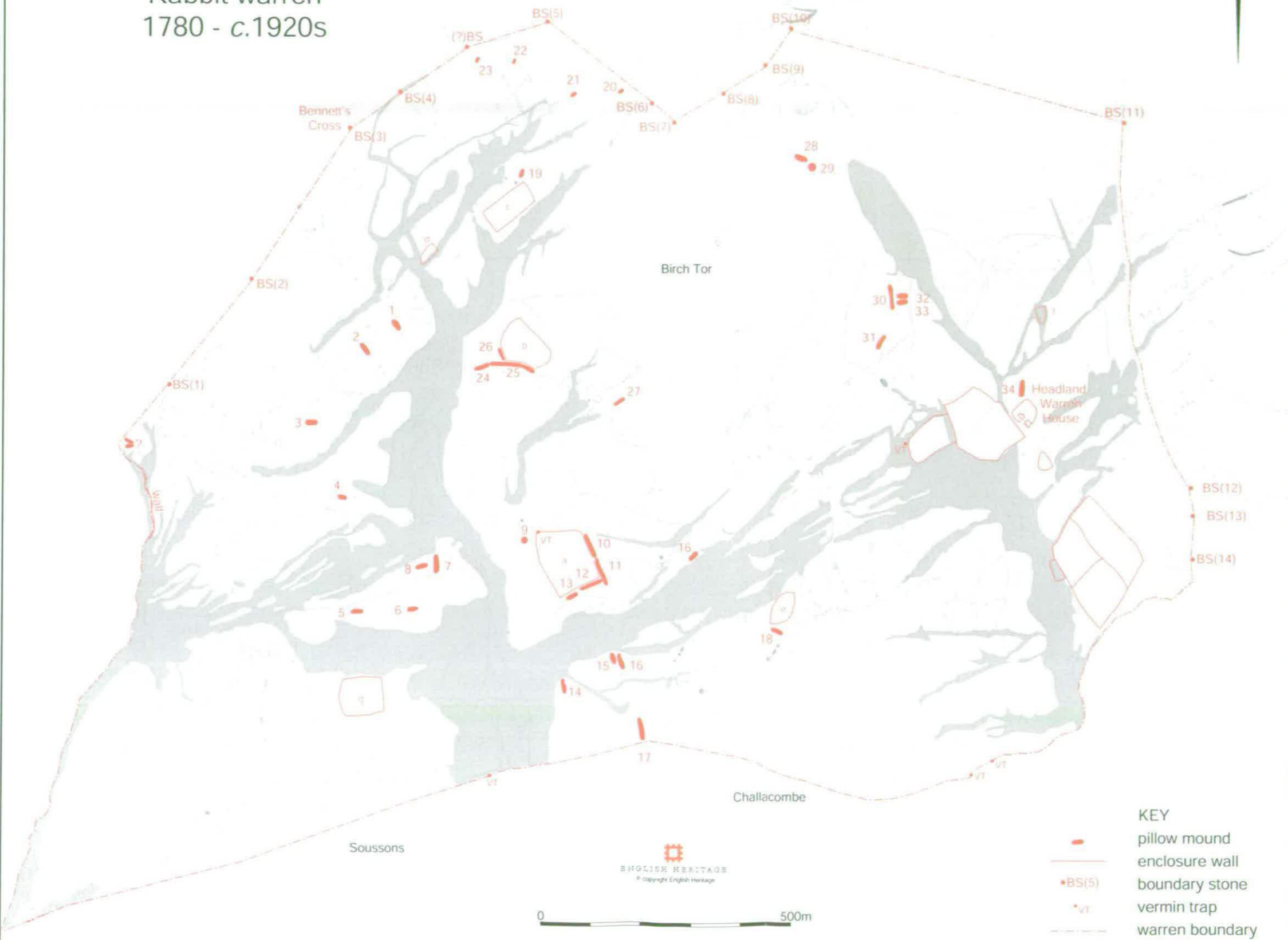
Enclosures (Pls 3:2 & 3:3)

Within the boundaries of the warren are six rectilinear enclosures (a-f) with stone walls and one with walls of stone-faced earth (g), each isolated in discrete areas of the warren. There are also three stone-walled enclosures associated with the warren house and others detached to the south; all were in existence in 1790.

The seven isolated enclosures have been the focus of much discussion by previous writers. Haynes' belief that the enclosures were the main element of the warren was based partly on his description of them having tall walls and no entrance, presumably making them rabbit-proof. In fact two of the enclosures (a & b) do have entrances, with gate posts (Plate 4), wide enough for a man to pass through. The walls on most of the stone-built enclosures (with the exception of f), particularly those attached to the house, are extremely robust. Brewer (1986, 22-3) believed the enclosures to have been constructed in a rabbit-proof manner also, but as a means of keeping the rabbits out rather than in, as he asserted that fodder crops to feed the rabbits were grown inside the enclosure. This seems more likely although there is still some doubt as to whether the fodder would be for rabbits or other stock. A recollected account from sometime shortly after 1900, possibly as late as WWI, has revealed that during this period some of the enclosures were being used to grow fodder for bullocks and enclosure (f) was at that time used as a vegetable garden (letter from Sydney Beard *Dartmoor Magazine* 1986c, 13). However, the rabbit rearing side of the enterprise may have been in decline by this time or husbandry practices may have changed.

Another account (letter from Freda Wilkinson, *Dartmoor Magazine* 1986b, 18) described the enclosures being used as an area where rabbits were lured through a small single entrance, which was then netted, to be trapped inside and harvested. Although this does not fit in with any known tradition of warrening so far recorded on Dartmoor, it is very similar to practices used elsewhere in Britain. In Yorkshire, Lincolnshire and East Anglia the use of what was known as rabbit 'types' or traps which caught rabbits lured into enclosed areas was commonplace. In these places stone-walled

HEADLAND WARREN
Rabbit warren
1780 - c.1920s



- KEY
- pillow mound
 - enclosure wall
 - boundary stone
 - vermin trap
 - warren boundary

Fig. 3.1. Headland Warren survey. Interpretation, highlighting evidence relating to the warren.

enclosures of between 10m square and up to 100m by 50m were constructed within the warren and the rabbits were lured into them to feed through one or several ground-level tunnels. When the warrener wished to harvest rabbits, special pit traps which were constructed beneath the tunnels, were activated and the rabbits caught (Harris & Spratt 1991, 204-7). Although no traps have been identified at Headland, the principle of luring the rabbits into an enclosed area to catch them by whatever means whether by traps or nets, does seem a credible explanation for the enclosures, especially as several of the major enclosures have now been proven to be associated with large pillow mounds nearby (see below).

The three main enclosures (a, b & c) are sited on the western lower slope of Birch Tor. The largest measures 126m by 100m and they cover an area of between 0.5ha and 1ha. The walls are of a robust dry-stone construction, the interiors are slightly raised in places. Only one (c) currently has no entrance while (a) and (b) both have small, gateways of less than 1m wide with gateposts; these may be later additions when the fields were used for hay cropping. All three of these enclosures have pillow mounds sited almost touching the walls.

A smaller enclosure on the south side of Chaw Gully (e) has no entrance but a large pillow mound is sited nearby.

A further small enclosure is curiously sited at the lower end of one of the massive tinworks on the west side of Birch Tor. The enclosure incorporates part of the tinwork, the wall running along the base of and up the steep-side of the V-shape gully. There are no pillow mounds nearby and the awkward siting of this enclosure is something of an enigma

The stone-faced banked enclosure (g) is the most isolated of the group, on the eastern slope of Sousson's Down; its use of an earlier wall building tradition may indicate that it was a precursor to its dry-stone counterparts.

Pillow mounds

Although considering the total area of the warren (246ha) the density of pillow mounds present is not great (cf Beardown Warren of 4.2ha with 50 pillow mounds; Probert 1989, 229-33) but previous writers have seriously underestimated the total which now stands at 37. This is possibly because not all the mounds conform to a typical shape and size and those recorded include circular as well as linear, some of the latter being up to 54m long. Some mounds are located within or close to tinworking and could easily be mistaken for spoil heaps. Several mounds were made by adapting existing earthwork features such as field banks or the upcast bank from a disused leat, utilising the already softened earth. Four examples of this may be seen to the south of Chaw Gully. This can, in some instances make them difficult to recognise when densely covered by heather.

The majority of the dispersed or isolated pillow mounds do not seem to be arranged with any scheme in mind and it seems likely they were placed anywhere that was not too disrupted by tinworking activity or in areas which were not in use by miners at the time they were created, although some are quite close by tinworkings. There are seven mounds on the west flank of the Walla Brook valley and 17 on the east flank, including five to the south of Chaw Gully. A further six are located around the headwaters of the West Webburn and a single mound is near to the warren house. Two possible mounds are located near the road at the head of the Redwater valley, but apart from these candidates no others are found west of the of the summit ridge of Soussons Common. No mounds exist on the east flank of Challacombe Down within the warren and it is notable that steeper slopes were definitely avoided as pillow mound locations.

The most common form has two parallel sides and rounded ends, some with ditches surrounding them. Their length varies between 103m and 8m approximately and 3m to 10m wide standing no

higher than 1m. It is notable that all the smaller examples of this form are located in the area to the north-west of Birch Tor and that the majority of this type are not sited within close proximity of an enclosure.

Some very long mounds exist and are notable for being sited adjacent and parallel to the walls of two of the enclosures (a and b). Enclosure a, has mounds running along its entire east and south sides and there is a similar situation at (b). These mounds stand up to 1.2m high and have ditches on either the exterior (a) or the side adjacent to the enclosure (b). The presence of these very large mounds, almost touching the enclosures certainly gives weight to the idea that the enclosures were used for trapping. If built for any other purpose, where rabbits were not wanted, pillow mounds would not have been built so close.

Two circular mounds have been recorded (9 and 29). These have a diameter of 11m and 15m. There is no obvious reason why circular mounds were constructed in preference in these cases, especially as one (29) is located within a few metres of a more standard example.

Several mounds were constructed using earlier, presumably abandoned, earthwork features, taking advantage of the previously loosened earth. Mounds no. 10, 11, 16, 17 are all built into disused hedgebanks, while 30 and 31 utilized the upcast bank of a disused tinner's leat. Others were built into areas which have been identified as once having been ploughed (1, 2, 5-8, 32, 33). This may be due to coincidence or the fact that these areas were free from tinworks. Alternatively the loosened earth of the once ploughed ground, as with the hedgebanks and leats, offered less resistance to the spades of the mound diggers and were favoured locations for that reason. The adding of material to existing banks raises the question as to whether these pillow mounds ever consisted of anything more complex than a simple mound and the use of internal stone structures placed on the ground surface before the mound was raised did not occur at Headland as has been recorded at some excavated examples elsewhere in Britain (Williamson & Loveday 1988, 304). This would not have been possible if the pillow mound consisted partly of a previously upstanding earthwork. Such a question will only be answered by archaeological excavation.

Vermin traps (Plates 4:4 & 4:5)

Vermin traps to catch weasels and stoats, which preyed upon the warren's stock, are very common on Dartmoor, especially in the earlier Plym valley warrens of Trowelsworthy and Ditsworthy where many survive. At Headland however, they are not common with only three intact examples recorded, together with remains of two others. This lack of traps has encouraged previous writers to believe that, due to the later founding date of this warren, guns were used for vermin control rather than traps. The best examples of traps are to be found in the south boundary wall separating Headland from Challacombe. These two are curiously positioned close together, within 50m of each other on a wall which is over 2km long. Only one other possible example was located in this wall and this consists of a side slab from a trap reused and built into the wall just west of the Golden Dagger Mine track. All three of these traps are sited some distance from any of the recorded pillow mounds. A very fine vermin trap (Pl. 3:4) first recorded by Brewer (1986) is sited in a gully adjacent to one of the enclosures west of the warren house. The capstone and funnel walls survive *in situ*. Two grooved stones from a possible fifth example are sited, displaced, in the northern corner of enclosure (a).

DISCUSSION

The human history of the Headland Warren area is long and very complicated, involving agricul-

tural and industrial activity. Although we cannot be sure of a date for the earliest existence of a warren here it seems that the abandonment of the medieval farming in the area, together with the major disturbance to the land that tinworking caused, rendered the area very marginal. Such marginality was often considered ideal for the siting of rabbit warrens. The warren certainly existed by 1754, and was perhaps initiated during the well-recorded hiatus in Dartmoor tinworking activity which occurred after 1730. The boundary of the warren was established using many existing man-made features including the trackway on the eastern side (which preceded the modern road) and the parish boundary to the south. The use of a disused field bank to delineate part of the northern perimeter is particularly intriguing and strongly suggests that the holding of Headland Warren was a continuation, in part at least, of the earlier farmstead which by 1780 had long been abandoned.

Of the isolated enclosures all seven existed in 1790, and if they were indeed purpose-built as entrapment areas in the manner used elsewhere in Britain, this would so far make them unique among Dartmoor warrens. However, no evidence of 'types' or traps associated with the enclosures has been recorded so it seems unlikely that this method of catching the rabbits was used or, if it ever was, then its use ceased some time ago. It certainly seems not to have been used in the period recollected by those who have recorded their memories of the warren when still working in the early 20th century. However, it seems plausible that the enclosures were used to trap the rabbits but using nets rather than traps.

Although this theory may satisfactorily explain some of the enclosures and the large pillow mounds close by, there is still a high number of mounds which are not within close proximity of an enclosure and it is possible that netting was also taking place away from the enclosures as is more traditional at Dartmoor warrens. As the warren was operating for over 100 years it is also likely that trapping techniques changed and developed over that period.

The total number of pillow mounds now recorded as a result of the survey now stands at 37 and makes Headland Warren far more typical when compared with other Dartmoor warrens of the period; this should stem further discussions of the site based on it only having 8 pillow mounds.

By comparison to the warrens of the Plym valley, Headland has few vermin traps for its size. Haynes (1970) considered that later warrens would have relied on guns as the major means of pest control, hence their lack of vermin traps. However, when Haynes was writing only two traps were known at Headland though he recorded oral information that stones from others had been reused for wall repairs. Three further traps have been recorded since that time bringing the total to five and it is likely that others remain to be discovered. Although the warren certainly operated in the period when guns would have been used, there is a sufficient number to suggest that vermin traps were also a part of the pest control strategy here, though possibly in the earlier period that the warren was working.



Plate. 3:1. Headland Warren House.



Plate. 3:2. Headland Warren and Hookney Tor from the west



Plate. 3:3. Enclosure c on the west slope of Birch Tor.



Plate.3:4. Entrance in east side of enclosure a.



Plate. 3:5. Slotted stones from destroyed vermin trap in corner of enclosure a.



Plate. 3:6. Remains of vermin trap near Headland Warren house.

PART 4: TIN MINING AND THE

BIRCH TOR AND VITIFER MINES

Summary

The Birch Tor and Vitifer tin mining complex is unquestionably the most impressive mining landscape on Dartmoor and its importance must rank high among such sites in the Westcountry as a whole. The sheer scale and concentration of the earlier extractive remains in the form of openworks is unequalled even in Cornwall but is made all the more interesting by being interlaced with the evidence of 19th-century mining and processing activity, albeit on a modest scale compared to earlier times. The area has the full suite of remains one would expect from the tin industry, including from the earlier period, streamworks and openworks with their associated water collection and storage systems, and shafts, adits, pumping systems, tramways, wheelpits and dressing areas dating from the 19th and early 20th centuries. There is, however, a lack of substantial evidence for earlier dressing and smelting with little evidence for early tin mills so far recognized in the area, though artefacts demonstrating their former presence are known. The area is also rich in non-mining archaeology, containing a fine multiple stone row, many cairns, some very impressive huts and settlements, and vestiges of reaves all of prehistoric date. Subtle remains of medieval agriculture have now also been observed within the upper Redwater and West Webburn valleys together with remains of a small settlement near Chaw Gully revealing the area to have been farmed during this period. Pillow mounds, enclosures and boundary features from an 18th-century rabbit warren also nestle among the mining remains(see separate reports).

INTRODUCTION

LOCATION

The Birch Tor and Vitifer mines are situated on central Dartmoor, 2.5kms east of Postbridge. The area affected by tin mining, discussed in this report, covers approximately 9km² and is centred around the water divide of the rivers Teign and Dart which includes the head region of two tributaries of the River Teign, running to the north, Boveycombe and the East Bovey and four of the River Dart tributaries, Statts Brook, Walla Brook, Redwater Brook, and the West Webburn flowing to the south. The terrain is one of moderate to steep slopes rising from the river valley floors to the summits of Merripit Hill (449m OD) Hookney Tor (497m OD), Birch Tor (487m OD), Water Hill (489m OD) and Challacombe Down (460m OD). The area is divided between three parishes: The Forest of Dartmoor, west of the Walla Brook; Chagford, approximately north of the B3212 road; North Bovey to the east and Manaton to the south-east. Historically the area has been divided into many different mining setts, most of which have been renamed through time.

