

Chapter 12

The Combe Down complex – chronology, development and case studies

Geography of the workings

The geographical and chronological relationships of the various parts of the underground quarries were revealed during the archaeological investigation in the Stabilisation Scheme and from documentary research, especially by quarry leases. The overall time relationships are summarised on the plan inside the rear cover; the various quarries determined by the archaeological survey in conjunction with any documentary evidence available, are displayed in colour-coded form based on the phase in which they were worked. The CD accompanying this volume contains a tabular listing of the features found in each quarry and quarry area on which the chronology was largely based.

Neither features nor stratigraphical relationships were available or sufficient in many cases on their own for dating, but could be used in association with information derived from documentary sources. Stratigraphic relationships in the sense used on a conventional archaeological site were not always available for study, as no actual archaeological excavation was normally allowed. However, micro-detail, of methods of disposing of spoil for example, was often revealed by the activities of the Stabilisation Scheme teams and their mechanical excavators. The most useful stratigraphic relationships were found at the spoil dumps and the spoil barrow-ways as, obviously, dumping of spoil from one quarry area in another, or within a single quarry, illuminates the activities of different dates.

This chapter therefore takes the historical and archaeological observations chronicled in the previous chapters and discusses the overall story that the marriage of these techniques presents. The development of the quarries is discussed by chronological phase and one, or usually two, case studies is presented for each phase. The location of these case studies is shown on Figure 12.1.

Determining chronological relationships

With no important known exceptions, the underground quarries began operations either from the southern margins, at Shepherds Walk and its Beechwood Road extension, or from within the outcrop, for instance north of Summer Lane or near The Brow (which partially may be fault scarps repeating the sequence). Alternatively, under-

ground operations were begun a little further north over the outcrop, from surface declines, in what were probably existing surface quarries such as Sheeps Pasture Quarry (below), dug out to a depth where the freestone beds could be accessed. These locations sometimes provide approximate starting dates with a good degree of confidence, notably from where Allen's cartways were driven around 1730.

The progress of quarry developments can to some extent be assessed from extant leases that, with care, provide us with fixed positions in time. In this we are particularly fortunate in that leases can be used for *c* 1800 right across the site from West to East Byfield and part of Far East Firs, allowing us once again to have a check on the progress of working with a fairly high level of confidence. It is possible also to date the end of working of some of these leases with some precision, because later workings often had rather conspicuous changes in their quarrying methods as new systems were introduced.

In Far East Firs, east of the Long Drung, the starting of works is fairly clear, but the late 18th- and 19th-century quarrying in particular is much more difficult to date because of the more diverse and smaller scale of specific workings found there compared to elsewhere. Relationships with the sale of plots and building above do, however, provide some assessable information and it is likely future local historians will be able to develop this further than time allowed us. Small later-phase workings fortunately tended to attract graffiti, which are potentially revealing about owners and workmen in locations not easily accessible except during the working phase.

For further refinement of a quarry's chronology, it is necessary to rely on technological changes reflected in the archaeology of the individual areas. The conclusions at this level of chronological analysis are less precise in terms of exact dates that can be put on the specific changes, though these conclusions can be tested by comparison with similar activities seen in different areas of the complex. In some cases working hypotheses about technology relating to chronology were tested as opportunity arose to approach other previously unseen areas. To a limited degree external data such as the demand for stone can roughly be related to the volume extracted at the supposed same phase.

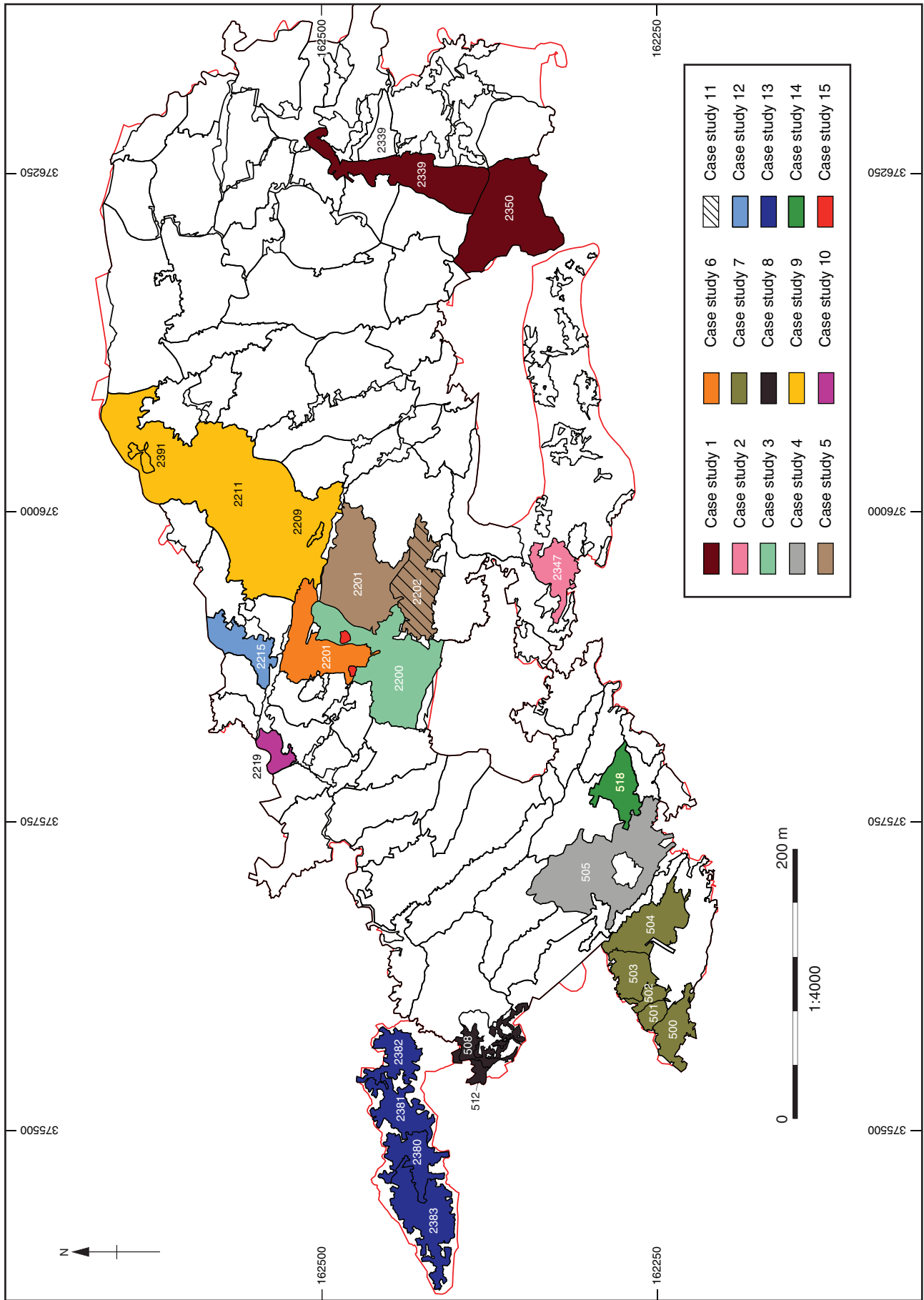


Fig. 12.1 Map of the Quarry Areas involved in the case studies

Although lacking the same level of precision possible with documentary sources, the repetition of associations of features in different areas supports the conclusions we have drawn below.

In addition, in a number of cases we can be reasonably confident about graffiti and artefacts used for dating purposes, even though these are not usually in a clear physical stratigraphical relationship in the normal archaeological sense. A clay tobacco pipe, or a date inscribed in an inaccessible position at the top of a high pillar can reasonably be assumed to have been placed contemporaneously with the original working. Similarly dates on graffiti with a contemporary flavour to drawings can cautiously be used to demonstrate they are contemporary with, or later than, the working date of the area where they are found.

Surface quarries were relatively few in the 18th century, though some map evidence survives, but in the 19th century it is often possible to use maps in conjunction with leases to not only date the starting of a quarry (within a few years), but its progress over time and even, sometimes, the type of technology in use.

The variation of technological change

Since the basis for a major part of our chronology is the technology of the features we have observed, it is important to be aware of its limitations. A key factor is the geology. The type of ground, for instance, would have been a major determinant of pillar shape – for instance the ellipsoidal plan and the hade (angle of inclination from the vertical of a fault) in the sailed pillars in north Central Firs were found where a zone of dislocation, probably a fault, ran through. Local variation in joint spacing and orientation was likely to have been reflected in roof spans and the pillar form and in blocks of unworked stone. The workman often had to tailor methods of working to the character of the rock rather than to what he had done nearby. The reverse could also apply; the apophygate shape of pillars seen at the southern boundary was at first taken by the engineers and others to be solely the result of frost shatter, rather than as a result of a deliberate pillar design, which became obvious when pillars further underground were examined.

Another factor is inertia. Once the infrastructure for the development of a quarry was established, for instance a cartway of certain dimensions or a barrow-way route made through narrow or low openings, then the method originally used would tend to remain the same until the utility of the system had ceased. To this could be added the inertia of both the master, in a reluctance to expend further capital or depart from a system he understood, and of the workmen unwilling to change tools or discard the experience of a lifetime. This could carry an outdated system long past the date when alternative methods were introduced elsewhere. Equally an innovative master might

force new methods to be used for efficiency or marketing needs, introducing new men if necessary. Such technological leads and lags can be seen in the West Byfield quarries, for example, in which a single lease had sections sub-let with the result that at least three systems of working were used within a comparatively small area, virtually simultaneously. These factors can distort our retrospective view of the likely date of actual working, although this does not negate the usefulness of analysing long-term trends.

The third factor is re-working. An existing but worked-out quarry might, to a later quarryman's eye, have substantial reserves left on pillars which then become diminished by the sawing-off of faces or even their total removal. The change may be observable by archaeological observation, but in circumstances where this is not possible, the newer faces and spoil dumped over the floors can make totally or almost totally invisible any evidence of the earlier work. This was a particularly difficult problem in many mines and underground quarries and affects parts of Combe Down.

Phasing of the workings

Phasing of the underground quarries

At Combe Down, known starting dates, termination dates (by death of an owner for example) and lease dates make it convenient to divide the two centuries involved into early, middle, and late, give or take a few years.

Phase I: 1700 – c 1728

Pre-Allen workings mainly of the 17th and early 18th century. Still earlier workings are likely to have been obliterated, or at least, masked, by the later intensive working over most of the area under investigation. They are likely only to be revealed through associated datable artefacts.

Phase II: c 1728 – 1764

Allen-period workings from around 1728-30 when he entered into the 'Stone Business' to the end of 1764 when the estate leased his quarries to independent freemasons after his death. This phase can be divided into two sub-phases based on changes in pillar form and method of working, probably around 1750. The change may also be associated with the decision to work surface quarries.

Phase III: 1764 – c 1803

Allen Estate workings (1764 – c 1803) with quarries leased by the estate and still almost entirely under its control, until around 1803 when the estate was broken up.

Phase IV: c 1800–1833

New leases were made for all the remaining ground in the core area from West Byfield to the Long Drung and just beyond in the north corner. Quarries

beyond the Long Drung generally were sub-divided by sales of small plots primarily intended for housing. The end date refers to the last of the large underground quarries ceasing work, by which time most of the other c1803 leases had recently ceased operations also.

Phase V: c 1833–1867

The transition period to high, open quarrying areas with use of saws becoming common in primary extraction. Far East Firs had many small quarries, some only extracting a very few metres depth of rock.

Phase VI: 1867 – c 1938

The period is divisible into two sub-phases, the second commencing around the beginning of the 1914-18 War. Cranes and rail systems became normal with some mechanical power common in the second sub-phase. The second sub-phase only concerned the smaller sites and not the main Firs / Byfield quarries.

Phasing of the surface quarries

Surface quarries have been considered separately – their dating is mainly based on historical data except for Phases I and II which have direct relationships with underground quarries. It seems likely the first extensive surface quarrying began in the later part of Phase II under Allen himself, continuing in the Combe Down core area and beginning in the wider area in Allen Estate times. Surface quarrying began to dominate in Phase IV when a specific type of derrick-type crane eased handling and certainly dominated in Phase V onwards. In Phase VI steam power for cranes and lorries was introduced, though by then the output had become very limited.

Phase I: Pre-Allen quarrying

Demand for stone before 1715

It is clear that despite Combe Down/Greendown/Quarr Down's relatively isolated position from a significant market, there was quarrying long before the early 18th century and Ralph Allen's dramatic entry to the stone business. The Roman villa found just below Belmont had a substantial number of stone coffins found nearby and more were found at the east edge of the Foxhill Estate. But since Belmont is on the edge of the freestone outcrop and was probably also quarried later for the building of Belmont itself and the ground in front dumped over, it is unlikely any direct evidence of Roman period quarrying will be located there. There has been a suggestion that the villa stone came from Vinegar Down Quarry, which is below it. Since this quarry is geologically distinctive compared with the main Combe Down stone, this might be tested palaeontologically, but this was

outside the present project's scope. The Foxhill coffins were found nearer the north rim of the freestone outcrop where there has been much less quarrying in recent centuries so it is possible that any ancient quarry there may still be undisturbed. It is not known, of course, to what extent Roman coffins were transported and it is quite possible that other than the closest suitable sources might have been used.

In the case of medieval Bath and for buildings en route into the city, quarrying up to the early 18th century seems to have been concentrated mainly around the old Fosse Way entry to the city, from around and below Odd Down where transport was relatively easy. Lansdown has also been suggested as a source. There are substantial remains of quarrying below Odd Down but these and Lansdown are both outside the present study area.

Closer to Combe Down, buildings and walls on the Prior's Park and Bishop's Park which were the precursors to Prior Park would have required some stone, though it is likely that it was derived from the abundant reserves close by. Small extant quarries adjacent to Prior Park, near the later house site or in adjacent Claverton might be considered but again there has been much subsequent alteration and it is not easy to distinguish early from later small-scale surface quarrying methods.

The main parent parish of Combe Down was Monkton Combe. However this village was more likely to have derived its considerable quantities of stone from the edge of the freestone above the village, near where Shaft Road begins to steeply descend to the houses. There are small roadside surface quarries there but these, though noted in the initial assessment made of the wider area, were not investigated in detail. An easier gradient to Monkton Combe was from around the Kingham Quarry, under which Summer Lane slants across the hillside, but it is substantially further away. The main Combe Down quarried outcrop is even further away. Kingham would have been the logical source for stone needed at the Tuckingmill which lies directly down-slope of it, perhaps using a horse and sledge for transport. The fulling or tucking mill had been long disused by 1700 and it is not even certain that freestone was used as there was substantial rebuilding by William Smith about 1800.

An obvious example of possible early quarrying in this context is Horsecombe Vale where a quarry is mentioned around 1663 though this might better be associated with the ways into Bath or the Cross Keys Inn which are both just outside the present remit. However, on the 1742 Thorpe Map, there is shown a farm or similar building, Horsecombe House, just under the freestone rim. There is a small quarry nearby worked at surface along the cliff face, and underground. The underground workings were infilled during the Stabilisation Scheme, and were partially archaeologically surveyed but the surface quarry remains intact. Horsecombe Quarry may well have been the source for building the

early part of Horsecombe House and the very few other buildings in the area. Most of the observed quarry-face surfaces at Horsecombe Quarry, however, seem to date from the later 18th or early 19th century (Phases III or IV), probably reflecting use for other local houses. It is the nature of a quarry face that later work destroys most of the evidence for earlier work.

The pre-Allen quarries up to about 1730

It is possible that the quarrymasters at work before Allen took over already-developed surface and underground quarry sites. Before Allen, there are known to have been about a half-dozen quarrymasters – freemasons and established building masons – working on the Monkton Combe portion of the Greendown/Combe Down area. Presumably each had his own small quarry. As described in Chapter 5, one or two of the quarries may have been east of the Long Drung (that is, outside Allen’s later quarry-designated area), operated by Milo Smith briefly and Thomas Greenway possibly, with successors, for the remaining part of the century. Underground quarries of early date which may have been operated by one or both of them may still exist and, given the apparent longevity of the Greenway connection, the substantial quarry (2350) in Far East Firs may well be one of them, with its long cartway extending northwards from what is today The Brow, into Phase II and even later workings (see Case Study 1 below).

West of the Long Drung to Combe Road

West of the Long Drung, across to Combe Road, there are more possible early quarries – certainly enough to accommodate the documented quarrymasters, John Pitcher the Elder, and his son John Pitcher (to the first of whom Richard Jones was apprenticed), William Biggs and, possibly Joseph Biggs and John Pearce (or Pierce). A deed (LL. A91/18/5/16) of some seventy years later mentions John Allen as well, though this may be an error as in other early 19th-century documents he is not mentioned, though he is named in documents as a quarryman at a later date.

The most positive indications of this early quarrying are datable artefacts, but also include inscribed or graffiti dates. Most such positively identified works have a system of roof support involving apophygate pillars and, sometimes, apophygate arches. Where these are isolated from the Allen cartways and rather small there is a good probability of them being Phase 1. However, apophygate pillars were in use substantially after 1728-30 so, in many cases, it was not possible to identify the transition to the Phase II period of working. However, workings penetrating deep inside the hill are likely to belong to Phase II. Conversely, it is possible that at the Allen workings the cartways passed through earlier workings. This

seems possible, for example, with the very small arches and apophygate spacing at the eastern Central Byfield entry, though at Central Firs there is some indication in the maturity of the pillar design and spacing that he may have avoided older (nearby) entries and positioned his entries to go in beyond earlier workings.

In the area between the Long Drung and Combe Road the position is fairly clear. Allen seems to have taken over all the quarries there. East of the Long Drung, however, the evidence indicates that Allen did not quarry there, but quarrying continued, run by other quarrymasters.

In Lyncombe and Widcombe parish, west of Combe Road, Allen did not take ownership until 1744, so that pre-existing quarrying (Quarry 910) presumably continued in operation, though perhaps ceasing after his takeover. It is possible that the competition from Allen’s railway-based transport had the most severe effect on quarries here, sited slightly even further away from Bath. It may thus be that production here declined during the general expansion of the industry.

The situation close to the Long Drung in south East Firs is complicated by later surface quarrying behind Hopecote, which has obliterated remains of early working comparable to that a few metres to the east, while the Masons’ Crane House Quarry has done the same on the southern margin of Central and West Firs. However there is a possibility of extant Phase I (grading probably into Phase II) working at Quarry 2204 at the rear of the quarry behind the Old Rank of Allen’s workmens’ cottages. Under the end of The Avenue at the junction with Church Road, Quarry 2347, which is largely east of the The Avenue, has dated artefacts and an inscribed date of 1725, despite not using apophygate pillars, making it a certain Phase I quarry (see Case Study 2 below). Quarry 2341 nearby has apophygate pillars, may have been part of Quarry 2204, and probably was accessed from the north-western edge of Burgess Quarry. Quarry 2338 may have been similarly accessed but, though this is far from clear-cut, there are indications that it may have had an entry from the north side, possibly from the Sheeps House Quarry.

Sheeps House Quarry has early entries predominantly on its southern side, where, either surface declines were made through the Twinhoe Beds to the freestone beds below, or the quarrymen took advantage of a pre-existing quarry. Given that outcrop entries, very close by, would have needed less excavation, then pre-existing surface quarrying seems at least possible. The positions may also have been advantageous in giving access to less-weathered rock, and being further back from the outcrop it may also have avoided quarrying in the unstable cambered strata there, which later caused William Smith such grief at his Kingham Quarry (see Chapter 6).

It is possible that Quarry 2341 was entered from Burgess Quarry on the western side, and it is likely

that Quarry 2200 on the north side of Sheeps House Quarry began in Phase 1 also, though its relatively large size suggests a long and intensive working period which would probably have continued into Phase II.

With one exception, Quarry 505 – which may have continued into Phase II – the early quarries in the Byfield Mine area are associated with the southern Oolite outcrop. Those in Monkton Combe, Quarries 911 and 916, are both isolated from any of Allen's cartways and were subsequently approached from the north in Allen Estate (Phase III) times, suggesting that quarrying was given up there when Allen took control of the area and then reopened later. Parts of Quarry 505, which does have Allen cartways (entering at Ralph Allen Yard today) may have pre-Allen working, but if so, it is not at all apparent. There is evidence of working underground south of this area, in Byfield Place (in Lyncombe and Widcombe) which, though the underground quarries were destroyed here in recent decades as part of housing development, they may well have been early, as were those others adjacent to the west in Lyncombe and Widcombe. If so Allen may have leapfrogged them to get access to more secure and whole ground beyond them.

Lyncombe and Widcombe

In this section of Greendown or Quarr Down west of Combe Road, described to differentiate it as 'late Collibees', Allen did not obtain ownership until about 1744. The boundary is nowadays inscribed on a stone on the former malthouse building at the east side of Rockhall Lane but prior to about 1800 when some changes had to be made in agreements, the exact location (affecting our judgement of which entries belonged to which parish) does not seem to have been clearly determined. Underground the Combe Road Pillar probably marks the boundary as understood in the 18th century.

Two entries (additional to those made by Allen on the east of the Combe Road Pillar in Monkton Combe) penetrated westwards from Ralph Allen Yard (the former Jones Quarry), into Lyncombe and Widcombe. Both passed through apophygate pillars into Lyncombe and Widcombe. Quarry 505 was very small, but formed the access to later workings, Quarry 501. To its south was a substantial underground quarry (910) which was, by 1805, part of the apparent surface-quarrying area of Jonathan (and later Sophia) Rudman (see Chapter 4), which has every appearance of being pre-Allen, probably continuing to be worked contemporaneously until at least when Allen took ownership. If the workings destroyed at the time of building the western part of Byfield Place were also early, then there was a considerable area of pre-Allen quarrying in this area. This is not apparent in

documentary sources, but would help account for known quarrymen mentioned in documents not associated with Allen.

