Breaking Chalk

THE ARCHAEOLOGICAL INVESTIGATION OF EARLY NEOLITHIC FLINT MINES AT LONG DOWN AND HARROW HILL, WEST SUSSEX, 1984–86

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Fieldwork undertaken between October 1984 and September 1986 at four of the six neolithic flint mining sites in West Sussex recorded the remains of shafts, drift mines and flintworking areas adjacent to the mines. Sample excavations at two of these sites, Long Down and Harrow Hill, revealed that ploughing had truncated nearly all the surviving remains in those areas under cultivation. The flintwork, pottery and organic material retrieved from the excavations provided information on the flint artefacts produced at these sites, and fragments of possible Carinated Bowl, together with radiocarbon dating, proved that mining took place at Long Down in the early neolithic period (4000–3500 BC). The discovery of drift mines at Harrow Hill is significant, as they are the only open-cast or drift mines to have been investigated at a prehistoric flint mining site in southern England. A supplementary report can be found on the ADS website.

INTRODUCTION

From 4000 BC onwards, the spread of agriculture from the Continent into Britain transformed the culture and social practices of communities in southern England, culminating in the construction of new forms of large-scale monuments, such as causewayed enclosures and long barrows. It has long been accepted that flint mining, specifically the sinking of deep shafts, was integral to the 'Neolithic Package' as it supplied flint for the manufacture of polished axes.

Since the discovery of flint mines in the late 19th century (Fig. 1), decades of research have changed their interpretation. Their significance was recently highlighted by refinements in the dating of monuments long thought to be their contemporaries (Healy 2008; Whittle *et al.* 2011). The construction of long barrows can now be considered to have started around the final few decades of the 39th century BC, with the building of causewayed enclosures around a century or so later (Healy 2008; Whittle *et al.* 2011). Equally, from the few available radiocarbon dates for flint mining (Barber *et al.* 1999; Whittle *et al.* 2011), it is evident that the earliest shafts were perhaps being sunk at least a century or so prior to the start of the 4th millennium BC (Fig. 2), long before the appearance of long barrows and causewayed enclosures. This makes the flint mining sites in West Sussex, which occur in two main groups on the South Downs, close to Chichester and Worthing respectively, among the earliest form of neolithic monument constructed in the landscape of southern England. These flint mining sites, which are dated slightly later than their counterparts in Northern France, Belgium and the Netherlands (Whittle *et al.* 2011, 24–56), exhibit a European influence (Wheeler 2008, 2011; Baczkowski 2014) and it has been suggested that fully-developed mining techniques were introduced to Britain with the transit of people from Continental Europe and may have been implemented to claim territory, enforce cultural beliefs, or to trade new types of lithic tools, complementary to new agricultural techniques (Baczkowski 2014, 149). As such, they appear to have functioned differently from the earthen long barrows and causewayed enclosures which followed later, and were concerned with the production of flint implements which circulated among the early neolithic communities of southern England, partly as woodworking implements and partly to serve ceremonial and symbolic functions, for example as votive deposits (Holgate 1995a, 158).

The following report outlines the results from two small, but important, sample excavations of flint mine complexes in West Sussex. Although the excavations are almost thirty years old, this is a timely piece of research, as flint mines are now understood as monuments in their own right, rather

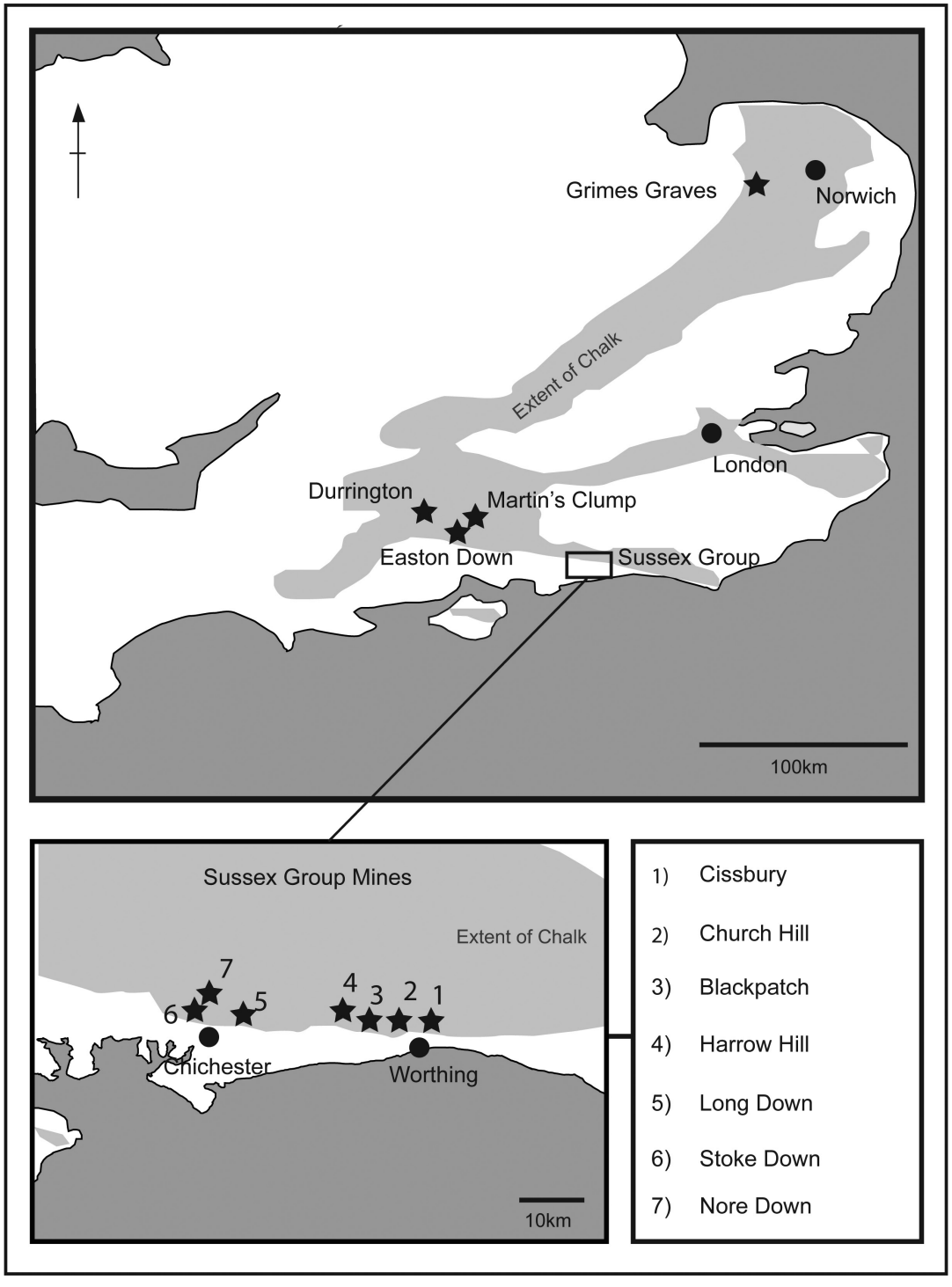

Fig. 1. Map showing the location of southern English flint mines.

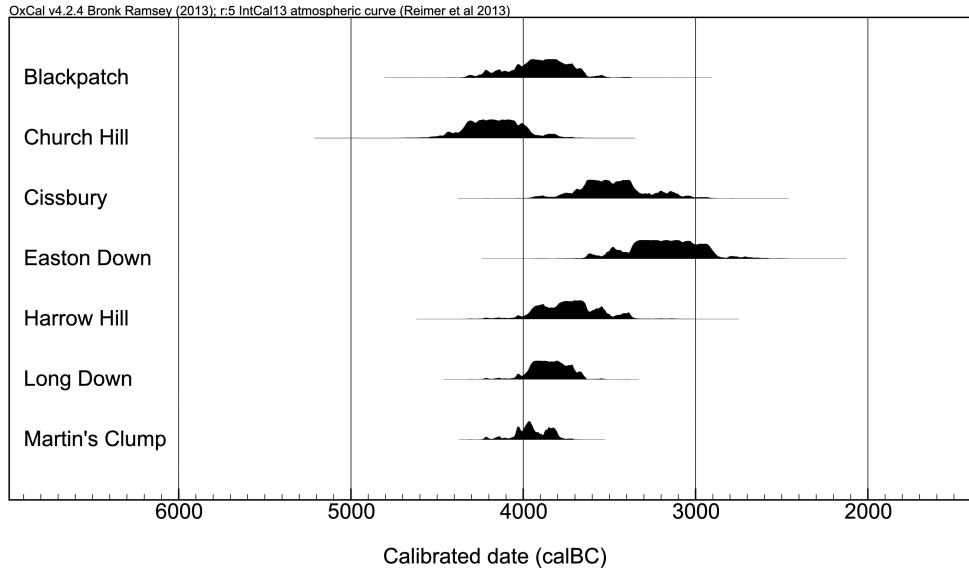

Fig. 2. Date ranges of southern English flint mines.

than being peripheral to communities whose focus, at the earliest phase of the neolithic period, was long understood to be on causewayed enclosures and long barrows (Drewett 1978). They extend the work of previous archaeologists (Lane-Fox 1876; Curwen and Curwen 1926; Pull 1932, 1933a, 1933b; Holleyman 1937; Salisbury 1961) by providing further information on mining techniques, the flint products from these sites, and the dating of Long Down.