WORK OF PREVIOUS RESEARCHERS

Much previous work looking into this area of Dartmoor has focused on the 19th- and 20th-century mines despite the dominance in the field of the earlier extractive evidence, and furthermore no serious attempt has been made until now to map any of the archaeological remains from the mining industry of all periods here. On the first edition 1: 2500 OS maps of 1886 the larger openworks were depicted to a limited extent and some of the buildings and features in use at the time such as

wheelpits, dressing floors and water courses are marked, but this has never been added to and has been used as the main source of depiction by all later writers. The mines have been described by Dines (1956), and Hamilton Jenkin has provided a useful summary of historical sources (1974, 101-8). The most thorough piece of research into the later mines of the area is that of Broughton (1968-9) who apparently had access to documentation which has subsequently eluded others. These include sketch maps of the mine dating from the 1850s and 60s, redrawn by Broughton, depicting named lodes, shafts and adits, tramways, wheelpits and pumping systems for the Birch Tor and Vitifer Mine and East Birch Tor Mine. Like previous writers however, Broughton was unable to shed any new light on the early history and mentioned the openworks and streamworks only briefly. Furthermore, Broughton's maps have to be treated with some caution because although claiming to depict features recorded on sketches of 1856 and 1867, the maps are quite clearly based on OS maps, and may include features not present in the 1850s and 60s. Greeves (1986) has provided an important collection of photographs showing Dartmoor tin mines and the men who worked them while they were still operating. These include Birch Tor and Vitifer Mine in the period leading up to the Great War and Golden Dagger from 1912 up until the late 1920s when the mine closed; the last on Dartmoor to do so. Several of Greeves' photographs show the mines shortly after abandonment. These views are all the more relevant because many of the features depicted suffered a remorseless programme of destruction upon disuse, followed by the encroachment of a plantation on Sousson's Common. In the 1980s a series of aerial photographic (AP) transcriptions covering the whole of Dartmoor were prepared at 1:10 560 scale by the RCHME. Although helpful in the identification of linear and some smaller features, their depiction of tinworks is wholly inadequate. A more recent AP transcription by Butler (1991) delineated the tinworks in a little more detail but omitted much of interest.

The RCHME/EH survey of this area to date is made up of three separate phases, spread over 10 years:

Challacombe 1990 (RCHME, not discussed in detail here)

Statts Brook and Wheal Caroline 1992 (RCHME)

Birch Tor, Vitifer, Bush Down, Hookney Tor, 2000-2002 (EH)

Golden Dagger (part of) 2002 (EH)

Although the surveys of the first two were completed some time ago, the completion of the recent phase has presented a good opportunity for discussion of the entire tinworking element of this piece of landscape. It is to be hoped that the opportunity will arise in the future to complete the survey by including the parts of Golden Dagger currently covered by conifers. It should be stressed that in the ten years since work began on this site, survey techniques have progressed quite significantly and the speed at which data may be gathered has multiplied with the introduction in particular of GPS equipment. This has increased the ability to include a greater level of detail on the 2000-02 work, although this is still within the limitation of 1:2500 scale map depiction.

MEDIEVAL AND POST-MEDIEVAL TINWORKS

STREAMWORKS

General description

Streaming was the technique used to work alluvial and eluvial tin deposits. Alluvial tin deposits, had been weathered from the lode in glacial times, then detached and transported by various geological

agencies to be deposited in the valleys of rivers and streams. Eluvial deposits, though weathered in the same way, often remained in their original location, overlying or replacing the lode. Extraction of these gravelly deposits was a matter of separating them from unwanted waste minerals. This was achieved by introducing the gravels into flowing water to take advantage of the greater specific gravity of tin over that of the waste materials. The interior or working area of a streamwork therefore consists of a series of channels through which the water flowed, and linear spoil dumps onto which the waste was deposited. Where no natural water supply existed, one would be diverted to the working area via a system of leats, water often having been collected in small reservoirs outside the working. Although no systematic study of streamworks on Dartmoor has yet been published, several detailed surveys at large scale have taken place (Gerrard 1992; Newman 1994b) and the results from studies in Cornwall (ie Gerrard 1987) have provided some information on the interpretation of these complicated sites. General descriptions of streamworking techniques on Dartmoor appear in Gerrard (1997; 1999) and Newman (1998). Limited time resources have not allowed for the recording of streamworks at large scale as part of the Birch Tor and Vitifer survey but their extent has been surveyed nevertheless and depicted on the main survey plan.

Dating of these remains is almost impossible. Unfortunately the majority of the streamworks in the Birch Tor area are unrecorded within known sources though they are likely to date from a period of known prosperity between the 11th and 18th century. More precise dates will only come from further documentary research.

Field Evidence (Fig. 4:2)

Perhaps the most extensive spread of streamworks within the survey area lies within the Redwater valley. The remains cover the entire valley floor from the head of the stream, down through the Golden Dagger area in the plantation and beyond to the south. Two additional spurs of shallow working branch off on the western side of the valley, and adjacent to Chaw Gully on the east, where a large openwork, is interspersed with streamwork evidence. The valley floor workings have been extensively disturbed by 19th-century mining activity with tramways, leats and tracks cutting through the remains together with evidence of underground activity which has pitted the area in places and caused large amounts of waste dumping amid the streamworks. The southern of the two spur workings is of interest however: firstly because some undisturbed areas demonstrate very clearly the parallel spoil dumps which are characteristic of streamwork remains; also a moderately deep openwork runs down the length of the streamwork, which probably worked a lode that lay beneath the stream deposit.

The Walla Brook has also been heavily worked for alluvial tin, with evidence of disturbance extending along its entire valley floor. Near the head of the brook the workings are very spread, particularly on the east side where, narrow, finger-like gullies reach up into the hillside. To the west and east the workings merge with the much deeper openworks, including the Vitifer lode, a massive openwork which extends right across Soussons Common to join up with the Redwater valley floor streamworks.

Although streamworks are to be found extending all the way up to the head of Stat's Brook, much of the upper section is marshy and inaccessible. However, at the southern end of the stream, near the confluence with Walla Brook, a section of workings on the south side has a large area of particularly well-defined linear spoil mounds and channels.

Streamwork remains in the valley of the West Webburn have now been partly disguised by the activities of underground miners in the 19th century, but a narrow band of clearly-defined streamwork runs along the valley floor of the brook between the Headland Warren and Challacombe settlements

Lesser streamworks are evident also along the head of the East Bovey River and its tributary the Boveycombe.

OPENWORKS

General description

Before the introduction of underground methods to exploit lode tin, such deposits were worked from open surface workings or openworks. Upon discovery of a lode, the tanners would dig down on to it from the surface to form trenches, then raise the tin from within the trench. The removal of waste and overburden was probably aided by flowing water, which was diverted to and stored in, small reservoirs close by the working (see below), similar to those used at some streamworks. The resultant remains are the massive gullies which scar the hillside and are perhaps the most visually striking aspect of the tinworking landscape in the Birch Tor/Vitifer area. Dating of openworks is, as with streamworks, almost impossible without documentation which is lacking for the Birch Tor area. However, studies on other areas of Dartmoor have revealed that most can be placed in the period between 1450 and 1750 (Newman 1987).

It is likely that tin lodes may often have been overlaid or partly overlaid by shallower detached deposits which could be exploited by streaming techniques. The result of this in terms of field evidence would be that at some workings the evidence, if any, of a streamwork phase may have been completely or almost completely obliterated by the later openwork activity. Also it can often be difficult to determine where streamworks end and openworks begin, when, as in many cases, the latter is attached to the former, at the head of the West Webburn, near Headland Warren house for example. Such evidence has led Gerrard to suggest that water supplies, apparently directed into openworks and used in the exploitation of the lodes, may not be as they appear and could have been part of the exploitation of a shallower streamwork which existed there before, evidence for which was destroyed by the later openwork (S. Gerrard pers comm).

Openworks – field evidence (Figs 4:1, 4:2)

The majority of the larger openworks follow an approximately east-west alignment between the Statts Brook watershed and the West Webburn, but extend also as far east as Hookney Tor. Their size and shape varies between the massive examples on the east and west slopes of the Redwater valley (Fig. 4:3) which are wide and very deep, to the many sinuous, narrow V-shaped workings such as those on Bush Down (Fig 4:12) and the slopes of the West Webburn (Fig. 4:13) and Water Hill (Fig. 4:9).

Openworks have sharply-defined, steep scarps marking the limit of digging activity, though in some cases the edges consist of vertical rock faces and granite outcrops. This is particularly evident at the upper end of Chaw Gully (Fig. 4:5) and within the Vitifer Lode openwork (Fig. 4:4). All openworks contain evidence of later exploration or exploitation of the tin lode by underground means, after the limits of the openwork technique had been reached. Chronologically this may have been a continuation of work at the site or there could have been a period of decades or centuries between these two methods of working. The evidence consists of shaftheads within the floor of the gully, which usually comprise conical pits with associated spoil, or adits at the lower end of the openworks to provide drainage. Two such adits are visible at the eastern end of the Golden Dagger openwork (Fig. 4:6).

Leats and reservoirs

Accompanying the remains of openworks and some streamworks is the evidence of water supplies, consisting of leats, channels and reservoirs. Unlike some areas of Dartmoor where the height above water sources necessitated the collection of rainwater runoff to accumulate water in worthwhile

quantities (ie Ringleshatts, RCHME 1998), most of the openworks in the Birch Tor Vitifer area could be supplied by diverting small streams, though rainwater runoff was also collected in two reservoirs on the slopes of Hookney Tor.

The leats may be roughly divided into two types:

Primary leats diverted water from its source to the various working areas often over great distances of up to 2km. They consist of a ditch with a bank of upcast on the downslope side. They were usually carefully positioned to follow the contour of the hillsides, with only gradual descent, maximising the height at which the water could be used, but in some cases disused field boundaries were adopted for part of the course if the descent was not too great. These leats frequently delivered the water into small earthwork reservoirs near to the working (below).

Secondary leats and channels were dug to divert water over shorter distances to the working area of the tinwork, either directly from a primary leat or from a reservoir. They resemble contour leats or in some cases are much deeper where their descent is greater, having a scoured appearance with no spoil on the exterior. Others may be slight, vestigial channels, indicating perhaps that they were not long in use.

The three main water sources were Statts Brook, Bush Down Stream, and Grims Lake, the latter being augmented by the headwaters of the West Webburn. For each of these streams primary leats survive at different altitudes and in several cases they diverted water to more than one working. The best visible evidence of the leats are those which run from Grims Lake around the base of Hookney Tor. They can then be traced to the headwaters of West Webburn where they once crossed the stream, though the remains are now overwhelmed by bog, and continued around to the northern edge of Chaw Gully. Here the leats were diverted in a variety of directions either to supply areas of Chaw Gully and nearby workings, including Garden Lode, or to carry on south to the workings on the east flank of Challacombe.

A further series of leats diverted water from the headwaters of Bush Down Stream on the north side of Birch Tor, then to follow the contour of Bush Down around to supply openworks on the west side of the Redwater Valley.

Three contour leats diverted water from the upper reaches of Statts Brook, to provide water to the workings on the west side of the Walla Brook and around the Warren House Inn. One of these at higher altitude continues past the area north of the Warren House Inn and probably to the King's Oven openworks.

Reservoirs

Although a comprehensive series of leats was constructed, at the altitude involved, water was still not available in quantity and must have been particularly scarce at times of low rainfall. Water was therefore stored near the tinworks in earthwork reservoirs. These comprise a hollow cut into the hillside, the upcast of which is formed into a dam on the downslope side, thus deepening the hollow. The most common shape for the dam is a crescent with a central sluice opening, but many linear examples, some very large, with an opening at one end survive also. Small channels (secondary leats) leading from the opening of the sluice directed water to the required areas of the working. When the altitude of the working face exceeded that of the reservoir the latter would be abandoned and another constructed further uphill, thus for several of the larger openworks, up to four reservoirs survive.

Some water courses in the area quite clearly utilised previously existing, probably abandoned

field boundaries. These hedge-banks, the evidence for which comprises a bank and parallel ditch, were part of a medieval field system which existed here before tinworking became as extensive as it eventually did. The ditches were ideal for adaptation into water courses often running for many hundreds of metres along and down hillsides. When connected to a water supply and additional sections of leat they could spare the effort of building completely new leats. In some of the steeper ditches, such as those to the north of Headland Warren house, the constant scouring of water has eroded the bank leaving a steep-sided gully in its place.

Pitworks

The landscape of Birch Tor is pockmarked with small conical pits and their accompanying spoil mounds. The digging of pits was carried out by the tanners for two main reasons: one was as a means of prospecting and the second was a method of exploitation. It is impossible to consign even an approximate date to any of these remains as no specific record of this activity is known but it is most probable that they date from a period between about 1450 up to 1800.

Prospecting or trial pits, otherwise known as essay hatches

The principle behind trial pits was that by digging into the ground near where a lode was believed to exist and evaluating the ore content of the material removed, or lack of it, the tanners could ascertain how close or distant they were from the ore sources. Further pits could then be dug making adjustments in position on the basis of what was found in each pit, until the location of the lode was discovered, hence the remains of long lines and clusters of small pits which indicate this activity. In the Headland Warren area the most impressive alignment of trial pits extends from Walla Brook, east across Soussons Common and down to the Redwater streamwork as a linear cluster. On the east side of the stream a further line of pits continues on this alignment over Challacombe Down and it is possible the tanners were chasing the same lode here over a total distance of almost 3km. A further separate large cluster is found to the north of the Birch Tor summit. Trial pits comprise conical pits which are now usually silted or filled, often with marshy interiors, of between 2 and 4m diameter. On the exterior downslope side is a crescentic spoil mound, which is usually fairly insubstantial. It seems likely that large concentrations of surviving trial pits indicate an unsuccessful search for a lode as at successful sites at least some of the pits would have been effaced by the extractive process.

Extractive or 'lodeback' pits

Extraction of tin lodes could also be achieved by digging pits down onto the ore-bearing strata. This technique was probably used on shallow sections of the lode and could have been a precursor to openwork techniques which were needed to dig to greater depths. The pits are usually much larger than trial pits with significant spoil heaps. Examples may be seen on the north summit ridge of Challacombe Common and on the south slopes of Water Hill.

LATER MINING

GENERAL DESCRIPTION

Underground mining involved digging vertical shafts down onto the lode which were met by horizontal adits to provide access and drainage. The shafts provided vertical access to the working area, ventilation, a route for pumping rods powered from the surface and if needed, a route to raise ore and spoil up to the surface.

Like the majority of Dartmoor tin mines dated to the 18th, 19th and early 20th centuries, the underground workings at Birch Tor and Vitifer mostly re-worked lodes which had previously been exploited by opencast or pit-working methods. The evidence for shafts and adits is almost all to be found within the old openworks or amid the streamworks of the lower ground. Of the abundance of shaftheads recorded many are undatable and in most cases their individual importance is not known. Unlike Eylesbarrow for example where 17 out of a total of 32 shafts have some form of documentation (Newman 2000), insufficient documentary evidence survives to enable such a comprehensive understanding here. However, the work of Broughton has revealed the names of some of the lodes, shafts and adits in the area in the 1850s and 60s although the source of the information is not known. Broughton's scheme is used in the following descriptions as is his documentary information.

Most shaftheads from the period under discussion are sharply-defined conical pits, in some cases very large and up to 15m diameter. They often have spoil heaps associated with them, either around the circumference or as short finger dumps. Some smaller shafts, sited within abandoned openworks, have been back-filled and are less easy to observe.

Unwatering the deep underground sections of the mine was achieved using pumps situated underground and powered by reciprocating rods which entered the mine vertically down the shafts. The reciprocal power was provided by waterwheels, often sited some distance from the shaft and, in several cases, providing power to more than one shaft at a time. Eight wheelpits survive in the combined survey areas which may be identified as having housed pumping wheels. All were, in existence by the 1850s and 60s.

The power was transmitted from the wheel via a flatrod which ran across the ground to the shafthead where the horizontal motion was converted to vertical by a counterweighted device known as a balance bob. Although the rods were laid out across the ground to take the most direct route possible, occasionally the horizontal direction of the rods needed to be angled. This was done using a device known as an angle bob for which several designs are known. Some earthwork and structural evidence for angle bobs survives around the Birch Tor lode.

Figs. 4:3-6, 4:9-13 highlight the positions of all the features which can be confidently identified as surface remains of 18th-, 19th- or 20th-century shafts, adits and spoil.

HISTORY AND DOCUMENTATION (SUMMARY)

Considering the extent and chronological span of the tin industry on this part of Dartmoor, published documentation is sparse, particularly for the earlier periods, but even for the 19th century the data is very limited, compared to other large Dartmoor tin mines such as Eylesbarrow (Newman 1999).

Although some recent research has revealed fresh sources for these mines (C. Kelland pers comm), detailed documentary research has not been possible as part of the EH survey and the

following historical summaries for each mine are based on the published work of Broughton (1968), Hamilton Jenkin (1974) and Greeves (1986).

Historically the mines in the area formed several separate setts, some of which are first documented in the late 18th century, and operated over time by many mining enterprises under different names. The main setts were:

Birch Tor and Vitifer (two separate mines for part of its working life)
East Birch Tor
Golden Dagger
Bush Down
Wheal Caroline

King's Oven Mine is also mentioned in documentation though details of it other than approximate location are obscure. East and West Vitifer mines are within the immediate vicinity but have so far fallen outside the area of the RCHME/EH survey.