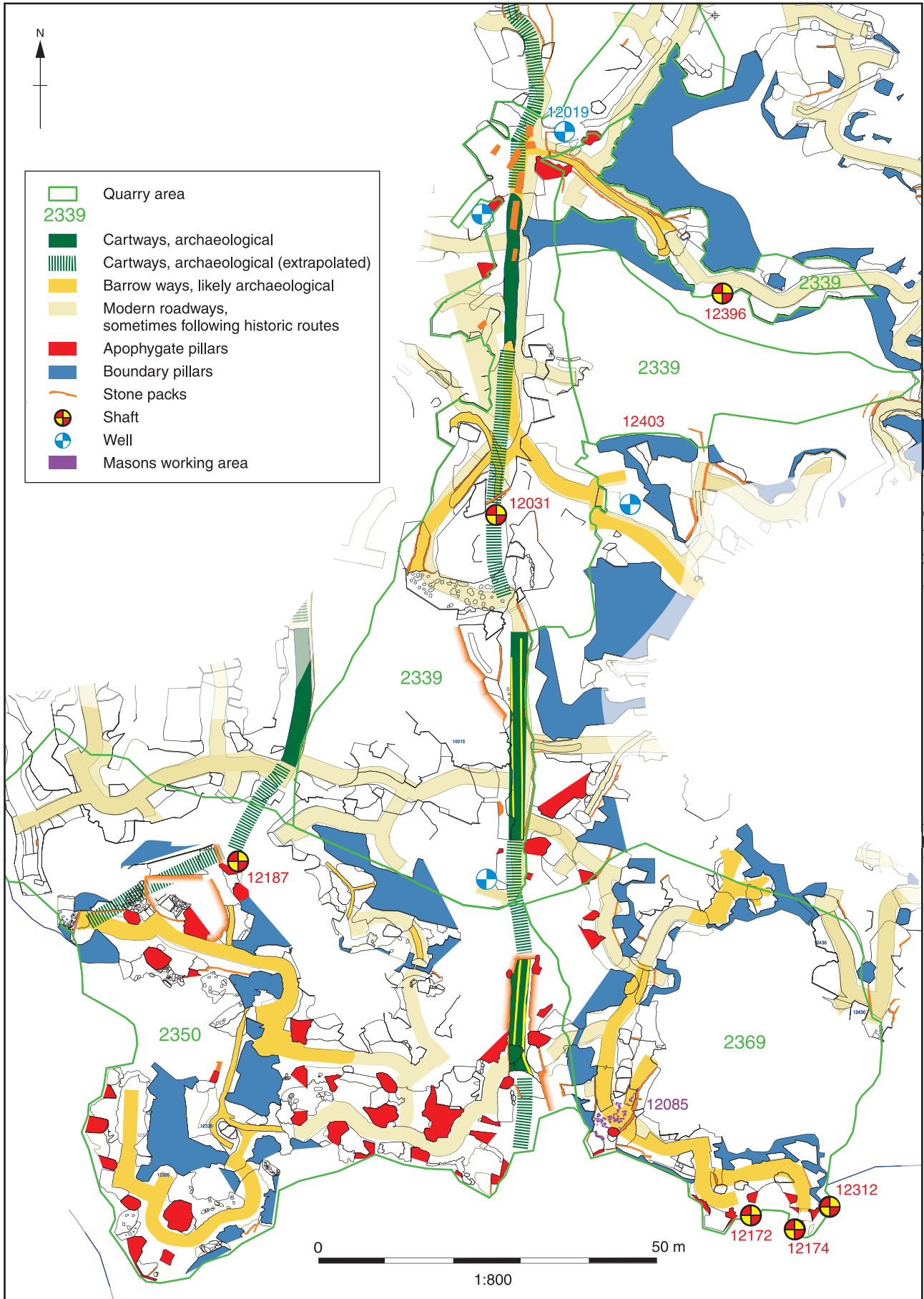
The phasing plan (inside the rear cover) shows that the west side of Byfield Place fills the gap between Quarry 910 in Lyncombe and Widcombe and Quarries 911 and 516 in Monkton Combe, suggesting an almost complete band of quarries probably originating in Phase I developed close to the southern outcrop within the Byfield Mine area. A further series of Phase I quarries (519, 914 and 2349) appear to be associated with Sheeps House Quarry. Quarries 2347 and 2351 may be associated with the southern outcrop, with Quarry 2351 located in the area east of the Long Drung near The Brow.

Case Study 1: Quarries 2339/2350 – east of the Long Drung. Phase I and II (Fig. 12.2)

This quarry was possibly associated with the Greenway family. However, since it has two, or possibly three cartways within the area shown on the map which are not clearly associated with each other, it may also have been the site of Milo Smith's fairly short-lived venture from circa 1729 when he bought Greendown Combe Down, to 1734 when he sold his quarrying and some other rights to Allen. It is bounded on the east by a long 'boundary pillar' which has been pierced to enter (and perhaps help ventilate) the adjacent quarry, and on the west by the land ownership boundary of the Long Drung which also is followed by a pillar underground for part of its course. To the south is the outcrop and, formerly, a cartway entrance. Northwards the cartway continues through a boundary pillar into workings of a later quarrying phase.

The longer cartway (Figs. 9.11 and 9.12) which dominated the transport system appears to have extended from near The Brow, where building of new houses in the grounds caused destruction of some underground workings some years ago. From there it extends north for nearly 200 m, to the later workings near East Tynning. The cartway varies from those driven by Allen further west in fairly subtle ways. Most significant is that in the observable short sections seen it appears to have been driven two beds lower in the sequence, with the roof under rather than in the picking beds. The worked freestone on both sides was full height, the picking bed having been removed, so the side passages (over spoil dumped in the worked-out side rooms) sloped down into the cartway. This probably gave it a better roof (Allen's cartways suffered badly from falls). It was somewhat wider than Allen's early cartways and was lined with rubble roof-supporting packs visible at the sides of most of the observed sections of the route, with recessed pillars seen only occasionally. A second cartway, whose entry was not traceable, runs some

Fig. 12.2 (facing page) Case Study 1: Phase I and II Quarries 2339 and 2350 – east of the Long Drung



25 m to the west to under Sydenham Place. This is a similar but not regular distance apart as compared with those in Allen's Firs entries (below). A probable third cartway lies close to the eastern boundary pillar, but could not be confirmed due to access limitations.

Many of the pillars in the quarry were apophygate, but often were less well formed than in Allen's quarries, the apophygation often almost vestigial and in some cases looking almost like a poorly defined corbelled pillar. Much of the area seen was a substantial way from the entrance, and this may thus be a similar transition in pillar morphology chronologically comparable to that seen in Allen's quarries. Such corbelled pillars probably mark the second sub-stage in Phase II workings which all suggests rapid adoption of new ideas, though which way these flowed is unknown. The corbelled pillar form involved stepping-out underhanging beds under the roof, probably leaving the upper picking bed (s) *in situ* and thus removing less poor-grade rock than the picking bed removal associated with the apophygate pillar.

Forming the corbel was done by use of jad slots, horizontal slots in the top of the freestone or in the picking bed, which had been cut using a one-inch (25 mm) hack (bladed form of pick) in a rather irregular way (regularity was a feature in most other areas). There were also chamfered jad slots and chamfered jads (v-shaped cuts with the lower surface horizontal) made, often back to a joint, to free the top of a bed below so that it could be barred out. Two examples were found of sawn faces of pillars (most faces are natural-joint defined) which appear to have been original rather than later pillar robbing.

Rooms between pillars were filled with spoil comprising rubble and fines, thus obscuring views in most of the quarry area. Two well-preserved barrow-ways were found, typically about a metre

wide, others having been buried under spoil. Both had been used to transport spoil to tipping-fronts at their southern ends, and had also been used as stone barrow-ways to bring out blocks or ashlar. The longest was 46 m, and was lined either side with roof-supporting rubble-stone packs.

Sawn material was found in the spoil in many places and it was clear that banker mason activity had taken place underground. This was confirmed by the discovery of a 'workshop' in the form of a substantial chamber at the southern margin of the areas seen. It had two apophygate arches, with supporting stone packs, probably close to a surface entry, with, in front of the arches, some forty individual sawn and scapped ashlar blocks adjacent to a working area (Fig. 12.3). In a side pack a small sawn stone had been marked '*Francis Oliver 1730*' together with a list of stone required or produced.

The graffiti and the apophygate pillars suggest this area was contemporaneous with Allen's workings or possibly pre-dated them. The workings appear to have continued through much of the century and the penetration of the cartway some 200 m is very similar to that reached by cartways in other areas of the quarries west of the Long Drung by the end of the 18th century. As well as the subtle differences to pillars which differentiate it from quarries further west, the production of substantial amounts of sawn ashlar underground (resulting in the observed waste and the assemblage of semi-finished stone) was something not generally seen in Allen's quarries. Documentary evidence asserts his quarries were used for blockstone, with banker mason work taking place at Allen's two known surface stoneyards. If Thomas Greenway was the mason involved in this quarry, it is perhaps more than a fanciable notion that it was the origin of stone for Beau Nash's house, built by Greenway in 1720.



Fig. 12.3 Apophygate arches and supporting packs with masons working area in the foreground

Case Study 2: Quarry 2347, under the south end of The Avenue. Phase I (Fig. 12.4)

This quarry was somewhat unexpectedly found to be of early date, and though it was subsequently classed as High Grade, thus requiring a high level of care and recording, unfortunately, this was after it had been significantly impacted as part of the E4 Stub, by the Stabilisation team. However, it did as a consequence receive more time to record detail than generally was the situation. The quarry was located at the south end of the Avenue, its southern margin more or less under the north pavement of Church Road. Initially it was anticipated that it was originally accessed from the south, from perhaps where Quarrybottom alongside Summer Lane is now. However, the only evidence of an access route came from a surviving 12 m-length of cartway on the north side, partially infilled at the southern end and fully infilled at the north. The spoil was derived from later workings to the north forming tipping fronts, and the rubble was stacked in packs either side, forming a barrow-way. This would indicate an original entry from the south east corner of Sheeps House Quarry (Rock Lane). It is one of several early underground quarries on the southern margin of this surface quarry which have forced a re-assessment of the latter's age, which thus appears to be definitely pre-Allen.

The quarry, in Hawkins Sector E, had been flagged by previous work (see Pollard 1994) as likely to be relatively early. He had reported a well associated with clay dumped in the workings which had clearly been drawn from it, with pottery sherds including early 18th-century ware. On further investigation (this volume) the date range unfortunately extended to later than the *c* 1750 date he indicated, but two further discoveries, of a clay pipe *c* 1720-1725, and an inscription of 1725 made pre-Allen working extremely likely.

The first notable feature observed as the supported roadway entered the area, was the well (see Figure 11.2). This is or was located in the back yards, more or less under the dividing wall of The Bank and Lansdown House, on the east side of The Avenue between the Carriage Inn buildings, and the eleven houses of the Old Rank or de Montalt Row. Originally the well probably served the Old Rank and the Carriage Inn and, perhaps, also a horse trough, since it was adjacent to Allen's railway in an area with scarce surface water resources.

Close to the well a substantial quantity of once rather fluid clay had flowed from where it had been dumped a metre or two away, over the surface of rubble spoil. This may have been when the pumps were installed a century or more ago, or possibly it was original, derived when the well was sunk (if so it implies the workings were already open when the well was sunk, which indeed seems likely anyway). Another deposit of clay had been investigated by Philip Wooster (amongst others) who explored the quarries in the 1980s. They had found broken

household waste items in the clay which seemed to have derived from a square hole near the well seemingly used for dumping by the Carriage Inn, though perhaps constructed to remove water from the front of the inn. The square hole was found infilled with a brownish clay with pottery sherds. The items found included numerous blue-grey fragments of some 80 Westerwald drinking mugs of quart, pint and half-pint sizes, two or more Westerwald jugs and dozens of Bath-made pipes. There were also mallet-type wine bottles and apothecary bottles and much early china including two nearly complete Staffordshire slip-glazed baking dishes. There were two silver teaspoons with insignia on the handles, dating between 1720 and 1750 (Paul de Ath, cited in Pollard 1994, 57-59). Pottery sherds examined as part of the present study from the latest deposit within the drain (see Chapter 11) suggest 1780 as a more suitable date for the cessation of dumping. Despite this obvious weakness in the evidence of the Wooster Collection its origin in an area away from Phase II development offers at least a hint of the possibility of Phase I working.

This was significantly strengthened by the recovery by Marek Lewcun (Chapter 11) of a clay pipe from a pack on the north side of the cartway, dated about 1720-25. Again this is not conclusive of pre-Allen working, but the present investigation also revealed a rubble stone pack built across the southern passage which had two carefully placed stones on either side at chest height, both bearing the neat inscription 'RJ' (the 'J' a crossed 'I'). Against the wall another stone in the same pack was inscribed (little more than neatly scratched) 'XXIX', which might indicate a date, and more positively, just beyond the pack to the north was the inscription, less neat, of 'JM 1725' (Fig. 12.5).

This is therefore a pre-Allen quarry in a condition only slightly affected by later entrants who were perhaps intent only on robbing pillars in two or three places. The intriguing possibility is that the initials *RJ* are those of Richard Jones himself, who was definitely literate, and an apprentice here from 1715 to 1722 or thereabouts. He was then bound to John Pitcher the Elder, mason of Bath and known to have been already at work at Combe Down years before Allen took over the quarrying area *c* 1730. Pitcher and others were first referred to in a deed of 1723 (see Chapter 5).

The cartway lies on the north side, running roughly N-S, nearly in line with the well and about 3 m wide and approximately 4 m high at the deepest position (Fig. 12.6). The floor is low with respect to the backfilled floors of the adjacent workings which gave access to it from working positions and which would have facilitated loading. The floor showed no cart ruts, but any of these would probably have been overlain by later barrowing and dumping.

South of the well there is a corner room where there was what appeared to have been a banker

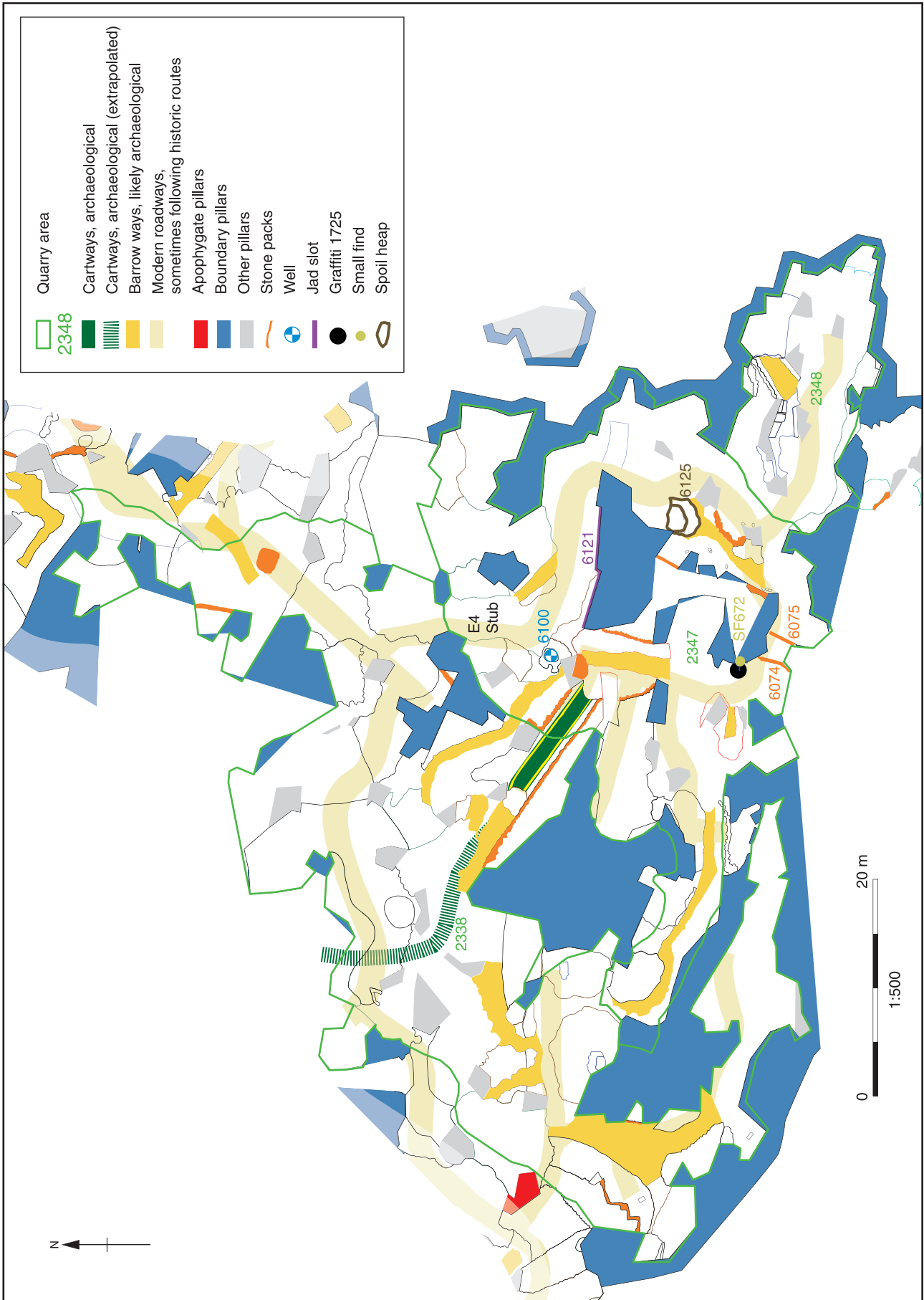


Fig. 12.4 Case Study 2: Phase I Quarry 2347, under the south end of The Avenue

masons' workplace (Fig. 12.7). The site had heaps of fine spoil derived from trimming blocks, which form small ridges running perpendicular from the wall. One or two working positions may suggest the masons had been seated next to the wall or along a plank parallel to the ridges. Several small pieces of stonework of good quality were found a few metres

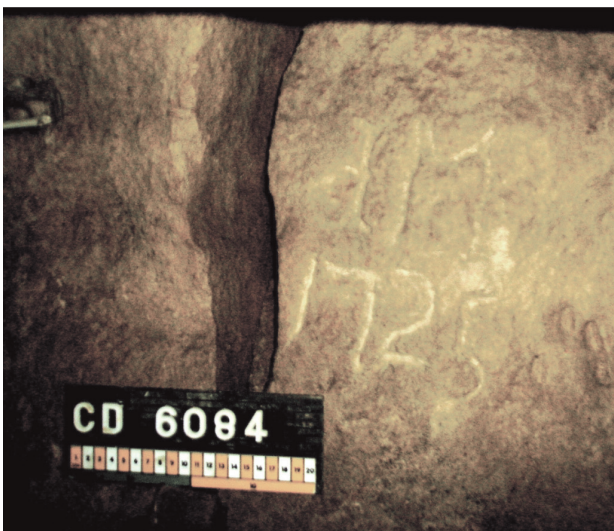
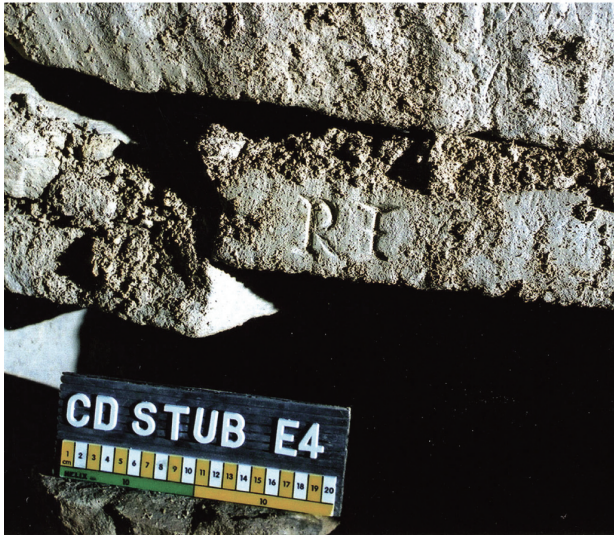


Fig. 12.5 Graffiti from the E4 stub, indicating early 18th-century workings

to the south in an area of later adjacent quarrying (2348), including a small classical pedestal (unfinished) and what may have been the early roughing out of a medallion. Several small tools were recovered including a comb (for surface finishing) and marking-out tools.

Near this was probably the northern extent of the quarry, which was indicated by the distribution of jad slots and the outermost of the corbelled pillars. The corbels here and elsewhere in the workings were substantial and long, a metre or so projecting under the roof each side along the length and above the pillars (Fig. 12.8). This is substantially longer than seen anywhere else in the Combe Down workings. They also did not seem to show signs of contemporary or post-working stress in the form of a crack in line with the pillar, so were a successful design for the local geological conditions, unlike very many in other places where they had failed. Most but not all pillars had them, with fewer at the east end.

The quarry has two or three parallel Long Rooms, each 3-4 m wide, linked by openings in the long pillars between (Fig. 12.9). The dominant feature, supporting the early date supposed, is that the pillars, including long pillars, are corbelled, using very regular and long jad slots about four inches (100 mm) high which seem to have penetrated to substantial depths. The length of the corbel, at its base, was not always back to a joint, indicating the jad was developed to a position it would break the rock, not the joint. It was possibly this which made them more successful. They were developed in either the second or third (downwards) of the usual three picking beds. A one inch (25 mm) hack had been used, perhaps in conjunction with a jadding bar (notably used to work the underside of the top of the slot to keep it parallel), for this purpose.

Long lengths of jads were found on the bounding walls of the quarry (Fig. 12.10). These were used to free the beds being worked below them. Two were up to 3 m long, though others were less. The jad was normally a much later feature in quarrying at Combe Down. Its use in this working was coupled by both a neatness in working, and in the condition of the workings and floors, which we associated with those areas in which banker masons, rather than just freemasons, worked underground. There were a few other such places. The implication is that the pace of work was slower and the care necessary higher, as a characteristic of the banker mason; perhaps only enough stone was taken at a time as was immediately required.

Parallel to the cartway were two longish rooms (not the type of Long Room described for Phase III working in Chapter 8), only some three metres wide and again with the well-formed jad slots. Eastwards around a corner the southernmost passage was formed on infilled spoil, leaving a height of just under two metres, continued to the rubble pack with the RJ initials, with beyond this a short length



Fig. 12.6 The partially infilled cartway suggesting an entry from the north-west side (in Sheeps House Quarry)



Fig. 12.7 Banker mason's workplace indicated by spoil heaps



Fig. 12.8 Long corbels on a pillar in the E4 Stub



Fig. 12.9 Long but narrow room in the E4 Stub

of passage and then a return north to the well. Since access was easy via the area near the well to the far side of the rubble pack, the pack may have been installed simply to guide the air, though the definite placing of the initials would suggest a boundary. Alternatively, perhaps being an apprentice, it reflects nothing more than pride in his work.

At the western end beyond the junction corner, was the adjacent Quarry Area 2348. The workings were again formed of two long and fairly narrow rooms. That on the south side had small rooms between partly formed pillars against the boundary wall with spoil placed on them with a barrow-way in front. Two carved stone capitals were found on the floor in this section (Fig. 12.11). The southern passage ended in a rubble decline with a 4m-high vertical slot formed in the 1.5 m-wide face. The rock here was closely jointed vertically and it is possible work was abandoned as the stone was too broken, though they may have been using the jointed central portion as an easy way to advance. The jad slots continued to the top of the rubble slope but were not used at the face.

Parallel to this, on the north side, ranging from the junction, was another narrow room, up to four metres high, but with an uneven floor, in which a small sawn face was found at a low level, and triangular wedge pits had been used fairly frequently to break rock from faces or doorways in what were incipient pillars. The wedge pits were individual, ie



Fig. 12.10 *Development of jads in the E4 Stub*

not used in pairs or threes, to break off a large face. At the junction, a vertically well-jointed pillar had wedge pits where the face had been formed by splitting. There were also several small faces that had been cut by vertically picked jads (more often a 19th-century technique). Two faces were noted which had been cut back by a four-inch (100 mm) hack, to allow space to extract the block below. However most faces were derived from natural joints and most extraction of blocks probably only needed a bar.



Fig. 12.11 *Capitals for columns. It seems likely these were produced to a pattern, not turned on a lathe (Quarry Area 2348)*

This quarry (2348) may have been part of Quarry Area 2347 to the north, but the difference in the extraction techniques and the number of disparities between the toolmarkings in both quarrying areas suggests that they were slightly later than 2347. Both areas and especially 2347 were of considerable importance in a number of ways. Its possible association with Pitcher and Jones has considerable human interest since it is very rare for this time to place people so closely in their workplace, and helps confirm the early date of the workings. The use of jad slots, wedge pits, and corbelled pillars at this early date is a salutary reminder not to take matters and methods for granted – these are simple techniques, at least to a skilled mason, and were probably long known and were also probably one of the most efficient ways of splitting and breaking bedded rocks. Almost the whole gamut of hand-quarrying methods were used. In a parallel way it was interesting to see the contrast in modern removal of stone by our own consultant mason (Gerry Melksham), and that of one of the best modern miners (who shall be un-named) using a pneumatic tool to cut out a slot. Neatness and speed and economy of effort were all to the great advantage of the mason.

Phase II: Workings mainly associated with Ralph Allen 1728-30 to 1764

Working in this phase by Allen took place east of the Combe Road boundary with Lyncombe and Widcombe at Rockhall Lane (Ralph Allen Yard

today), from north of Sheeps House Quarry and from the later surface quarries north of the Old Rank (later de Montalt) cottages and Hopecote Lodge (see plan inside rear cover). Other quarries were also active in this phase, east of the Long Drung in the works possibly attributable to Thomas Greenway and Milo Smith Case Study 1 above) and also probably south-west within the Lyncombe and Widcombe workings.