BACKGROUND

In 1984 English Heritage commissioned the Field Archaeology Unit (then attached to the Institute of Archaeology, University of London) to undertake a plough damage assessment of the flint mines. The project was directed by Robin Holgate and supplemented by funding from the David Thomson Charitable Trust and the Margary Fund of the Sussex Archaeological Society. It involved a surface artefact collection/recording survey, a geophysical survey, an earthwork survey and excavation at four sites: Long Down, Stoke Down, Harrow Hill and Church Hill, between October 1984 and September 1986. These sites comprise three main elements: flintworking areas; shafts and drift mines, defined as mining by the opening of small entrances or adits, horizontal passages leading into a vertical chalk face to follow seams of flint (Weisberger *et al.* 1980); and surface spoil dumps, potentially sealing vestiges of the neolithic land surface. The two sites where excavations took place were Long Down, ten kilometres north-east of Chichester, and Harrow Hill, seven kilometres north of Worthing.

The main objectives of the project included determining the limits of the flint mining and flintworking areas on the sites under cultivation; recovering a sample of flintwork in order to determine the range of implements being manufactured; obtaining ceramic and organic material which could be used to provide dates for the activities taking place at the sites; and establishing the relationship between working areas and the immediately adjacent flint mines.

A CENTURY OF RESEARCH

Since the late 19th century archaeologists have excavated all known early neolithic flint mines in West Sussex. These mines account for six of the proven ten prehistoric flint mining complexes found in southern England (Barber *et al.* 1999) and, along with Martin's Clump and Easton Down in Hampshire (Whittle *et al.* 2011, 261), are the only mines proven to date from the early neolithic period (Fig. 1).

The West Sussex mining sites are broken into two groups. To the west, the smaller Chichester group consists of mines at Long Down, Eartham, and

Stoke Down, Funtington, and a probable complex at Nore Down, Compton. To the south-east, the larger Worthing Group comprises four mine complexes: the largest and best-preserved complex at Cissbury, Findon, its smaller neighbour at Church Hill, the destroyed Blackpatch and the well-preserved complex on Harrow Hill, both near Patching.

The history of 19th-century research at the West Sussex mines parallels the development of archaeological investigation into the monuments of prehistoric societies across southern England. This is epitomized by the first major excavation of a flint mining site by Colonel Augustus Lane-Fox and Canon Greenwell on Cissbury Hill during 1867–68, followed by the excavation of a shaft at Grime's Graves by Canon Greenwell in 1870 (Lane-Fox 1876), which helped develop the notion of a neolithic age and also influenced a century of subsequent excavation at West Sussex mines (Holgate 1995a, 136–44; Barber *et al.* 1999, 4–14).

During the 20th century, all the mine complexes were subjected to various episodes of archaeological investigation, the most notable undertaken by Worthing postman John Pull who first excavated at Blackpatch from1922–32 (Pull 1932), then at Church Hill, from1933–52, and finally at Cissbury in 1952–56 (Pull 1933a, 1933b; Pye 1968; Russell 2000).

Of the two sites excavated by Holgate, the large complex on Harrow Hill, with around 160 known shafts, was subject to three excavations, firstly by E. Curwen and E. C. Curwen (Curwen and Curwen 1926), then by G. Holleyman and the Worthing Archaeological Society in 1936 (Holleyman 1937), and finally in 1982 by G. de G. Sieveking, assisted by P.J. Felder (McNabb *et al.* 1996). In contrast, the small complex of around 30 shafts at Long Down was partially excavated between 1955 and 1958 by E. F. Salisbury (Salisbury 1961).

Over the last few decades, research on flint mining has focused predominantly on its wider social role, questioning many of the theories formulated by early archaeologists who argued that extraction was an intensive industrial process (Clark and Piggott 1933; Childe 1958; Piggott; 1965). Evidence, including the lack of permanent structures close to flint mines, gives little or no indication of domestic activity, and the generally fast nature of shaft backfilling now supports a hypothesis that mining was periodic and episodic (Holgate 1991, 1995a; Edmonds 1995; Barber *et al.* 1999). Analysis of lithic debitage at flint mines has further inferred the transient nature of flint mining, as the final stages of tool production seem not to have occurred within the mining horizon, with the finishing and polishing of axes taking place off-site (Gardiner 1990).

The symbolic function of flint mines in early neolithic belief systems has also been studied (Edmonds 1995; Barber *et al.* 1999), and ethnographic studies of communities that until recently mined and produced axes, such as Aboriginal Australians, have been drawn upon (Topping, 2004, 2011a). Recent research has also expanded the cultural meaning of chalk art, or *graffito*, found etched into the walls of mine galleries, most notably at Cissbury and Harrow Hill, with mine structure itself interpreted as a symbolic space within which creative social interactions were equally as important as mining (Teather 2011, 2016). Comparisons have also been made between the West Sussex mines and the Langdale stone axe quarries in Cumbria (Bradley and Edmonds 1993), where quarries were located in remote places, possibly to control the supply of stone (Bradley and Edmonds 1993; Edmonds 1995). It can be hypothesized that the inaccessibility of a deep and backfilled shaft restricted access to a material resource from deep below the ground (Edmonds 1995; Barber *et al.* 1999; Russell 2000). It should also be noted that there are instances where weathering occurred, showing erosion may have been responsible for the accumulation of some silts, for example at Cissbury and Blackpatch, demonstrating that shafts were not always fully backfilled promptly, but in a series of separate episodes, either as new shafts were opened close by, or as possible communal events (Barber *et al.* 1999, 62).

Overall, it is now broadly considered that the deep mining of flint during the earliest phases of the neolithic transition was undertaken by small communities on a seasonal basis, as part of a yearly routine within a semi-sedentary lifestyle (Edmonds 1995; Holgate 1995a; Barber *et al.* 1999; Topping 2011b). Flint mining in Sussex can therefore be interpreted as an activity central to the establishment of neolithic lifeways, both as a nascent form of corporate activity to maintain bonds, and as an essential pursuit to produce flint axes. Mining communities were at the forefront of new neolithic ideologies and customs that were becoming established across southern England.

FIELDWORK RESULTS

LONG DOWN

On the southern edge of the South Downs, close to the village of Eartham, a mine complex of around thirty shafts is located on the western edge of Long Down (SU 93138 09357), a prominent spur of land with chalk and Clay-with-Flints deposits overlooking a dry valley that runs north from the downs and south to the coastal plain (Fig. 3). Here, the neolithic miners exploited flint from a single seam of large tabular flint (Holgate 1995b, 350).

1984: Field survey

In October 1984 Holgate undertook a surface artefact collection and earthwork survey on the eastern part of Long Down in an area under cultivation (*see* Archaeological Data Service supplement, hereafter ADS). The survey identified the location of a well-defined flintworking area, measuring around 25m in diameter and containing axe roughouts and axe-thinning flakes (Fig. 4). To the north and east of this area four depressions were recorded, similar to the earthworks of the main minefield, which were interpreted as the hollows left by mineshafts.

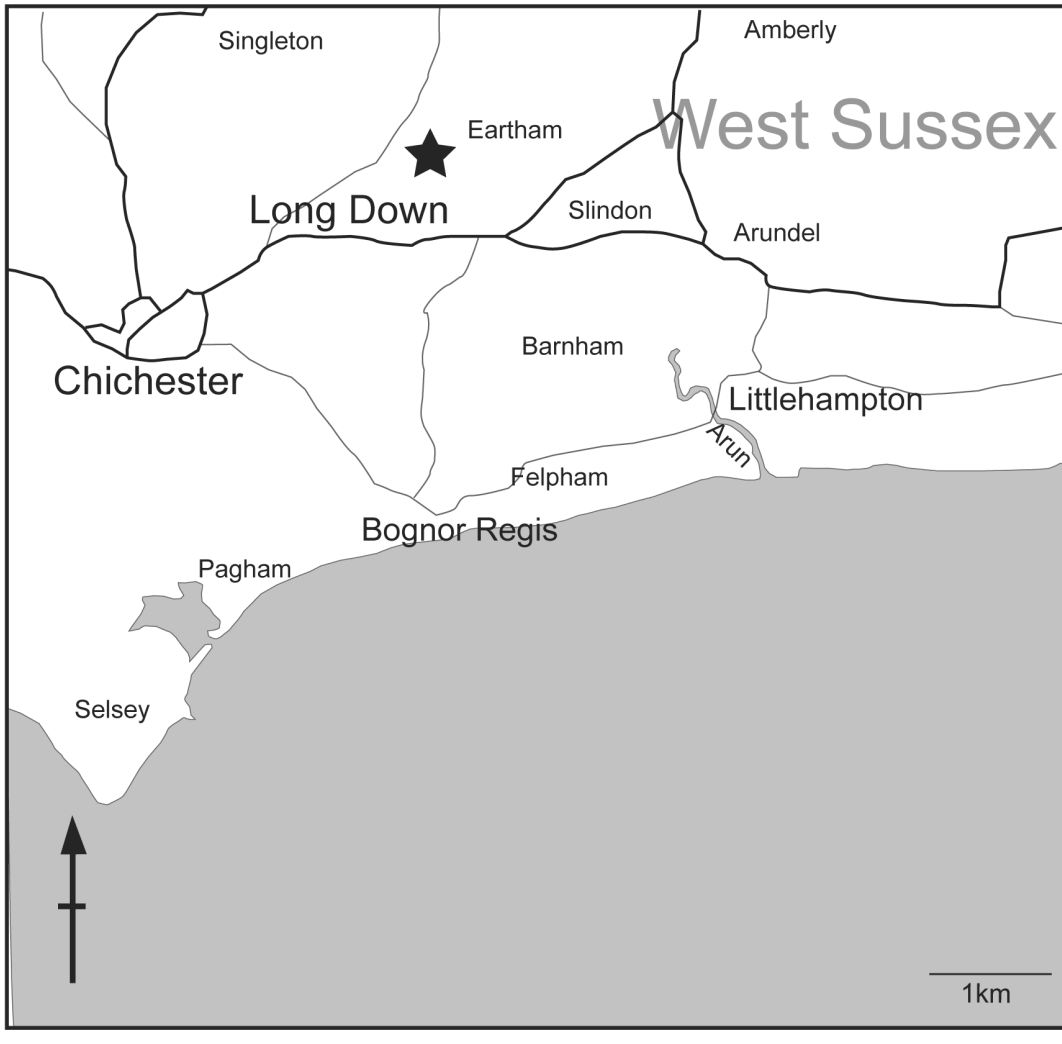

Fig. 3. Map showing the location of Long Down.