BIRCH TOR AND VITIFER MINE

Historical summary

It is likely that underground exploitation of the tin lodes in the Birch Tor Vitifer area did not begin in earnest until the mid 18th century when 'Vitifer Mine' was recorded in 1750 and 'Burch Tor Bounds' in 1757 (Greeves 1986, 21). In the 1780s 'Vitifer' was being worked together with 'New House' and 'Runnigemore' (Broughton 1968), by which time the practice of underground mining would have become well established here. When Charles Hatchett visited the site in 1796 he noted that Vitifer mine employed 40 men and had 13 shafts; Engine Shaft was 21 fathoms deep; the pumps were powered by an overshot wheel and work on Western Shaft was in progress, sinking to 40 fathoms. Tin concentrate was at that time sent to Tavistock for smelting. (Hamilton Jenkin 1974, 101-2). The Revd John Swete visited one year later in 1797, providing a watercolour of part of the mine and he remarked that there was a pumping waterwheel of 36ft diameter and an ½-mile long adit driven up the valley (Gray 2000). In the early 19th century Birch Tor and Vitifer were worked together by the Davey Brothers of Redruth but during a period of depressed prices they were persuaded to sell the mine to the manager, John Palk at a fraction of its worth. In the 1830s the mine was stated to be 'large and profitable' under Captain John Paull and in 1838 it is recorded that Birch Tor was employing 117 people, including women and children. A new company was formed in 1845 by a group of Plymouth businessmen, combining the Birch Tor and Vitifer setts, called Birch Tor Tin Mining Co. under the captaincy of Richard Dunstan. Two 45ft pumping wheels existed at this time. However, disputes between the company's directors and the mine captains, together with disappointing progress and a shortage of labour soon led to work being suspended (Broughton 1968, 10). A revival in the mine's fortunes came about in the late 1850s when another new company New Birch Tor and Vitifer Consols Tin Mining Co. was formed. The mine then enjoyed some prosperity employing 150 people above and below ground in 1863, and shareholders even received dividends (Greeves 1986, 23). By the 1870s it was in decline again and from 1880 no further exploration was undertaken; in 1886 the whole sett was abandoned. Moses Bawden took on the lease in 1887 and resumed working the mine, mainly reworking the old dumps, until 1903 when a new lease was granted to Phelips and Padfield who employed on average 22 miners each year until

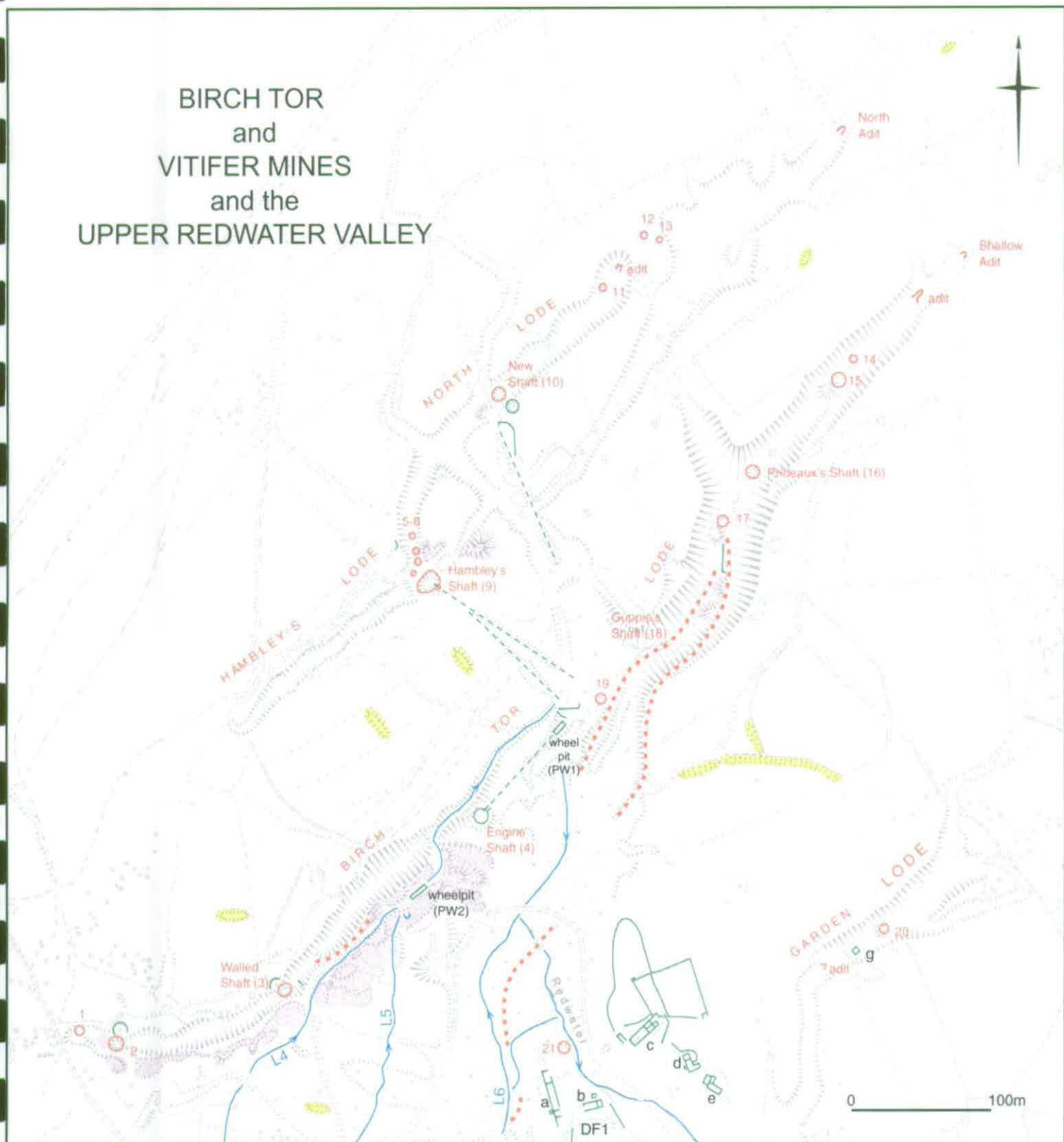


Fig. 4.3. EH 1:2500 survey, highlighting 19th - 20th century mining features in the upper Redwater valley.

1913. They also held the lease for East Birch Tor Mine (below) from that date. Various individuals continued working the surface dumps until 1925 and after that date only the bunkhouse remained in use by miners working at nearby Golden Dagger Mine.

In the following descriptions shafts are named where known. Numbers are used for unnamed shafts and all shafts are annotated on Figs 4:3-6, 4:9-13.

Shafts and Adits

Hambley's Lode and North Lode

These two lodes are the northernmost of the Redwater valley lodes. The shafts and adits are all sited within earlier openworks. Broughton depicts four shafts on this lode, two of which are named, New Shaft and Hambley's Shaft, and both of these have pumping equipment depicted. The remains of Hambley's Shaft is one of the largest shaftheads at the mines. It consists of a very large elliptical hollow of approximately 19m on the long axis and 4-5m deep with a rectangular, walled bob pit on the southern edge. A granite structure which probably accommodated a further counterweight at the end of the flatrod is located a further 40m to the north. Large amounts of deads have been dumped to the east of the shaft, forming finger shaped mounds. New Shaft is the northernmost of Broughton's named shafts. It too has had a large quantity of deads dumped on the exterior and has an adjacent circular plat on the south side, probably for a horse whim or angle bob. The main pumping mechanism was probably contained within the level area to the south of the shaft which is defined by a granite revetment wall on the east side. Although two adits have been recorded, one on north lode at the east end of the openwork and the other on Hambley's, also at the east end of the working, neither are likely to be associated with these shafts and the precise location of drainage adits has not yet been identified.

Birch Tor Lode

Underground work on the Birch Tor Lode is evident within the two massive openworks which had been dug to exploit the lode in earlier times extending across opposite sides of the valley. Broughton depicts nine shafts in total, including four named examples though two others are shown with pumping equipment in the form of flatrods. Walled Shaft is sited approximately halfway along the western openwork. To the east of the shafthead, within the gully are remains of a masonry structure associated with the flatrod system which extended from wheelpit (PW2) and on the exterior of the gully to the north is a semicircular earthwork which probably housed an angle-bob to extend the flatrod further up the gully to an additional shaft. The course of a tramway or barrow run is visible from the shaft, exiting the openwork on the south side where deads emanating from this shaft have been dumped, adjacent to one of the pumping wheelpits (PW2). The remains of Engine Shaft are not particularly conspicuous but the adjacent circular plat where an angle bob was housed is clear. A linear opening in the encircling bank of the plat on the east side, aligns with a stone conduit some 50m to the east which in turn aligns with the wheelpit (PW1).

On the eastern arm of the lode Guppies Shaft is near the lower end of the openwork and Prideaux's is about half way up; neither have very impressive remains, while three other shafts in the gully (14, 15 & 17) are not recorded by Broughton despite having more substantial remains. Shaft 17 is particularly impressive; the visible upper section reveals that it had squared sides and a large quantity of spoil has been raised up through it and dumped nearby. A tramway originates near an opening in the spoil heap and runs out of the openwork to the south, clinging to the south side of the working. It continues south and was probably used to transport ore to the dressing floors though was also used for the dumping of deads within the openwork. Part of the course of the tramway is revetted near the shaft (17). A second tramway starts further up the working and exits it on the south side. Outside the openwork its course is faint but it is likely to have continued down to the valley floor.

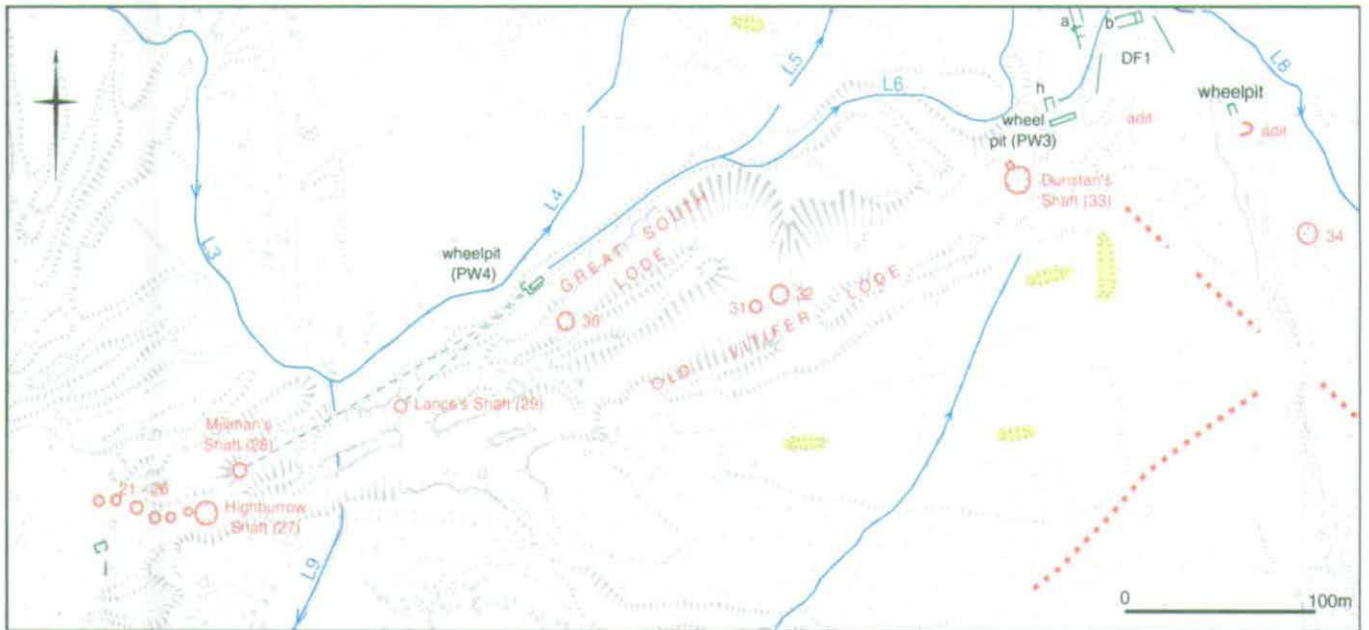


Fig. 4:4. EH 1:2500 survey, highlighting 19th - 20th century mining features on the Great South Lode and Vitifer Lode.

There is no field evidence associated with pumping on these eastern shafts of the Birch Tor lode neither was any depicted by Broughton.

Pumping

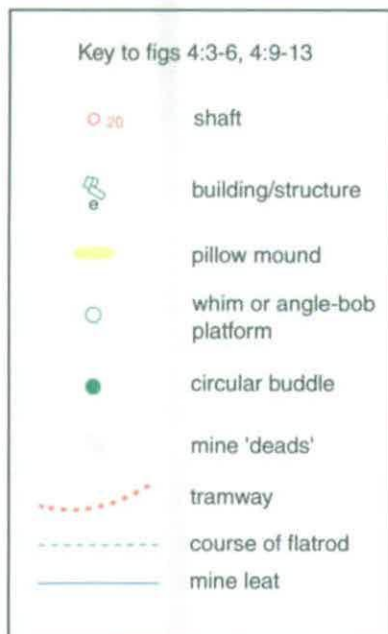
Wheelpit PW1

Sited in the old streamworks and aligned with the Birch Tor lode, this wheelpit which is sunk deep into a hollow measures 11.2m long and could have accommodated a wheel of 10 to 11m (32-35ft) diameter. It was used to power pumps in shafts on North Lode, Hambley's Lode and Birch Tor Lode involving a complex series of cranks and mechanisms for directing the motion of the flatrods in these different directions. Several collapsed stone structures are visible around the area of the wheelpit, which would have been associated with these mechanisms, including a revetted platform to the north of the wheel and a stone lined channel on the west end of the wheelpit hollow, through which rods passed towards the Birch Tor Lode. Additional stone installations are to be seen in the vicinity of the shafts themselves.

To the south of New Shaft on North Lode a flattish area defined on two sides by a revetment wall was a likely position for a flatrod mechanism, and from there traces of a channel cutting through the old streamworks may be seen running to the south and would have accommodated the rods.

Hambley's Shaft has a large bob pit on the south-west side which aligns with a linear V-shaped flatrod trench running down the steep slope to the wheel. A second gully which also runs between the bob pit and the wheel area, on a slightly different alignment suggests that the rods had been moved at some point. An additional structure to the north of the shaft may be an end fixing point or counterweight position for the flatrod.

On Birch Tor Lode Broughton has depicted PW1 connected to two shafts,



with a second wheel PW2 (below) connected to two others. Unfortunately the exact positions of some of the shafts is not immediately apparent. However, evidence for the positions of one of the angle-bobs, used for altering the direction of the rods, survives as a circular plat adjacent to Engine Shaft, with the upper surface defined by a low bank. An opening on the east side lines up with the stone-lined channel which exits from the wheelpit through which the rods could pass.

Wheelpit PW2

Sited just south and at the lower end of the western openwork on Birch Tor Lode. The stone wheelpit is 13m by 2.2m and has a tunnelled tailrace with a stone arched roof. Some additional masonry survives on both sides of the wheelpit where parts of the flatrod installation were accommodated. According to Broughton this wheel powered pumps in Walled Shaft, and a further shaft at the head of the openwork (2). This would have been feasible though the rods would need to have been angled to run along the interior of the openwork. Some walling survives adjacent to Walled Shaft, together with a semicircular platform to house an angle bob or whim. A similar platform is located adjacent to the unnamed shaft (2) at the west end of the lode. The exact course of the rods as depicted by Broughton cannot be confirmed from the earthwork evidence.

VITIFER LODE (Fig. 4:4)

Shafts and Adits

Within the largest and deepest openwork at the site, which extends between Redwater and Walla Brook valleys, are a number of lodes named by Broughton, which were worked underground, including Great South Lode and Old Vitifer Lode. The easternmost shaft is Dunstan's which is equipped with a balance bob pit and was pumped by a nearby wheelpit (PW3). At the western end of the openwork Highburrow and Millman's Shafts have substantial remains, Lances's Shaft is rather inconspicuous at the base of a steep rock face. A probable adit opening is visible at the point where the openwork meets the streamwork at the eastern end. Evidence of a tramway survives here but the branch illustrated by Broughton lies in the boggy area, east of the adit.

Pumping

Wheelpit PW3

This wheel apparently powered only the pumps in Dunstan's Shaft. The stone wheelpit measures 14.5m by 1.8m and is almost completely rubble-filled. The only evidence of pumping is the large, stone-lined balance bob pit on the north side of Dunstan's Shaft. Water to the wheel was supplied from a branch of the main Vitifer leat (L6) but also, possibly by the return leat from the tailrace of the engine wheel sited over Machine Shaft at Golden Dagger, over 700m to the south-west.

Wheelpit PW4

Sunk into a narrow gully on the north side of the Vitifer lode openwork, this smaller pumping wheel measures 8.3m by 2.3m and has further retaining walls on both sides. It was supplied with water from a short branch of the main Vitifer leat (L4) and powered pumps in two shafts – probably Millman's and Lance's - further to the west inside the openwork. Two parallel, V-shaped cuttings reveal the positions of the rods. The northern rod was cranked to continue at an angle in a separate channel to reach its destination at Millman's Shaft while the other took a direct route to Lance's.