Lack of access prevents certainty, but the largest area of suspected Phase II workings (perhaps with some Phase I) appears to be in East Firs, north of the quarries behind the Old Rank and Hopecote Lodge. These were much affected by roof collapse. The second most important area was certainly in Central Byfield which (for its time) had a large quarry with very wide pillar spacing, though collapses were more modest in scale. Central Firs was somewhat smaller and, in terms of internal layout, apparently slightly more organised, which may suggest it was slightly later to be developed.

The most characteristic feature of Allen's quarrying was its organisation. Much of this has been dealt with in Chapter 5, and archaeologically the features extant at surface are still clear – in the village houses at the Old Rank and the Carriage Inn buildings, in the layout of the roads in the modern village and the former railway route down what is now Ralph Allen Drive past the masons' cottages near the river. There are also the quarries at surface, which will be considered below, and the inclined surface accesses these gave to the underground levels. This high level of organisation was continued underground, in the regular development of pairs of levels or cartways with workings advancing between them and at the immediate sides and less obviously in the provision for both spoil-dumping and stone barrow-ways. Shafts appear to have been sunk in conjunction with the use of levels, again in a regular pattern and the working areas are substantial and completely worked out. The same pattern of development can be seen in each of the probable four sets of entries, to the extent, as fieldwork and assessment progressed, that it was possible to forecast the main features in areas not yet seen.

What seems to have been the traditional working method seen in most of the earlier workings was maintained for between 15 and 25 years, in that apophygate pillar and room working remained the norm. Whether the lower sections of pillars were worked in the same way as previously is, however, unknown, since we have no examples of these because of spoil backfilling in all areas. Except along cartways and barrow-ways, generally there was little space left above the spoil and with the exception of a major underground quarry in Central Byfield, views of more than 10 m ahead were rare and limited.

Access to the areas between The Avenue and the Long Drung (East Firs) was limited, in a large part by the existence of high hazard areas identified by

Hawkins (1994) which were at their most common in this area. It was possible to access the cartways within them from further inside. In all there were four or five cartways fitting the Allen blueprint, three at the western end, two at the east. In addition there was a branch cartway from Allen's Sheeps House Quarry, which cut across at least the western-most of the East Firs cartways. It cut across the back of the collapsed zone and may, with use of shafts, have replaced the earlier cartways. Features including cranes on the first part of this cartway may suggest it was of Phase III construction and it will be considered under that section.

During the archaeological examination, the Stabilisation Scheme access to the southern area of East Firs provided a transit across the Phase II workings there, as represented by the pillar type, showing them to follow a similar sequence to elsewhere: across corbelled into apophygate and across corbelled again, with a further similar sequence to the east. Each set of cartways was associated with two wide shafts placed to the side of the levels. It was possible to view up the 5-6 m of largely unlined shafts to a very-flattened-arch or domed underside of a cap in semi-dressed stone blocks. They were very similar to each other and of architecturally high quality, which might be described as 'mason-like' in contrast to the more common lower quality of other arched caps seen in the workings. It is not clear if the two areas had direct connecting transport links or, in effect acted as separate quarries, as a number of boundary pillars in the areas of East Firs seem to suggest.

Phase II was sub-divided as the significance of the pillar systems became more apparent. It was a significant moment when it was realised there was sufficient information about the workings that a line could be drawn around the apophygate pillars in Central Byfield and that they were surrounded by the second sub-phase of corbelled pillars, with some pillars actually being apophygate on one side and corbelled on the other. Entabled pillars were found in both Central Byfield and East Firs at the junction of the two sub-phases and reflects the taking of all three picking beds for the apophygate working, but only one or two (if any) with the corbelled pillar area. The result was that there was a great reduction in spoil created and a great deal less work needed to open up the beds below for extraction.

The change was thus an important technological advance. The apophygate pillar method was clearly the established way, but if Richard Jones did leave his initials in the early quarry in Sector E, then he was clearly aware of an alternative, the use of jads and corbelled pillars. Apophygate and arched pillars were a common feature in other underground quarries too, such as at Beer in Dorset and in Browns Folly at Monkton Farleigh, in Wiltshire. As practised at Combe Down, the original arch, a very good roof-support structure, was 'stretched-out', leaving just the small apophygation to support a wider spread of roof above, but placing the area

between into tension. Given the frequent and often loose joints due to cambering of strata, and the ever-wider spacing, which seems to have been adopted, this was a fundamental weakness. There were substantial roof-falls, largely from this cause in the Central Firs cartways, and even worse in East Firs where the worst areas of unstable ground were located. There were falls too in the Byfield cartways.

It is not clear if it was apparent at the time the pillars and rooms were being worked, but the apophygates had a tendency to spall badly, small thin fragments of rock splitting from the pillar sides. This was caused by the almost imperceptible sag in the roof between pillars causing the span load to bear on the weak edges of the apophygation and, eventually as the pillar thins, on the slightly curved sides of the pillar. It was perhaps these collapses and signs of weakness in pillars which persuaded Jones, or allowed Jones to persuade Allen, to change to the corbelled pillar supports. John Wood (1765) commented on the dangers Allen became aware of in underground mining and the accidents and deaths it caused, and commented that Allen began quarrying from the surface to avoid it. This was probably a reference to surface quarrying, but it might just be a reference to use of shafts as an alternative to the long and sometimes dangerous treks down the cartways. Fairly narrow shafts had been used within the early sub-phase, probably for ventilation only, but wide winding shafts became used later. At least one was probably sunk within the early sub-phase but others as part of the second. This transition between phases, judging by the relative areas of exploitation, probably took place about 1745-55, not necessarily simultaneously in the different quarries.

The enormous amounts of spoil backfilled into the apophygate workings, and the limited heights of the cartways prevent collection of data about the quarrying techniques on the lower parts of the pillars, while the top section of many pillars was further damaged by spalling, and – near entries only – by some possible frost damage. The apophygate style of the pillars appears to be confined to the softer, poor weathering stone of the three picking beds which allowed picks and, probably, the small hacks to form the curved shape. This did, however also open-up the roof to the so-called Bastard Bed which, though much harder, has strong and often fairly open jointing which makes the bed very vulnerable to failure. The consequences were seen especially in the cartways, partly since these were more open to view, but also possibly because lateral support of the pillars from spoil was less. Much of the actual failure would have been delayed until post-working stresses took over and failure progressed, perhaps in a domino effect. The situation was thus less unsafe during the initial working phase, becoming more and more dangerous as time went on. This was possibly still within the time the cartways were still developing in Phase II, but certainly was apparent by the early and mid 19th

century when quarrying operations included repairing the damage.

Of tool marks observed there is evidence of the wider blade hack marks on the face of some of the pillars and perhaps smaller picks were used near the roof. There is no evidence visible of sawn work, and use of wedge pits is rare. In corbelled pillars jad slots or chamfered jads were used but long sections of jad are rare, and as with an example in East Firs, probably belong to the next phase.

The transport of stone was clearly well-organised where this can be observed, with wheel ruts in cartways suggesting wagons of about four feet wide, but dumping of spoil from later periods presumably has obscured the systems away from the cartways. There was no obvious trace of two-wheeled carts or wheelbarrows, though rare single-wheel ruts show the latter were used.

The use of wide shafts, sometimes considered as light shafts (erroneously – they only light a very restricted area below), can only have been justified for winding to surface to avoid long distances in the cartways, though they would also have assisted with ventilation. The wide shaft would have allowed long or substantial blocks to be lifted horizontally off a vehicle below, and lowered on to a cart or wagon at surface without the hazard of turning the stone, but there is no actual record of this. It is likely these shafts were mainly introduced towards the end of Phase II. With one exception, in Central Byfield where it is surrounded by apophygate pillars, the four or five wide shafts likely to have been sunk in the Phase II period were placed just to the side of cartways, some tens of metres within the corbelled pillar areas. Their use was probably one of the major reasons, together with likely consolidation of production, why the post-1764 Allen Estate map only showed one crane installed on the underground level entries, that at Sheeps House Quarry.

Of the four wide shafts it was possible to investigate, each of which was just off the cartway, there was found evidence for associated cable haulage, probably over only a short distance. This was represented by cable grooves usually worn in the rock of pillars, and examples were found also near the level entries at Sheeps House Quarry and at the Central Byfield easternmost cartway entry. The shafts examined were the second wide shaft in Central Byfield, the so-called Firs Shaft in Central Firs and two shafts with near-identical caps in East Firs. It is not clear whether the cables were used to drag blocks to the shaft bottom, or whether they pulled wagons or carts along the level. Almost certainly each used a cable (chain or rope) passed down the shaft from the winding gear above, through a pulley block and along the cartway. It was a very simple and, given the presence of a cable down the shaft, an intuitive technology used also in some coal mines in the mid 18th century, which could relieve much labour. That it was common to all four shafts and quarrying areas suggests it was an imposed

business-wide technology, perhaps at the very late stage of Allen's exploitation.

This repetition and commonality in development methods also offers the possibility that the change from Phase II to III can be observed in the diversification in the methods of working which followed the leasing of quarrying to individuals after Allen's death, with, of course due deference to leads and lags in developments.

Areas being worked at the end of Phase II

The leases which controlled working in the Central Byfield area after 1803 extended south from the Turnpike (North Road) to include the area around the second wide shaft in Central Byfield. Only one of all the leases (for further east in Byfield, adjacent to West Firs), mentions the existence of substantial old workings within the lease. This and the documentary evidence in the Allen Estate Map of the removal of the crane over the Central Byfield entries, suggests that work shut down at the Central Byfield site at or prior to Allen's death. This may be a reflection of surface quarrying production at the Masons Crane House Quarry whose crane was still in position in 1764, and centralisation of production based on the Central and East Firs quarries.

In Central Firs, Phase II work extended between and alongside the two cartways as far as the Firs Shaft and the immediate vicinity. There may have been working to the west near the two entries, but to an undetermined extent. In East Firs a broad band of workings extended across the south front of the whole area, penetrating northwards as far as or a little beyond the two similarly-capped shafts. Work seems to have continued in all the Firs areas through into Phase III.

Because of the limitations of access in the East Firs area, the two case studies which follow will concentrate on the workings in Central Firs and Central Byfield.

Case Study 3. Phase II: Allen underground quarry 2200, entered from Sheeps House Quarry (Fig. 12.12)

The entries were at the foot of the surface quarry face in Sheeps House Quarry at what later became known as Davidges Bottom and now Rock Lane. There were two belonging to the initial phase which penetrate, not quite in parallel, directly northwards into the freestone beds, almost in a straight line. Above the east side on the cliff was one of the Padmore cranes and it is likely the floor outside the two entries was levelled to provide handling and stacking space reachable by the crane. The floor level was probably somewhat lower than today so as to be at the level of the cartway floors. There were cable grooves on the west wall of the easternmost cartway just inside the entry (Fig. 9.32). Both cartways were initially driven in solid rock formed as apophygate arches. After a few metres the area, some 15-20 m wide between the two cartways, had

been worked out, leaving apophygate pillars along the inner side sides and usually, two more in the area between the cartways, the whole backfilled almost to the roof with spoil. The roofs of both cartways had suffered roof falls and the sides had been reinforced with fairly heavy pack walls as necessary: these may well in part have belonged to later phases of use. Prior to the falls the cartways would have been about 2-2.4 m high above the backfilled floor, but falls have increased this. Traces of cart wheel grooves were found in the floor but for the most part this had a rubble surface.

In the eastern cartway, about 55 m in, a shaft about 1 m wide had been sunk from the surface to the centre of the level with a rubble cone below it, although the shaft was found capped at the top. It belled out above the cartway, though the cone shape did not reflect this, suggesting the shaft was sunk to the gate (and not the gate driven to it), and that the rubble tumbled in later before capping. The shaft may well have been at the end of the very first section of driving, providing ventilation to both cartways and adjacent areas and the need for it suggests air conditions had deteriorated. The cartway widened just before the shaft at an intersection with a cartway driven, angled slightly back, to meet the other cartway, the area still within apophygate pillars. On the opposite, eastern side was a branch cartway (Fig. 12.13), driven between apophygate pillars but after a few metres either bounded by an un-pierced wall of rock on the north side, or corbelled pillars on the south. This branch will be considered in the Phase III section below.

Apophygate pillars continued to just above the junction(s) for one or two rooms, but then both cartways entered areas of corbelled pillars. The apophygate pillars extended well to the west but not to the east. They marked the first phase of work in Quarry 2200, which continued in a second sub-phase to include part of the area with corbelled pillars, probably as far north as the Firs Shaft (Fig. 12.14).

Because of access restrictions the detail of the eastern cartway north of the junction was not easily visible, but at about 110 m in from the entry, the cartway intersected with a partially backfilled cart or barrow-way ranging to the west from a wide shaft placed just to the east of the cartway (the 4 m-wide Firs Shaft used in the Stabilisation Scheme). Cable grooves were seen cutting into the pillars immediately supporting this shaft (there was also a number of Lewis slots, but these seemed likely to belong to the next phase in which cranes began to be used underground). The pillars were mainly corbelled with some direct, and substantial rooms were left clear of heaps of waste especially around the pillars and cartway near the shaft, where there was approximately 2 m or more of headroom, presumably as an area for handling and storing stone. What other areas alongside the cartway and between the cartways could be seen had mainly

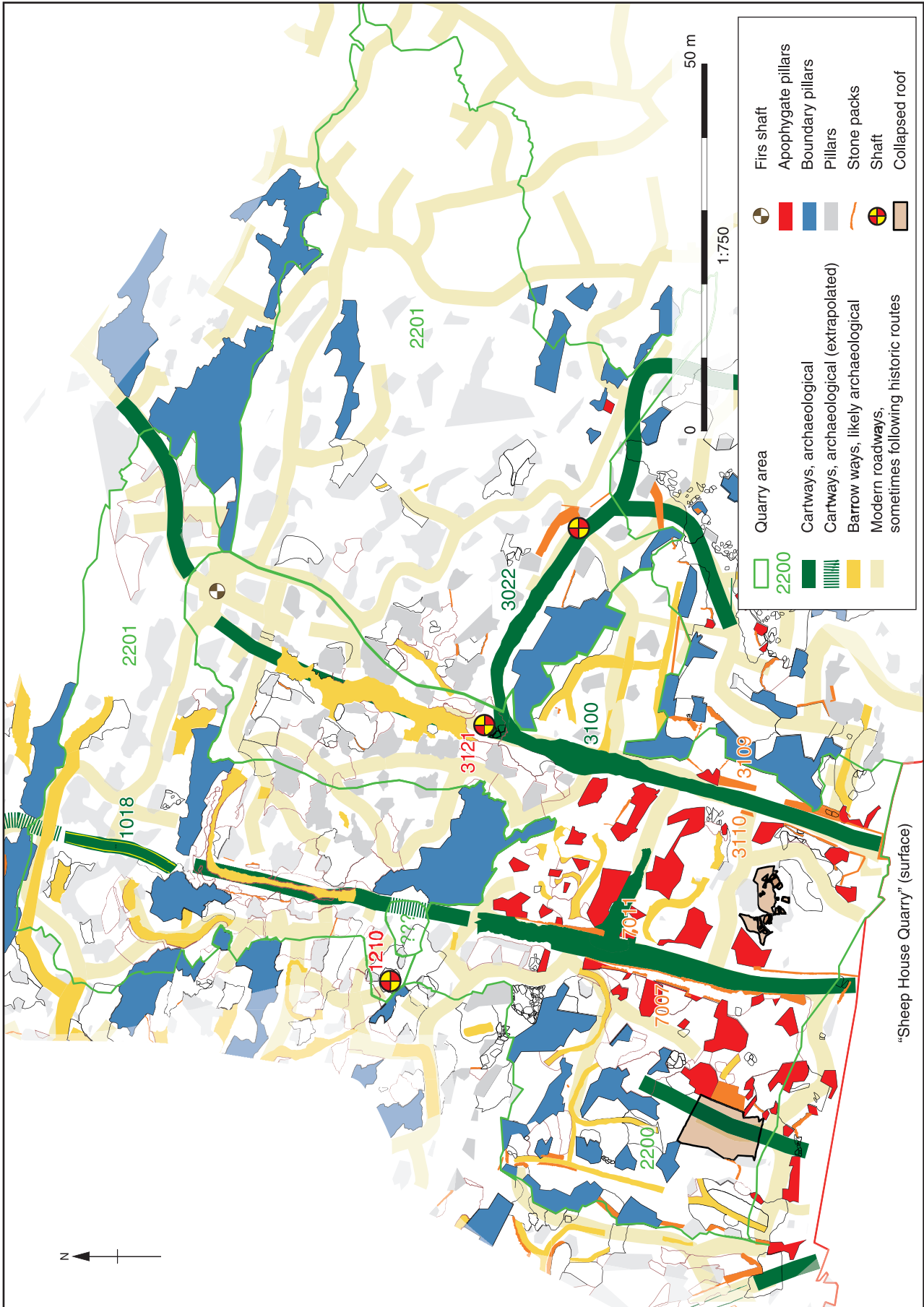


Fig. 12.12 Case Study 3: Phase II: Allen underground quarry 2200, entered from Sheep House Quarry

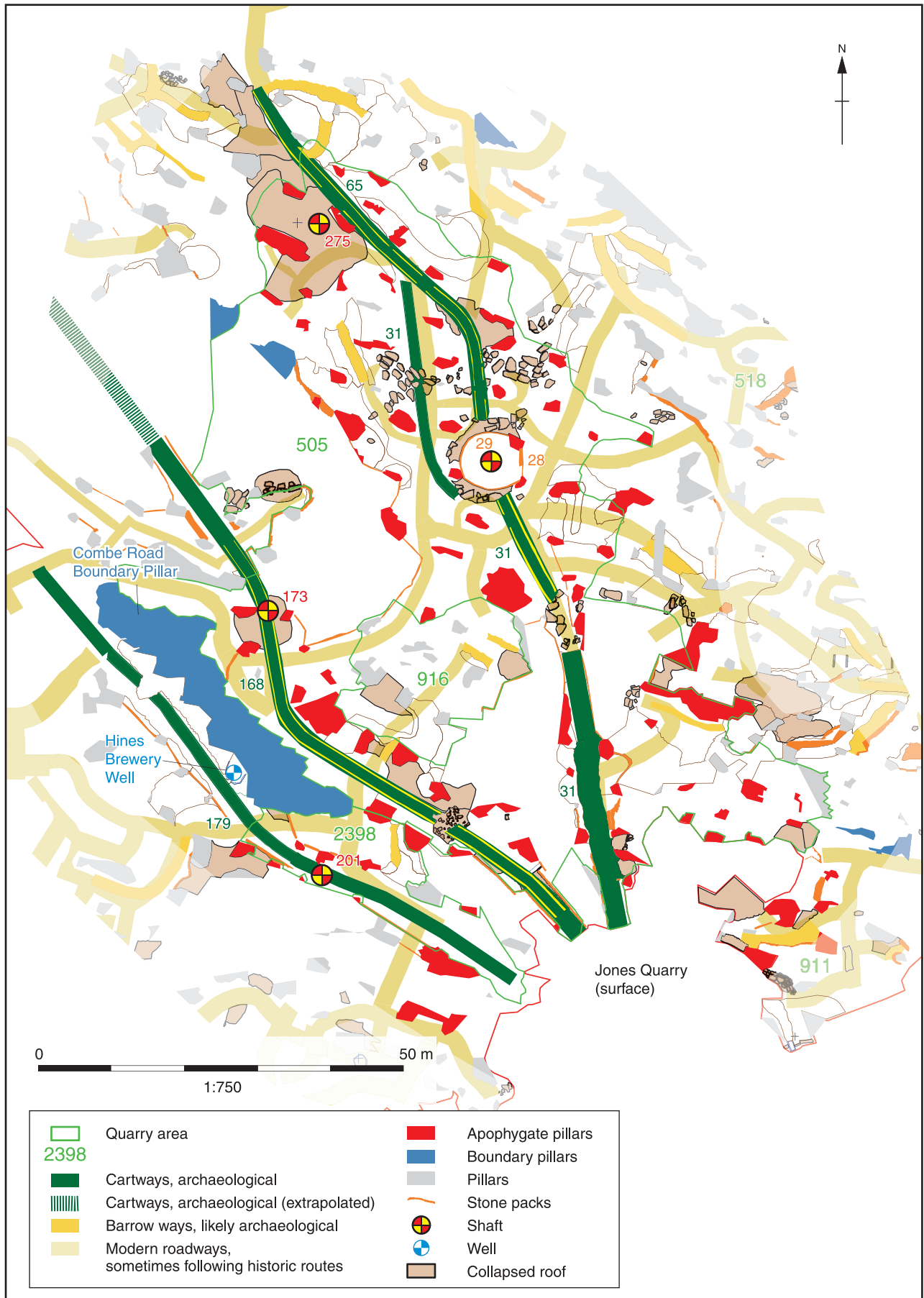


Fig. 12.13 View along the eastern Allen cartway at the junction with the branch cartway



Fig. 12.14 View down the eastern cartway near the Firs Shaft

'Finished Labour of a Thousand Hands'



large amounts of spoil in heaps and banks. The Firs Shaft may mark the limit of development in the second sub-phase, though some work fairly close by almost certainly belonged to Phase III.

The western cartway continued past the junction to just pass, on the west side, a wide shaft about 70 m in. In this area a late 19th-century quarry (2344) had been developed both on and at the side of the cartway to a greater depth than the Phase II workings and will be considered later, below. Beyond it the cartway continued (but re-used as a later barrow-way associated with Quarry Areas 2344 and 2368), between corbelled and direct pillars, until it widened out into workings with openings around 2 m high, intersecting with the cartway/barrow-way ranging west from the Firs Shaft. At this point it was certainly part of the Phase III workings and these will also be considered later.

Access limitations make it difficult to determine the extent of the second sub-phase, but it included most of those between the cartways and probably to the west before the later quarry (2344) where there was an unexploited area of stone left. It is also not clear that the shaft in Quarry 2344 was Phase II or was sunk for the much later working. It would fit the pattern of wide shafts established in other Phase II areas, but, given Firs Shaft's accessibility, it was not totally necessary until the later phase.

Case Study 4: Phase II workings in Central Byfield Quarry 505 (Fig. 12.15)

These workings were within the Monkton Combe Greendown, east of the western boundary at Combe Road (today). The parish boundary was reflected underground by the near-continuous Combe Road boundary pillar.

The workings were again entered by two cartways, which diverged from a starting point next to each other in what is now Ralph Allen Yard. This was possibly a small existing quarry with older workings opening off it, but it seems most likely the entries were made directly into freestone so as to avoid old work. Cable groove marks just inside, and deductions about the course of the surface railway make it clear a crane was positioned above the entries.

The western side cartway followed up the east side of the Combe Road boundary pillar, the latter left entire except for a (later?) doorway and short passage through to the Lyncombe and Widcombe workings some 30 m from the entry. The pillars were apophygate, though later falls of rock meant lost definition in their form. On the east the pillars enclosed a triangular area between there and the pillars lining the eastern cartway. The western cartway had well-defined ruts, and banks at each side were built-up of light-coloured mud, apparently cleaned from the cartway floor. After some 50 m the cartway appeared to pass under a shaft, but

this was entirely hidden by rubble and rubble packs which were placed, probably in the early 19th century, by adjacent quarries. The northern side of the shaft was ultimately to be accessed from the other direction. Rubble and packs again obliterated the shaft itself, but cart ruts were just visible beyond, extending to the second pillar beyond the shaft. There appeared to be apophygation on a remnant of pillar close to the shaft. The cartway changed to a barrow-way beyond, and was driven further north possibly in this same phase, until it came under the present church, a former telephone exchange, in Combe Road, where the roof was in a dangerous condition, only a metre below surface. Rubble stone roof support packs had been built in this section against the wall, each vertical portion advancing a very short distance and completed to roof level before the next section was started, to cut down risk. The original way forwards was abandoned at this point and other working in the area was probably done from the north-east.