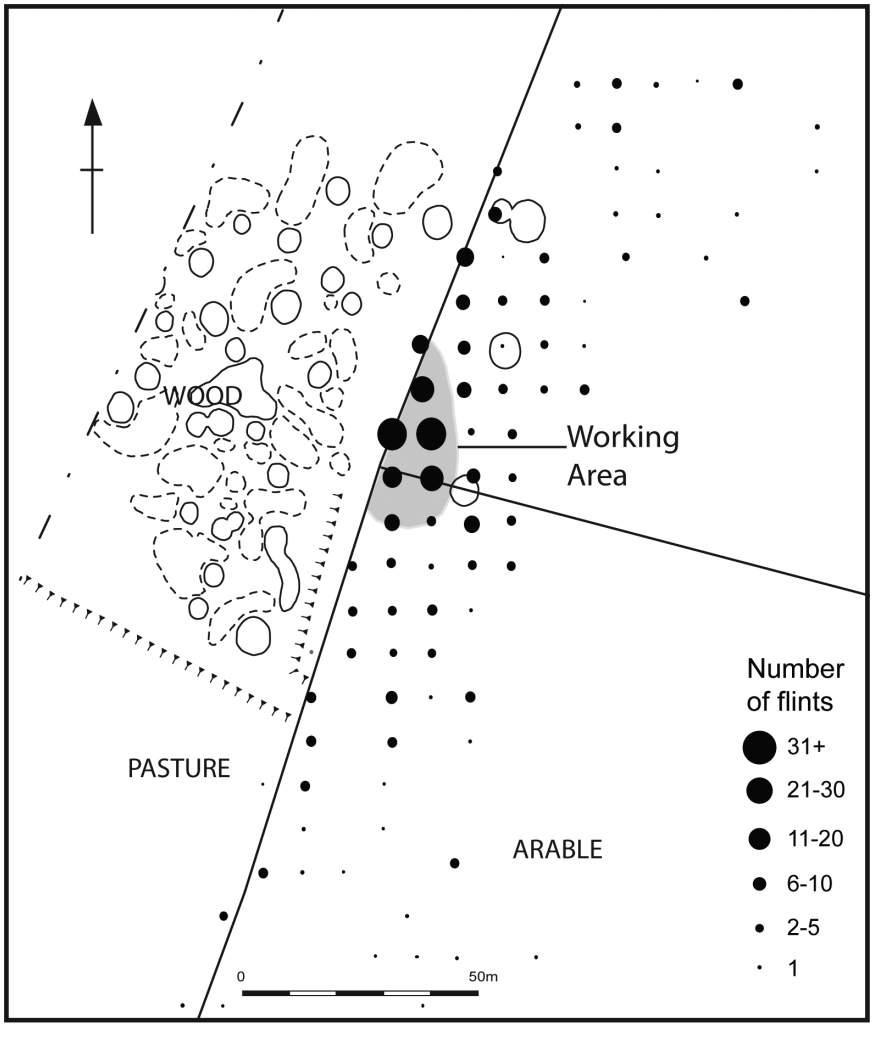

Fig. 4. Ground survey of Long Down, showing the working area and the densities of flint recorded in the 1984 field survey.

The density of the worked flint was highest along the western boundary of the area, close to where the earthworks are located (Fig. 4); here, the number of flints reached over 31 pieces per square metre and included soft hammer-struck axe-thinning flakes, axe roughouts and a small number of discoidal knife roughouts (*see* ADS supplement). Interestingly, the area of the four depressions, two of which would later be excavated and prove to be flint mines, produced very little flintwork in the surface collection.

The precise nature of the relationship between the working area and the surrounding mines was not established, but the dating of the scatter is inferred from the worked flint, the pottery found with it (*see* below) and dates obtained from the excavation of the mineshafts, which all fit within an early neolithic date range. Therefore, it is highly likely that the working area was contemporary with episodes of mining, rather than representing the re-use of mine debitage in later prehistory, as recorded at other mines in West Sussex (Barber *et al.* 1999). However, the presence of the discoidal knives and a fragment of Peterborough Ware pottery found on the surface of the site in the early 1980s (Drewett 1983) indicate activity in the middle neolithic

period (3400–2900 cal BC), although it is considered unlikely that any formal flint extraction was taking place at the site during this period.

1985: Excavation and methods

Andrew David, of the Ancient Monuments Laboratory (AML), first carried out a geophysical survey using an EM16 Fluxgate gradiometer over a 120x60m area of the cultivated field to the east of the mine complex. No new flint mines or features were located in the course of the survey and it was decided to target the features recorded in the 1984 survey for sample excavation, namely two of the four hollows and the flint scatter. The edge of the shaft recorded in Salisbury's 1956 excavation trench was also chosen for investigation, with the objective of locating a buried land surface, preserved under an upcast spoil dump, for palaeoenvironmental analysis which could reveal dating evidence, such as pottery or mining implements.

Three areas were targeted for excavation by hand (Fig. 5). Firstly, two 3x1m trenches, A1 and A2, were placed across the known mine shaft encountered by Salisbury; secondly, 35 test pits (grouped into trench B), measuring 1x1m and amounting to a five percent sample of the total area were opened across the flintworking scatter; lastly, two of the four circular depressions were investigated by the 3x1m trenches C and D.

The test pits (trench B)

The best results were obtained from test pits B9 (Fig. 6) and B10, located around 5m uphill, to the east of the western boundary. These two pits revealed *in situ* worked flint 0.3m below the topsoil (57) in layer (54), a mixed layer of chalky rubble, chalky pea grit and loam, interpreted as an undisturbed remnant of the horizon upon which mining occurred. Crucially (54) was overlying (53), a chalky pea grit soil, which had formed just above the natural. This soil represented the remnant rendzina soil dating to before the commencement of flint mining. Many of the flint flakes found at the bottom of (54), on the interface with (53), were interpreted as being *in situ* and formed by mining activity on the original ground surface.

Of significance was the discovery in trench B10 of three fragments of early neolithic pottery (*see* below). These were found in layer (45), in association with 147 pieces of worked flint and numerous chalk blocks that were almost certainly the waste from deep mining. A further 117 *in situ* flint flakes were found below (54), at the interface with (53), indicating that two different episodes of lithic production had occurred in this area.

A similar density was found in B9, with 127 pieces of worked flint found *in situ*, including one core, in the interface between (54) and (53). After examination of the *in situ* debitage from both trenches, it was confirmed that they were located in an area of flintworking focused on the production of axes. These scatters survived because Iron Age or Romano-British ploughing formed protective colluvial layers, as evidenced from potsherds recovered from layer (52), a dark brown, loamy soil that lay above (54) and (53) and was heavily plough sorted.

The remaining test pits mostly produced quantities of struck flint not *in situ*, having been turned by ploughing. Plough marks were found penetrating up to 50mm into the subsoil and demonstrated that cultivation had destroyed, or disturbed, the shallow archaeology in this area. However, it is unclear if any flintworking scatters or other features survive outside this area; when the variable depth of the soil and the formation of lynchets are taken into consideration, it seems likely that pockets of neolithic activity may survive elsewhere on Long Down, as demonstrated by test pits B9 and B10.

Trench A

Trench A started as two trenches, A1 and A2, opened in the area where Salisbury had located the top of a single mineshaft. It was subsequently extended into a single 11x1m trench, renamed trench A and excavated to a depth of 2.2m. The trench successfully located Salisbury's 5x10m trench and the top of his mineshaft. The diameter of the shaft was not established, having only exposed its northern edge. No traces of the neolithic land surface were discovered; instead, the edge of a neighbouring shaft was exposed and datable artefacts in the form of pottery fragments and antler and bone tools were recovered from the upper fills.