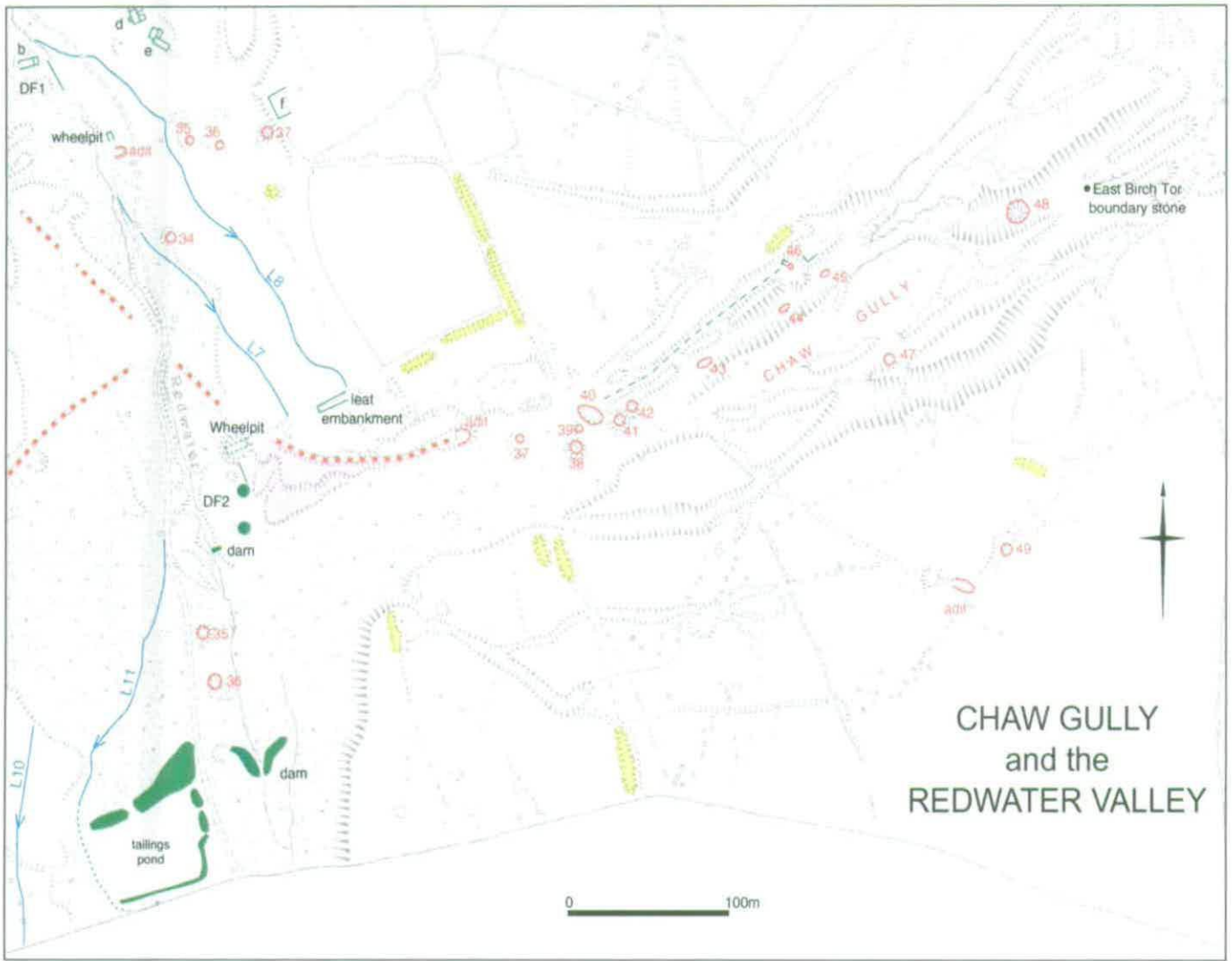


Fig. 4:5. EH 1:2500 survey, highlighting 19th - 20th century mining features in the Chaw Gully area of the upper Redwater valley.

GARDEN LODGE (Fig. 4:3)

Garden Lodge is a smaller openwork and contains evidence of one unnamed shaft (20) and an adit, together with a small rectangular building (g). A further very wet adit survives just west of the mine track. There is no evidence that pumping ever took place on this lode. A wheelpit of unknown purpose sits adjacent to the adit portal but is wrongly aligned to have powered rods on this lode (Fig. 4:5).

CHAW GULLY OR OLD VITIFER LODGE (Fig. 4:5)

Shafts and adits

The western end of the massive complex of openworks and streamworks, which extends between Redwater and West Webburn valleys, including Chaw Gully is not depicted by Broughton though on his plan of East Birch Tor Mine, the lode is referred to as Old Vitifer or Stone Row Lode. None of the shafts within these old workings named by Broughton, although at least 11 survive (37-48), and some were clearly substantial and significant shafts. Two adits are also visible including one near the western end, which has evidence of a tramway leading from it to the dressing area (DF2) to the west. This tramway was visible in a photograph of the dressing floors of c.1915 (Greeves 1986, Pl. 25). Shaft 46 has a robust stone platform on the north-west side – possibly a base for headgear - and a bob pit to the north-east. The location of the waterwheel which supplied the motive power to the pumps is not certain but it is likely the flatrods ran south-west from the bob pit along an old gully.

Dressing

There was originally possibly two dressing floors at Birch Tor and Vitifer Mine, where tin ore was crushed and refined, but unfortunately both have been badly disturbed since abandonment. It is not known when either was established but both were illustrated on Broughton's plan based on information from about 1856 and 1867 (Broughton 1968) and some evidence of structures is shown on the 1st edition, 25-inch OS of 1885.

DF1

Sited at the main area of activity near the miners' dry and carpenter's shop, is a flat terrace defined on the east and west sides by a revetment wall. This is the position of a possible dressing floor though it is not specifically mentioned in any documentation or by previous writers. On Broughton's plan a waterwheel is shown though no evidence survives today, and, on the OS 25-inch 1st edition map the side retaining walls, a roofed building, and three circular features - which could be buddles - are depicted. The area between the two retaining walls is now engulfed by mire and the only features visible are some low depressions which could be interpreted as buddles or settling pits.

DF2

This large dressing floor was depicted in part on the OS 25-inch 1st edition map of 1885 but more fully on the 1904 2nd edition. It is clear from these differing depictions that improvements had been made to the site between those dates, including a roofed dressing shed, an additional much larger leat to supply water to the wheel and, possibly, a larger wheel. This is confirmed by oral information from miners, recorded by Greeves, who recall a new wheel being installed in 1903 (1986, 31). Some very detailed photographs of the dressing floors have been published by Greeves (1986, Pls 25-7) showing the site at work between 1905 and 1915 and after abandonment in the 1930s (*ibid.*, Pls 34-6). The photographs reveal that the floors were once covered by extensive galvanised sheds, that a round chimney stack stood at the site and that the leat was conveyed between the leat embankment and the wheel via an elevated section of launder.

Sadly the dressing floors were obliterated during WWII when unexploded bombs were detonated here and much of what remains is today unrecognisable. The area is now very wet and boggy and part of it has been colonised by dense tree growth. A deep, elliptical pit or crater is all that survives where the large waterwheel once stood and the walls and chimney of the roofed dressing floor have been reduced to an amorphous mound of rubble. However, the outlines of two circular buddles are visible on the dressing area and the robust, stone-built leat embankment survives intact to the east of the wheelpit. Rotting timber stumps reveal the former position of the stamps frame. North of the wheelpit the faint course of a tramway may be traced, which was once used to cart ore from an adit on the Old Vitifer lode; a clearer section of tramway runs into the back of the dressing floors from an adit on the Chaw Gully lode to the east. Two-hundred metres south of the dressing floor is large tailings pond consisting of a flat rectangular area, enclosed on three sides by an earthwork bank and containing copious quantities of tin slimes; this was probably delivered to the pond in a semi-liquid form from the dressing floor via wooden launders.

Leats

The pumping and dressing floor waterwheels for all the mines in the Redwater Valley as well as Wheal Caroline in the Statts Brook Valley were supplied with water by a single leat from the East Dart River although it was augmented by Winneys Down Brook, Varracombe Brook, the North Teign River, Statts Brook and the Redwater.

Two branches of the leat served the remote Wheal Caroline mine at the extreme north-west of the study area; one (L1) served the pumping wheel (PW6) on the east side of the valley while a second (L2) powered the wheel on the small stamping mill (DF8) on the western valley floor. Both wheelpit tailraces returned water into Statts Brook to be diverted back into the substantial leat channel (L3) which runs south-east passing beneath the B3212 road, then to negotiate a sinuous course through the openworks to the south of the Warren House Inn. The next wheel was the small pumping wheel (PW4) at the head of the Great South Lode openwork. Here the leat splits into two: one branch (L4) bypasses the wheel and continues steeply down hill to PW2; the other (L5) passes over PW4 and out through a tailrace channel which also splits into two. One channel (L5) travels north where it rejoins L4 above PW2 while the second (L6) goes east to the wheelpit PW3. That the presence of the wheelpit PW4 created the need for two channels to PW2, suggests PW4 may be a later addition. After passing over PW2 the channel (L5) crosses the Birch Tor lode openwork via an embankment to supply the large pumping wheel (PW1) at the head of the valley. After passing over this wheel water exited via an underground tailrace, and flowed south via the Redwater Brook. The other branch, from the PW4 tailrace (L6), arrives at a small reservoir just above PW3. From here water could be diverted onto the PW3 wheel or continue north in a contour channel to meet the tailrace waters of PW1, near the track. From there the reunited leats, augmented by the Redwater Brook, flowed in a modified stream course down the eastern side of the valley, supplying water to a small wheelpit near Garden Lode and the large dressing floor wheel (DF2), which has two chronologically distinct branches; L7 is the earlier leat and L8 was dug in about 1903 when the dressing floors and waterwheel were enlarged (see also Golden Dagger leats below).

Domestic and other ancillary buildings

A cluster of domestic and other buildings is focused on a sheltered part of the valley floor at a central point at the mine, midway between the main dressing floor (DF2) to the south and the underground workings to the north. Many of the buildings feature in a series of photographs taken around 1912, when the mine was still operational (Greeves 1986).

The Miners' Dry (a) is a long narrow building, which once had an external chimney stack on the west side. The building is ruined almost to ground level, though the layout of the rooms and internal divisions and the position of the stack are still visible. Recorded as a dry by Greeves from oral sources (Greeves 1986, 31) the size of the building, over 42m long, suggests it could have served other purposes as well.

The Carpenter's Shop (b) is just east of the dry. It comprises two compartments, that on the east end being a later addition. On the west end a 2m-wide entrance gave access for large items of equipment. Outside the building to the north is a shallow, rectangular stone-lined pit.

The main domestic buildings (c) were on the east side of the valley centred around the captain's house which is likely to be the oldest of the buildings here, possibly of 18th-century origins though difficult to date precisely. This was a two-storey, stone house of typical Dartmoor farmhouse appearance, which appears to be thatched in a photograph of *c.* 1912. A large, half-timbered building was added to the south-west end of this sometime after 1905. This is recorded by Greeves as the miners' house, with kitchens on the ground floor. There is a sunken, stone-lined rectangular pit at one end of the building which is a possible cellar. On the north-east end of the Captain's House another stone cottage was added, sometime before 1885, when it is depicted on the OS map of that date. All these buildings are now ruined to just above ground level and the wall foundations are covered by turf-covered tumbled stone. A series of small enclosures is attached to the north side of the buildings, incorporating a small garden plot and livestock enclosures. An outdoor privy is sited

in a corner of one of the enclosures (see Greeves 1986, Pl. 22).

South of the Captain's House is the ruin of another fine, two-storey stone building (d), which may have originally been a house, but in the early 20th-century was serving as a mine office. The position of the stone porch is visible on the west side and lean-to structures are visible on the north and east. An alleyway to the rear of the house is defined by a low, stone revetted wall. (see Greeves 1986, Pl. 22).

Stone support foundations of a single-storey timber bungalow (e) are visible south of the office. It was constructed on a levelled piece of ground and has an L-shape ground plan. (see Greeves 1987, Pl. 22).

South of this bungalow, another timber bungalow with an elaborate veranda features in one of Greeves' photographs of c.1913 which was apparently burned down before WWI. The remains consist of a level stance (f), cut into the ground part way up the eastern valley side. Stone foundations and a revetment at the rear of the terrace also survive, plus fragments of heat-distorted glass providing physical evidence of the fire.

North of the wheelpit PW3, at the foot of a steep slope is the remains of a smaller rectangular building (h) which may have housed a turbine for generating electricity. The walls, constructed from stone and some brick, still stand to a good height and the building has generally survived better than most at the mine.

GOLDEN DAGGER MINE

(Fig. 4:6)

Historical summary

Nineteenth-century mining was occurring at this location by 1809 when the position of stamping mills are indicated on the 1st edition 1-inch OS map, and Broughton states that the mine was particularly active from 1835 to 1860 (Broughton 1968, 14). However, it was not until the 1850s that the name Golden Dagger is first recorded (Greeves 1986, 45). From 1879 Moses Bawden became associated with the mine as secretary and chief agent and in the following 25 years is believed to have spent £20,000 on developing it. In 1892 41 people were employed at the mine and tin was produced to the value of £1530 (Greeves 1986, 45). Work underground was halted at the outbreak of hostilities in 1914 but surface working continued after the war, under several companies, reworking the waste heaps of earlier tanners, within the confines of the Redawter valley floor. The Torr Trust was the last of these companies operating between 1925 and 1930. Many photographs of the tin dressing operations survive from this period and have been published by Greeves (1986), though much of the activity depicted is no longer evident, having been overwhelmed by bog, scrub growth and conifer plantation.

Underground activity - surface evidence

The lode worked by the Golden Dagger Mine runs east to west across Soussons Down and its course is marked by a deep and narrow openwork extending between the Redwater and Walla Brook. All of the 19th-century underground activity is located within or close to this working, unfortunately much of this is currently covered by conifer plantation, some of the trees have fallen over the remains, prohibiting survey. A number of shafts are known to exist within the openwork including the Machine Shaft which has a wheelpit sited adjacent to it. At the far west end of the openwork three shaftheads are accessible (Fig. 4:10, 56-59) referred to by Broughton as the Old West Shafts. The positions of two adits are also visible; one at the eastern terminal of the openwork, survives now only as a small opening. The main evidence for this adit has been destroyed by forestry activity. A

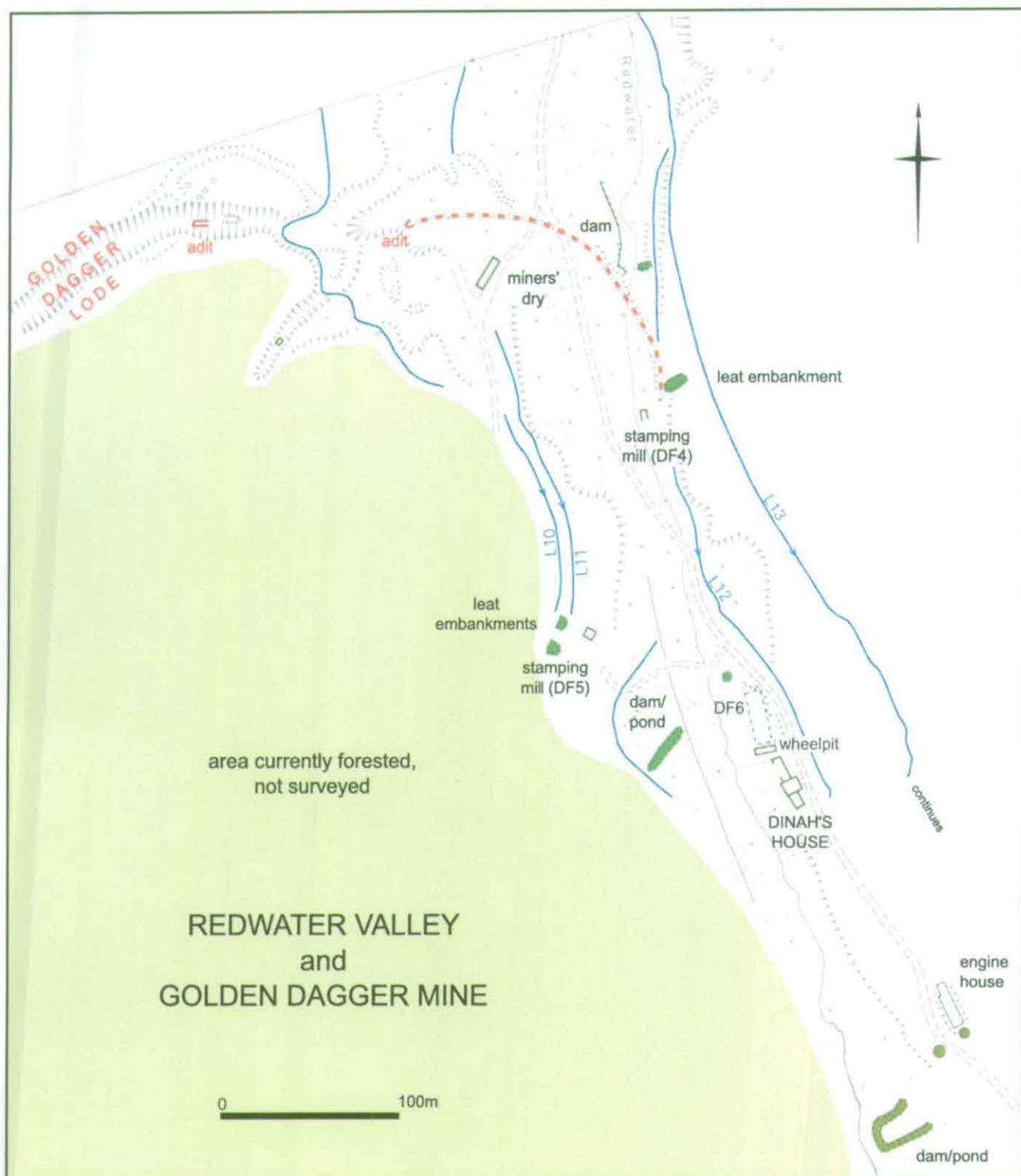


Fig. 4:6. EH 1:2500 survey, highlighting 19th - 20th century mining features at Golden Dagger Mine.

photograph of c.1912 shows a portal of approximately 1.2m high, revetted sides to the approach gully and a tramway (Greeves 1986, Pl.39). A second collapsed adit is visible 125m to the west and uphill in the floor of the openwork. The masonry revetments which lined the side of the tramway are visible and a small finger dump occupies the bottom of the openwork to the east.