The eastern cartway, which had cable grooves in the east wall near the entry, was eventually continued almost to the North Road, the Phase II section perhaps as far as the second wide shaft (after passing, according to documents, an unseen well shaft in the first section). The pillars were apophygate alongside both the two cartways (but internally between them were direct, reflecting a probable later working).

The level entry to this eastern cartway had been arched over, followed by a rubble pack at the east side as a buttress for a short distance. There were then apophygate pillars on both the west and east for a short distance with very small rooms between – about three metres across and filled with spoil. An opening on the east led into corbelled pillar and room working but otherwise the sides had either rock walls or rubble packs. Just before the cartway reached the first of the wide shafts noted above, and beyond it, there were faint traces of cart wheel ruts (about 1.3 m internal width and 1.5 m external) and a substantial fall of rock.

Near the first wide shaft corbelled pillars appeared to take over (some were possibly transitional) in one or two rooms back from the cartway. This suggests the cartway was first driven through with a room or two either side, then the extraction area was later widened, presumably in the second sub-phase. The first wide shaft was surrounded by apophygate pillars, suggesting a Phase I date, but was walled around and presumably filled, so no detail was available of the shaft bottom and it is not clear whether the shaft was sunk at the time of driving, or later, though its position suggests either alternative was of the first sub-phase date. It may have been sunk specifically to serve the large quarrying area to the north east (see below).

North of this the quarried area was much more open and may have served to store stone, since there

Fig. 12.15 (facing page) Case Study 4: Phase II workings in Central Byfield (Quarry 505)

were two or three substantial squared, scapped blocks piled near to each other, and, nearby, a stone with a groove to allow it to hold saws for sharpening (which may suggest later activity than Phase II). The roof height around the shaft was typically about two metres, but on the east side there had been a very substantial roof-fall, with large and small rubble and boulders under a large cavity in the roof. This and perhaps falls associated with the shaft had blocked the cartway which ran under the shaft, and a diversionary cartway had been made round to the west of the shaft. This resumed the original course to the north, heading for a second wide shaft. Apophygate pillars terminated just short of this shaft. Later wide shafts here and elsewhere, with the exception of the shaft on the west-side cartway, seem all to have been set at the side of the cartways. The position of the shafts on each of the cartways here, amidst the apophygate pillars, may indicate they were the earliest of their type and the lesson of the relation with cartways was possibly learnt through experience here.

North-east of the small area around the first shaft, alongside the original cartway was a very substantial quarried area with very wide spacings between two lines of apophygate pillars (Fig. 12.16). Many of these were very substantial, almost direct pillars, with only vestigial apophygate characteristics. It is not clear why this huge area remained nearly free of collapse when many other smaller areas between pillars were so damaged. Perhaps the massive pillars used helped, and, as it was at the centre of the freestone outcrop, it is possible

that joints were either less in number or less open.

Within the quarry area the floor was dumped over with heaps of rubble and, on the southern side, there was a long boundary pillar that had been occasionally pierced. Through the area to its south the pillars were mainly vertical and in the area were long barrow-ways mainly running eastwards with lateral dumps of rubble indicating the (last) spoil-disposal method used there. The rubble spoil heaps were to about half a metre to a metre under the roof, the barrow-ways up to two metres. South-west of the shaft was another 'organised' dumping area, with barrow-ways with lateral dumps and distributary ends, some dumps with arcuate tipping fronts. These appear to contrast with the dumping of spoil generally and suggest this activity was becoming more systematic, freeing space in the producing or working areas. It may, however, simply reflect later working in the peripheral areas to the quarry under present consideration.

On the south-eastern side of this large quarry most of the pillars were mainly corbelled with some direct, and at the meeting point with apophygate pillars again there was the 'entabed pillar' noted earlier. The corbelled pillars continued to the east until again apophygates were found around what was called Hills Shaft (Quarry Area 519), an opening formed through a probable Phase I small quarry at the west side of Sheeps House Quarry. To the south east the apophygate and corbelled pillars extended into an area known as H Pillar (Quarry Area 517), a much later quarrying area operated by James Riddle after 1900.



Fig. 12.16 View of the 'Great Quarry' in Central Byfield (505). This was by far the largest area open to view in the Allen workings

As in the last case study, the amount of tool-working which could be seen was minimal, except for jad slots under the corbelled pillars. There was one example of a pillar side under a jad slot being worked for a large block which had been partly scapped *in situ*. It seems likely however, this may have been an example of later intrusion for pillar robbing, for which the saw-sharpening bench stone was further evidence, although there is the possibility that it was a relic of the Allen Phase II.

This Central Byfield quarry was thus a very complex area, which clearly provided a substantial part of Allen's production. On the post-Allen estate map (Figure 5.1), the crane above the Central Byfield entries was shown as gone, though the location was clear from a crescent-shaped area marked over the entries. This suggests the present quarries had either shut down or were being served by one of the wide shafts which were not marked on the map, anywhere. The second wide shaft had cable grooves a few metres to the south down the cartway and the marks of where a wagon wheel had backed into a pillar. These marks may have resulted from winding at this shaft, though later activity there is likely too. Otherwise the only cranes known from documents to be apparently operating at the end of Phase II were at the Masons Crane House Quarry and at the Central Firs entries at Sheeps House Quarry.

Phase III: The Allen Estate leased quarry workings 1765 – c 1803

Documentary sources show that by December 1764 at the latest Allen's wooden railway had gone and that leasing the quarries had replaced the earlier direct estate management. The cranes were also sold, though by then only the two at Masons Crane House and Sheeps House Quarry had remained at the quarries. There is reasonable evidence to suppose that the quarrying at Byfield had ceased by the time of Allen's death. Underground quarrying appears to have become concentrated on the quarries under the area we now know as Firs, west and east of The Avenue. Quarrying at surface was being done at Masons Crane House Quarry and at the quarry immediately to the north of the Old Rank of workmen's cottages. There may have been some surface quarrying also at the Sheeps House Quarry, at the east side under the old crane position, and at the west side where new entries were made in this phase. At Byfield west of Combe Road, the 1799 Charlton map (BRO copy) at the Byfield location shows no quarrying despite it being clearly shown around Entry Hill and Crossways. Other evidence suggests quarrying, with the exception of one underground area immediately adjacent to the Combe Road pillar, started (or restarted) at West Byfield in Phase IV. This is contrary to a suggestion by Irving (2005, 29-30) that the leases there were to existing occupants, though some had undoubtedly held leases elsewhere.

It can also reasonably be supposed that the most likely quarrymaster-freemasons after 1764 were those who had held responsibility under Ralph Allen and Richard Jones. Jones, in alliance with his son, appears to be one such independent contractor, possibly taking a lease at Byfield west of Combe Road. This suggestion is based upon the somewhat flimsy evidence that his surname seems to have survived there. In other respects we have little documentary material until towards the end of the century, when a number of freemasons are listed with their production of the years 1795-98 (see Chapter 6).

Most of these freemasons listed in the 1795-98 accounts took out new leases from about 1803, at the beginning of Phase IV. At about that date Benjamin Wingrove and Henry Salmon had purchased the whole quarrying area west of the Avenue across into Lyncombe and Widcombe after which it was sold on or leased out (see Chapter 4). The extant leases and the included plans have information about the areas which the new leases applied. This is most useful where the plans provide evidence of the extent of previously-driven cartways – that is. in the earlier phase(s) – and, also where new cartways should be driven.

This line of reasoning has obvious dangers. If the same lessee who had worked the old lease simply took a new lease for the same area, then neither he nor the landlord would require further detail in the new lease, and it might have been considered immaterial to either as payments were on the area worked since the last payment, with no time limit imposed. Previous working was stated in one of the leases, but this may have been because the lessee was new, or indeed that the owner (Nathaniel Hadley) was new. In this respect the portrayal of actual cartways on lease plans is superior as indicating the true (minimum) limit of the working.

It is accepted that there will also have been technological leads and lags, which will mean that the exact boundaries between Phase II and III, and Phases III and IV, may have considerable overlap. Accepting there will be likely inaccuracy in detail, we can, however, assess the general limit of working of Phase III in certain areas, and by assuming that similar technology elsewhere is of roughly the same phase, apply this to other areas.

The differentiation of Phase II from Phase III is difficult and in a large part has to be done by elimination. It is considered likely to be about half the area quarried up to 1803. Not only did the cartways penetrate further north, but we can also expect areas to be worked east and west of the original Allen workings along his cartways near the southern margins. These should all be distinguishable by the technology used. It is also possible to rule out some areas that have demonstrably later phases of operation.

As noted above, this phase may be indicated by new methods and diversity in their use; that it happened is certainly the case. There were two new

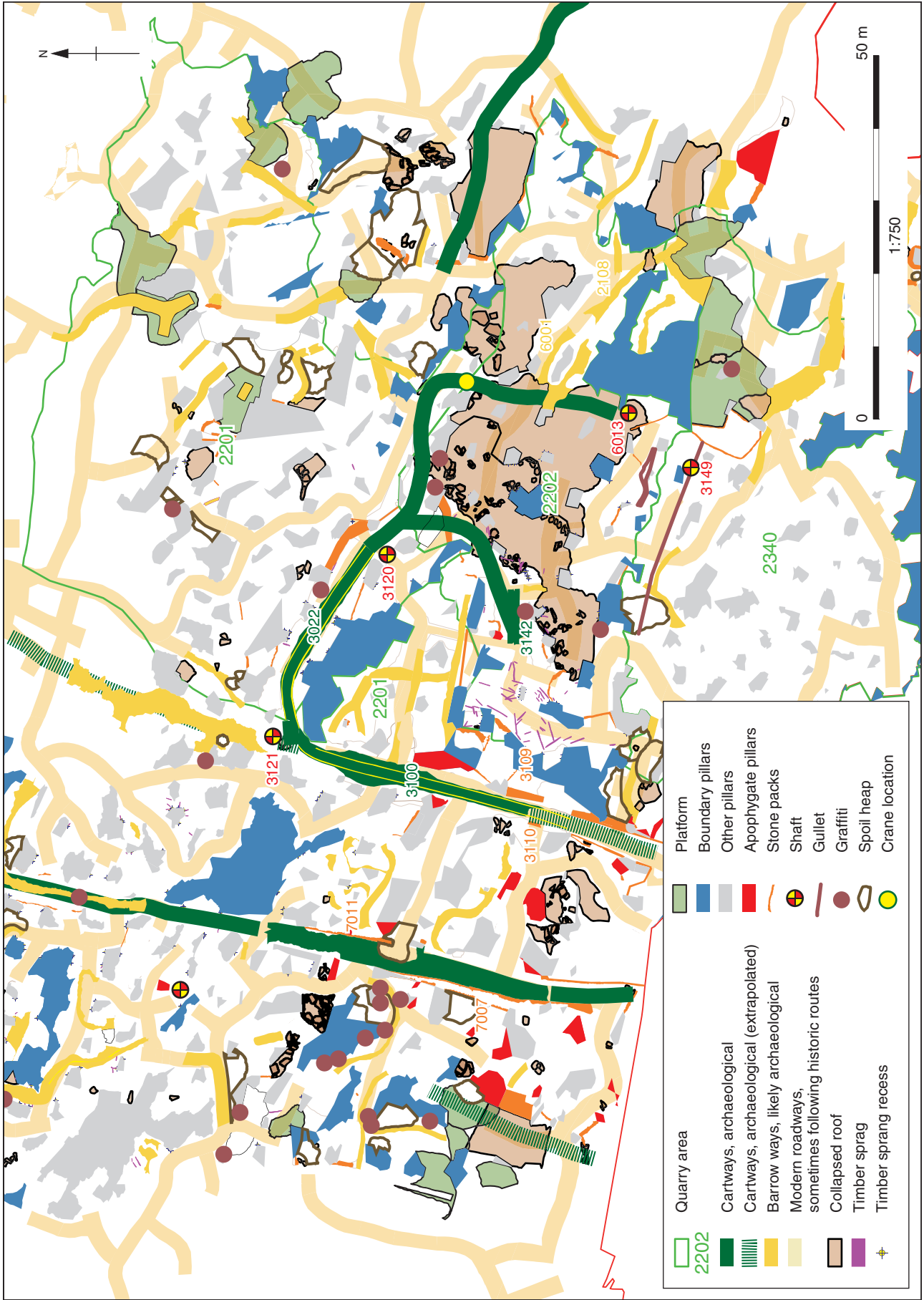


Fig. 12.17 Case Study 5: Phase III. Workings east of the Allen cartway in Central and East Firs

methods of working, Long Room, and Long Wall with gullet and pillars, the first of which may have been adopted for reasons of stability and was not generally used, while the second came into general use over wide areas. There was also more systematic use of jad slots in some places, perhaps associated with a single controlling individual, and the common but not particularly systematic use of wedge pits and the wedge-and-chip for breaking stone. Most dramatic, however, was a trial of the use of cranes underground, though in a small area, apparently only in conjunction with Long Rooms, and then abandoned.

Phase III working largely took place in two main areas, the largest probably west of the Allen Phase II workings in Central and West Firs, including a substantial portion of the spoil-backfilled area (Quarry Area 2397) on the western Firs boundary which is a blank on Hawkins survey (1994). Second, there was a large area on the east side of the east Allen cartway and largely north of the branch cartway in East Firs. The more eastern areas of the latter were probably served by shafts. At Byfield, there were underground workings just west of the Combe Road Boundary, reached through much older apophygate pillar workings (910) on the west side of Ralph Allen Yard, ranging under the William the IVth Public House. In the far east, beyond the Long Drung, it is likely the area north of The Brow and alongside the Long Drung continued to be worked, possibly, by the Greenway family who were still associated with it in 1800, reaching, by the end of the phase within some 120 m or so of the Turnpike (North Road). However, the lack of access to the workings there make this difficult to show. This was a very substantial output area to help satisfy the demand of the building booms in Bath, but in addition to this were the outputs from the surface quarries in the centre of Combe Down north and south of the Old Rank cottages and also at Sheeps House from under the former crane position and maybe also near the west side entries. Also substantially before the end of this phase, in direct competition and with possibly a small transport advantage, four or perhaps five quarries, one of which was underground, were in operation at the western limit of the Combe Down area, at Entry Hill and Crossways. There may also have been other output from east of the Long Drung; Mount Pleasant and other quarries were either already in operation or were being planned.

Case Study 5: Phase III. Quarries 2201/2202 Workings east of the Allen cartway in Central and East Firs (Fig. 12.17)

The branch cartway runs eastward from the junction on the eastern of the two Allen cartways, from under the first metre-wide air shaft about 40 m from the entry. The shaft and the first two rooms lies within the apophygate pillar area and the branch to the east extends about 20 m to a further 1 m-wide shaft from

surface. Here the pillars are both corbelled and direct and either side, beyond the apophygate pillars, had distinctive jad slots, common but not systematic use of wedge slots and Long Rooms nearly entirely filled with spoil. The height of the cartway was about 4 m, although roof collapse in sections had left a greater height exposed.

There were very substantial rubble roof-support packs installed on the north side of the cartway following the substantial roof falls which involved large blocks, as is apparent from the gaps in the roof. At a later phase, to which these substantial packs belong, the cartway branched and was extended further to serve quarries to the south but, initially, it was driven eastwards and probably passed just south of a boundary pillar, working the rooms immediately adjacent. Beyond this the cartway was covered with a large fall of rock, but could be accessed again at the other side, continuing eastwards and linking with at least one, and possibly two of the cartways in the east of the Long Drung, then ranging north and connecting to the area just south of the Grand Canyon south boundary pillar. Long Rooms were found in much of this area, and also earlier workings as the cartway cut across them.

The most unusual features were the remains of cranes. These seemed, from remaining Lewis slots used as anchors and from cable grooves (Fig. 9.32), to have been worked from immediately after the apophygate pillars were passed. They appear to have comprised a form of mast crane, with stays or cables of chain or iron rods holding the top of the mast in position – probably from four or five points. Locations of two cranes could be deduced. One was on the north side of the cartway opposite the 1 metre-wide shaft. This position was behind the massive but later pack lining the cartway, and would (presumably) have loaded on to wagons on the cartway. At least two of its chains passed over the cartway (one leaving cable grooves where it passed around a pillar) and others were located close to it. The second crane was on the north side of the roof fall and used wedge slots, Lewis slots and a cable around a pillar as anchors. It may have also dragged stone to what seemed to be a low loading bay a few metres away, and in line with the crane and the workings. Other slots along the cartway just before the fall suggest a crane or cranes were moved as work progressed. Conditions locally appeared very confined, though the full height was, of course, not available to see, and it is for this reason, perhaps, that crane use seems to have been discontinued, although later it became a normal feature of stone quarrying underground, at Combe Down and elsewhere.

It is possible that this branch cartway was driven across to this area, either to avoid unstable areas, which abound to its south, or perhaps to centralise handling at the Sheeps House Quarry, or both. Together with shafts, of which there are several, it enabled the working of the northern half of the area

between the older Phase II workings and the later Phase IV workings by Burgess in the north. The abandonment of old cartways passing under it may also have facilitated the surface working of the quarry behind the Old Rank cottages.

Case Study 6: Quarry Area 2201. The long-room and gullet workings west of the Firs Shaft

These workings were at the upper end of the western cartway at Sheeps House Quarry and a further cartway to the west was also started in this phase, penetrating perhaps 35 m by the end of the 18th century. These may have divided further in to serve this area, though the actual divisions were not accessible to us. Of the short sections seen, they were at least 4 m high, wider than the earlier Allen cartways, and had traces of cartway ruts. Jad slots had been used for exposing the beds below, and again wedge pits were common but not systematic. There is a regularity seen in the pillar plan made by Hawkins (1994) in this northern half of the supposed Phase III working which is not apparent further south, where often irregular but more substantial pillars have been left. These latter were possibly of the earlier phase and may partially be due to ground conditions which were often not good. The pillar plan (Figure 1.9) suggests smaller pillars and a higher proportion of stone removed than is the case further south, which was presumably the result of the method of working.

At the north end of the Allen Phase II workings (2200) a former cartway or barrow-way, discernable under systematically dumped spoil, extended from the Firs Shaft to the west and was followed by one of the modern supported roadways, which was thus unfortunately but necessarily destructive of substantial detail between archaeological visits. This cartway followed the south side of a long boundary pillar and later experience suggests its partially rubble-filled hollow against the pillar was, in fact the final stage of a gullet following the earlier working face. It first crossed the west Allen cartway, which had passed the boundary pillar and which was associated with Long Room working. After some 20 m it crossed a further cart or barrow-way into Quarry 2224. This was the site at which the diagram for the Long Room and pillar method was sketched out (Fig. 8.12), though the area was destroyed before full recording was possible.

On the east side of the cartway, to the north the freestone had been removed and the area backfilled to a walking height below the roof. The infilled area had clearly been served by the cartway, since the latter's deep trench had been blocked by a substantial rubble pack at its south-west corner. West of this rubble pack the cartway curved and opened out into a gullet running along the working face with behind it a row of corbelled pillars. The gullet was about 4 m deep (but with substantial rubble fallen in) below the roof and about 15 m long. Two pillars were beginning to be formed against the long

backwall pillar and a wrist stone had been removed to allow the face to be advanced. At the back of the gullet, more or less in line with the fully formed pillars, was a low and irregular rubble wall from which a bank of spoil rose to the upper floor level at a normal angle of rest. Thus the cartway had accessed the centre of the quarry working area, the east side had been worked-out and its final gullet filled, and the new gullet progressed forward. The partially formed pillars suggest the intention had been to advance further.

This simple system, which apart from the pillars resembles surface working methods in many pre-crane stone quarries, probably occurred over wide areas, notably in the workings in East Byfield (of the later Phase IV) where the pillar plan also shows regularity and where small traces of similar gullets could occasionally be seen.

Phase IV: Workings between c 1803 and c 1838

The main areas of working were laid out by Salmon for west of Combe Road and through Wingrove and Layton eastward to The Avenue (see Chapter 6). Most of the land west of the Combe Road was surface-quarried, but underground William Hulonce took the area under the later William IV Public House extending to what is now a gridded bat entrance. There was also a fairly small area in the north-east corner, inside the Combe Road / North Road junction worked underground by John Scrace and close to it another very small quarry of extraordinary neatness, suggesting again a mason at work. Both these areas are considered in the case studies below.

Any attempt at describing the underground landscape in the northern parts of either central and East Byfield or West Firs is dogged by the limited availability of viewpoints during the Stabilisation Scheme and the apparently chaotic distributions of spoil and often low barrow-ways used to transport it from working areas. On closer examination this was less chaotic than first appeared, the spoil from one area usually passing southwards to be dumped in the adjacent worked-out area, which thus became almost totally hidden below spoil. The area between the notional Byfield and Firs quarries, the southern part of which was worked in Phase III became almost totally filled with spoil. The most coherent way to approach a general description is by means of the cartways of which some are shown, together with shafts mentioned on leases, or otherwise planned during the archaeological survey. The planned cartways were frequently used in conjunction with shafts and are shown in Figure 9.2.

The first leases extended east to a boundary running south to Rock Lane from Stonehouse Lane (a boundary probably established by the original Combe Lane track). This included unworked ground to the east, beyond Allen's workings) and to the south, within the curve of Combe Road / Church Road / Rock Lane.

In Central and East Byfield four 40-perch-long quarries were measured out west-east from Combe Road to the Stonehouse Lane-Rock Lane boundary. The Phase II cartway (originally Allen's east cartway) to the second wide shaft was extended northwards into Quarry 2213 (that on the west was abandoned as it was in bad ground), to serve the quarry on the west (2342 and 2343) belonging to Samuel and John Pearce, as well as that of Richard Lankasheer who leased the adjacent quarry with the cartway at its centre (2220). As the cartway progressed northwards a further two wide shafts were sunk on it, regularly spaced so that in all four shafts served the workings to the northern boundary (North Road), almost in a straight line (only three are shown on the early Ordnance Survey maps – presumably by then the southern shaft had been filled in, perhaps because of instability).

The two remaining quarries on the eastern half of Byfield were originally leased to Samuel Pearce and Ann Godwyn (Quarries 2221 and/or 514 and 520). They also were to share an entry, and the cost of making it, against the value of the stone got from it, was to be shared between them. It seems to have been made on the west side of Sheeps House Quarry, probably utilising an old apophygate pillar working (Quarry 519). This area became known as Hills Shaft in the Stabilisation Scheme – a misnomer for a partially backfilled level entry). The actual cartway followed a more direct route than indicated on the lease plan to a denoted shaft in virtually the centre of Godwin's workings, Quarry 514. This cartway in its northern section ranged north to a

small loading bay for wagons which were pulled back southwards to the shaft (hidden by a fall) by cable which has left traces of wheel-ruts and cable grooves and abrasions (curved faces just above floor level) on pillars on its slightly winding course back to the shaft (Fig. 9.13). The loading bay area had graffiti including the date 1816 on a sawn face (Fig.11.8), indicating saw-use at that fairly early date for quarrying rather than banker mason work.

A second entry was shown on Job Salter's 1816 lease, just south of the above Hills Shaft entry. This was driven into John Davidge's working (East Byfield, Quarry 520), with from here a further cartway ranging south, taking a slightly curving course through a fairly narrow worked area. The cartway was in a deep trench, the pillars were direct and corbelled, and there were distinctive jad slots and both single and rows of wedge pits (Fig. 12.18). The way was flanked by interconnecting, more or less spoil-filled rooms. The presence of many Lewis slots showed that mast cranes had been used for handling stone blocks throughout the length of the cartway. It was not clear how transported blocks were hoisted out, possibly via an incline either just inside or at surface.