The stratigraphy of trench A was complex, exposing the backfilling sequence of the original mineshaft (Fig. 7). Fill (15), found at an average depth of 1.8m, was typical in composition to backfills excavated from other West Sussex mines (*see* Pull, in Russell 2001). This consisted of large unweathered chalk blocks, loose in composition and

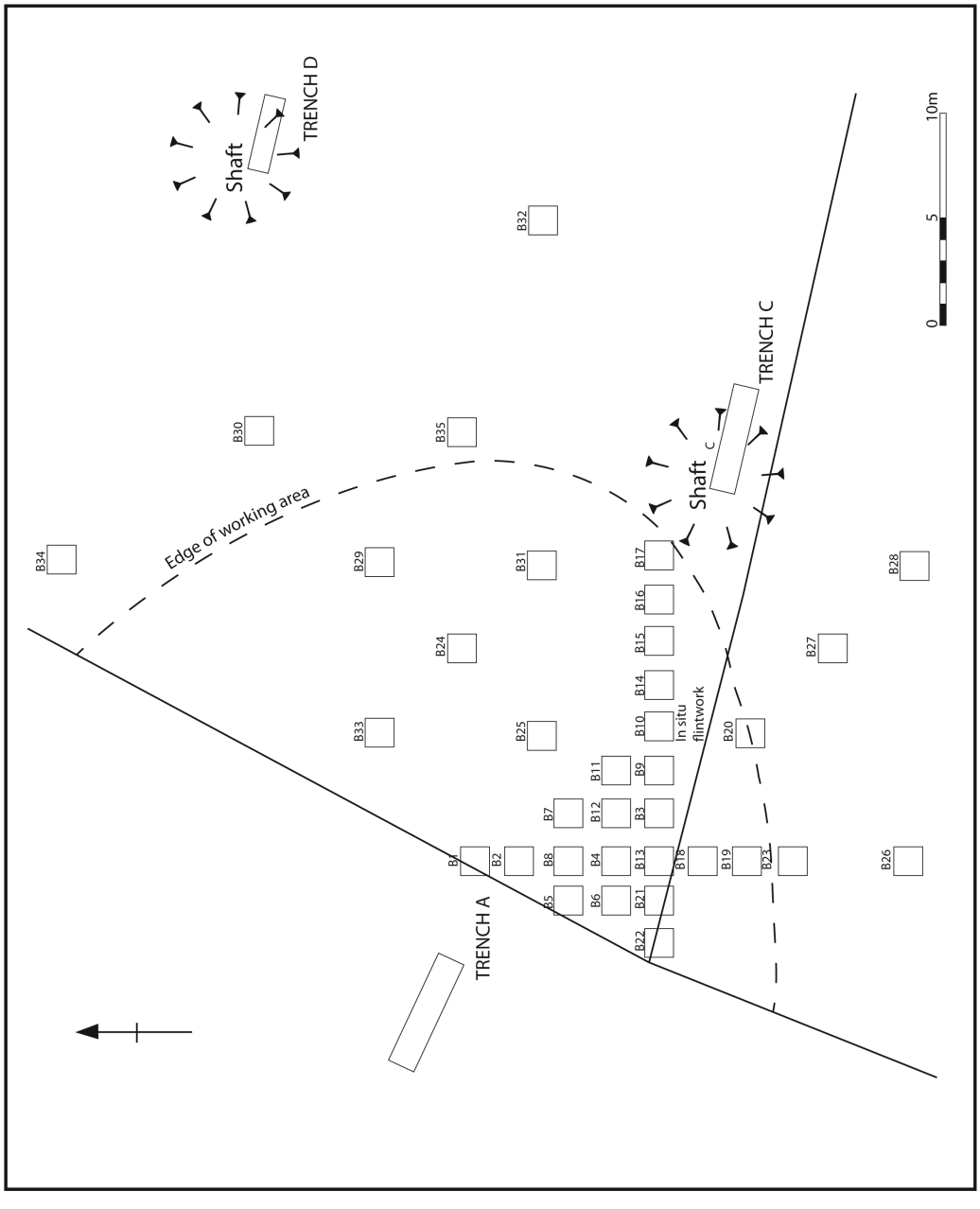

Fig. 5. Plan of the Long Down trenches.

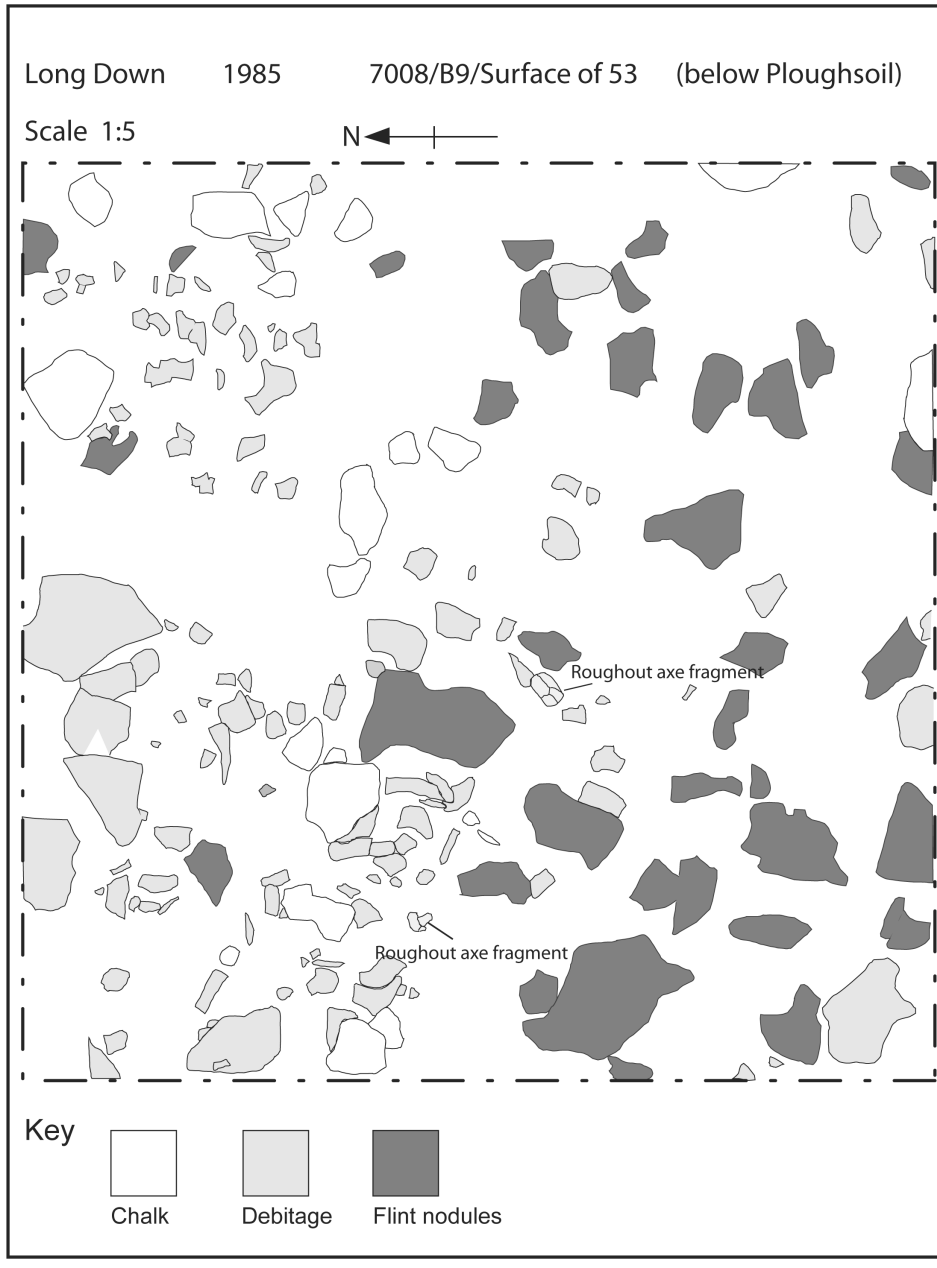

Fig. 6. Plan of Trench B9, showing *in situ* flint scatter.

representing the redeposition of mine spoil, either directly into the original mine, Salisbury's shaft in this case, or from the sinking of a neighboring shaft. The edge of the shaft was located on in the northern side of the trench and consisted of a vertical edge cut into to the chalk; the depth of the shaft remains unknown.

Finds recorded in fill (15) included a cluster of worked flint, an antler pick (Fig. 8), two axe roughouts, a large flint point, a cluster of flint flakes