Dressing

There are several locations at Golden Dagger where stamping and dressing is known to have taken

place. Two of these are likely to be earlier dating from the early to mid-19th century and included stamping and a third was working in the late 19th to early 20th.

(DF4)

This stamping mill, on the east side of the Redwater, was in existence by 1885 when depicted on the 1st edition OS 25-inch map and may still have been in use as late as 1904 (OS 2nd edition). The remains consist of a ruined stone wheelpit and stamps area. Water was drawn from a leat (L13) whose source was on the Redwater, below the Vitifer dressing floors (DF2) which conducted water onto the overshot wheel via a raised leat embankment. A tramway from the mouth of the lower adit on the Golden Dagger lode is depicted on the OS maps which transported ore across to these stamps. This has mostly been effaced but its course survives to the north of the mill where it has been adopted by a forestry track. There is no clear evidence of buddles beside the wheelpit and it is likely that crushed tin from these stamps was further processed at a dressing floor sited 100m downstream to the south depicted on the OS maps, in an area currently covered by dense shrubs.

(DF5)

This stamping mill on the west side of the valley, downstream of DF4, is well-known from a widely publicised Chapman and Son photograph of 1912 recording the site while still operational and showing the very broad waterwheel and attached galvanised sheds (Richardson 1992; Greeves 1986). All that remains today is the stone wheelpit, which although intact has been fenced off for safety reasons, a level area to the south where the shed which housed twelve heads of Cornish stamps once stood, and two leat embankments just up the slope to the west. One of these embankments certainly aligns with the wheelpit but the purpose of the second is not obvious though it may have diverted water onto a smaller wheel housed within the sheds. This mill was not depicted on the 1904 OS map though was in use by 1912 when photographed. A large tailings pond consisting of an earthwork dam oriented east-west is located 75m south of the wheelpit.

DF6

On the 1st-edition OS map of 1809 a stamping mill is marked adjacent to a small cottage in the vicinity of the later Dinah's House (Greeves 1986, 45). The site was omitted on all later maps, suggesting an early abandonment in favour of DF4 and 5 though it is marked by Broughton (1968). The wheelpit is sited west of the track at the foot of a slope under dense undergrowth, just north of Dinah's House. The masonry is incomplete but both ends survive giving an internal measurement of very approximately 13m long by 1.5m wide. A concrete feature at the top of the slope by the track may be later and not associated with the wheel. A level earthwork terrace on the north side of the wheel marks the position of a probable dressing floor. This area is now very boggy. The faint outline of a possible circular buddle is visible just north of the dressing floor. Buddles of this type were not in use in 1809 so this example may be associated with the later dressing floor just to the north.

DF7 (Fig. 4:7, 4:10)

A stamping mill, also likely to be of earlier date, is located on the far west extent of the Golden Dagger sett, on the east side of the Walla Brook. The mill is built into a gully associated with an area of streamworks which would have been long disused when the mill was built. Although the mill itself is clear it is currently surrounded by conifers. The remains consist of a stone wheelpit with stamps area attached to the east and a level terrace, with revetted rear wall cut into the base of the gully forming the dressing floor. On the dressing floor are four shallow hollows which represent

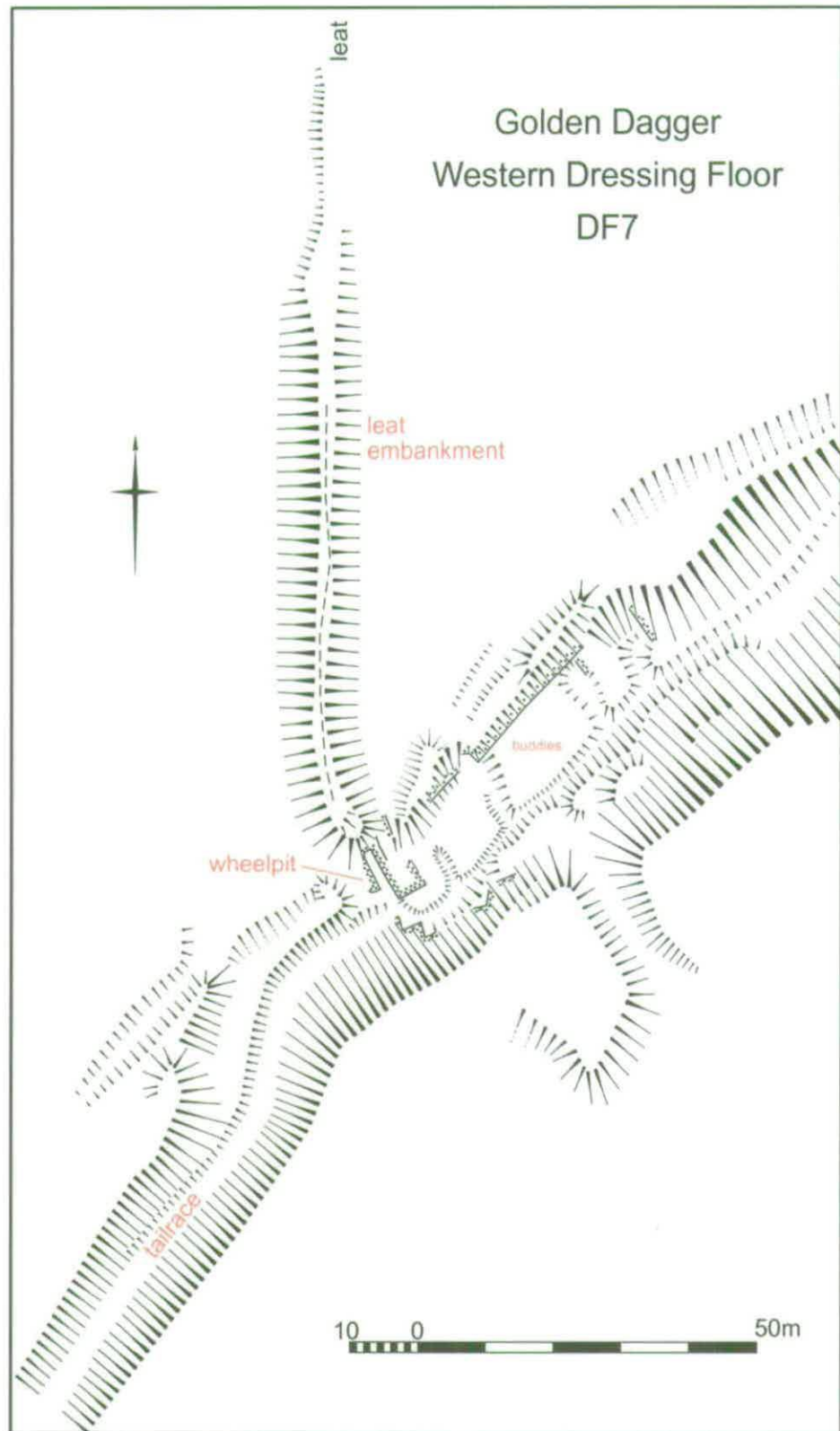


Fig. 4:7. 1:500 scale earthwork plan of the stamping mill and dressing floor (DF7) on the east bank of the Walla Brook, within Soussons Plantation.

remains of the buddies; each had its tail running into the base of the earlier channel, which also served as a tailrace on the western end below the wheelpit. North of the wheelpit is a substantial raised 50m-long leat embankment which delivered water from two leats L13 and L14, though the final section of L14 is not clear. The earliest date for this stamping mill and dressing floor is not known but it is of design and layout which was common on Dartmoor from the 1790s to the 1860s. It was abandoned by 1884 when it was depicted but not annotated on the OS 1st edition 25-inch map.

The Engine House

The Engine House represents the main survival of the 1920s activity at Golden Dagger under the Torr Trust Co Ltd and although the building housed a range of equipment, some dressing was also carried on here. The remains consist of a narrow concrete foundation outline which supported a galvanised shed bolted to the concrete. The concrete bases of several pieces of plant survive within the floor, complete with rusting threaded studs, including the site of the Petter engine and the magnetic separator. All such equipment has been described in detail by Richardson (1994, 23). At the south end of the terrace are two earthwork hollows, one of which is likely to be the rectangular buddle shown in a photograph of 1927 (Greeves 1986, Pl. 59). Two well-preserved circular buddles complete with concrete central cones survive on the exterior of the building, one just to the west of the track. They have diameters of 3.8m and 5.4m. The latter has intact masonry lining around the diameter and a concrete floor.

Much additional processing took place at Golden Dagger in the 1920s within the area now engulfed by bog and conifer plantation close to the Redwater Brook. This activity is shown in detail in the photographs of Donald Smith who worked at Golden Dagger during this period (Greeves 1986). Evidence is difficult to identify within the bog and the conifer covered area has not been investigated as part of the EH survey. However, a probable tailings pond has been identified to the south-west of the Engine House.

Ancillary buildings

The Miners' Dry

Built sometime between 1885 and 1904 (see OS 25-inch) the miners' dry just east of the main level beside the track is a ruined rectangular stone building of three cells all having entrances on the south-east side. The overall internal dimensions 17m by 3.8m.

(?)Explosives store

A small stone-built rectangular building is concealed within a deep branch of the openwork, west of the main adit. Its positioning and size suggest it may have served as an explosives store, or possibly for tool storage.

Dinah's House (Pl.4:9)

The origin of the name of this building is not known neither is its original construction date, but it was in existence by 1885, when it appears on the 1st edition 25-inch OS map. The building has two probable construction phases which commenced with a central rectangular building of three rooms. To this a further two rooms were added at a slightly offset angle on the south side, and a porch added across the join on the east side. A range of outbuildings was placed leading off the northern side one of which is known to have served as a garage. The house was occupied by mining families and also served as an office. It has been abandoned since 1942 though the walls survive in robust condition, benefiting from quite recent consolidation carried out by the National Park Authority.

Leats

South of the Vitifer dressing floor (DF2), the stream has been deepened and an earthwork dam built to retain water. This was likely to have provided a head of water for the Golden Dagger Mine dressing floor leat (L13) which continues on the east side of the track, down into Soussons Forest to the dressing floor (DF4). A second earthwork dam remains approximately 80m north of that dressing

floor (DF4). The leat has a lower branch (L12) which provided water to the waterwheel to the north of Dinah's House (DF6). Leat L13 was extended in the 1920s to supply the machines and processes at the Engine House where it was conducted from the leat down to the building via an iron pipe.

The main Golden Dagger mine leat (L9) is a branch of the Vitifer Leat which forks off to the south just before the leat meets pumping wheelpit PW4. This branch was created sometime between 1885 and 1904 as it is not depicted on the OS map of the earlier date but is on the latter. Two wooden aqueducts would have been needed to span the gullies of the massive openworks here and divert the water onto the raised section of leat to the south. A stone-faced embankment then carries the channel for approximately 70m and from there it continues south, just east of the summit of Soussons Common, crossing the parish boundary wall to arrive at a wheelpit sited at the head of Machine Shaft in the Golden Dagger openwork (not surveyed or illustrated). After passing over this wheel, a substantial tailrace leat then conveyed the water back north along the slope of Soussons Common, probably terminating at the eastern foot of Vitifer lode openwork. From there it may have had an aqueduct across to PW3 or was used to augment the Redwater supply to the dressing floors of Vitifer Mine (DF2) and at Golden Dagger Mine further down stream.

An additional leat (L10) was cut to supply the stamping mill on the west side of the Redwater (DF5). It has its origin below the dam, just west of the Vitifer dressing floor (DF2). Its course goes around the western end of the large tailings pond, though the remains are partly lost in bog, then crosses the Headland Warren boundary wall to pass just east of the Golden Dagger adit. South of the adit the remains have been disturbed, but the channel continues south of the track to terminate just west of the stamping mill (DF5). Parallel with this final section is another leat (L11) which may be an earlier cut of L10. Another, probable 19th-century leat (L15) has its origin apparently within the area of streamworks to the south of Vitifer, though where precisely is unclear. After crossing the boundary wall the leat negotiates the Golden Dagger openwork area then descends the slope to the track. Its purpose is unclear.

WHEAL CAROLINE

(NB. Wheal Caroline was surveyed by RCHME in 1992 [Figs 4:9, 4:10]: the following is a summary description of the remains based on individual site reports written for the NMR)

The bounds of Wheal Caroline as set out in 1826, cover much of the western slopes of Water Hill and extend as far south as the Walla Brook (DRO 3665Z). The mine had closed by 1889 when the wheels were reported to be standing idle (Newman 1996, 145). Unfortunately the intervening period is poorly documented. Some of the mine buildings were adopted and enclosed as part of a farm of the same name, possibly while parts of the mine were still operating. The farm is now also derelict.

Underground activity

Evidence of underground activity has survived at three locations, though it is not certain that they all date from the documented period when Wheal Caroline is mentioned specifically and names for any of the shafts or lodes have not survived. To the east of the deserted farm is an alignment of three shaftheadings (50-52), spaced approximately 20m apart and to the west of the lowest shaft is a blocked adit with linear spoil heap.

An engine shaft (53) surrounded by spoil heaps is located inside one of the old openworks. Power to the pumps was provided by a waterwheel sited approximately 230m to the south-west (PW6). The masonry of the wheelpit has been removed since abandonment leaving only a pit of

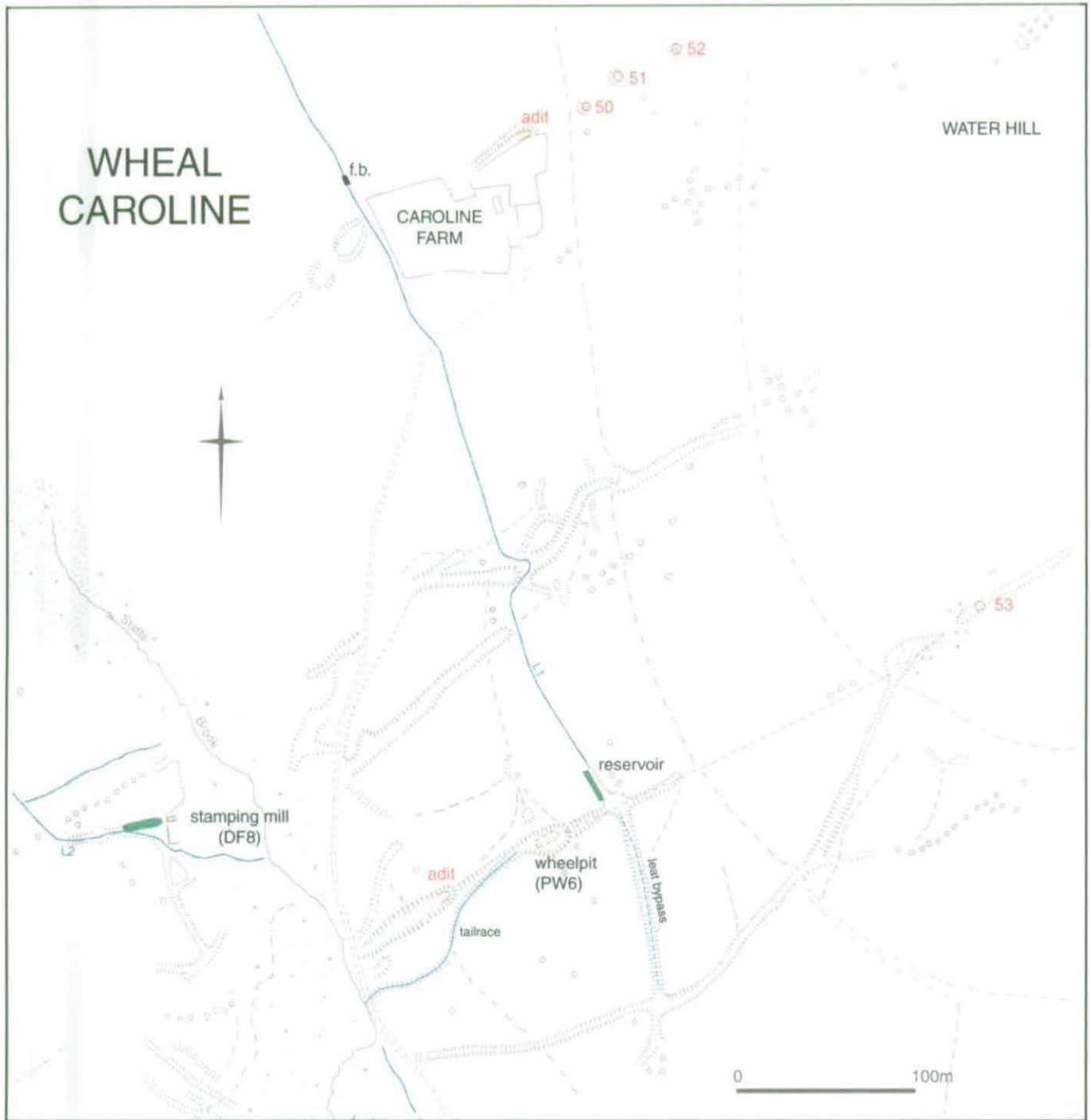


Fig. 4:9. *EH 1:2500 survey highlighting 19th - 20th-century mining features in the Statts Brook valley.*

30m long. A tailrace is visible below. Water for the wheel, provided from a branch of the Vitifer leat (L1), was stored in an earthwork reservoir to the north of the wheelpit.