A major (negative) feature of the Hawkins survey had been an unexamined area between the Firs and Byfield Mines. During the Stabilisation Scheme it was shown to be almost entirely infilled with spoil. It took in halves of two quarries, one the eastern half of a moiety of Samuel Pearce's quarry, then owned (1816) by John Davidge (Quarry 2397), and the other part of the western side of Godwyn's Quarry then



Fig. 12.18 John Davidge's working, to the south of Hills Shaft in East Byfield (Quarry 520)

owned by Job Salter, Quarry 520. The original cartway came to its eastern margin, but no trace was found of the arrangements in Davidge's half. It is possible that the arrangements were shared.

A further tranche of leases affected land east of this which remained west and north of ground worked in Phase IV, largely in the north of West and Central Firs. Extending east of this, John Greenway had a lease in partially worked and unworked ground, and east of Firs Shaft took a large area of unworked ground in a triangular area with its apex opposite the Prior Park carriageway gates (under the Hadley Arms today). This area, when leased to John Burgess, was described as of three acres and this gave its name for our identification purposes to this substantial quarry. This group of quarries, all let from around the same time showed both rapid changes of ownership and a considerable diversity of methods used (emphasising how this might be valid as a phase change criteria between Phases III and IV). The methods used were usually very traditional, but there does appear a willingness to retry methods used but not generally applied earlier, maybe stimulated by the ability of the Kennet and Avon canal to bring in competing supplies of stone if they failed to gain efficiencies to protect their local market. By comparison, however, as will be seen below, the organisation of the quarrying methods was far less sophisticated than taken up by John Burgess further east. However, it is possible that the lease-areas granted were too small

to allow the larger-scale methods used by Burgess.

The cartways shown in leases show substantial working took place between the above leases and the Three Acre Quarry, in West and Central Firs. The quarrymasters here were Samuel and John Pearce who seem to have worked mainly from the cartway in the north-west of Sheeps House Quarry (Fig. 12.19). Southern parts of this area had been worked in Phase III, and at least one cartway, west of the Allen cartways, was shown extending about 36 m from its entry in 1803, but this would have left substantial amounts of stone in the northern and north-western parts of Firs for the Pearces. Probably two or three of the cartways in the north-west of Sheeps House were used if not initiated by them. They too followed a fairly conventional mode of quarrying.

The plan (Fig. 4.2) deduced from the lease plans and underground observations, shows the likely grant, which excludes an area in the four acres known to already have been worked previously and another part of the four acres not worked until significantly later in the century. The remaining part, known as the Three Acres Quarry and within it, what seems to be a late, even last, stage of working in Phase IV became known as the 'Grand Canyon' because of its spectacular near full-height pillars and gorge-like topography. Two contiguous small areas of $\frac{1}{2}$ acre each at the top of Combe Park and the Tyning were also worked by Burgess. This is the subject of one of the case studies below.



Fig. 12.19 Late 18th- to 19th-century cartway with cart ruts in West Firs (Quarry 2342) which belonged to Samuel and John Pearce

Case Study 7: Phase IV. Quarries 500/501/502/503/504 west of Combe Road – Hulonce’s Quarry (Fig. 12.20)

William Hulonce was one of the two Lyncombe and Widcombe quarrymasters who took leaseholds from Harry Salmon *c* 1805 (see Chapter 6) and developed underground quarries. He almost immediately subleased the western half of his ground to Patrick Byrne and he may have also subleased another part to Henry Street when Hulonce possibly gave up quarrying about 1816, although the evidence is somewhat confused (Irving 2005, 41-2). This is reflected in the diversity within the workings.

The underground area stretched from Ralph Allen Yard, under the William IV Public House and yard ranging for about 100 m west to the present grilled bat entrance. A large part of the underground area remains open today for a bat sanctuary, but has been almost completely impacted by concrete support to the original pillars, masking archaeological features.

Hulonce took a lease which included workings of earlier phases. The eastern end workings (and south of his leased area roughly under Tor House) are both pre-Allen and Allen period, though unlikely to have been worked by Allen (Phases I and II), and display mostly apophygate pillars (Quarry 910). The entry envisaged in the lease has a fine stone arch, as seen from inside, and a cartway of probable Phase III age (Quarry 501) passed through the apophygate pillars and through a Long Room-form of working alongside the Combe Road pillar, at the far end of which a wide shaft had been sunk. These Phase III workings, possibly those of Richard Jones and Son, may have curved round the north side of the quarry a short distance to another wide shaft. Hulonce’s decision, alone amongst his immediate neighbours, to quarry underground, may have been influenced by the existing underground access. Even so, only the eastern half of his lease was eventually quarried underground.

Despite the existing access, a new entry was made on the south side, behind (the later) Tor House, in the form of a decline (Irving’s Incline – see Fig. 7.5). It has a wide arch with cut stone including some sawn pieces and, from its size, was clearly intended to be the main access to the centre of the Hulonce workings leaving the extant pillar between them and the older work. Its exit seems to have turned sharply east behind Tor House, following the low cliff and wall at the end of the pub yard. Unfortunately the decline hit bad ground at its lower end, caused by a large gull or open joint, and a heavy rubble support pack had to be built across its path. This left a 1 m-wide opening with the main entry turned to the west, then down another, smaller, declined ramp into the central area. To the east it links via a low doorway with both sawn and picked (jad cut) sides opposing each other to

workings and a passage leading through the Combe Down pillar, perhaps for ventilation needs. The main Stabilisation Scheme entry to the Byfield workings was at the north-west end and may have been formed (or enlarged) by adjacent surface quarrying and was almost certainly at a late stage in development there.

At the north west corner of the central area (Quarry 501) adjacent to what was known during the Stabilisation Scheme as Bat Alley – now a bat incubator, along the north wall and adjacent to the Phase III workings near the northeast corner, the existence of a long high bank of dumped material suggested this was the first work done, probably from the Ralph Allen Yard entry. The direct pillars in the corners have jad slots used to excavate the picking beds, with 0.9 m high cavities left at the top of the fairly substantial pillars. Similar picking bed removal follows along the northern side, at the northern boundary pillar. It seems likely that a way was formed round the central area in a U-shape as the initial work in the area, possibly using the Phase III cartway entry, though the cartway has definite features distinctive from it. It was an idiosyncratic form of working by that time, though somewhat similar features can be seen in northern parts of Central and East Byfield.

The main part of the central area served by Irving’s Incline had high pillars, with approximately 5 m of space above the floor (Fig. 12.21). These workings were also of an unusual form for Combe Down, some with jad slots in the picking beds and either natural vertical faces or vertical jad cut faces distinguished by sweeping pick marks from roof to floor, or with wedge-cut faces. Subsequently the picking bed-portion of workings at the north side was used as a dump for large quantities of spoil composed of fines with some rubble, apparently largely derived from the vertical jad cuts. This formed a wide bank, to within a metre or so of the roof, which was partially held back by the first line of the jad cut pillars, but otherwise sloped steeply to the lower floor. It was not possible to determine the full height of the working, as no gullet area remained open, possibly because of some re-use of the workings for storage at a later date.

The western end, between the Bat Alley and the western entrance had direct pillars made using jad slots of which some two metres remained above floor level. The floor had probably been cleared to allow a secondary use including, apparently, storage of mushroom boxes (Quarries 500 and 501). At the eastern side was a line of rubble stone pillars supporting ground with a sewer pipe running above (the Horsecombe Vale sewer).

The Hulonce quarry, particularly at the western end, had many sawn faces. On the whole these appear to be later than the general work, but some may be contemporary with the main working phase. Such faces appealed to the literary sense of many who came in, including those who worked

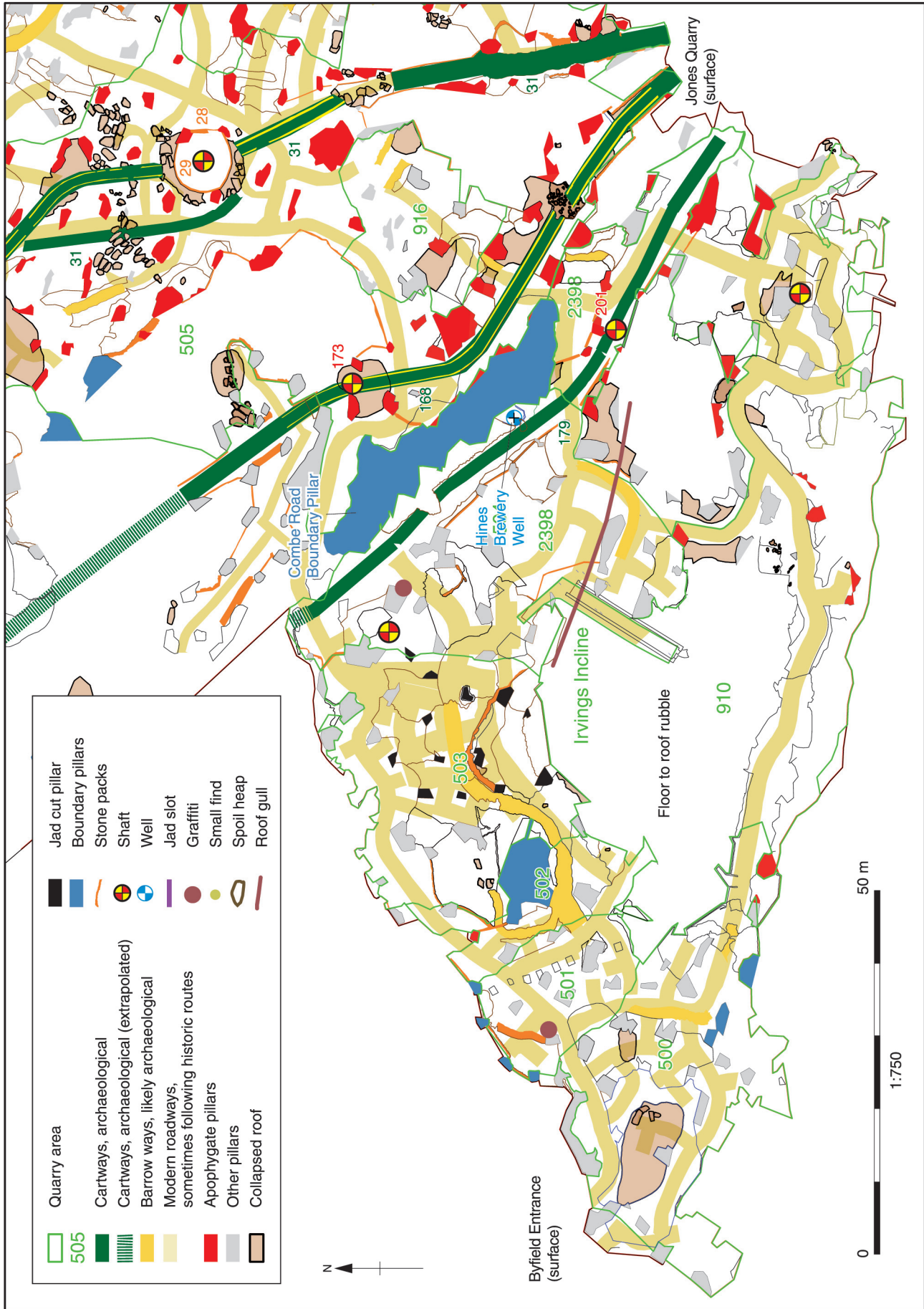


Fig. 12.20 Case Study 7: Phase IV Quarry west of Combe Road – Hulton's Quarry



Fig. 12.21 High pillars in William Hulonce's Quarry (West Byfield)

there. Of particular value is one close to the entry displaying a graffito listing names of workmen and (probably) the production which can be attributed to them. This particular graffito (Fig. 11.18) was removed as a sawn slab, and so remains available, but it, and others await detailed analysis outside the scope of this report.

The picking bed system seemed decidedly old-fashioned to have been used in Phase IV. The jad slot used at the top of the high pillars in the central area is much more typical of its time, but the very few examples of vertical jad cuts are known in all the quarry areas in Combe Down. They are however, a very common feature indeed in the Wiltshire quarries such as at Box, with literally miles of jad cut faces recorded. Whether the technique was derived from Wiltshire, or whether the technology flow was the other way is currently unknown. The picking bed work was clearly earlier, as demonstrated by the dumping over its locations, so it may be this was done by Hulonce, and since the Irvings Incline would have opened on to the edge of the earlier area, then it too probably belongs to Hulonce's time. Whether the work at the west end is by Hulonce, Byrne or Street is unknown, but, as it is later and Street eventually succeeded to all the area, it was most likely his.

Of other features within the quarried area, the most notable is the Hines Brewery well (see Fig. 11.1). This had been sunk by 1813 when access to it was granted by Henry Street by Hulonce, then presumably for a private house (Irving 2005). The original brewery was started in 1824 by Job Salter. The date of walling around is not known, but walling seems to have been a normal practice when the area was originally built-up. The Hines Brewery

was built soon after 1840 (Bone 2000, 112) and subsequently became the William IV Public House.

Case Study 8: Phase IV. Quarries 508/512, John Scrace's two-level quarry and the mason's quarry (Fig. 12.22)

Scrace's very small but unusual quarry lies at the south-west corner of the North Road and Combe Road junction. It was a small part of the leasehold property, running north to south lengthwise, granted to him by Harry Salmon in c 1805 – Quarries 508 (upper) and 512 (lower). The working was bedevilled by a bed of freestone, between about 2 to 3 m below the usual picking bed roof, which contained 'cockles'. These are small cavities within the bed, also called vugs, lined with calcitic, 'dogtooth' crystals, which ruined the masons' saws and the smooth appearance of the built stone. They were not commonly found elsewhere and were usually either discarded or the bed made into coursed rubble for backs of buildings or interior dividing walls. Scrace's access is not clear since the workings on the opposite side of Combe Road did not approach there until much later. He may have had a shaft, and his workings area on the south side has a well that might originally once have served as a shaft. Unless he worked at surface on the south of his plot from 1805, rather than later, an access from it is also difficult to conceive. An incline or level entry was probably possible, and would have been more suitable, from close to or in his neighbour Abraham Sumsion's quarry with whom he probably shared a crane and two winches (as revealed by details of the sale of Scrace's property). The upper working, apart from a stooping-height

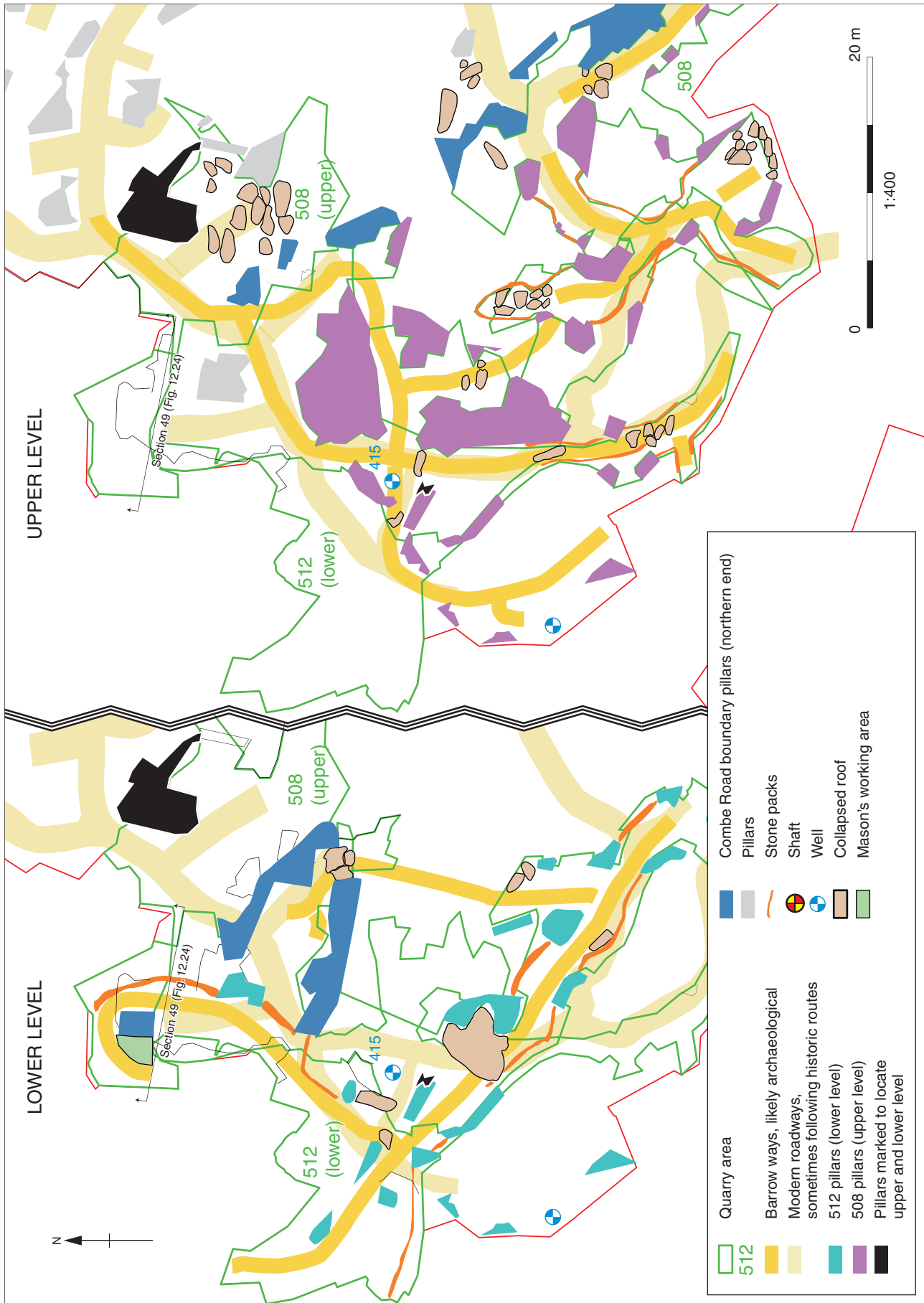


Fig. 12.22 Case Study 8: Phase IV, John Scrace's two-level quarry and the masons' quarry



Fig. 12.23 The unstable lower working in Scrace's quarry (Quarry Area 512, Byfield)

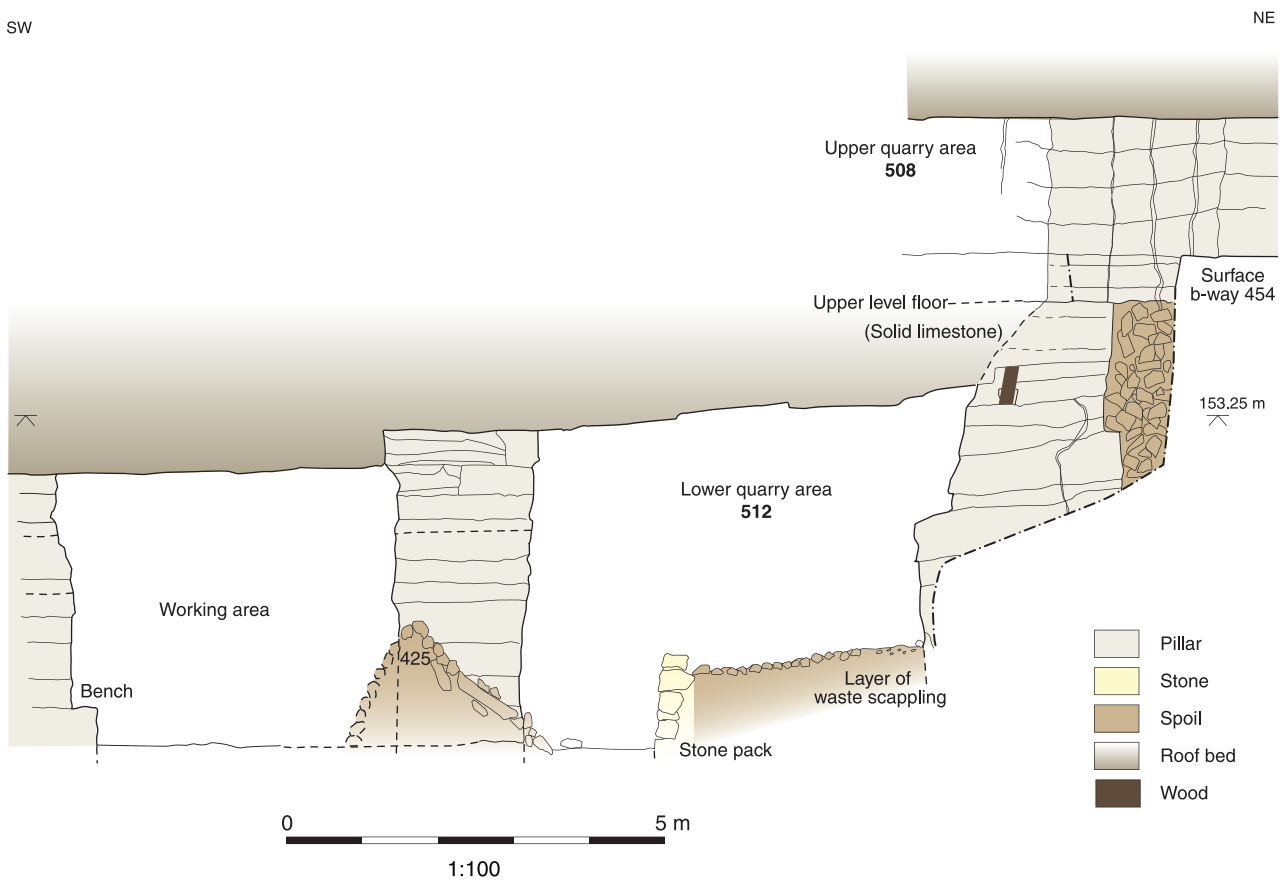


Fig. 12.24 Section of the masons quarry, showing step-down from John Scrace's Upper Quarry (508) on the right

barrow-way was found almost completely filled with rubble dumped behind packs, perhaps because of the instability more apparent in the lower working. This led at the south end to the small quarry working area (422) where it was necessary to step down a metre as the roof was lower with no upper working directly above.

The northern part of the lower working was a long chamber with a blocked side (Fig. 12.23), showing signs of extreme instability and many already fallen blocks of stone. At the north end was an opening in the roof, giving access to the upper level. The instability to the north was probably caused by the upper working pillars not being directly superimposed on those of the lower. Scrace went bankrupt, and most of his plot was subsequently worked by surface means.

The masons' quarry working area was reached by a 1 m-step down from the upper workings (Fig. 12.24). It was remarkable for its neatness, both in its working faces and the careful stacking of spoil on a low bench at the side. The floor appeared almost to

have been swept before abandonment. The north-south barrow-way, used for both stone and waste, entered around a rectangular direct pillar some 3 m high, with neat jad slots and regular broken faces, each bed emphasised (Fig. 12.25). At the back of the working, a row of triangular wedge pits was found low down. Behind the pillar several cubic or rectangular, scapped blocks, with minimum dimensions of 300 mm were scattered around. Two lengths of timber lay on the floor. It is difficult to believe this was by the same workmen as seen elsewhere in Scrace's lower working. Possibly it was that of a mason and labourer, perhaps as in some Far East Firs workings, exploiting the stone below to build the house above.

A further small quarry working area within the same phase was located some 8 m to the north of the workings described above and was linked to it by a barrow-way. It was fairly similar in appearance but had been substantially filled by spoil and was also next to a roof collapse. The well, mentioned earlier, was 3-4 m away in a short branch on the west side



Fig. 12.25 *The masons' quarry: note the clear floor, spoil neatly stacked and the clear-cut faces on the pillar*

of this further working area. What appears to have been clay from the Fullers Earth Formation below was dumped over the floor of the connecting branch, suggesting the bottom of the shaft, if not the upper section, may have been sunk after quarrying there had ceased. At surface the well is now under the entrance road to the recent Byfield Mine access just off Combe Road. A supposed former bakery was demolished some years ago at the well site and houses were built there about by about 1830, by when Scrace's and the mason's working was presumably finished.