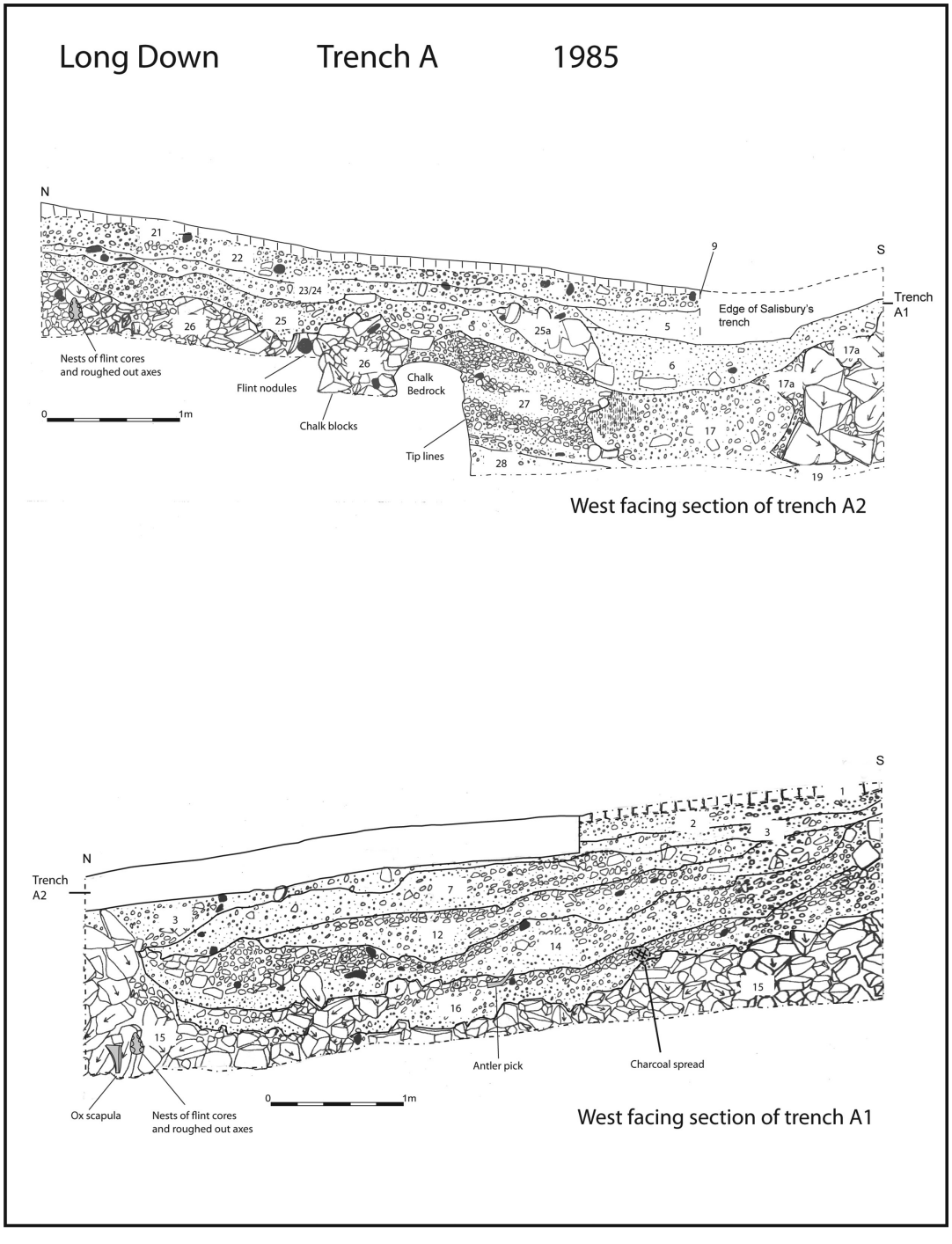

Fig. 7. Complete west-facing section of Trench A.

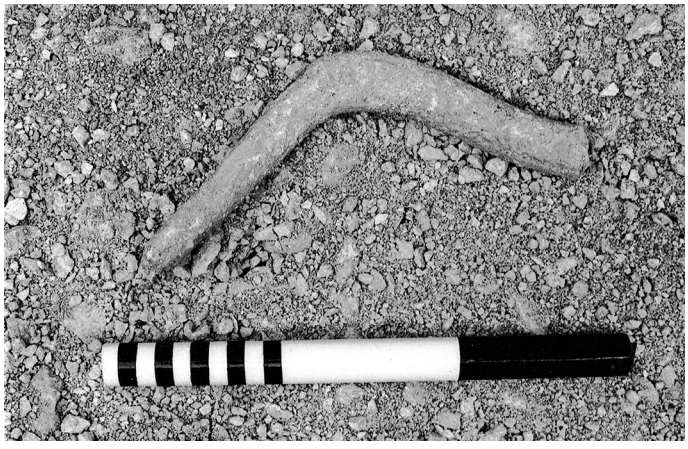

Fig. 8. Antler pick from Trench A, *in situ*.

Fig. 9. Cattle scapula from Trench A, *in situ*.

and a cattle scapula (Fig. 9). The upper parts of the layer also contained a large quantity of flint nodules and flakes. Many of the nodules were quartered into blocks, while others showed signs of being tested for their knapping suitability. This indicates that much of the primary working of reducing flint nodules was done close by, or within the confines of the mine spoil, before being backfilled into the open shaft.

Cut against (15) in the middle section, around 1m to the south of the northern side of the trench A shaft, was a markedly different layer (17), 1m in depth and made up of small compacted chalk wash. In this deposit a flint nest was found, in association with fragments of early neolithic pottery. Interpretation of this layer is difficult, as it cuts (15) into the northern side of the mineshaft, close to where the original side of Salisbury's shaft cut the chalk bedrock. It is directly below (6), a layer of small pieces of chalk, which had been truncated by [9], the cut of Salisbury's shaft, and filled with (5), a loamy orange and loose soil. That *in situ* artefacts were found in (17) almost certainly indicates that Salisbury did not excavate this layer. The truncation of (15) must have therefore occurred after the shaft had been backfilled; how long after is unknown.

A key deposit for understanding backfilling is (18), a layer of light yellow and friable deposit composed of small pieces of chalk and soil. This layer was interpreted as containing wind-blown soils; therefore, this deposit must have been open to the elements long enough for this soil to accumulate and form. The yellow colour of the chalk further indicates that weathering had occurred to this layer. As this weathered layer is below (15), it must have been the top of the original fill of the deep shaft, left open for a period before (15) was deposited on top of it. Therefore, all layers higher in the matrix must have been deposited into the hollow left by the earlier backfilled shaft from an adjacent shaft.

This sequence of backfilling explains why the large blocky chalk of (15) occurs high up in the matrix of the backfill; as at other West Sussex mineshafts this sort of material is associated with the working of deep shafts and occurs much deeper in the backfilling below the various layers of chalk wash and silts. The discovery of fill (15) as originating from a neighboring shaft has important implications for the dating of the artefacts from this layer, as they date the working of a neighbouring shaft, almost certainly located uphill, rather than the actual sinking of Salisbury's shaft.

It is also apparent that fill (17) truncates fill (15) and is therefore the last event in the trench's narrative. What this feature represents is difficult to ascertain, but it is probable that it is a later episode of

mining. This type of activity has also been observed at other mines, including Blackpatch, Cissbury and Church Hill, Findon, and possibly represents either the re-use of mine spoil, or secondary extraction processes. Although it is doubtful that deep shaft mining continued in Sussex beyond the early neolithic period, other less labour intensive methods, such as open-cast mining, may have continued well into the Bronze Age (Barber *et al.* 1999, 69–71), which was certainly the case at Grime's Graves (Healy *et al.* 2014).

The date of this truncation can be determined by potsherds and the *in situ* nest of flakes, both indicating an early neolithic date (*see* report below). Therefore, the date of the sinking of Salisbury's shaft and its neighbouring shaft both pre-date the truncation. However, all of these extraction events occurred within the early phases of the neolithic period, especially as the nest of flakes was *in situ* and not residual. It is unlikely that this truncation represents the reworking of mine waste, as there must have been plenty of easily obtainable waste on the surrounding spoil heaps long after the period of deep mining ceased. It could be the backfilled remains of a prospecting shaft, dug to assess the underlying geology, although it seems improbable that this would take place within a backfilled shaft, but it is worth noting that similar mine features have been recorded located close to shafts on Harrow Hill (McNabb *et al.* 1996).

The trench demonstrates the complexity of backfilling and reworking events that occur at the West Sussex mine complexes. The sequence of backfilling in Salisbury's shaft is confused because within this 11m trench three different phases of activity are observable: the sinking of the primary shaft, the sinking of a neighbouring shaft, and the possible truncation undertaken during a later episode of extraction. This sequence is further complicated by two distinct episodes of backfilling: the filling of Salisbury' shaft and the filling of its hollow after an unknown period of time.

Trench C

The location of trench C was chosen to confirm if one of the two hollows observed in the field survey related to neolithic mining activity. Trench C was placed in the southern most hollow. It measured 5x1m and would eventually be excavated to a depth of 2.3m. It successfully located a single mineshaft but, apart from worked flint, no datable artefacts were recovered. The exact dimensions of the shaft were not established but, by observing the size of the hollow and the angle of its exposed side, it is possible to calculate that it was between 6–9m in diameter.

The stratigraphy of trench C was clear, with the upper-most fills of a single backfilled mineshaft exposed down to the characteristic blocky chalk layer (Fig. 10). The upper fills of loamy soil (102), overlying lenses of chalky pea grit, flint nodules and chalk lumps (101) to (104), were formed by cultivation events. These upper fills were interpreted as originating from post-1st millennium BC ploughing, mainly due to the presence of Iron Age or Romano-British potsherds.

The chalk pea grit is diagnostic of ploughed rendzina soils, common on the South Downs, formed by a combination of agricultural activity and natural processes, such as worm sorting. This persisted as a relic soil in the upper layers of the hollow left by the mineshaft, and had accumulated in the hollow as a result of ploughing, wind activity or erosion. Considering the size and depth of the hollow, it is most likely that these layers were formed by erosion, as they must have represented a significant obstacle to the plough until the modern age.

Eventually, after a layer of loamy, humus-rich soils (104) and a deposit of washed in chalk blocks (105), a fill of fresh chalk rubble (109) was reached at a depth of 2.2m. This abutted the vertical cut of the original wall of the shaft in its western side and was the primary backfill, consisting of chalk blocks and occasional broken flint nodules.

Trench D

This trench was located over the northern-most hollow observed in the surface artefact collection survey. Measuring 3x1m and dug to a depth of 1.9m, this trench successfully located the possible side of a single mineshaft (Fig. 10).