Two shafts (54, 55) and an adit are located at the south of the sett amid the Walla Brook streamworks (Fig. 4:10). The blocked adit has a well-defined, 50m-long outflow channel, with banked earth sides. A ruined rectangular building (n) near the shafts may be associated with this activity.

Dressing

DF8

On the west bank of Statts Brook are remains of a stamping mill with attached dressing floor, consisting of a disturbed leat embankment, wheelpit and buddle area. The wheelpit survives only as a rectangular

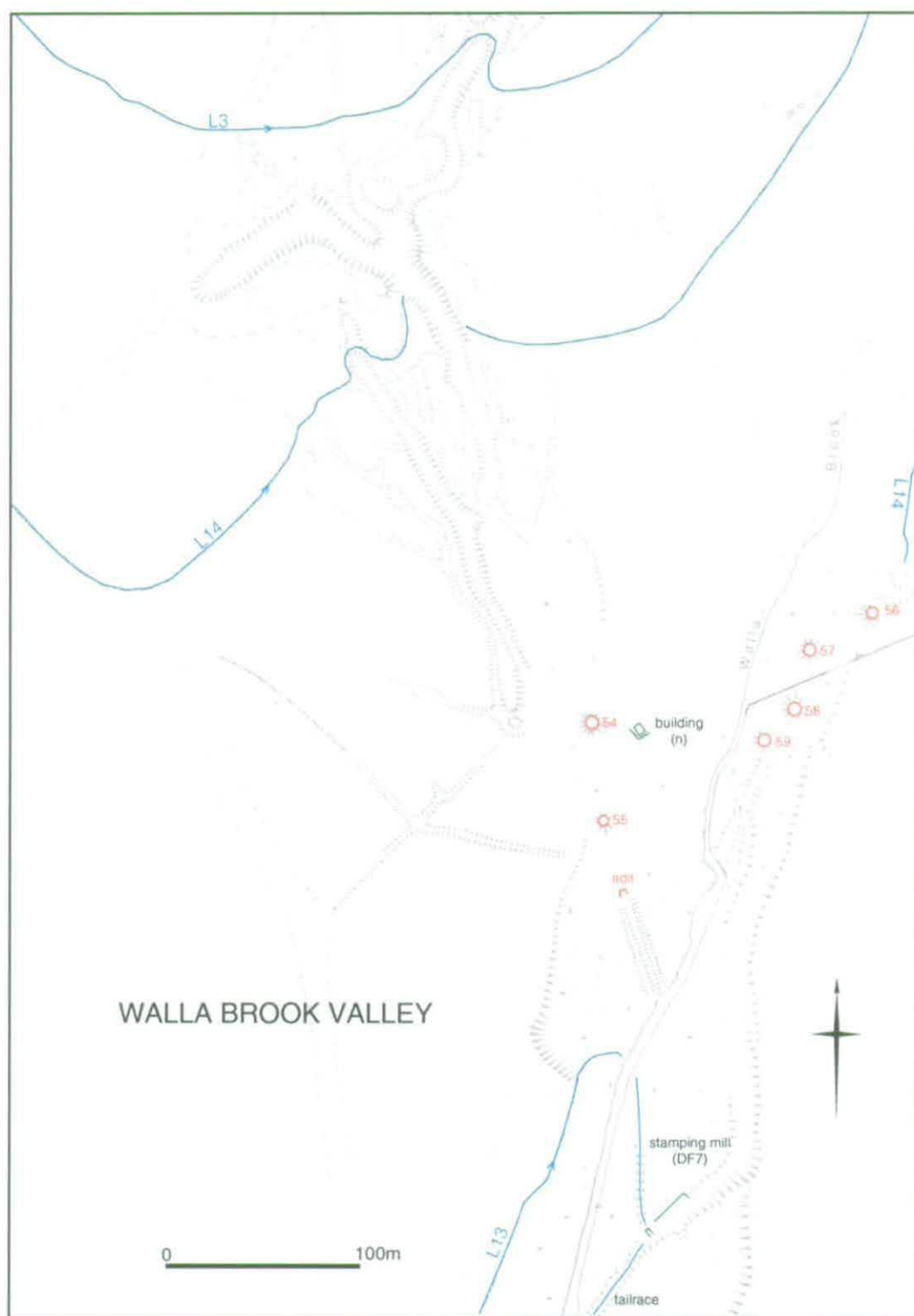


Fig. 4:10. EH 1:2500 survey highlighting 19th - 20th century mining features in the Walla Brook valley.

stony hollow of 1.5m by 1.5m by 0.5m deep. The dressing floor was located on the 17.5m-long levelled area and would have contained rectangular buddles, though none survive. The raised leat embankment on the west side, delivered water from a branch of the Birch Tor and Vitiifer Mine leat (L2). This stamping mill is depicted on the 1826 map of the sett (DRO 3665Z).

BUSH DOWN AND KING'S OVEN

Nineteenth century mining activity is evident to the north of the B3212 in the Boveycombe catchment area. Several mines are documented here though somewhat briefly, mentioned by Hamilton Jenkin

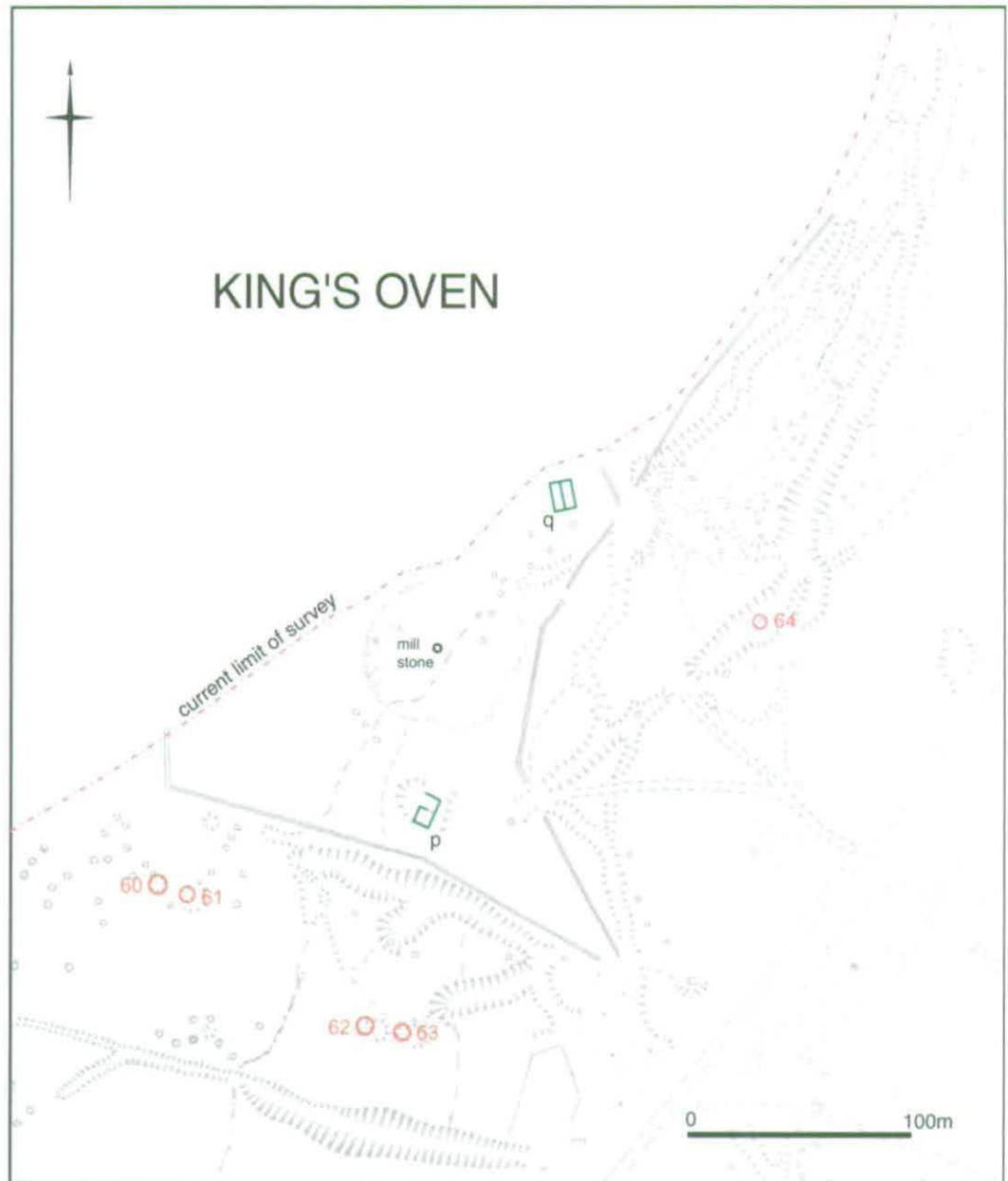


Fig. 4:11. EH 1:2500 plan highlighting 19th-20th century mining features at King's Oven

and Broughton. According to Broughton Jacob Stancombe began digging an adit which was to connect to an engine shaft to the south west. This attempt was abandoned by 1852 due to lack of capital. In 1866 activity took place under William Skewis in the area to the north of the Warren House Inn at the Waterhill and Kings Oven setts where shafts were sunk. By the 1870s much of this valley formed part of the West Vifer sett, but by 1875 this too was abandoned.

King's Oven (Fig. 4:11)

Evidence for mining here consists of several substantial shafts (60-64), adjacent to an old openwork; two of these are likely to be Valley Shaft and Waterhill Shaft mentioned by Broughton (1968, 15). Two buildings are located nearby. One (p) is sited just to the east of the openwork on a levelled platform. It is built in two compartments and is ruined to ground level. A second, larger building (q) of two compartments is sited 150m to the north-east. The purpose of these structures is not known for certain and there is no archaeological evidence that they were associated with mining though it seems very likely. The latter building was still depicted as roofed in 1885 on the OS 25-

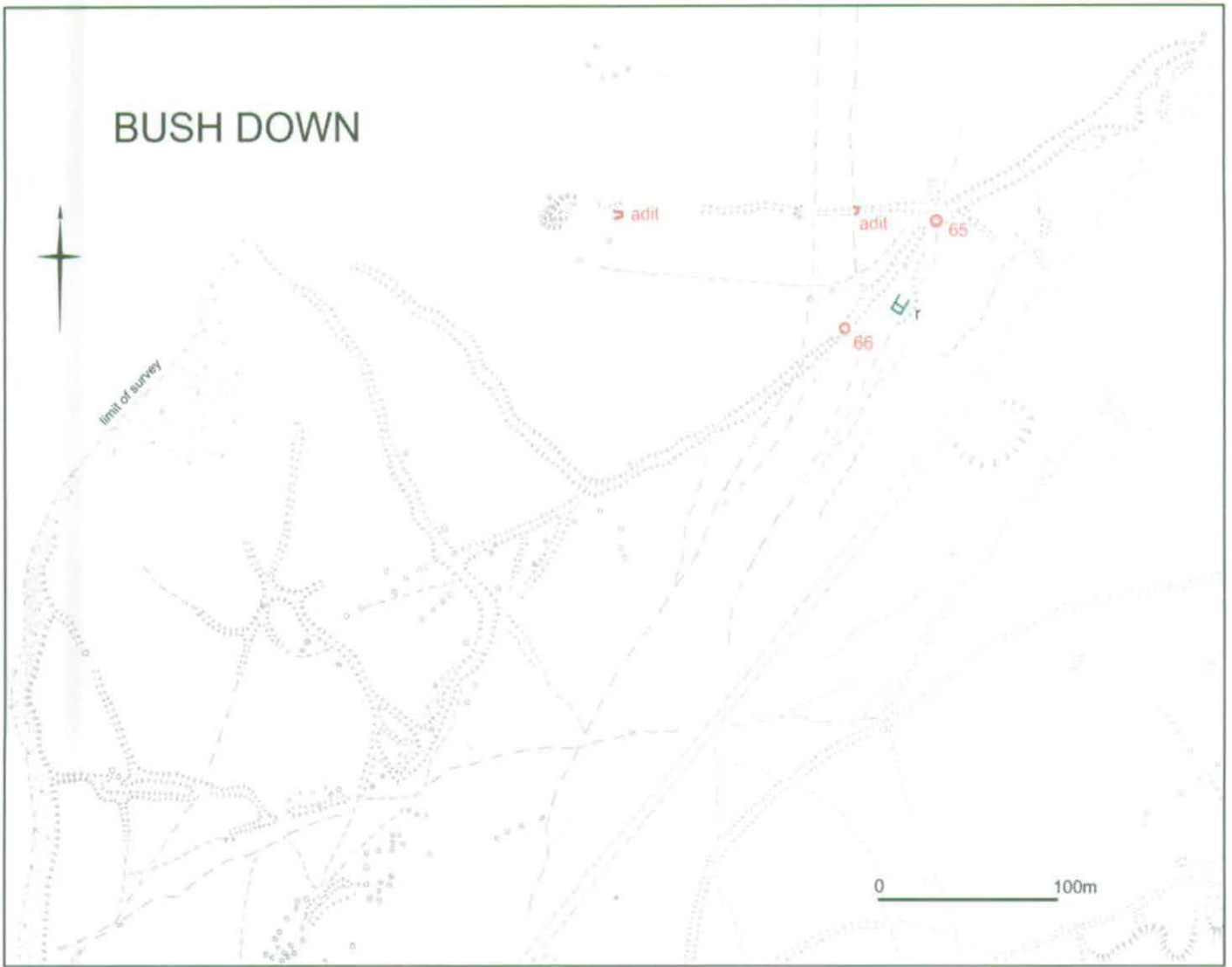


Fig. 4:12. EH 1:2500 plan highlighting 19th- 20th century mining features at Bush Down.

inch map but both were ruins by 1904.

Bush Down (Fig. 4:12)

On Bush Down an open adit with a large spoil dump to the west of the portal could be remains of the work which took place between 1850-52. A corresponding shaft (65) is located in the base of the old openwork due east and a second (66) is sited further down the cutting. Near the shafts are earthwork foundations of a rectangular building (r), likely to be associated with the mine.

EAST BIRCH TOR MINE

(Fig. 4:13)

Historical summary

East Birch Tor mine is first recorded in 1836, though underground work is likely to have commenced here before this date, possibly under a different name. In 1848 the East Birch Tor Tin Mine Co. leased the mine under Captain James Browning. This company only carried out limited exploration underground and after financial troubles the sett was abandoned in 1851. The following year it was reopened under the Devon Great Tin Croft Tin Mining Co. appointing John Penrose as managing agent. Kelly (1856) recorded that three lodes were being worked in 1856 – South, Graham’s and

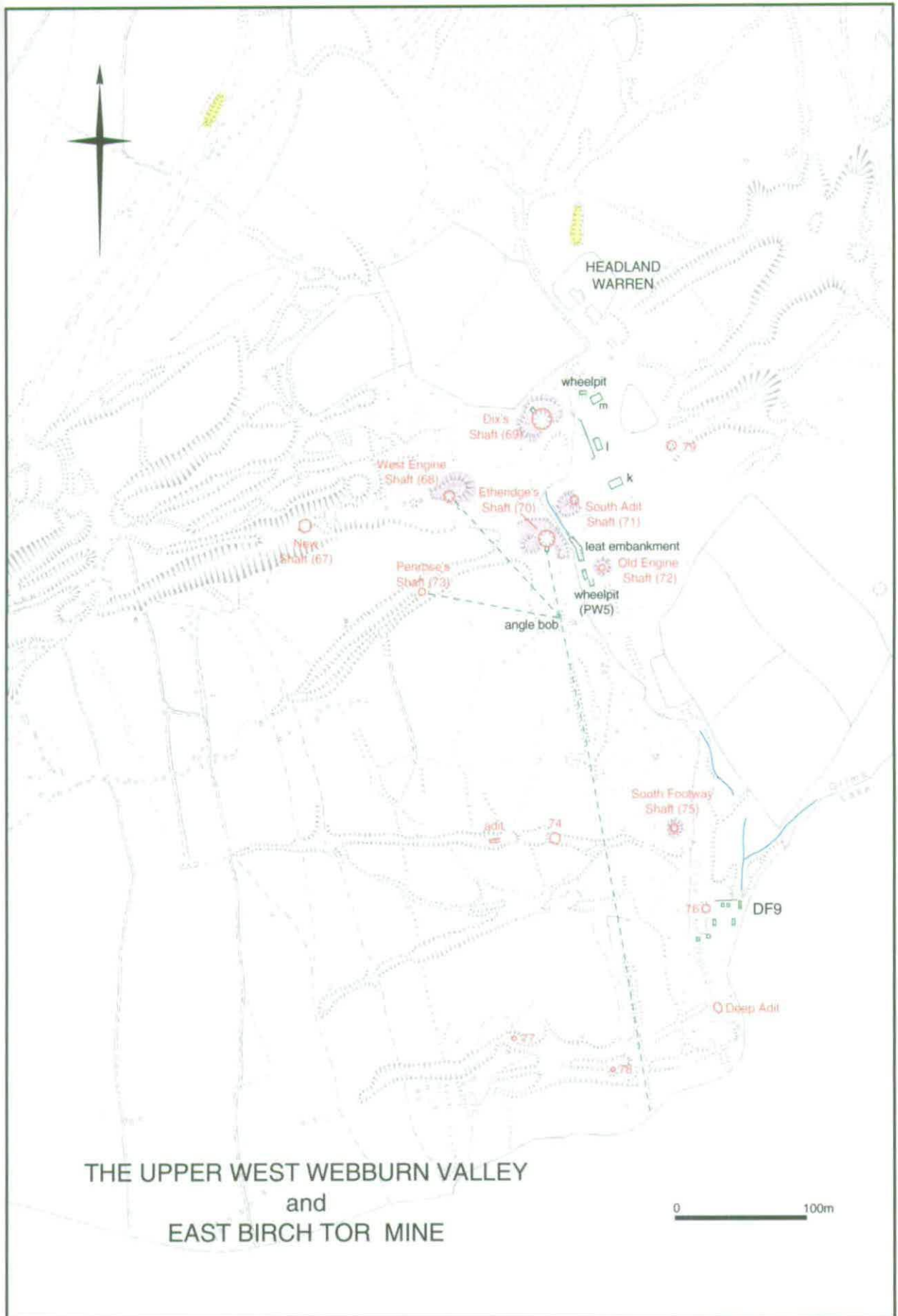


Fig. 4:13. EH 1:2500 plan highlighting 19th - 20th century mining features in the West Webburn valley.