Case Study 9: Phase IV. Quarry 2211, The Three Acre Quarry and the Grand Canyon (2209) c 1809-1838

The Three Acre Quarry occupies a roughly triangular area with its apex under the road junction at the then Prior Park Gates (Hadley Arms today), extending south-west to a nearly continuous boundary pillar. This seems to have terminated the Phase III workings; on the west it came against Phase II and Phase III workings in Central Firs near the cartway to Firs Shaft and the cartway to its north. The north boundary was the Turnpike Road (North Road today), perhaps extending to half way across under the Turnpike (Fig. 12.1). There seem to have been several small underground workings alongside the Turnpike, some possibly preceding the Three Acre, and at least one after (Quarry 2212) possibly worked by William Stennard from an entry under the North Road in his surface quarry near what is today Selway House. John Burgess acquired the Three Acres via John Greenway on a lease from Nathaniel Hadley in 1809, along with two further $\frac{1}{2}$ acre plots either side of the north end of the Long Drung. Burgess presumably worked them together, perhaps starting at the north-east end and proceeding westward (see below). He had previously operated the surface quarry on the north side of Hopecote Lodge, off Church Street and there are strong indications that by 1810 it was nearly worked-out by the time building on the south edge of the site began.

Working the Three Acres was clearly carefully planned from the start. In the two small plots at the north end of the Long Drung, two wide shafts had been sunk, one near the apex of the properties, the other under what is today the floor of the motor car repair garage on The Avenue. In the Three Acre Quarry itself, a cartway was driven centrally through the area from a shaft just south of the present day Hadley Arms, south-west to a point close to the Firs Shaft. This may have been done from the shafts simultaneously or progressively from the first one sunk, but stone extraction would have proceeded immediately it was feasible. The shaft near the Hadley Arms was not seen but it and the next two shafts were regularly spaced at about 40 m apart, but the nearest of the new shafts to Firs Shaft was some 60 m away. The haulage distances

along the cartway are thus very short to one or another shaft.

Firs Shaft probably dated to the late stage in Allen's time. The second shaft ('Chestnut Shaft') was located close to the War Memorial on the northern side, and under the chestnut tree on Firs Field. It was tunnelled under during stabilisation and was found with much rubbish at its bottom. The third, on the east edge of the field was used recently as the materials shaft and was called by the survey team the Arched Shaft. The fourth shaft was not accessible, and was encircled by floor-to-roof stone packs to retain surface-derived materials. The Firs Shaft was certainly used by the quarrymen for winding stone out from a depth of about 11 m to the cartway floor, since wheel-ruts led from the nearest working (the Grand Canyon) towards it but were not seen in the cartway beyond (Fig. 9.14). There is evidence in cable grooves at the shaft and a worn curved surface on the first north side pillar on the cartway that a cable was used to drag wagons back to the Firs Shaft. There were also Lewis slots in the shaft itself centring on a post about 1.5 m from the south wall. This may have been a mast crane situated in the shaft hauling from the cartway. There can be little doubt similar technology was used elsewhere within the quarries. It is unsure whether the Chestnut Shaft and that near the Hadley Arms were ever important for winding, since the facilities at the bottom of the Chestnut Shaft were minimal, and possibly their function was mainly ventilation, but the other, recent materials shaft was clearly important and was probably the main shaft used.

On its west side the Arched Shaft had a spectacular stone-arched opening into which the cartway level directly led (Fig. 9.15). It and the shaft whose actual opening lies approximately 2 m beyond, were reinforced by a very large rubble stone pack, at least 5 m high, facing west but continuing around the north side. The round arch was about 2 m high and 3.5 m wide, springing off the sides of two pillars about three metres from the cartway floor. It and the walls were about 0.9 m thick. The upper part of a second arch was subsequently found during heavy machine works to convert the shaft to the recent use, on the south side, the top of which was roughly at the level of the upper arch springing. It probably led into another, concealed cartway, perhaps at a slightly lower level.

From beneath the west-facing arch, the shaft was seen to bell-out at the bottom, so the rock underside sloped back some four metres to what was the base of the Twinhoe Beds. Thus the west-side top of the shaft was some 4-5 m east of the inside of the arch. It was heavily buttressed on the south side, and above the arch there was rubble and clay fill surmounted by a rubble pack to support the natural roof. From the inside, the rubble pack on the north wall was seen to line the shaft and was probably additional to that seen outside the shaft, rising some 9-10 m to within the Twinhoe Beds some two metres from surface.

On the east side the lower part of the shaft similarly belled out, and though the shaft had a huge clay shaft cone within it (mainly not touching the sides) it was clear the east side cartway had been filled in and was disused. This supports a hypothesis of quarry development from east to west.

The belling-out gave a large area for manoeuvring loads at the bottom of the shaft, but at the expense of stability and a large investment in reinforcing stonework (Fig. 12.26). The shaft was much more massive in all respects than any of the other shafts observed and would have probably needed a substantial hoisting arrangement above it. On the east side of the shaft the wooden shaft of a (probable) two-wheeled cart was found. It was approximately 150 mm square in section, and reinforced by iron bands which ran down the sides and joined over the end: presumably this was to withstand colliding with the roof when it was moved into a vertical position during loading. It had a stout crosspiece inserted near the end to allow one or two men to handle the load, but the actual carriage and platform were missing.

The cartway route was visible from the west side of the Arched Shaft back to the Firs Shaft and had been impacted by fallen rubble from the sides, so only in the section from near the Grand Canyon to the Firs Shaft was the floor visible, again emphasising the east-to-west progression of working. On the north side of the cartway, continuing from the main shaft to just east of the Grand Canyon entry, at a similar floor level, the adjacent ground had been kept clear for between 3 – 5 m width. Beyond this, a

rubble pack extending to near roof level held back spoil. This may have been either a working area for banker masons or a storage area. On the southern side a rubble pack rose from the side of the cartway, again up to or near the roof, supporting spoil. In either case there was no visibility beyond the packs, illustrating how thorough and organised spoil disposal had been, a feature noted elsewhere in the work done under Burgess.

The Grand Canyon junction was only about 15 m from the Firs Shaft, and by it the cartway passed through long pillars on either side. This appears to be the long boundary pillar dividing the Canyon from earlier work. Between there and the Firs Shaft the cartway cuts obliquely through two Long Rooms from the Phase III working north and north-east of Firs Shaft.

In the area eastwards beyond the Arched Shaft the cartway was not visible, but towards the later Hadley Arms, the workings were generally found fairly open between the pillars, with level floors consisting of waste stone and fines. The tall vertical pillars had some sawn faces in the majority of the workings. The pillars were generally some five metres high above the floor with spoil presumably stacked some distance away on the south side, beyond view. The pillars, and one strong continuous pillar were aligned so as to cross the predominant regional joint system as was the boundary pillar at the Grand Canyon. Both these boundary pillars had successive sections offset, presumably to prevent a linear weakness in the roof developing through the system. This can clearly be seen on the



Fig. 12.26 Supporting stone packs at the Arched Shaft

pillar plans and demonstrates knowledge of how to exploit weakness for working purposes without succumbing to it – a fine example of underground quarrying. This area also has several survey marks in the form of an incised cross, usually on pillar walls, but with one example on a boulder.

The working of the freestone seems to have gone out under the Turnpike or North Road and one section has a serious collapse which may have penetrated to surface and been filled. East from this, a very substantial rubble-pack wall had been built, following the edge of the road, then curving under the Hadley Arms walls. This was probably following the original roadside opposite the Prior Park carriageway gates. It is not known when this was done but it may have been at the time of quarrying. Alternatively it may have been done at the time of road widening for the electric tramway, *c* 1900.

It is probable that the unsupported, partially collapsed areas along the road west of the strong supporting pack or wall (near to the surveyor's marks) were not carried out by Burgess, and they have been shown as separate quarry areas in the survey based on their archaeology. Their existence may add credence to the North Road Wall being built under Burgess.

The North Road Wall was pierced in two places near the Hadley Arms, first at the west of the Hadley Arms yard for the Hadley Steps, an entry with a corbelled arch which predated the wall and the 1845 building of the Public House. Another corbelled arch was found a short distance away, leading to the Hadley Arms well.

Opposite the former Prior Park gates, underground, was a further similarly corbelled-arched entry. This, however, had a Roman-arch branch within, leading under the road at the junction. A passage and chamber under the road has been driven from the Prior Park side to it. A surface quarry was worked at the south-west corner of the Park in the early-and-mid 19th century. Crown-holing (upward development of a roof collapse to surface) and subsidence under the tramway took place around 1920 (Hawkins 1994, 13), presumably under an unsupported section.

The Grand Canyon – a complete working area

It was unusual anywhere in the quarries to observe complete working places because of their subsequent use for backfilling. The so-called Grand Canyon was the most spectacular, and canyon-like feature of all, and the only one observed where a complete system of major working remained unbackfilled (see Fig. 12.27). It was not possible to physically enter the deep trench of the gullet due to access restrictions, so views and features seen were generally from above from a short length of spoil platform on the western side and nearly the whole length along the dumped spoil on the east side all from just under the roof, and from a slightly lower viewpoint at the southern end. The west end was

obscured by a corner in the cartway which ran for a few metres before disappearing into the gullet out of sight. Use of cameras extended up to five metres on arms or slides, or running on a cable across the width allowed more detail to be recorded but the lower sections have, at best, only been viewed from a distance, though some detail was recovered of these by laser-scan survey.

The dominating feature in the Grand Canyon was a row of direct pillars up to 8.5 m high exposing almost the whole of the worked freestone sequence with a narrow gullet between them and in the front of a worked face. This had a barrow-way running along it on the south side along the long boundary pillar (Fig. 12.28). There was also a subsidiary working face in the north east corner connecting with working rooms behind on the north side. Between some of the line of pillars, tall rubble-stone packs had been constructed retaining rubble spoil (Fig. 12.29). The widest part was about 19 m and it was 70 m long overall with an incline leading east from it as a barrow-way to transport spoil into largely worked-out areas. At its west end the gullet and solid pillars alongside turned at a slight angle into the Firs-Hadley Arms cartway; this ran back to the Firs Shaft and displayed wheel ruts showing the Grand Canyon operation to be the last in the immediate area.

It is the most western of the lines of workings, many presumably with similar features but buried under spoil. Its survival was presumably caused (allowing for some secondary working) by it being the last part of the Burgess Quarries and the last major working within the general vicinity. Working of the wider area began about 1809 by John Burgess and ended, at the lease termination, under his son Harry in 1838. Stratified clay tobacco pipes have been recovered from the western end of the canyon and have indicated dates from the mid to late 1830s suggesting that the workings were indeed worked towards the end of the Three Acre Quarry's operations.

The pillars were developed along the joints, especially the main NW-SE direction but apparently to achieve a regularity of dimension, joints aligned some 40° from the main set were largely ignored. To do this the other rock faces were broken by splitting, sometimes by use of wedge pits and wedge-and-chip. Most pillars were thus rectangular in form, vertical, mainly direct but some with a corbel (Fig. 12.30). However viewed from the south-east side one was split into a V-shaped plan, presumably due to a joint direction affecting it. A photograph, taken remotely from a position just under the roof and directly along the gullet showed the pillars to be well-jointed with about five vertical joints in the width. These, probably under post-working stresses were opening, suggesting that stability today is poor, though no doubt it was adequate when worked. Typically the pillars were about 1.5 m wide and some 2 m long with gaps between around 4 to 5 m. Several pillars had sawn faces, and at least one

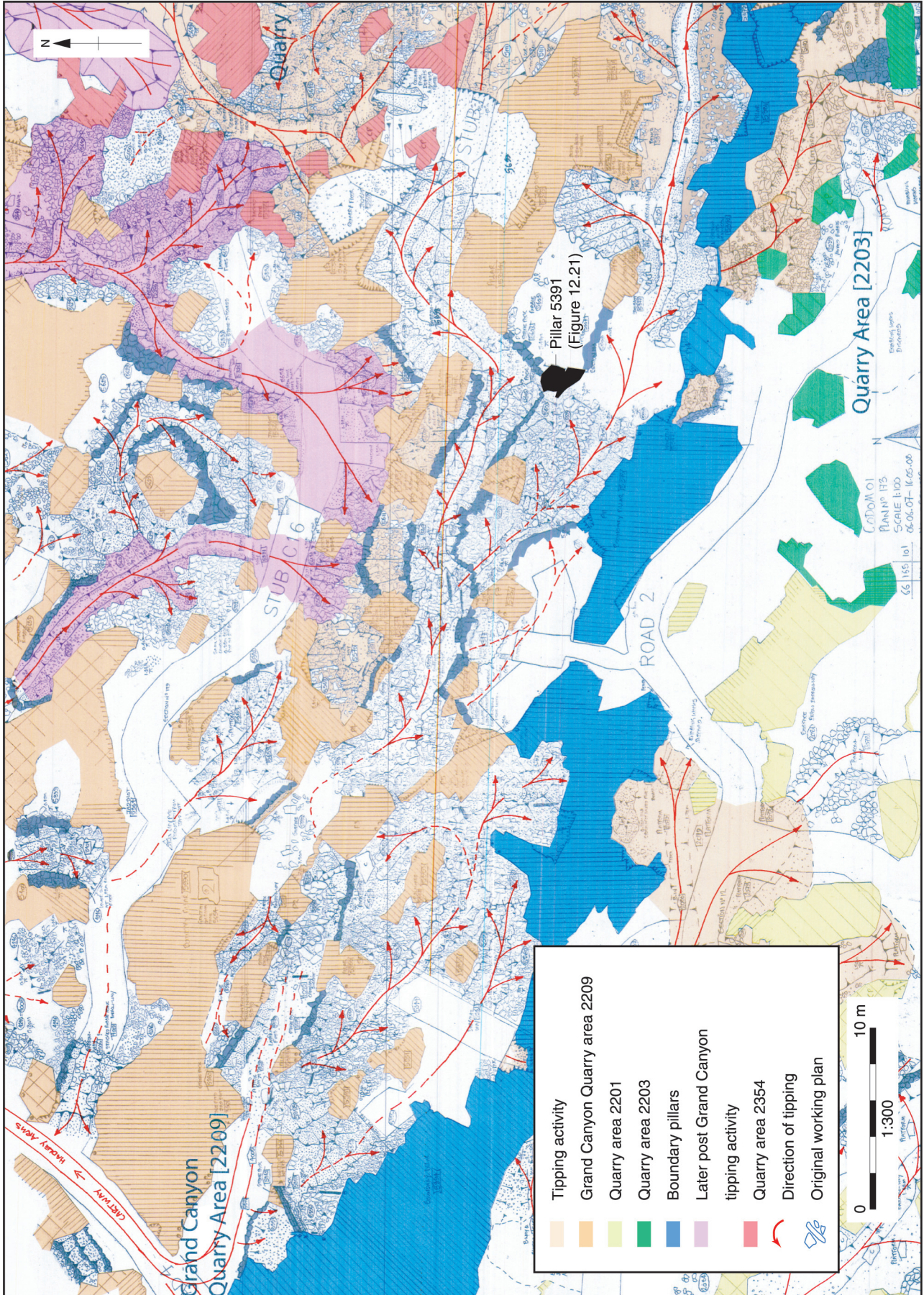


Fig. 12.27 Plan of the Grand Canyon area (2209) of the Three Acre Quarry



Fig. 12.28 View towards the north-west from just under the roof of the Grand Canyon, directly over the central gullet, showing the full 8.5 m maximum height of the direct pillars and the barrow-way below, with over 5 m-high rubble stone packs at the side



Fig. 12.29 Direct pillars seen from the southern end of the Grand Canyon

such face was so positioned that this must have been part of the original working, but was certainly not the usual method of working. Other sawn faces might reflect a final aspect of the working process – taking the last morsel, as it were, or might have been an entirely separate secondary pillar robbing operation.

Pillar 5391 was located at the east end of the Canyon and had an exposed face surviving to a height of about five meters with a significant amount of evidence for tool-markings. These included the initial chamfered jad slot beneath the

corbel at the top of the pillar (Fig. 12.30). Below, on several beds are a series of wedge holes with associated chip impressions, showing their use to extract blocks of stone in conjunction with a vertical jad cut on the pillar face; wedges were also driven in along the bedding plane to prize the blocks from their horizontal beds. Numerous 3½ inch and 4 inch-wide hack marks (88 to 100 mm) or scappling axe marks were noted on the face. These were used to trim the face of the pillar to prepare an access to the bed beneath. A pillar located on the northern edge of the Canyon had similar tool-marking features,

'Finished Labour of a Thousand Hands'

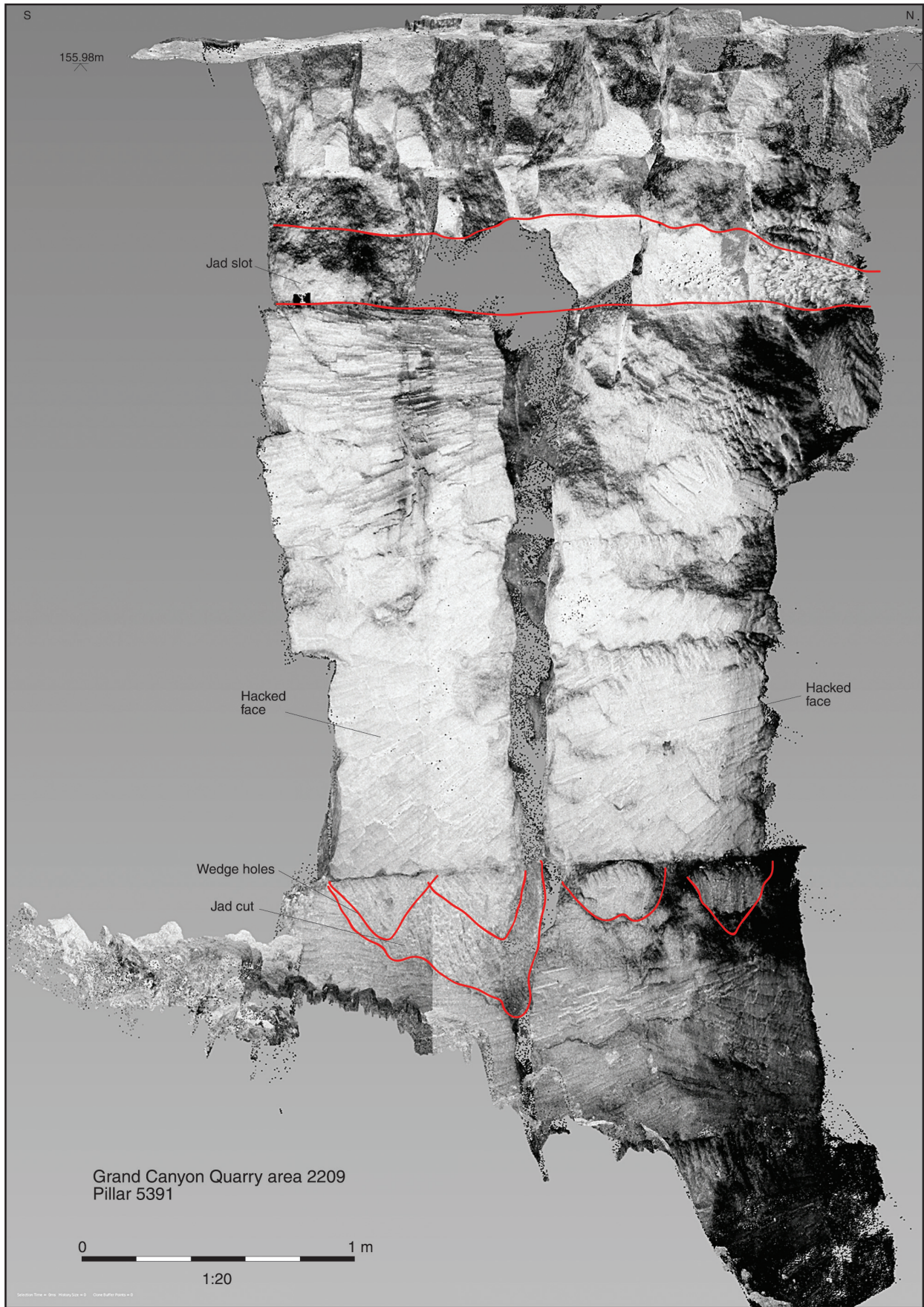


Fig. 12.30 Laser scan image of the east face of pillar 5391 (within the Grand Canyon), showing working features

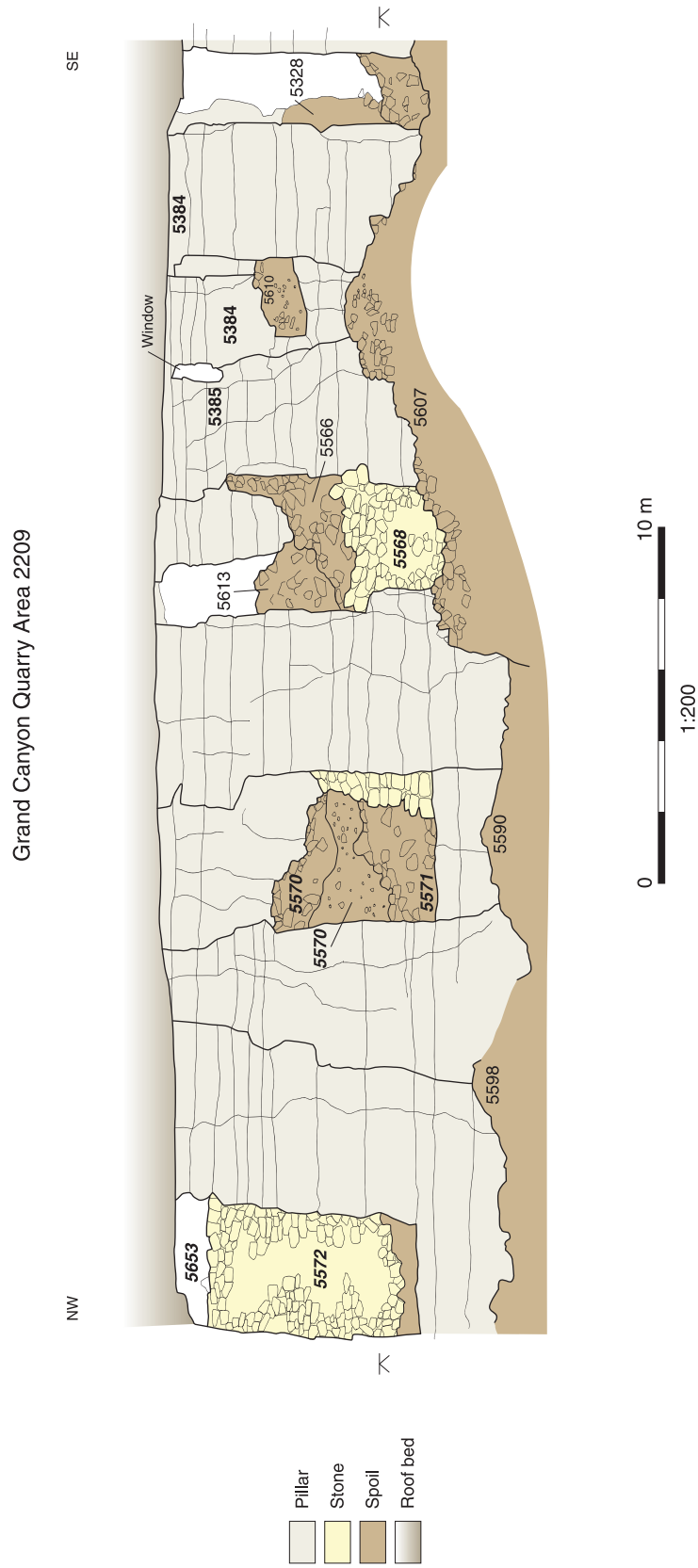


Fig. 12.31 Long elevation of the Grand Canyon produced by laser scanning, viewed to the north east of the central row of pillars, intervening spoil-supporting packs and the north-east wall between. Note the over-deepening of the floor shown by the higher level of the base of the rubble packs

especially the vertical jad cuts and the wedge holes. The two pillars are fairly representative of the type of extraction techniques used in the Grand Canyon, and exploited the secondary joints, perpendicular to the primary NW-SE joints. Evidence for the use of crowbars to lever blocks of stone from the quarry face was always difficult to determine archaeologically, the occurrence of such tools (elsewhere) indicates they were almost certainly used in conjunction with the wedges and jad cuts.