The upper fills of trench D (111) to (114), were similar to those of trench C. In (114) Iron Age or Romano-British pottery was noted, indicating that the upper fills were derived from post-1st millennium BC ploughing. Under (114) was a loose chalk layer (Fig. 10), the chalk rubble of backfilled mineshaft (115) that was deposited above (116). It is unknown if this layer of spoil related directly to the shaft in which it was deposited, or to a neighbouring shaft. There was a notable lack of

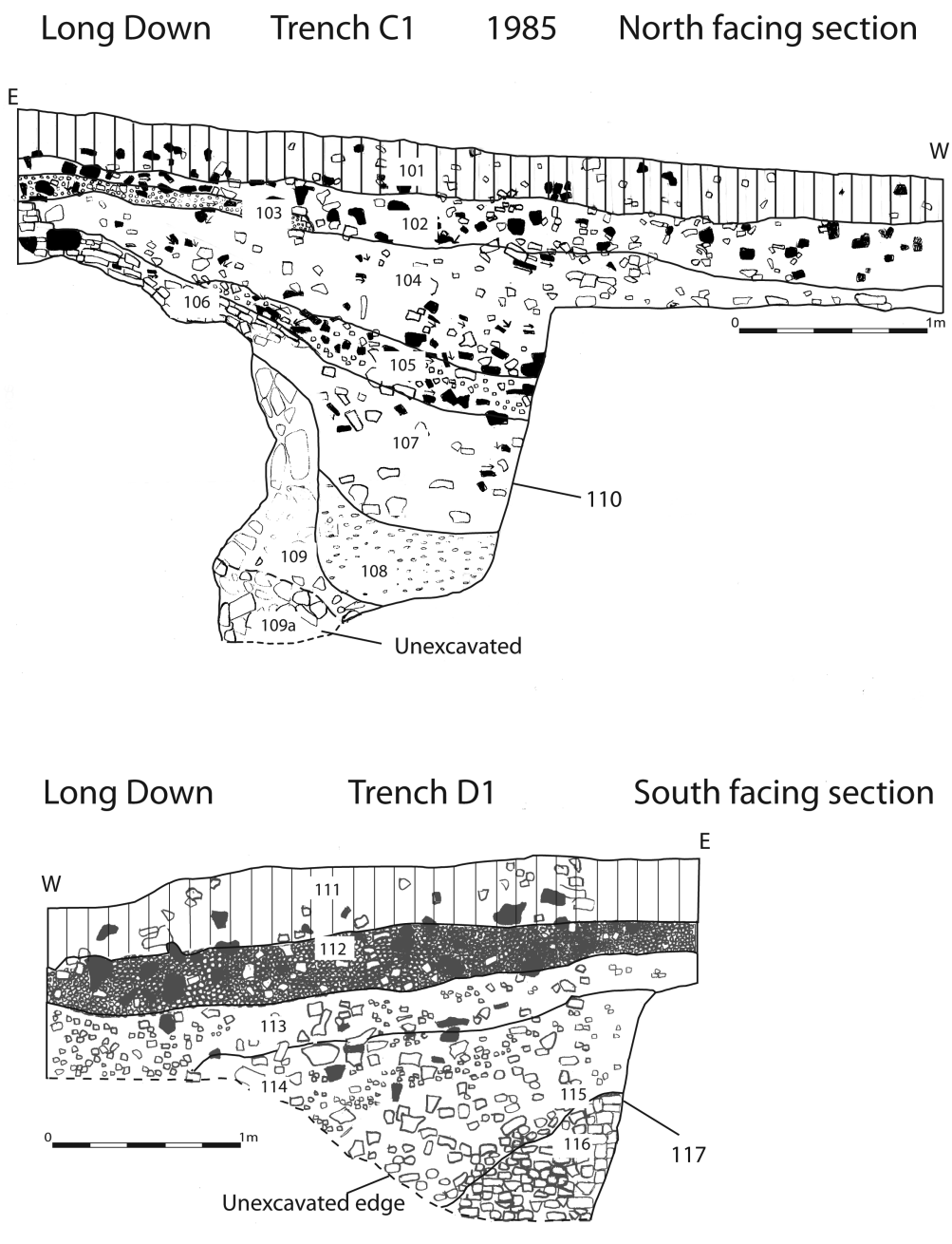

Fig. 10. Section drawings of Trench C1 and Trench D1.

finds from the lower fills in trench D, thus precise dating of the shaft was not possible, although its size and profile is comparable with the other early neolithic shafts excavated on Long Down.

The flint

In total, 29,661 struck flints (Fig. 11) were recovered from both the surface artefact collection survey and the excavations (*see* ADS supplement).

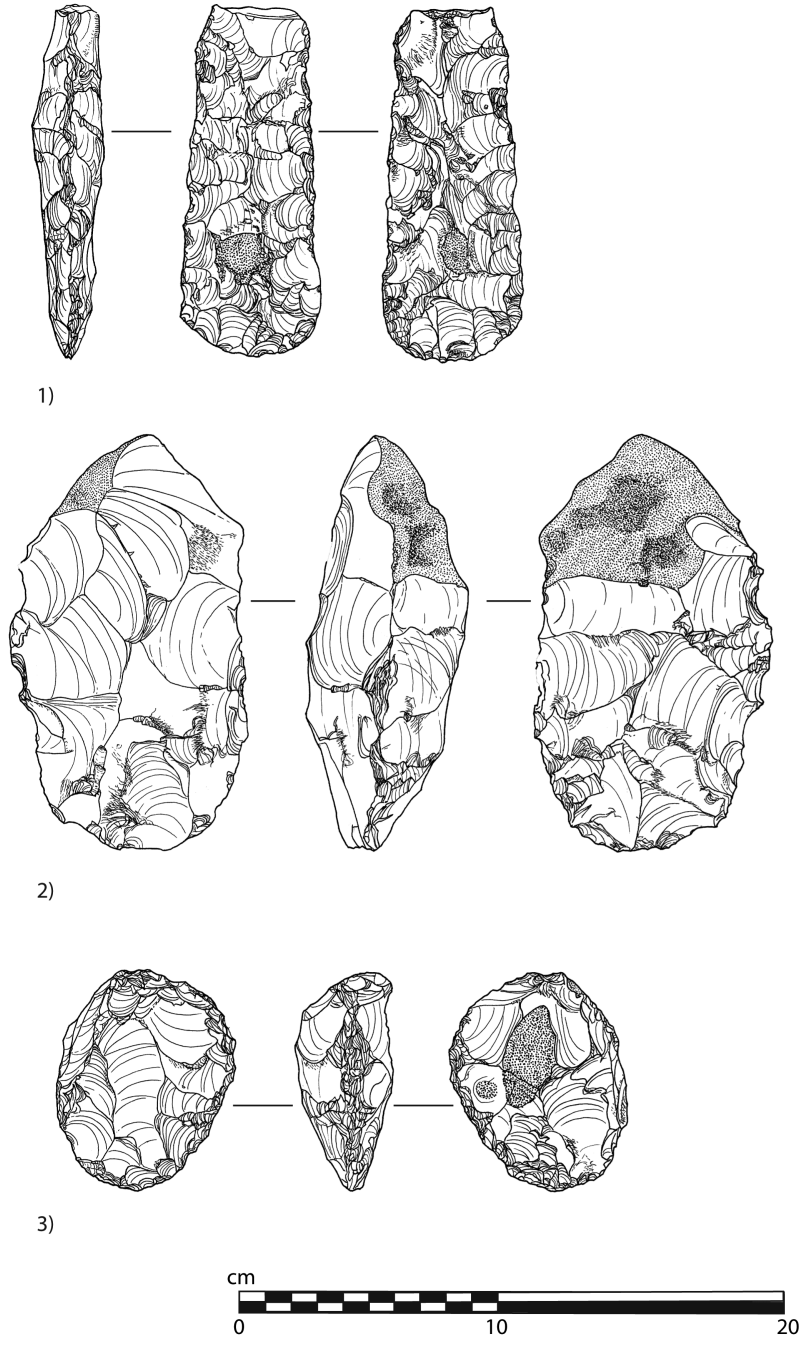

Fig. 11. Worked flint from Long Down. 1) Axe preform; 2) axe roughout; 3) ovate roughout. (Drawn by Lys Drewett.)

Surface collection survey

The survey recovered predominantly debitage, along with four roughouts/performs and three implements (*see* Tables 1 and 2, ADS supplement). The majority of the flints represent a neolithic working area associated with the flint mines. The implements and some of the debitage, including hard hammer-struck flakes and the cores, can be dated to the neolithic period, although the majority of the debitage is largely non-diagnostic and can be assigned a wide prehistoric date.

Excavated flint: Trench A

The excavation of trench A produced 5574 flints (*see* Table 3, ADS supplement). Of the flakes, 48 percent were hard hammer-struck: a higher proportion than that of the flakes recovered from trenches B (30 percent) and C (38 percent). Although soft hammer-struck axe thinning or axe finishing flakes comprised 75 percent of all the flakes and blades, this was a lower proportion than for trenches B and C (both around 90 percent). There was also a higher proportion of tested nodules (that is, those with only one or two flakes detached from them), quartered pieces and shattered pieces from trench A (seven percent compared with 0.3 percent and 0.01 percent from trenches B and C respectively), indicating that a significant proportion of the debitage from trench A was associated with the extraction and preparation of flint for making tools. The presence of axe thinning and axe finishing flakes (64 percent of the flints) and roughouts shows that the production of bifacial implements was taking place in this area or close by.