North – and of the six shafts sunk prior to 1856 only three were in use, including Etheridge's and Dix's. This company was dissolved in the early 1860s but was reformed in 1862 as New East Birch Tor Co. This company, which also had permission to work part of the Birch Tor sett, survived only until 1867. In the same year James Willcocks took over the East Birch Tor sett, followed by George Perrin and George Cole but the success of neither operation is recorded. In 1903 the sett was leased by Phelps and Padfield who were also leasees of the Birch Tor and Vitifer mine at that time. Underground work is said to have continued under this company until 1927 when the sett was finally abandoned. A boundary stone marking the western extremity of the sett survives at the head of Chaw Gully and bears the inscription 'East Birch Tor' (Pls 4; 10).

Shafts and Adits

Although evidence for East Birch Tor Mine is spread along much of the upper West Webburn valley, between Headland and Challacombe, the majority of the extractive evidence is clustered around Headland Warren house, within the old streamworks.

There is evidence of 12 shafts (67-79), of which 10 are named by Broughton, plus two adits, one of which is Deep Adit. All these features were in existence by 1852 when depicted on a plan surveyed by Penrose (Broughton 1968), although some shafts marked on the same map are without substantial surface evidence. Only five of the surviving shafts are sited within openworks (67, 73, 79, 74, 78), the remainder are within streamworks of the valley floor. These have large spoil collars, especially West Engine Shaft, Dix's Shaft and Etheridge's Shaft, possibly because of the lack of adit access to the working areas of this low-lying mine, and much of the deads needed to be raised up the shafts. Deep Adit, is located at the southern end of the site from where a copious spring now issues. A second adit, penetrated a narrow openwork on the west side of the valley; it is undocumented and could have been exploratory.

Pumping

Pumping was clearly very important at this mine. Two wheelpits survive which have some association with pumping and four of the shafts have bob pit remains.

PW5

The stonework is incomplete but the wheelpit was about 7-8m in length by approximately 2m wide, sunk into the ground. Adjacent to the south-east corner is a ruined rectangular, stone structure which would have housed the counterweight for the pump rods. This wheel is likely to have provided motion for pumps in Old Engine Shaft (72) which stands adjacent, but perhaps also Dix's Shaft (69) via a straight flatrod; a bob pit survives on the north side of the shaft. Water was provided to turn the wheel via a short leat from the head of the West Webburn onto a substantial stone-built embankment, which terminates near the wheelpit.

PW6

The wheelpit is sited lower down the West Webburn valley within Challacombe (surveyed as part of the Challacombe survey in 1990), some 720m from the shafts for which it provided power. The reason for this distance was probably the lack of a reliable water supply at the head of the valley, suggesting that the other wheel (PW5) was inefficient for the same reason. The flat rods ran in a perfectly straight line to the site of an angle bob, just south of the shafts. Straight V profile gullies mark the course of the flatrod where it has been cut through natural obstacles. The angle bob evidence consists of a shallow pit with an approximately rectangular stone lining.

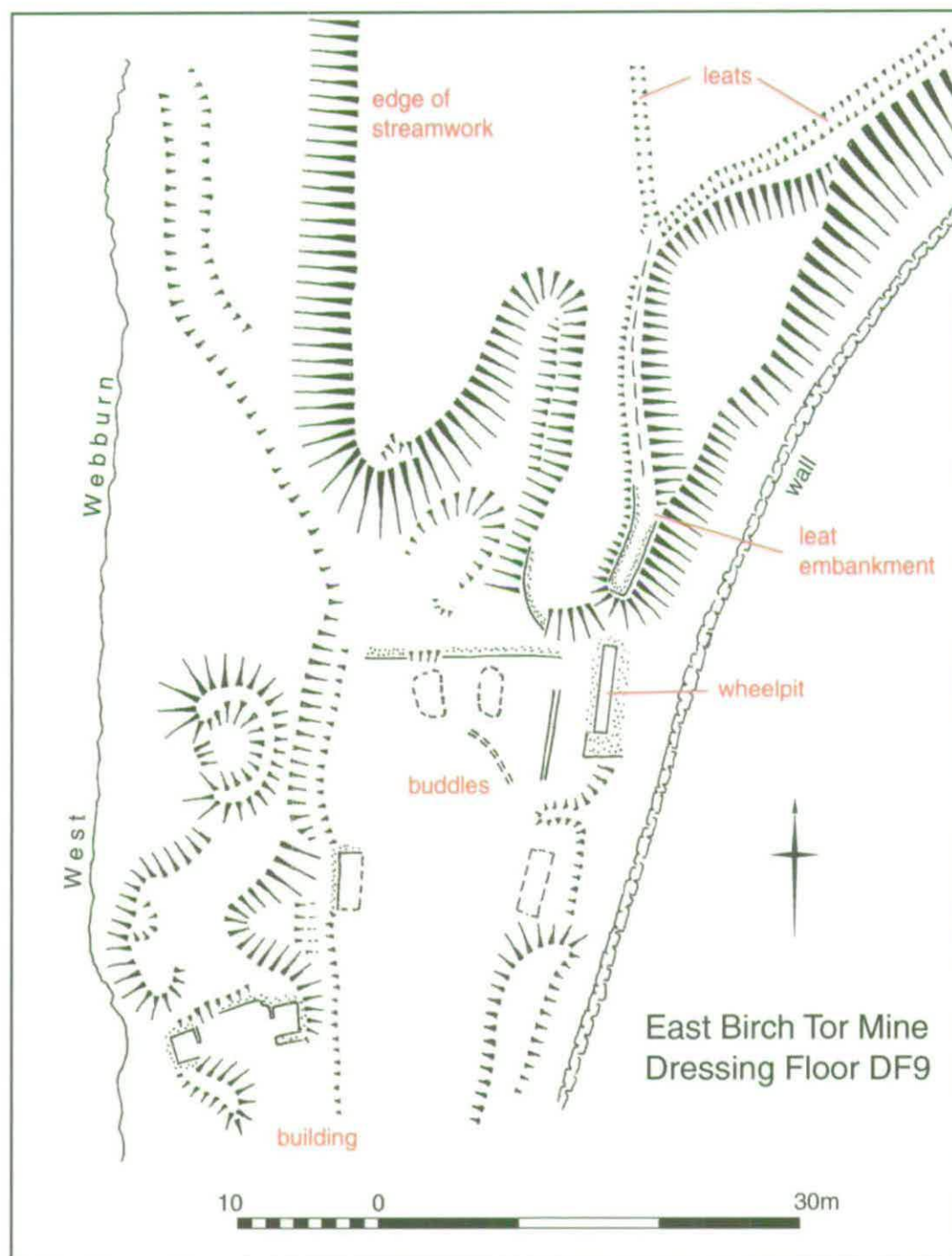


Fig. 4:14. The main dressing floor at East Birch Tor Mine (DF9). 1:500 GPS survey (with sketched additions).

Broughton depicts the pump rods splitting into two at the angle bob, then extending to West Engine Shaft and Penrose's Shaft though there is no evidence of bob pits or any such installation on either of these shafts. There is however a very fine bob pit on Etheridge's Shaft, which aligns perfectly with the main flatrod and there can be little doubt that this was the source of power. The bob pit measures 3.2m by 2.5m and is certainly one of the best preserved examples of its type on Dartmoor.

Other features

Several buildings near the Headland Warren house, now used as outbuildings, are likely to be associated with the mine. This includes a now ruined rectangular stone building at the south of the yard (k) and a narrow building (l), currently used to house pigs. To the west of the latter building is

a level terrace with a low retaining wall. A building (m) standing just to the north is crudely constructed in stone and has a granite door lintel. Its appearance is redolent of surviving 16th- and 17th-century tin mills found elsewhere on Dartmoor, though no diagnostic artefacts have been found here. A ruined wheelpit lies just to the north-west in a hollow. Both the building and the wheelpit are illustrated on the Penrose survey of 1852 (Broughton, 1968) but it is not clear if the wheel was driving pumps, perhaps in Dix's Shaft, or stamps. The latter would suggest that the terrace may be a dressing floor but no buddles have been identified.

Dressing floors

Two stamping mills with dressing floors survive associated with East Birch Tor Mine. One lies well down the West Webburn valley near Challacombe and was recorded as part of the RCHME Challacombe survey in 1991 (not illus.). A second (DF9, Fig. 4:14) is sited 450m down the valley from the Headland Warren house and was depicted on the Penrose map of 1852, published by Broughton (1968), though is not marked on the OS 25-inch of 1904. A short but well-defined leat from the West Webburn, merges with another from Grims Lake to divert water onto a substantial stone launder which stands above the wheelpit, taking advantage of the change in height at the edge of an old streamwork. The layout of the site is typical 19th-century design comprising a level terrace with a stone revetted retaining wall to the rear and a wheelpit to power the stamps sited at one end. On the level area are the silted hollows of two rectangular buddles and 10m to the south two additional rectangular, reed-filled pits represent further components of the refining process. To the south of the site are two, small rectangular structures built into the base of a mound, connected by a low retaining wall. Their size and appearance is similar to the 'reck houses' recorded at Eylesbarrow Mine (Newman 2000), where apparatus for recovering tin from dressing waste was installed.

Leats

For the upper section of East Birch Tor Mine only water from the upper reaches of West Webburn was available, making the reliability of these waterwheels questionable. Water was taken out of the stream just below the warren house and diverted onto the small waterwheel there, then flowed back into the stream for approximately 80m to be diverted again onto the launder of PW5. After passing through the tailrace of PW5 the stream was then directed via another leat onto the wheel of the stamping mill DF9. There is no certainty that all the waterwheels were working at the same date, though they are all depicted on Broughton's version of the Penrose map.

CONCLUSION

The combined data from these three survey programmes has provided the first detailed plan of the the entire Birch Tor and Vitfier tin mining complex. Despite the limitations of scale it has been possible to unpick the evidence to provide a basic understanding of the types of mining-related remains and their place within the chronology.

It is clear that the great majority of field evidence dates from the earlier periods of tin extraction when both streaming of alluvial deposits and digging openworks to attack the shallower lodes were the major techniques employed, though it has not been possible to establish if there is any distinct chronological definition between openworks and streamworks. However, as with elsewhere on Dartmoor, it has to be assumed that the more easily won stream deposits would be worked before work commenced on the altogether more labour intensive working of lodes. The origins of streaming in these valleys could potentially lie well back in the medieval period, possibly the 12th or 13th

century. The openworks are likely to be a little later, probably between 1450 and 1750 and the many prospecting and lodeback pits would be of that period also.

One achievement of the survey has been to unravel the detail of the leats and water channels, differentiating between the earlier examples which supplied the openworks, and the 18th- 20th-century leats powering the many waterwheels. Forty-four tinnerns' reservoirs have been recorded and many kilometres of extant leats, sometimes diverting only very meagre stream sources and some rainwater run-off to the openworks and streamworks.

The discovery of a medieval settlement and field system set amidst the tinworks has provided useful information on how the transition from agricultural to industrial landscape may have occurred, though without datable features or documentation we can only speculate about how this may have developed. The further re-use of the area as a warren from the mid 18th to the 20th century is also illustrative of transition though the warreners and miners appear to have worked side by side for the entire life of the warren.

18th to 20th-century tin mining has left its mark to a far lesser extent than the earlier works. The survey has been able to pinpoint with accuracy the positions of many shafts and adits from this period, though it is likely that others remain to be rediscovered. An attempt to record some of the 'deads' or spoil heap from this period, although not comprehensive, has revealed that although there are some large heaps, on the whole it is not extensive. Evidence for the processing or 'dressing' of tin ore is well represented in the area with a total of 10 dressing floors with associated stamping mills, buddles and tailing ponds. This set of remains represents a good chronological spread from the typical stamping mills of the earlier 19th century (DF7, 8 and 9), with modest wheelpits and rectangular buddles, followed by the late 19th-century examples at DF2, 4 and 5, with larger wheelpits, circular buddles and other processes contained within galvanized sheds. Finally, the 1920s processes which were contained in and around the Golden Dagger engine house where circular buddles, trommells and a magnetic separator were used.

A search for new documentation for the mines has not been possible as part of the present survey, neither has it been possible to re-evaluate the known documentary record, published and unpublished, in the light of the survey. Hopefully, now that a more comprehensive basic scale plan of the area is available, future attention can focus on the documentary aspects of the mining landscape here, fleshing out the work begun by Broughton (1968) and Greeves (1986). Also, however, large scale survey of some of the more intriguing areas of the mine would greatly increase our knowledge of the activities and chronological detail here. Clearly a vast untapped source of information on the mines lies hidden beneath the ground. Properly conducted investigation of this resource, where known to be accessible, would also be well worth pursuing.

THE SURVEY

The majority of the Headland Warren 1:2500 scale survey was carried out using a Lieca single frequency GPS system. Areas affected by tree cover were surveyed using a Total Station Theodolite. Coded data from both sources was downloaded into a computer and processed within an OS national grid framework, established using OS trig pillars. The plans were then plotted and annotated in the field.

ACKNOWLEDGEMENTS

We are very grateful to Miss Wyn, leaseholder at Headland Warren for allowing access and for her cooperation and interest and to Forest Enterprise for allowing access through their land. Mrs Min Cullom of Challacombe kindly provided a secure location for the GPS base station. Dartmoor National Park Authority part-funded the survey.



Plate 4:1 General view of the Birch Tor and Vitifer openworks at the head of the Redwater valley. Looking north.

Plate 4:2. View of the interior of the Hambley's Lode openwork showing rock-cut faces.



Plate 4:3. View of the interior of Chaw Gully openwork.



Plate 4:4. Birch Tor and Vitifer mine, view looking south to Challacombe. Enclosures associated with domestic buildings in foreground. Also showing Garden Lode openwork and Chaw Gully in distance.

Plate 4:5. Birch Tor and Vitifer mine. The carpenter's shop.



Plate 4:6. Birch Tor and Vitifer mine. The miners' Dry. Foundations of barracks in foreground.



Plate 4:7. Birch Tor and Vitifer mine. The turbine house and wheelpit PW3.

Plate 4:8. Birch Tor and Vitifer mine. The ruined mine office.



Plate 4:9. Golden Dagger mine. Dinah's House from the west.



Plate 4:10. Boundstone marking limits of East Birch Tor Mine sett.



Plate 4:11. East Birch Tor mine. Stamping mill wheelpit at dressing floor DF9.