The south-west working face against the long boundary pillar and the opposing north-east faces were not very instructive, as these – like the pillars – were aligned with the main joint direction and had long sections of face unmarked by tools. More could be seen in corners at an angle to this, where it was clear jad cuts had been used to free the beds below the picking bed for 1.4 to 1.6 m, with then three or four thinner beds broken out – as a wrist stone to allow extraction to proceed regularly sideways and down. Frequently ledges had been left.

The method of working is a variant of the common Long Wall, gullet and pillar system, in which the advance is along a working face in front of a trench or gullet which provides access along it, and with spoil being dumped behind. However, the unusual height here, at least 1½ times that suspected in some

earlier areas of working, in the absence of cranes required an adaptation of the system. The elevation (see Fig. 12.31) shows secondary deepening along the gullet floor in the central part of the Grand Canyon, perhaps done on the final retreat. The rubble packs are shown in the laser scan to have their footings at least 2 m above the final floor depth, resulting in the exceptional overall height of 8.5 m. It was normal for the face to extend approximately 2 m below the cartway floor levels which originally here would probably have been only about 5 m below the roof). Unfortunately, although the use of ramp or step could be deduced from considerations of roof heights at either side, the actual position was obscured by the corner in the Grand Canyon length, leaving the problem unsolved of how blocks from below the cartway level were handled.

The south-east corner of the Grand Canyon offered a useful insight into the method of working in these conditions. For approximately 10 m this end appears not to have been initially worked, with only a sufficiently wide opening made to allow spoil to be transported out of the way on a spoil-incline (see below). To work this end a narrow vertical opening was opened on a cross-joint alongside the packs and dumps behind the gullet, through the long joint face forming the east-side

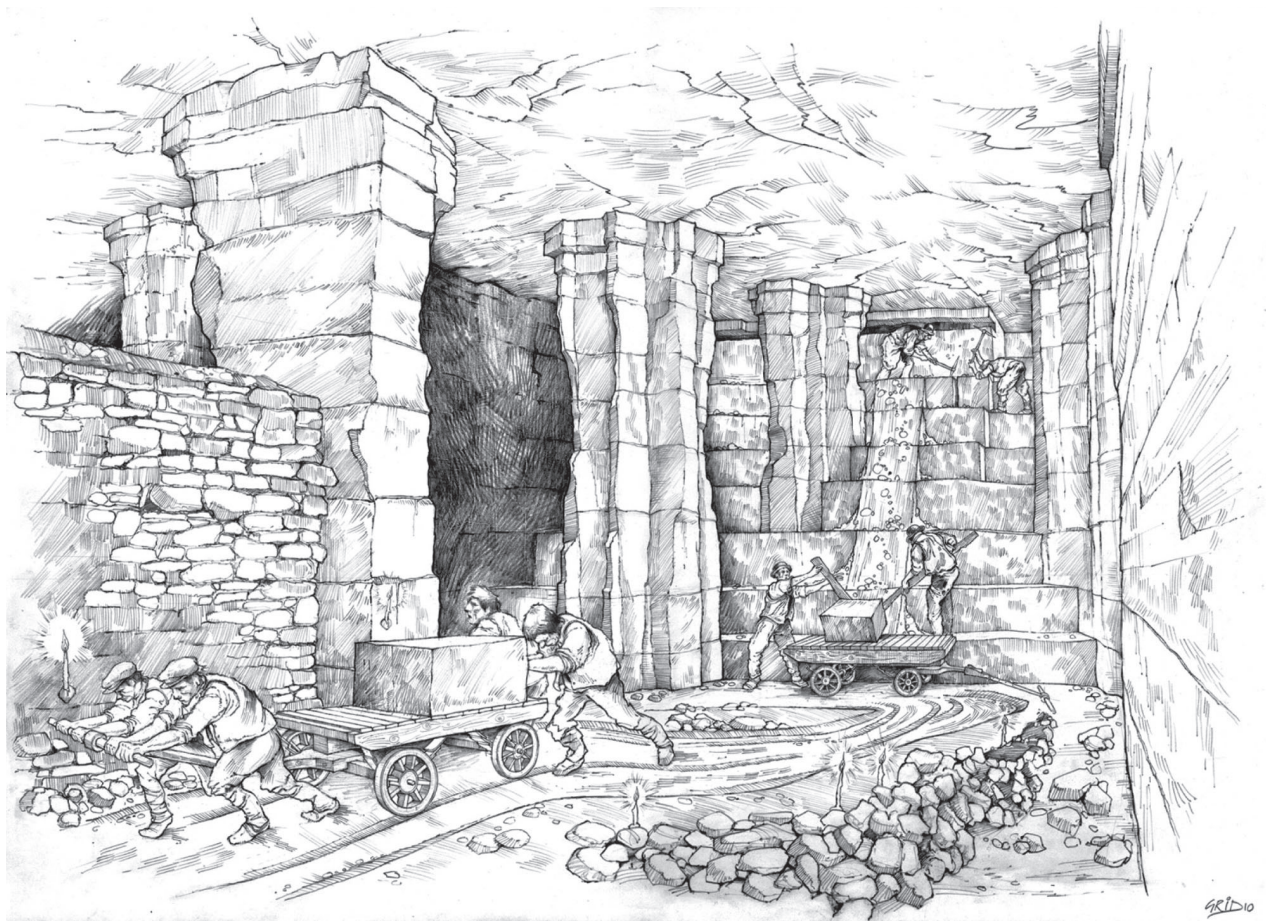


Fig. 12.32 Reconstruction drawing to show how stone may have been worked at the south east end of the Grand Canyon

wall, communicating with other near contemporaneous workings of a similar type behind.

From a level barrow-way at the bottom of the gullet at the above opening, leaving pillars as the advance was made, a spoil-covered ramp was developed, possibly accessed from the adjacent spoil barrow-way-incline to some three metres below the roof, so extraction could begin in the normal way at the top. Thus the main joint was at the left or eastern wall, and the last breaking-out of rock occurred at the top. Presumably as a block was extracted, it was dragged down the spoil-covered ramp, and any spoil, surplus to the ramp-needs, was sent out via the inclined barrow-way (Fig. 12.32). In other words the end, at least, was worked along the length of the room between the joint-faced north wall and the opposing row of pillars. It is unsure whether a form of bedded 'staircase' was made under the rubble or the face kept near-vertical and a rubble incline was built to a vertical face. The spoil would have been removed in either case as the lower beds were revealed.

To what extent this was a typical symptom of working in the Grand Canyon Area we cannot tell, though it could be adapted in several ways, such as turning into the eastern wall (leaving pillars as appropriate), for example, at the top, and then working the upper part forward in the conventional way. In another part of the quarries, heavy and long planks were located and clearly, as well as being used for transporting spoil across exposed heights to dumping areas, these could be used as temporary ramps to manoeuvre blocks and some form of temporary shear-legs would also sort many problems with blocks too heavy to manhandle. Raising from below the gullet floor in other areas within Firs was certainly facilitated by ramps. Allowing blocks to fall from such heights as here was unlikely due to the risk of fracturing. Sawing or

splitting *in situ*, which was certainly done in surface quarries, was an option underground though sawing as a normal method of working new faces was still a few years off at the time of the Grand Canyon. As seen there the method of working can be thought of as transitional, the problem being finally solved in Combe Down underground stone quarrying by the mid and late 19th-century use of underground cranes.

Spoil disposal was always a major problem and here it was a particularly complex operation. The south-eastern end of the area was well-defined by the boundary pillar, and only a narrow gap end gave access in this direction, but at the eastern side the workings had impacted and truncated the western limits of Quarry 2354. The western and south-western side has broken into former quarries (2201, 2203, 2206 and 2355), and there had been both tipping from the present working into these and tipping from elsewhere into it (see Fig. 12.27).

There were clear phases of tipping fronts and barrow-way activity within the Grand Canyon area. The upper beds of the quarry, extracted close to the roof and forming the first areas to be extracted, produced significant waste material. Side piercings in the south-western boundary pillar forming windows, had been used for access for successive barrow-way routes, including driving southwards into the former Phase III (Allen Estate) quarries 2201 and 2203 delivering material to substantially-sized tipping fronts.

There were also significant amounts of waste material transported to the south-eastern edge of the quarry, into an earlier Quarry (2353), on long lengths of barrow-ways with dumps with arcuate tipping fronts (Fig. 12.33) at the intermediate quarry heights, at 3 – 6 m below the roof. The waste stone was deposited laterally into adjacent long-abandoned Long Rooms at the different levels.



Fig. 12.33 Arcuate tipping front in Quarry 2353 from the Grand Canyon

Waste at the base of the Grand Canyon had been tipped eastwards on level barrow-way routes, but the most significant feature was the inclined barrow-way delivering material southwards into Quarry 2334. The inclined barrow-way had an overall length of 50 m with several spurs or distributaries and associated tipping fronts at the easternmost ends, and had an incline of about 1 in 6 (Fig. 12.34). Substantial amounts of small to large rubble had been deposited laterally along the inclined barrow-way edges and some had also been stacked into low stone packs where space was available. Exterior to the Grand Canyon itself, successive tipping ways could be seen to be one above another, and at inclines with similar gradients suggesting that the gullet end has retreated away from the dumping area to maintain the angle and/or to access higher levels.

On the southwestern side of the Grand Canyon a platform of vertical stone packs had been constructed to a height of 4.5 m from the floor, and had probably been formed from both an inclined barrow-way on the western edge and partly from

stone transported at a higher level in its final construction. It was possibly accessed from routes of barrow planks, placed at height above the floor, and delivered from the northern edge of the Grand Canyon from other contemporary barrow-way routes. Another barrow-way transported materials from the extraction cartway or barrow-way at the western end of the Grand Canyon, situated about 6 m below the quarry roof level, to about 1.5 m below the roof located at the tipping front at the eastern end. Several successive barrow-way surfaces consisting of mixed fines and small rubble formed the feature.

Though the Grand Canyon at the southernmost working of the Three Acre Quarry was initially considered to have represented the end of that extraction period, there have been workings on what were probably residual blocks close by. From the north two main barrow-way routes had been used to deposit significant quantities of waste stone on the northern edge of the canyon, so must have remained active while the Grand Canyon was being exploited, or very soon after.



Fig. 12.34 *Inclined barrow-way at the south-east end of the Grand Canyon*

Phase V: Small-scale working in the mid-19th century 1838-68

With the opening of the railway in 1840 from London through Bath to Bristol, the competition already felt at Combe Down from the Wiltshire quarries by the building of the Kennet and Avon Canal intensified, and it was not to be long before the Combe Down quarries were eclipsed by their competitors. However, there was still a preference, justified or not, for Combe Down stone over Bath Stone in Bath, and quarrying continued, though probably under pressure from reduced real prices, especially in more distant markets. It is this that probably motivated changes in working methods, some, for instance, probably forced on the local producers by the example of the much larger quarries developing at Corsham and Box. Several small underground quarries are described below, which illustrate how they reflected changes taking place in the wider industry.

Large parts of the central area of Combe Down by 1838 were nearly worked out. Henry Street continued until he retired about 1851 at the surface quarries west of Combe Road, though some production seems to have continued, but (with the exception of secondary pillar robbing) only at surface. Pillar robbing seems to have been the only activity in most of the Monkton Combe Byfield underground quarries, though John Davidge may still have been at work in the southern part of East Byfield workings, where even after 1900 a block of unworked ground remained for James Riddle to quarry (518).

North of the Turnpike or North Road, a large area of surface quarrying continued, leased from the Thomas Trustees, with probably five separate operations at, or soon after the time of the Tithe

Award c 1851-2; West of Stonehouse Lane was worked by Isaac and Giles Sumsion (Addison 1998, 45), William Stennard (Henry Stennard after 1870) east of the Lane; next was James Stone up to Farris Lane, then Richard Lankasheer and James (Edwin after 1872) Love at the east, coming up against the Blind Lane or Popes Walk as it now is known. By then the quarries were approximately 100 m back from the road towards the north rim of the Down. This later reduced to three, as Lankasheer and Stone ceased operation. Their surface quarries gave opportunities for easy access under buildings or under the Turnpike and south of the road.

Two blocks of ground near the Turnpike were worked underground. At the northwestern end of the long boundary pillar bounding the Three Acre Quarry, (just east of Farris Lane today), an area north (Quarries 2216 and 2218) and south of the Turnpike (2214 and 2215) possibly began work in the previous phase. The last of these to be worked (2215), seems to have been worked out by soon after 1880 so probably began in the present phase under William Stennard, continuing into Phase VI (see Case Study 12). Another small area of ground, this time north of the Turnpike under the oldest buildings in Combe Down at the (present) entrance to Stonehouse Lane could not thus be surface-worked, and so was tackled underground by means of entries, probably from the Isaac and Giles Sumsions's surface quarry, around or soon after the mid 19th century.

In the southern part of Central Firs a block of ground, Quarry 2202, remained unworked on the east side of the Allen entries in Sheeps House Quarry, and to its south under Gay Staithe. It is not known who worked these, and though the name Davidge's Bottom was applied to the area, this was probably because of his brewhouse having earlier been built there. It is quite possible it was another quarrymaster, since Greenway had earlier acquired rights to the underground entry areas, and he or a successor would certainly be seeking a return on this long-ago investment. Another small block was left half-way along the western Allen entry, Quarry 2344, perhaps marking the Phase II cessation of work there, but its working seems to have been in the late century.

In Combe Park, now considerably built over, the Hadley Estate leased the underground to Richard Lankasheer in 1856; graffiti suggests an earlier start than 1856, but many parts were not datable. His royalty, expressed in the quantity of stone extracted, rather than the area worked, suggests that though new areas may have been worked, this was essentially a secondary working operation. This may explain the substantial amount of pillar robbing that went on there, not all of it commendably carried out.

This left the larger number of underground quarries of this period, though probably far from the larger production, in the area east of the Long

Drung. Here quarrying, some on a very small scale, continued until the century end. These quarries (denoted on the Phase Plan as Phase V or VI), all apparently accessed from shafts on the small leasehold properties let out since about 1830, were very diverse and suited either the needs of a single mason, or for building the house above.

Probably a greater amount of stone was being, by the mid century, produced in the outlying quarries which came within the bounds of the new Ecclesiastical Parish of Combe Down in 1854. They included those around Entry Hill; at the top above Horsecombe, and at Foxhill on the west, and at Lodge Style eastwards to near Combe Manor on the east. Probably only the Shaft Mine area had underground quarrying before the latter part of the century. Mid-century surface quarrying may have continued east of the built area of Combe Down and, possibly north of North Road in Prior Park and the Rainbow Wood areas. There was also a small quarry north of Brassknocker Hill which may be mid-century also.

Case Study 10. Phase V, Stonehouse Lane Quarry (2219)

There were two houses above the quarry, possibly with outbuildings shown on the 1742 Thorpe Map of Bath and Five Miles Around. One house remains, on the west corner of the Lane with North Road. The other was at the eastern end of the plot shown by Thorpe, and was demolished in about 1950. The underground quarry extends south of the road, but the southern workings are dissimilar from those to the north side, possibly suggesting a separate operation (with whom and when unknown). The north side would almost certainly have been worked by Sumsions who owned the surface quarry which gave access to it.

At the east end there was a boundary pillar and, under the road a series of rooms of which those at the east appeared to have dumps derived from the west. Close to the eastern end there was a well, which had been partially infilled from above, forming a shaft-foot cone at the freestone working level. Remains of a rod and pipe suggest it had a pump, but detail was not observable. The well would have been at the rear of the east side house.

Further to the west behind pillars with jad slots and wedge slots, was a clear floor (Fig. 12.35), with nearby scapped blocks or slabs leaning against the wall. More slabs were found north of the pillars along the front of the clear area. The area narrowed as it went north and at the west side were openings walled up with packs or with spoil of a type we had learned to associate with surface quarries. The multiple entries from the surface quarry suggest the underground, after the initial working, was probably used as a convenient shelter, either for working stone (possibly in the winter) or for storing it. As found today the open workings were largely just west of the



Fig. 12.35 Cleared floor at Stonehouse Lane Quarry, with scapped slabs

modern lane, but it seems likely they actually followed under the original quarry road, which maps show curved to the north-east.

Case Study 11. Phase V, Quarry 2202 – east of Sheeps House Quarry

This was accessed via the east Allen cartway and the branch cartway from its east side. The cartway and branch, much of it through apophygate or corbelled pillars, had clearly severely deteriorated by the mid 19th century, and, in the first section, large blocks, probably of bastard stone, had collapsed from the roof, or had been barred down. The substantial rubble packs lining the route were probably derived from them. The somewhat wider and higher branch cartway appears to have been in an even worse state, with large collapses over the whole of the roof, and massive rubble packs were built at the sides (in front of the old crane position) virtually all the way to the entry into the quarry (2202). The quarry too was also prone to falls – a massive example lay just inside, which was obviously post-working and was used as a test site by Hawkins (1994) in his survey. This was to determine whether such stone falls were cumulative or catastrophic, though this particular example obstinately seems to have remained stable since.

The quarry was worked Open Room (with wide cleared floors between and round pillars rather than a narrow gullet – see the Grand Canyon, above). It was L-shaped around and up against older workings and cut into spoil dumped in them. The use of mast cranes was probable from numerous anchor points left, mainly Lewis holes, although inability to access the area prevented

possible location of actual crane sites. Some form of winch or pulley system was probably also used, held back to a pillar by spigots in holes hand-drilled either side. The line-up suggested it was used to drag stone up a ramp at the foot of (the final) vertical working face at the north-west side of the quarry on to the wide flat working floor of the quarry (Fig. 12.36). The ramp was steep, vertically rising about two metres, so the overall stone quarried was over seven metres high, with nearly six metres height left above the working floor. Another pillar had two spigots high on the pillar with a chain stretched between them around a small portion of the circumference. The purpose was not obvious as a substantial pull on the centre of the chain would probably have dislodged it.

Pillar faces, when not natural joints, were usually split by wedges or wedge and chip, but some were sawn, and at the north-west end of the quarry a right-angled projection from a boundary pillar was sawn roof to floor on the three exposed faces. The outstanding differentiating feature from any other workings at Combe Down was the use of large numbers of timber sprags or scorters (Fig. 12.37). Some were still in position, but the holes chipped into the rock for them were very numerous indeed, in both the individual pillars and the boundary wall and in the roof. They were used to support roof blocks, probably by pressing the adjacent blocks together so they held by friction. Clearly they gave the quarrymen considerable confidence and apart from the fall near the entrance, their confidence seems to have been justified.

There were large amounts of spoil, but some would have been derived from the workings broken into which spilled out on to the floor. A long



Fig. 12.36 Open room working floors in Quarry 2202



Fig. 12.37 Pillar with scorter recesses

barrow-way incline was used to transport the spoil to a level high enough to be dumped in old workings (2340).

On a high ledge, where they must have been thrown or left before the rock was cut down, were a pair of leather shoes, definitely too soft and delicate a quality for working in a quarry. There were also several graffiti items, including dates of 1856 and 1886, and an argument over the respective merits of the beer and its price (3¹/₂d a quart) at the Hadley Arms (built about 1845) and Coxes (perhaps the Foresters Arms) (see Figure 11.13). Actual working dates are not known – several other sawn faces had the name 'James Morris' and the date '1863', which are thought to be associated with secondary pillar robbing activity, but the graffiti dates here were probably close to the working period of the mid 19th century.

South of this working, extending nearly to under Gay Staithe, a further block of stone was left (Quarry 2340), possibly worked contemporaneously or slightly earlier than the above. The principal feature was a high final working face, worked from a narrow gullet, perhaps as high as eight metres. Spoil had been dumped into it preventing any detailed assessment of how the quarry had been worked. The origin of the spoil was unclear but it obviously represents later working, probably in the same area and possibly small-scale reworking. It appears to have completed the working of substantial blocks in the southern area of Central Firs, though why such conveniently available stone to Sheeps House Quarry and under the core area of the village should be left is hard to discern.

Phase VI: Working from the late 19th century to the early 20th century

By about 1868, it is likely that working had just begun or at least resumed on the underground Stennards Quarry (2215) served from his surface quarry north of North Road. The working (2202) near Gay Staithe (above) was perhaps completed in the early part of this phase, while two small reworking Quarries (2367 and 2368) and the small but deep working at the shaft on Allen's western cartway (2370) extended through it. Quarry 2370 exploited a very small block at the junction of boundary pillars and is the only known example of re-excitation below the old (Phase II) cartway floor into the freestone beds remaining below, to depths which had become normal by the second half of the 19th century. The quarryman clearly recognised that the shaft, located to the west of the cartway, allowed easy handling using a direct surface hoisting arrangement which would compensate for the costs of moving existing deposits of spoil. Another Quarry (2344) located 30 m to the north, is also thought to have been worked during a similar period, possibly as part of the same late scavenging operation, also used the same shaft for handling stone. The quarry had survey marks

delimiting the area, so was probably preceded by a professional assessment of this area of Combe Down. Graffiti dates continue to suggest that pillar robbing, though on a smaller scale, remained a frequent activity, and small-scale working and banker mason activity is also evidenced from the Far East Firs area.

There was substantial activity continuing on the outer fringes of the Combe Down parish, at the Springfield Quarry especially at Entry Hill and in the surface and underground quarries between Combe Manor and the Lawns, including the Lodge Style or Shaft Road underground workings and St Winifred's (cited as the only quarry underground still working in 1895 in *The Builder*) and at Mount Pleasant. Nearer to, but outside the older quarrying area, four small underground quarries, including Coxes Vertical Shaft Mine and Tankfield Quarry operated under what is today the Foxhill Ministry of Defence establishment back towards the Combe Road junction. All these were active from the 1870s, closing by the early 20th century. In the main body of underground mines, James Riddle's small quarry (518) completed all underground work there about 1911, though officially it remained active until 1914.

The major business development of the period was the formation of the Bath Stone Firms Ltd, a combination of some of both Combe Down and Wiltshire quarries which aimed, with reasonable success, to regulate the Bath Stone business. This took place in 1887 and involved the Combe Down quarries of Henry Stone and family (adjacent to the Prior Park carriageway) and Isaac Sumsion (Lodge Hill or Shaft Road underground Quarries and the adjacent Combe Down Quarries, and the Mount Pleasant Quarries) and Randell and Saunders (Springfield Quarry and later, under Foxhill). The initial chairman was CJ Pictor (Pictor and Sons of the Corsham quarries), but soon after Isaac Sumsion succeeded him, with his son taking over about 10 years later. The name of the group was changed in 1911 to the Bath and Portland Stone Firms Ltd and the stone business remained effectively within their control into the 1930s. Early on they rationalised some minor quarries and remained active until the around 1938-39 when demand fell away because of the imminence of war. The underground quarries on Shaft Road: Lodge Hill and Mount Pleasant both closed about then, as did St Winifreds.

Independent operators still continued to operate, including the Hancock family at Lodge Style (the Lawns) which still operates today, and James Riddle who was the last to operate underground in the old, traditional area of underground quarries, at Allotment Shaft (518).