Trench B

Excavation of this area yielded 21,564 flints (*see* Table 3, ADS supplement), almost all resulting from the production of bifacial implements from the flint mined at the site. The flints are associated with fragments of early neolithic pottery and appear to derive from a working floor that was contemporary with the mining activity taking place at the site. Two flake tools, an end scraper and a knife, were also recovered. The discovery of a fragment of Peterborough Ware (Drewett 1983) from the surface of the site, along with ovate or discoidal knife roughouts which are usually dated to the middle to late neolithic period, suggests that there was some working of flint taking place on the site during the later 4th millennium BC.

Trench C

The trench C excavations produced 2070 flints (*see* Table 3, ADS supplement). Just over 90 percent of the flints were recovered from the topsoil and the upper layers (contexts 101, 102, 103 and 104). In common with the flints recovered from trench B nearby, a significant majority of these derived from the production of bifacial implements.

Trench D

Trench D produced 16 pieces of debitage (*see* Table 3, ADS supplement), most of which were hard hammer-struck flakes or blades retrieved from context 114.

The finds

In total, 30 small finds were identified during the excavation, ranging from roughed out flint axes, early neolithic potsherds, charcoal, and antler and animal bone (*see* Table 4, ADS supplement).

Of the 63 potsherds recovered, both during the field surface artefact collection and sample excavations, 28 derive from early neolithic pottery forms, the rest range in date from the Middle Bronze Age to the Romano-British period (*see* ADS supplement).

Early neolithic pottery

The early neolithic pottery was examined by Andrew Merion Jones, who confirmed the date and form of the small assemblage (*see* ADS supplement). Although the collection was small, and nearly all of the sherds lack clear diagnostic features, the overall fabric type and thinness of the pot walls, combined with their context within mining contexts, clearly demonstrate they belong to an early neolithic horizon. Only two sherds, from context (54) in test pit B9, showed any sign of a profile. Both can be tentatively identified as belonging to forms of probable Carinated Bowl (Cleal 1992, 291–92; 2004, 174–175). Overall, the fabric of the pottery was sandy, either brown or black in colour, and was with calcite or burnt flint. The collection, albeit small, is significant, as all of the potsherds were found within early neolithic mining or flintworking contexts and demonstrate that the communities active on Long Down are associated with pottery use.

Other artifacts

Miranda Armour-Chelu examined two artefacts, an antler tine and a cattle scapula (*see* ADS

supplement). The antler was from a red deer (*cervus elaphus*) and was part of a pick. The scapula was from the right-hand side of a domestic ox. A similar scapula was found at Cissbury during Lane-Fox's excavations and was interpreted as a shovel (Lane-Fox 1876). However, as there was hardly any abrasion along the proximal edge, it is deemed unlikely that it had ever been used as such.

Environmental data

Only a small amount of charcoal was recovered. It was examined by Caroline Cartwright (*see* ADS supplement). The amount was too small to infer any environmental or economic interpretations.

Radiocarbon dating

Four dates were obtained in total (*see* ADS supplement), two from charcoal fragments, one from the antler pick and one from the cattle scapula. The samples were originally dated by the Oxford University Radiocarbon Accelerator Unit in August 1987 and further calibrated for this report using the OxCal program [OxCal Version 4.2]. All the samples came from the chalk fill, 1m below the current ground level in the top of the shaft in trench A, from secure archaeological contexts.

The charcoal produced a date range of mid- to late 2nd millennium BC and the tools an early 4th millennium BC date range. The charcoal can be considered intrusive into the chalk backfill and must relate to later Bronze Age activity within the mine hollow, as the flakes and pottery were *in situ* and therefore unlikely to have been out of context. As is the case with all radiocarbon dates from the West Sussex mines, they only indicate singular mining events and do not help form a clear chronology for the development of South Downs mining. Although mining on Long Down may have overlapped with causewayed enclosure and long barrow construction at the bottom end of the date range, the presence of possible Carinated Bowl pottery indicate that the mines belong to a pre-enclosure horizon.

HARROW HILL

Around eight kilometres north-west from the mine complex at Cissbury Hill, is the prominent, bowl-shaped Harrow Hill (Fig.12). On its eastern flank are the remains of around 160 neolithic mineshafts (TQ 08162 09986). Four flint seams were exploited here, two sheet and two nodular, located in the Campanian-aged (83.6 to 72.1 Mya) Newhaven Group chalk bedrock (Mortimore and Wood 1986).

1984: Field survey

From October to November 1984 a surface artefact collection and earthwork survey (*see* ADS supplement) were undertaken on the cultivated field on the south side of Harrow Hill (Fig. 13). Use of the same methodology as at Long Down enabled the identification of a large flintworking area, 50m in diameter and consisting mostly of axe roughouts and axe-thinning flakes, was identified (Fig. 14). Two circular depressions were also recorded within this area and initially interpreted as the remains of mines located beyond the main complex. The flintwork recovered mostly consisted of roughouts, axe thinning flakes and cores, and was broadly comparable with the flintwork retrieved from Long Down. There was also evidence of sickles being produced.

The north-western end of the survey area was an area of Clay-with-Flints deposits overlying the Chalk. No obvious mining features were observed in this area, although a low-density scatter of prehistoric potsherds and hard hammer-struck flint was recovered. The pottery from both the survey and excavation (*see* ADS supplement) relates to the small Late Bronze Age enclosure on the summit of Harrow Hill (Hamilton and Manley 2001). It is not known if the worked flint, possibly dating to the Bronze Age, was sourced from the debitage of the neolithic mines in this later period (Barber *et al.* 1999).

1986: Excavation

Following the field survey, it was decided to target the main flintworking area and the series of circular depressions located in the north-east of the survey area (Fig. 15). In total, 69 1 × 1m trenches were dug by hand and the soil dry-sieved through a 0.5cm mesh. All the test trenches in the area of the working floor were given the letter W as a preface and numbered between 1 and 51.

Larger trenches, measuring up to 3x1m, were located along the northern boundary of the research area. Close to the southern end of the main minefield, they were chosen to investigate the possibility of mine features in this part of the site. These trenches were given a letter prefix, starting with A and running through to S.

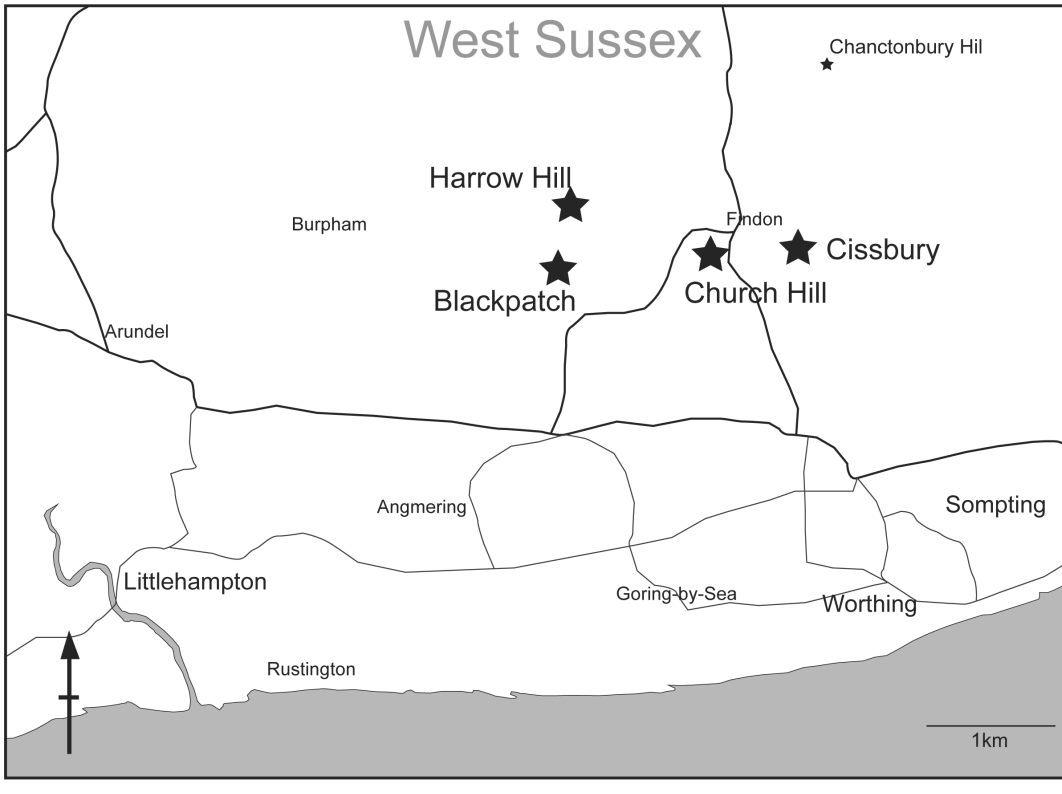

Fig. 12. Map showing the location of Harrow Hill.

Many of the trenches recorded plough marks at an average of 5cm in depth, which in six trenches (W8, W22a W25, W27, W34 and W44) had scored the subsoil. The plough soil averaged between 10–22cm in depth, with deeper soils found towards the bottom of the hill at the eastern limits of the survey area.