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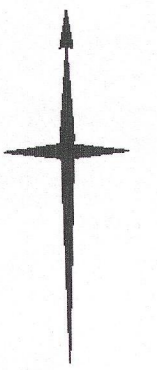
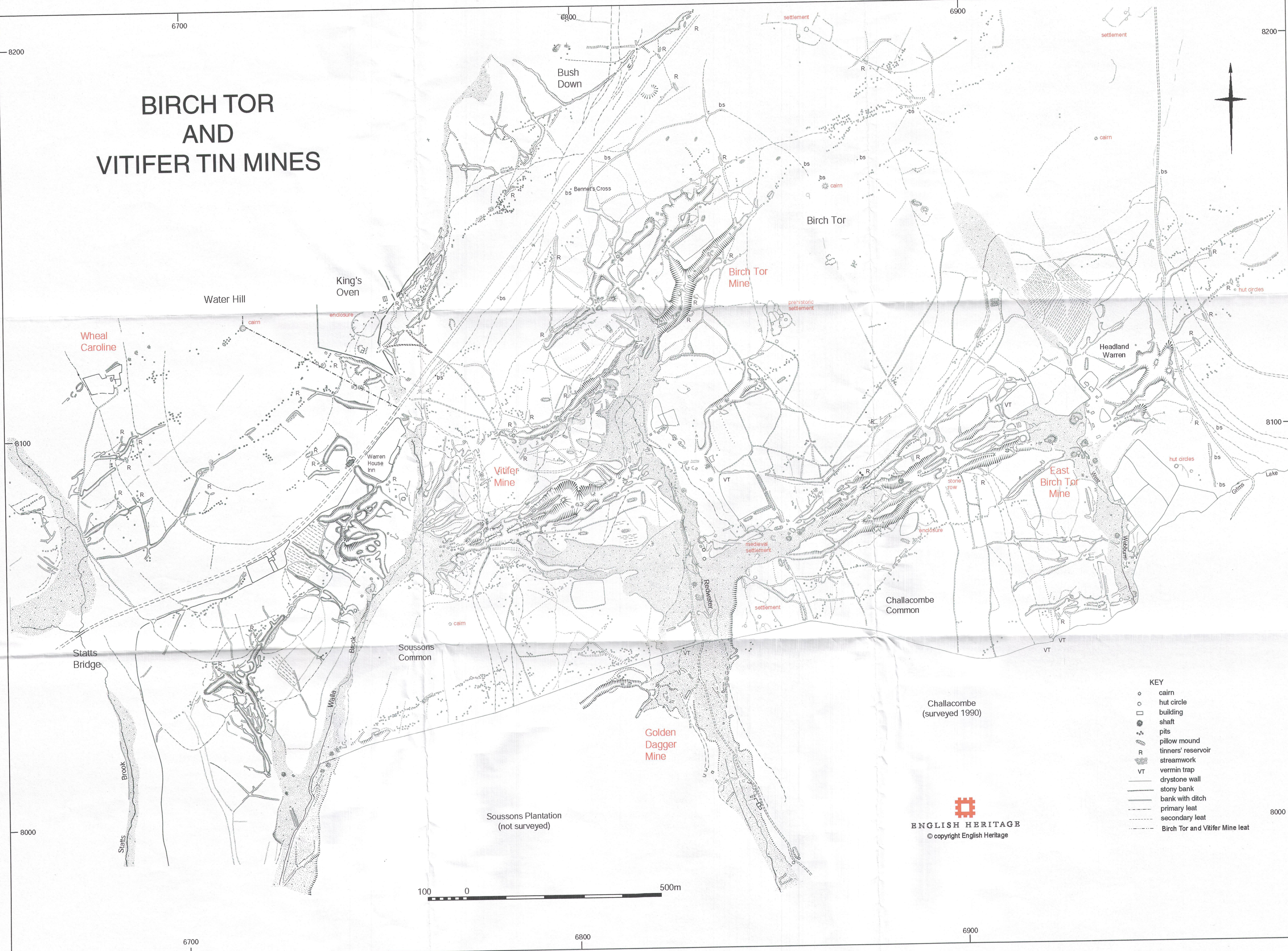
APPENDIX
Gazetteer of NMR/SMR numbers

Hob UID	NMR No	SMR No (if known)	Description	Period
445636	SX78SW10	SX78SW22	Kerb cairn	BA
443796	SX68SE15	SX68SE33	Robbed hut circles	BA
443799	SX68SE16	SX68SE90	Cairn	BA
443800	SX68SE17	SX68SE52	Granite cross	M
443815	SX68SE27	SX68SE85	Hut circles and enclosure	BA
443816	SX68SE28	SX68SE36	Stone row	BA
443818	SX68SE31	SX68SE10	Hut circles and field system	BA
443821	SX68SE32	SX68SE16	Mound of stones	BA
443830	SX68SE35	SX68SE40	Enclosure and hut circles	Uncertain
621684	SX68SE36	SX68SE47	Tor cairn	Uncertain
443890	SX68SE86	SX68SE139	Cairn	BA
443903	SX68SE96	SX68SE73	Enclosure and hut	Uncertain
917771	SX68SE150		Pump rod or flat rod gully	PM
918024	SX68SE165		Tinners' leat	PM
918027	SX68SE166		Tinners' leat	PM
918032	SX68SE168	SX68SE8	Vermin traps	PM
920073	SX68SE213		Streamworking	PM
1327518	SX68SE295	SX68SE295	Cairn	BA
1327521	SX68SE296	SX68SE296	Cairn	BA
1327523	SX68SE297	SX68SE297	Cairn	BA
1327527	SX68SE298		Hut circles	BA
1329219	SX68SE299		Hut circles	BA
1330917	SX68SE300		Birch Tor & Vitifer Mine	PM
1330988	SX68SE301		Tin Mines	PM
1330991	SX68SE302		Surface features associated with underground work	PM
1332107	SX68SE303		Tin openworks	PM
1332389	SX68SE304		Tin openwork	PM
1332391	SX68SE305		Tin openwork	PM
1332395	SX68SE306		Tin openworks	PM
1332951	SX68SE307		Tin openworks	PM
1337125	SX68SE308		Settlement with hut circles	P
1337166	SX68SE309		Rectangular stone built structure	PM
1337183	SX68SE310		Tin extraction and prospecting pits	PM
1338394	SX68SE311		Ruined bungalow	M
1338401	SX68SE312		Deserted settlement	M
1338412	SX68SE313		Wheelpit	M
1338505	SX68SE314		Bungalow	M
1338508	SX68SE315		Bungalow	M
1339493	SX68SE316		Stone wheelpit	PM
1339505	SX68SE317		Ruined rectangular building	PM
1339509	SX68SE318		Ruined building	PM
1339514	SX68SE319		Wheelpit	PM
1339524	SX68SE320		Wheelpit	PM
1339529	SX68SE321		Ruined building or tinner's hut	PM
1339533	SX68SE322		Cairn	BA
1339535	SX68SE323		Wheelpit	PM
1339538	SX68SE324		Leat	PM
1339545	SX68SE325		Possible tin dressing floor	PM
1339548	SX68SE326		Ruined tin dressing floor and stamping mill	PM

Hob UID	NMR No	SMR No	Description	Period
1339558	SX68SE327		Tin streamworks	PM
1339565	SX68SE328		Field system	M
1339586	SX68SE329		Ruined building	PM
1339596	SX68SE330		Rectangular building	PM
1339608	SX68SE331		Ruined building	PM
1344286	SX68SE333		Robbed and disturbed cairn	BA
1344295	SX68SE334		Ruined buildings	PM
1344303	SX68SE335		Vermin trap	PM
1344307	SX68SE336		Vermin trap	PM
1344315	SX68SE337		Medieval fields	M
1344323	SX68SE338		Medieval fields	M
1344328	SX68SE339		Rabbit warren	PM
1344344	SX68SE340		Sub-rectangular enclosure	PM
1344363	SX68SE341		Sub-rectangular enclosure	PM
1344741	SX68SE342		Granite boundary stone	PM
1344753	SX68SE343		Opencast tin workings	PM
1344759	SX68SE344		Tin openwork	PM
1344765	SX68SE345		Enclosure	PM
1344768	SX68SE346		Tin prospecting and extractive pits	PM
1344809	SX68SE347		Tin openwork	PM
1344814	SX68SE348		Tin pits	PM
1344844	SX68SE349		Tin openworks	PM
1344849	SX68SE350		Tin openwork	PM
1344856	SX68SE351		Tin openworks	PM
1344861	SX68SE352		Fields	M
1344877	SX68SE353		Tin streamworks	PM
1344886	SX68SE354		Fields	M
1344897	SX68SE355		Tinner's leat	PM
1344904	SX68SE356		Tin mine	PM
1344936	SX68SE357		Wheelpit	PM
1344959	SX68SE358		Tin stamping mill and dressing floor	PM
1344969	SX68SE359		Isolated enclosure	PM
1344983	SX68SE360		Pillow mounds	PM
1344999	SX68SE361		Ruined building	PM
1345013	SX68SE362		Shallow tinworks	PM
1345180	SX68SE363		Tinworking	PM
1345189	SX68SE364		Tin pits	PM
1345193	SX68SE365		Rectangular enclosure	PM
1345199	SX68SE366		Sub-rectangular enclosure	PM
1345205	SX68SE367		Polygonal enclosure	PM
1345223	SX68SE369		Five parallel tinner's leats	PM
1345258	SX68SE370		Building	PM
1345266	SX68SE371		Hut circles	BA
1345273	SX68SE372		Disused trackway	PM
1345276	SX68SE373		Two sections of reave	BA
1345283	SX68SE374		Tin pits	PM
1345313	SX68SE377		Tin openworks	PM
1345324	SX68SE378		System of leats	PM
1345326	SX68SE379		Leats	PM
1345332	SX68SE380		Leat	PM
1345341	SX68SE381		Leat	PM
1345848	SX68SE382		Hut circles and rectilinear field system	BA
1346473	SX68SE383		Hut circles and sub-ovoid enclosure	BA
1346477	SX68SE384		Hut circles and sub-rectangular enclosure	BA

1361930	SX68SE386		Enclosure	BA
1361932	SX68SE387		Ruined building	PM
1361945	SX68SE388		Ruined building	PM
1361949	SX68SE389	SX68SE288	Kings Oven Mine	PM
1362078	SX68SE391	SX68SE235	Tin openwork	PM
1362080	SX68SE392		Tin pits	PM
1362082	SX68SE393		Tin openwork	PM
1362086	SX68SE394	SX68SE62	Bush Down Mine	PL
1362156	SX68SE395		Ruined building	PM
1362161	SX68SE396		Leats	PM
1362163	SX68SE397		Stamping mill	PM
1362166	SX68SE398	SX68SE64	Golden Dagger Mine	PM
1362168	SX68SE399	SX68SE297	Ruined building	PM
1362170	SX68SE400		Ruined building	PM
1362172	SX68SE401		Stamping mill	PM
1362177	SX68SE402	SX68SE296	Stamping mill	PM
1362182	SX68SE403	SX68SE295	Miners' dry	PM

BIRCH TOR AND VITIFER TIN MINES



- KEY**
- ◊ cairn
 - hut circle
 - building
 - ⊙ shaft
 - ⊙ pits
 - ⊙ pillow mound
 - ⊙ tinners' reservoir
 - ⊙ streamwork
 - ⊙ vermin trap
 - drystone wall
 - stony bank
 - bank with ditch
 - primary leat
 - secondary leat
 - Birch Tor and Vitifer Mine leat

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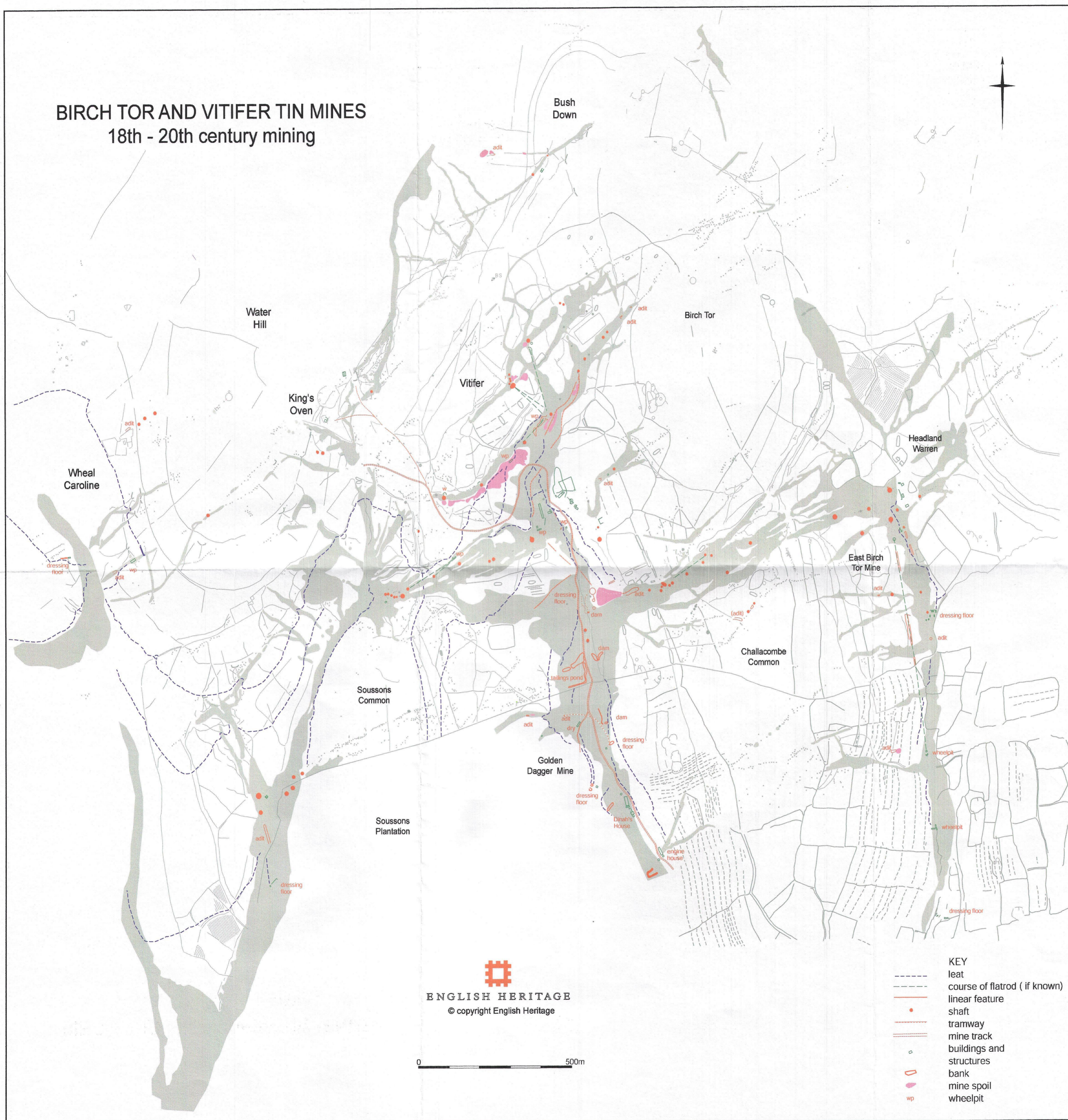


Challacombe (surveyed 1990)

Soussons Plantation (not surveyed)

BIRCH TOR AND VITIFER TIN MINES

18th - 20th century mining




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0 500m

- KEY**
- leat
 - - - course of flatrod (if known)
 - linear feature
 - shaft
 - tramway
 - ≡≡≡ mine track
 - buildings and structures
 - ▭ bank
 - mine spoil
 - wp wheelpit

Fig. 4:15. Summary plan highlighting surface evidence of 19th and 20th-century mining.

Medieval and Post-medieval Tin Working

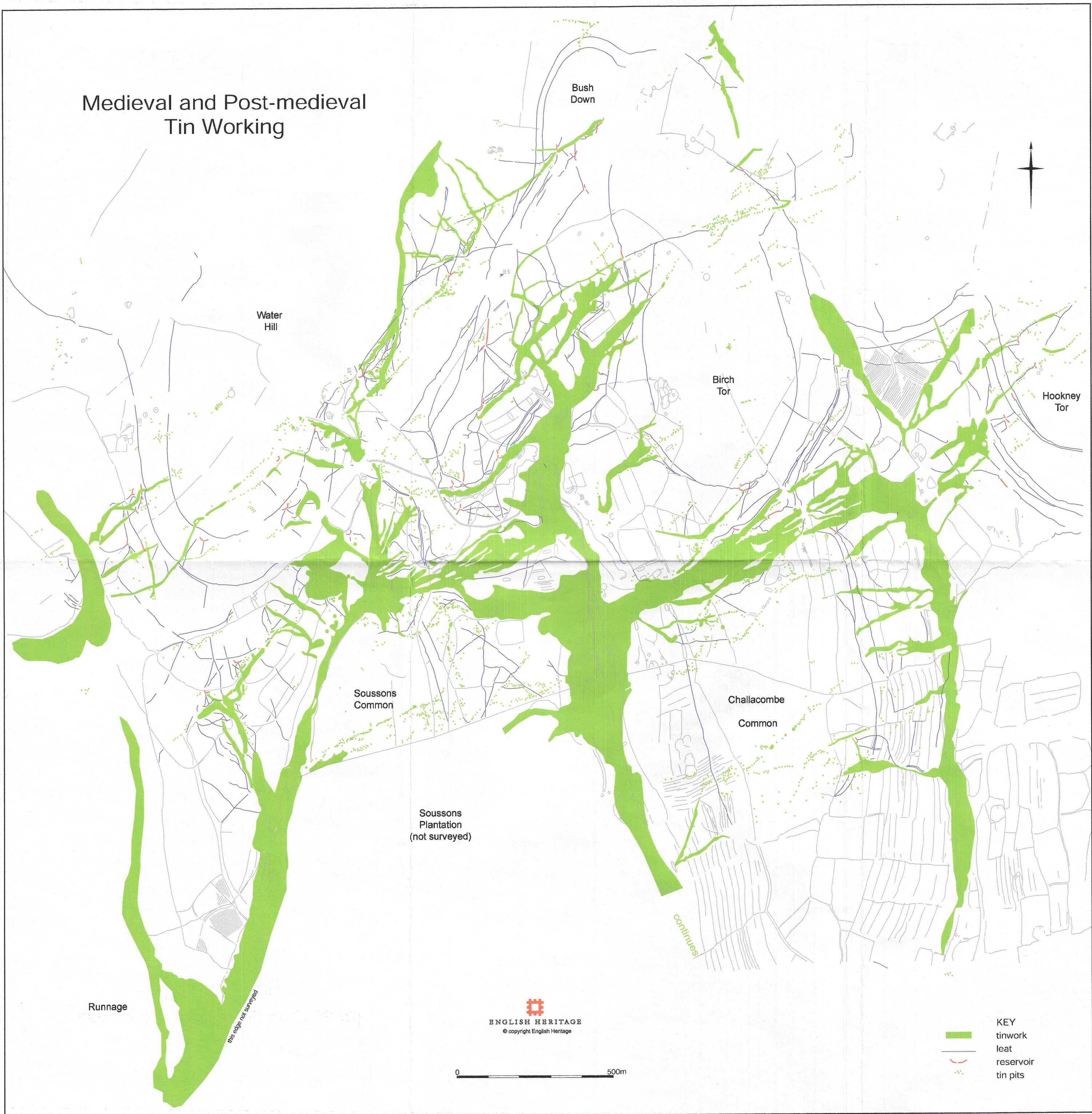


Fig. 4.2. Plan highlighting medieval and post-medieval tinworking remains in the Statts Brook, Walla Brook, Redwater and West Webburn valleys. Based on data from the RCHME Challacombe survey (1990), Statts Brook survey (1992), EH Birch Tor, Headland Warren and Golden Dagger survey (2000-2).



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