Case Study 12 – William Stennard's underground quarry (2215)

The quarry was worked from Stennard's surface quarry on the north side of North Road, but was originally accessed by the survey from the exten-

sion of the Allen cartway (313) where it turned north-east. This is just through the long boundary pillar and at a point of a probable fault that had resulted in the sailed pillars and poor stone which led to abandonment in Allen Estate period (Phase III) since the pillars appear to have been worked in the Long Room way, similarly to the workings to the south. This seems to have led to the abandonment of ground to the north which was not worked until the mid and late 19th century. Here the undated workings around Quarry 2215 to the north and north-east were accessed from north of the road, with a cartway entering into Quarry 2217. These were older than Stennard's quarry 2215, probably belonging to the previous phase since the surface quarries almost certainly had to be there to service them. Details of their relationship with both Samuel and John Pearce, the adjacent quarrymasters and the Hadley Estate, the landowner, are unknown.

Stennard's Quarry, which probably dates from around 1870 was worked using cranes. In effect it was a substantial flat-bottomed hole with dumped material on all sides, some from the hole, some remaining in place from adjacent quarries. This was a form of wide room, still with pillars but with spoil removed from the immediate area allowing the space for cranes to operate efficiently, much as they would in a surface quarry. These cranes were probably very similar to the surface cranes, though possibly slightly smaller, with a central mast supported by cables (iron wire or chains) running back to anchors, and a swinging jib which could be used to haul blocks towards it. One cable anchor on the west side was a large Lewis (Fig. 9.33) which was recovered. Other Lewis slots were noted and chains were probably also wrapped around pillars. No crane base was found.

The pillars here were nearly all sawn, with a wide jad slot just under the roof to let the razzer in, followed by the frig bob, completed bed by bed to the bottom. Most pillars had their faces inclined inwards, so that the base of the pillars could be very thin, dangerously so in places, but fortunately the area was not large and thus stresses were less. As a working method sawing probably produced much less spoil. The spoil generated by the working of the pillars, and from the collapsing in of older waste, was stored on wide flat-topped or bench-like tips at the sides, reached via small inclines. This was a more systematic method and was used in several of the later workings, possibly facilitated by a reduction in the spoil produced.

The quarry probably closed about 1880, so would have begun late in the present phase. The 1st edition OS 25 inch (1882-3) showed it as accessed by a wide hole left behind from the current quarry face, located to the side of the later Selway Court; it probably used a crane to hoist stone to surface level. The second edition OS map showed Selway Court built over the area.

Case Study 13: Phase VI. Foxhill Underground Quarries: Wilks Quarry, Coxes Vertical Shaft Mine and Tankfield Quarry (2380, 2381, 2382 and 2383) (Fig. 12.38)

This is a group of three or four (two may belong to the same stage of working) small, connected underground quarry workings extending from the north-west corner of Combe Road across the front of Bradford Road under the houses and west under the MOD establishment which occupies the former Foxhill Farm. It was probably either here or at one of the Sumsion quarries that rail and post crane techniques were introduced underground to Combe Down, almost certainly from Wiltshire where Randall and Saunders of the Corsham Quarries pioneered them (Pollard 1994, 43).

The site was originally part of Widcombe Field. There was a surface quarry north of the junction of Combe Road, known by Addison (1998) as Wilks Quarry, and a quarry is shown here in its early development on the 1882-3 OS 25 inch map. There is very little to indicate the other three quarries on the maps. The water tank which gave the mine its name was shown on the Ordnance Survey map for 1882-3 onwards and to its west is a small square of ground which appears to be a quarry, possibly with a shaft or depression which may be at the shaft site between Quarries 2390 and 2393, and a well (shaft?) is marked north-west of the Wilks Quarry. On the 1902 map the Wilks site had its Bradford Road frontage built but and no indication of quarrying activity at all. Indeed a house has also been built in the south-west corner of the field. The 1912 map does show possible activity just north of the water tank where there are two small buildings or enclosures which may relate to the Coxes Vertical Shaft being used by the Tankfield Quarry, and the well. By 1930 houses had extended along the frontage and the west side of the field, except, perhaps significantly where the Coxes Vertical / Tank Shaft had been. The area was by then known as Ralph Allen Park. Taken together, this seems to indicate a phase of activity in the late 1870s and 80s, and (with the other evidence below) a renewal of activity around 1912, with termination early in the 1920s allowing housing development to commence.

Wilks Quarry underground (2382)

The underground workings 2382 appear to be associated with this quarry as the entries all emerge on the north or north-west side. It is unlikely that the Stonehouse Quarry to the east of Combe Road end developed the underground workings since it was over 50 m away. Wilks Quarry was shown on the 1882-3 OS 25 inch map as a small area of worked ground at the south end, with a crane, and it is probably the 'new quarry near the Turnpike' (almost certainly a surface quarry from absence of reference to shaft or underground) mentioned in connection with the death of 70-year-old James

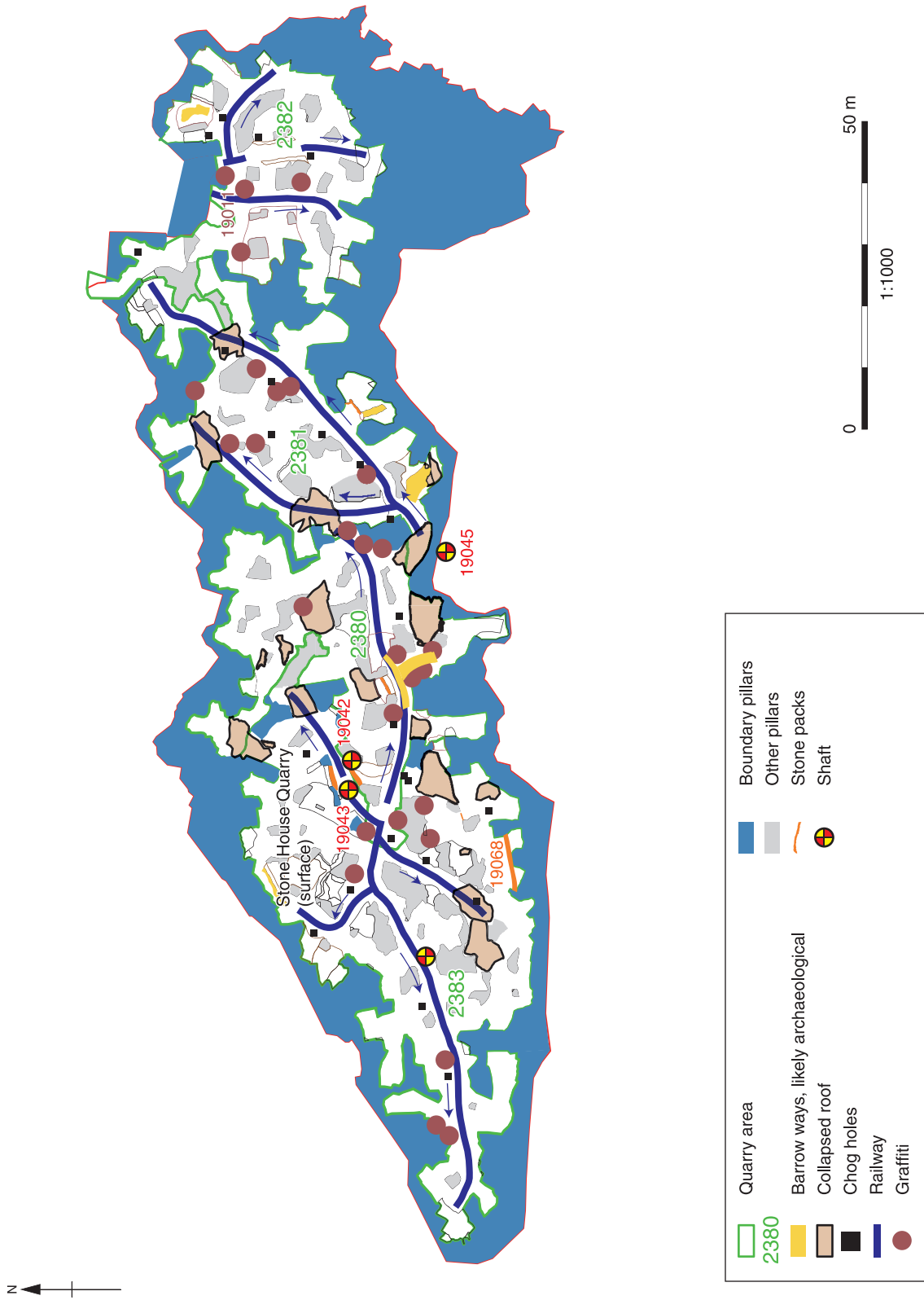


Fig. 12.38 Case Study 13: Phase VI. Foxhill Underground Quarries: Wilks Quarry, Cox's Vertical Shaft Mine and Tankfield Quarry (2380, 2381, 2382 and 2383)

Hillyar who was struck by the windlass handle he was operating (*Bath Express* 11 September 1875). It or the Coxes Shaft may also have been the Randell and Saunders quarry where Edward Filo was killed by a falling four-ton block of stone two years later (*Keenes Bath Journal* 28 July 1877). According to Addison (1998) the houses were built alongside Bradford Road by 1891, strongly suggesting that nearby quarrying activity had ceased by then, and certainly by 1902. This seems to date the Wilks Quarry and its underground section as operating between 1875 and the late 1880s.

The Wilks (2382) underground section appears to be functionally separate from the others and the only connection was a 'window-sized' opening on the west side. It is possible that initially, *c* 1880, the south side of the surface quarry was used for stacking the 'ridding' – the extracted material – from behind, where the crane stood. Rather than remove the spoil dump, entries were made under it and the stone brought out while the crane was in a suitable operating position to handle stone from both surface and underground.

The archaeological survey found that four entries had been made, all from the north or north-west side. The two north-west entries may have been of small enough penetration to allow the direct dragging-out of blocks of stone. The two southern entries had sleeper voids indicating use of rails with the eastern-most track dividing into two. The tracks, possibly two to two-and-a-half feet (750 mm) gauge, ran down long Open Rooms between substantial pillars. On the main track, two post crane positions, marked by chog holes about 12½ inches (313 mm) square, were placed either side of the track at about 9 m intervals. These marked the advance of the working face that was about 12 m ahead of the southernmost crane. From roof to railway was approximately 3.7 m, suggesting that about 5 – 6 m of stone was removed. Three other chog holes were noted close to the eastern and western quarry entries. All had an associated Lewis hole, used for pulling the post into position. An *in situ* Lewis was recovered from the southernmost crane position, perhaps resulting from its last use.

There was graffiti, most of it near the entries, some of which may have been contemporary with working. Unfortunately no dates obviously related to the working period one example, 'P Long 1818' was clearly much too early for the type of working and other dates all appear to relate to later entry, possibly via the window (unless the well was a shaft remaining open into these workings). However, a list of tools was much more likely to be contemporaneous: '7 saws, Bars – 3 big and 1 small – 2 pair of Lewises – 1 snatch block – 8 planks – 1 crane – 1 jack – 1 shovel'. These are mostly obvious in their use, but the snatch block (an openable pulley block) was probably used for redirecting the crane cable to the required pulling direction, and the jack was probably necessary for getting loaded wagons back on rail, or for manoeuvring a block of stone.

Of the later graffiti, 'BEC 30 Dec 1944' indicates that the group of four workings was still open at that time (at least at the western end). This may reflect its wartime usage as a shelter.

Coxes Vertical Shaft Mine (2381)

Addison also refers to Coxes Vertical Shaft Mine or Tankfield Quarry (the tank was present on the 1882-3 map and was demolished in 1973). The Tankfield is now thought to be identified as Quarry 2383, through archaeological evidence. The quarry has its shaft near the MOD gates and the tank. This shaft, re-utilised and effectively destroyed by the stabilisation programme before we gained access seems to originally to have served the adjacent quarry to Wilks. This leaves two further quarries adjacent to the west with a further shaft, probably the later Tankfield Quarry (see below). There is an obvious relationship with the name Coxes Quarry for that south of Bradford Road, opposite, and, probably a name of a Public House seen on graffiti in Firs Mine.

The quarry was apparently operated by Randall and Saunders between about 1875 and 1885 and there was a graffito date 1882 at the shaft bottom which seems to confirm the dating. This is very similar to that ascribed to the Wilks Quarry, but this may reflect a landlord issuing leases simultaneously. The quarry seems to have been developed using a railway from the shaft bottom to the NE corner, where it came against the Wilks Quarry boundary pillar, there fairly thin. A second railway may have been developed against the eastern boundary pillar. A length of rail was recovered but the gauge could not be determined and the track had been dumped over.

There were four chog holes in the roof at about 8 m, then 10 m and 12 m intervals and a fifth possible but obscured by a roof fall. They ranged along the north side of the railway, the first 9½ inches (238 mm), the rest each 10 inches (250 mm) square with the usual Lewis slot. This suggests the first crane may have remained *in situ*, a second being moved along as work progressed. There are two lines of pillars in the central area and another two in the south east – a lack of chog holes suggest stone from there was pulled directly back to the shaft.

Graffiti may indicate names of workmen, though this is always uncertain, including Edwin Riddle 1889 (cf James Riddle, later a quarrymaster in East Byfield) and J.E. Dowling and W. Hole 1882. The Dowling family left their names very widely through all the Combe Down workings (and on the Palladian Bridge in Prior Park).

Coxes Vertical Shaft Mine may also have been worked, in sequence, with the 'Unknown' Phase working below, which may be supported by graffiti dating between 1898 and 1911.

Unknown and Tankfield Quarry, (2380 and 2383)

The early or first stage quarry (2380) cannot be firmly dated (except by accepting graffiti dates

between 1898 and 1911). It has traces of a railway with 9¹/₂ inch (238 mm) chog holes above, at eight metre intervals, crossing roughly east-west, and several Lewis holes. This does not serve the whole quarried area well and it may thus be that the cranes pulled from substantial distances and possibly the old Coxes Vertical Shaft was used for the parts near to it. One of the chog holes near the shaft seems to indicate a crane position was re-used in the second stage of operation

The second stage, westernmost, quarry had a notably more complex railway following the long Open Rooms within the pillars with a notably central open area in the southern part. The main length was developed south-west from near the shaft, but is substantially overlain by dumping. Four 12¹/₂ inch (320 mm) chog holes were somewhat irregularly placed along its length, located 8 and 12 m apart on its north side. Two more chog holes were found to the north and two to the south, while two collapses may mask others. A length of wire cable was found below one chog hole, and a single chog remained *in situ*. Two Lewis holes were found at one chog hole.

The name seems to be derived from the water tank placed near the Coxes Vertical Shaft Mine and may suggest this shaft was used as part of the present quarry development. The Coxes shaft is placed at the boundary between the older and newer quarries, but a second winding shaft was installed between the two phases of the present workings with a nearby smaller diameter shaft possibly remaining from the first phase, no doubt for ventilation or statutory escape purposes.

The Combe Down (Bath) Freestone Co. Ltd was set up in July 1909 with £2000 capital to acquire a lease of 21 years for the Bath Stone Quarry in Tank Field, owners James Tucker, Frederick Armstrong and Frederick Box, with equal numbers of shares, the property involved extending to an acre. It continued to be registered until 1924, though by 1921 the registered address was Ralph Allen Park, suggesting interest had by then turned to property development. It employed up to sixteen workers, in 1912, but seven or eight were more usual up to 1914. During the War, only one or two were employed until 1917, then none until in 1924 nine workers were engaged.

The main working shaft, 3.5 m wide, and found backfilled, appears to have been that between the two phases, placed centrally, which are separated by a pierced boundary pillar. Dumping via barrow-way from the western working into the east establishes the phasing, with the eastern clearly completed first so that the railway system is almost completely sealed. Because the Coxes Vertical Shaft is also placed centrally between phases (Quarries 2381 and 2380), in absence of other firm dating of Phase I it may belong to either Coxes Vertical or to Tankfield Quarry, or, of course to both. Certainly Tankfield had control of the earlier phase in order to carry out dumping.

These workings had many artefacts left within them, including two saws at the base of the shaft, sharpening files used as coat hooks, containers for water (drip cans for sawing, or bottles) and items associated with the railways – bars, wedges and oil-lamps.

Comment

The choice of underground working at these quarries is puzzling. Wilkes was partially worked underground, and a rational reason can be advanced for this, but the other three linked locations were only worked underground. It points to a landlord insisting on it and this could only reasonably be because housing was conceived as a future use and undermining was less damaging. If so the explanation for Wilks Quarry having some workings in the same range almost certainly has to have the same underlying reason, though storing spoil on it temporarily would be a sensible option still.

The two earlier workings appear to be contemporaneous, and it is possible the third was wholly or partly worked in sequence after them as part of the Coxes Vertical Shaft Mine, but probably after Wilks had closed. The delay before Tankfield Quarry operated is possibly an indication that other quarrying methods were economically preferable.

Case Study 14: Phase VI – James Riddle's Quarry (518) 1905-14

This was probably the last area of the main Byfield/Firs complex to be worked (Fig. 12.39), and was known as Allotments Quarry (Addison 1997, 43). It was at a very small remnant block of stone surrounded by older worked-out areas. It was the only one known to use an underground railway in conjunction with post cranes: the former left sleeper troughs in the floor and the latter a series of chog holes in the roof, and one instance of a crane base stone in the floor. The two areas were at one end separated at what became known as 'H Pillar', a significant landscape feature of unidentifiable age which had been extremely overworked and left in an unstable condition (Fig. 2.4). Close by H Pillar the railway, which ran back to shaft around a corner cut through an older spoil bank, came to a loading point served by a crane. The crane, indicated by a base stone and chog hole directly above in the roof stood next to a pillar (Fig. 9.34).

The first area to be worked seems to have been on the south side where pillars are of two forms, vertical with deep jad slots and sawn, split and natural faces and a northern area where the majority of faces are sawn vertically (see Fig. 8.30). Pillars on the south side also had cable grooves and it is possible a mast crane was also in use at some time, though part of the area had several post crane chog holes too.



Fig. 12.39 Pillars in James Riddle's Quarry

Both areas have been worked Open Room, an obvious advantage for where cranes are in use, with spoil from the earlier area apparently dumped in old Phase I and III workings, which Riddle's workings abut, (516 and 915 respectively). Spoil from the northern area had been dumped on flat-topped banks on the southern area. The floors in the area are built up above the bottom of the worked stone and kept flat and clear, with stone dragged by the crane(s) to the rail-served loading point.

The northern area (and part of the southern) with totally sawn pillars is arranged in an avenue about 15 m long and about 7 m wide. There were two sets of rooms extending for approximately 8-10 m on the west side. A chog hole in the roof shows the position of a crane inside the first of these, possibly situated there to drag stone back to where the railway once extended, or alternatively, to where the crane noted above stood next to the railway.

The eastern line of pillars had been worked in a straight line along a single joint which was open to some 50-100 mm width: the western line was less obviously weakened. Timber sprags or scorters had been placed just below the tops of the pillars to help support the roof and the fact it had not collapsed perhaps justifies their optimism.

Case Study 15, Phase VI – The deep quarry on Allen's west cartway in central Firs – Quarry Areas 2368 and 2370

This study examines the reuse of an Allen western cartway (see Chapter 6) in the late 19th century. The southern extent of this cartway had passed under a narrow shaft 70 m in where there was no substantial evidence of cart-ruts. A 3 m diameter shaft was

located near the interface between the apophygate pillars and the slightly later corbelled phase of the Allen workings (Phase II), though several apophygate pillars were noted to the north of the shaft, abutted by later 19th-century stone packs. The shaft was probably used during the 18th century for winding stone out and was certainly used in the 19th century for localised pillar robbing activity associated with Quarry Areas 2368, 2370, and also 2344. The northern extent beyond the shaft was sealed by later barrow-way activity and a loading platform associated with activity from Quarry Area 2368. pillar robbing from Quarry Area 2370 beside the shaft had cut through the cartway section and the loading platform of Quarry 2368, fortuitously exposing a stepped face cross-section through the Allen cartway route, extending down to the natural freestone.

A large shaft cone of surface-derived material, including pottery sherds, had formed at the base of the shaft. This had accumulated prior to capping of the shaft with a slightly domed stone-block construction during the mid-late 19th century.

The upper stepped face in the sequence through the cartway route (see Fig. 9.26 – Section 191) was investigated across the whole width of the former cartway and mainly recorded in section the later barrow-way activity, from the earliest sequence (1443) to the latest (1226), from the pillar robbing from Quarry Area 2368. Earlier barrow-way surfaces below this had sealed the latest extant cart-ruts (1018). The later barrow-way activity was probably mid 19th century, as the deposits appeared to be contemporary with cartway (3022), dated on other evidence to the 1850s or 1860s. Graffiti within Quarry Area 2368 was dated to 1863 with the initials

'J M', which were probably written by the quarryman James Morris, who had left other examples of dated graffiti in the year 1863 besides his full name during other episodes of pillar robbing activity noted in Quarries 518 and 2201. The recorded barrow-way activity included several later barrow-way surfaces and associated lateral tips above the cartway. These were mainly associated with dumps of waste stone produced during quarrying of the working faces, while those used within the construction the cartway were layers of finer limestone spoil deposited well above the base of the quarry working level, noted in section 192 at 5.55 m below the roof. There was little deposition depth in the later thin layers above the ruts, which were about 4.1 m below the roof. This suggests that at least part of the cartway sequence was of 19th-century date. Several phases or layers of small rubble and limestone fines were noted below the uppermost surviving of ruts in plan (1018). There was an absence of the concave features in the centre of the cartways, usually located between the ruts, and typical of many of the observable cartway sequences seen in plan within other Combe Down complex quarries. The characteristic low convex heap of fines that formed in the centre of the cart-ruts were partly indicated within the fines/cartway surface layer 1457. There was also an absence of clearly defined cart-ruts below the uppermost 19th-century cartway. The potential absolute absence of ruts, ie use of wheeled carts in the early period, and the absence of the distinctive concave feature were also noted below the contemporary cartway (Ctx 3100) located to the east. The lack of evidence for the use of carts in both cartway sequences may indicate that a change of methods occurred in the nineteenth century with the introduction of the carts underground within the quarries and not just employed at the surface for the moving of the stone. This may suggest the use of rollers or sledges for the removal of the stone from the underground quarries in the earlier 18th century.

The lower part of the stepped section (Figure 9.26 Section 191 & 192), records the lower sequence of cartway activity, with the uppermost cartway surface (1018), being the contemporary height of the cartway floor leading from this location southwards back to the surface quarry. It is unclear how

much further this cartway extended northwards beyond the section. However, it may have been extended during the Allen period as far as the northern boundary pillar (1161), and the line of the route was well-defined by the adjacent wider pillar alignment. A small section of cart-ruts were preserved close to the boundary pillar, and a corresponding breach in the pillar suggests that the route may have extended through this quarry boundary. The period of this breach could not be established archaeologically but Lynn Willies had noted the cartway alignment, covered with debris, extending through the pillar face. By around 1800 leases show the cartway extending beyond the boundary pillar (LL. 91/18/5/30) for about 30 m to the north-east. A shaft which may be the present day Firs Shaft is shown 20 m to the south of the north-east extension.

The easternmost cartway route was over 100 m long and 3.60 m wide between the apophygate pillars. The southern stretch of the route was re-used by a later cartway (3022) branching towards the east, and later Quarry 2202. A shaft thought to be contemporary with the early development of the cartway, located about 70 m from the entry in an analogous position to that on the western cartway, was *c* 1.40 m in diameter. It was one of the few examples of a probable ventilation shaft and was of a similar diameter to another located 30 m to the east above the branch cartway. The latter may have been contemporary with the later part of Allen Phase II or, more likely, was an early Estate, Phase III cartway, as it was associated with Long Room working and crane usage.

Beyond the 70 m distance from the entry shaft the cartway was extended northwards to the Firs Shaft and probably just beyond during the late Allen period of working. This change was noted in the development of pillar type from apophygate to corbelled along the route. The shaft, though much modified by modern recent use, had Lewis holes positioned on one side so as to suggest a crane post support, and cable grooves were found on the pillars. Though no date could be confidently ascribed to either, the adjacent areas had Long Rooms similar to those further south-east associated with crane use, considered as either late Allen or early Allen Estate (Phases II and III).