The flintworking floor

The 24 trenches located in the area of flint scatter recovered a large amount of worked flint, including hard and soft hammer-struck flakes, axe-thinning flakes, chips, tested nodules, cores and axe roughouts. The density was particularly high in trenches W2, W3, W23, W38, and W43, with examination of the flint recovered from this area demonstrating that axe roughouts, and other core tools, were being produced.

The highest density of worked flint came from trench W38, located in the western margins, close to the area of Clay-with-Flints. This single 1x1m trench produced just over 700 pieces. Most of these flints were small, under 50mm in length, with soft hammer-struck flakes making up less than 20 percent of the collection. This was typical of the debitage from the other trenches, with a high percentage of hard hammer-struck debitage present from preform production. Only one true roughout was found in trench W6, an example measuring 110mm in length.

Examination of the assemblage supported the findings of the surface survey that production activities were focused on the primary testing of nodules and the production of roughout and preform axes. No cores were recovered, suggesting that axes were the only product being manufactured in this area; other implements may have been produced elsewhere on Harrow Hill (Holgate 1995c).

Although none of the flints were *in situ*, there was limited evidence of damage on their surfaces, suggesting they had barely travelled any distance

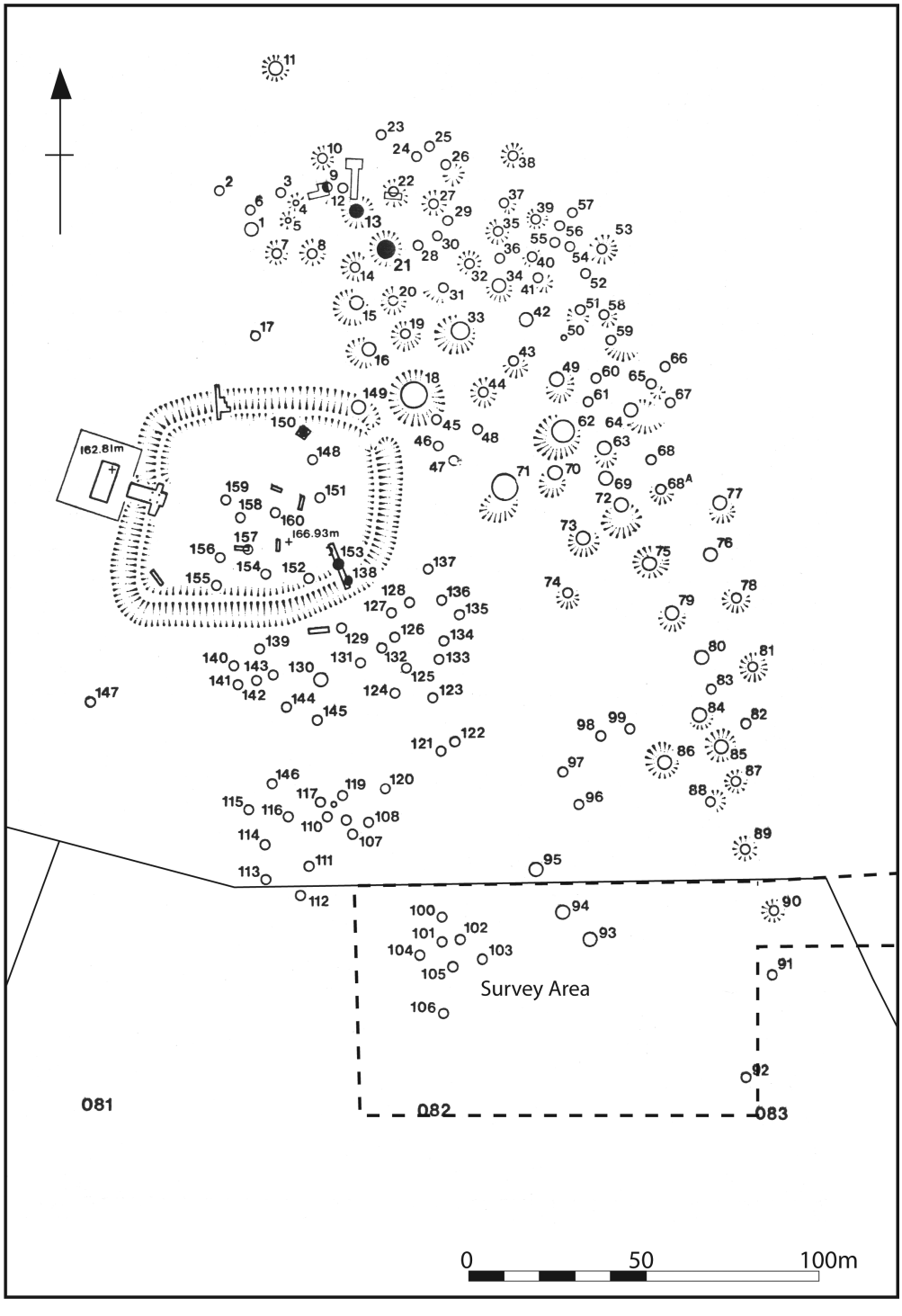

Fig. 13. Recorded mine workings on Harrow Hill and the survey area (after a survey by Fred Aldsworth).

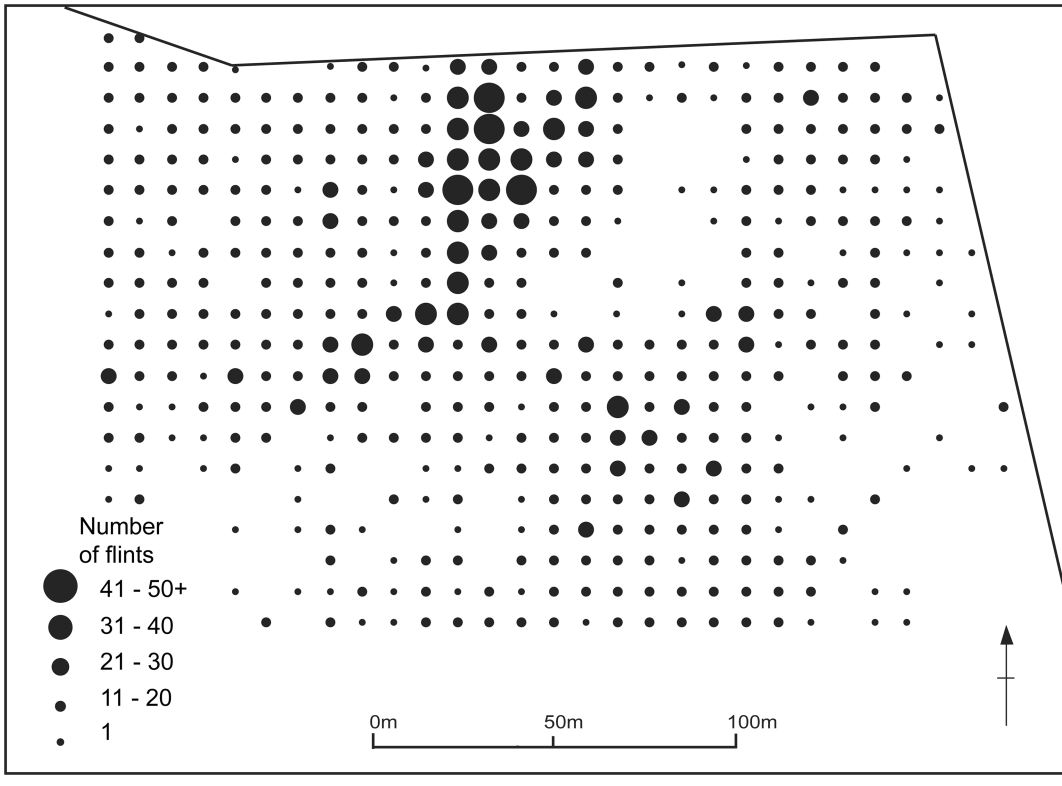

Fig. 14. Distribution of flint from field collection survey, Harrow Hill.

from their place of deposition. Virtually all the flints had a white patina, from their contact with calcareous-rich soils, except those from trench 37, located on the edge of the Clay-with-Flints towards the top of Harrow Hill, which held their original dark brown-to-black colour. These flints were noticeably unabraded, indicating the preservation of *in situ* flint scatters existing in this area.

No ceramic or organic remains were recovered, making absolute dating for the flint scatter impossible. However, examination of the flintwork placed the working floor in the earlier centuries of the neolithic period, in keeping with findings from previous excavations (Curwen and Curwen, 1926, 1937, McNabb *et al.* 1996). It was concluded that the majority of the area had been truncated by ploughing, except in the vicinity of the Clay-with-Flints deposit. It was also not possible to identify if the floor had a stratigraphical relationship with either the surrounding deep mineshafts or the open-cast quarries described below.

The open-cast quarries

At the northern end of the site, close to the modern field boundary, trenches F, G, J, K, Q, W4, W20, W22 and W52 encountered the remains of drift mines consisting of small entrances, or adits, forming cavern-like mine workings cut horizontally into the slope of the hill and exploiting a location where flint seams would have naturally outcropped from the chalk bedrock. This discovery was of importance, as Harrow Hill is the only prehistoric mine site in southern England, to date, where open-cast or drift mines have been discovered

These mines exploited flint from thin, nodular seams that outcropped on the surface along the south-eastern flank of Harrow Hill. The chosen method of excavation was to cut into the steep slope horizontally to create a vertical face, within which galleries could be opened to extract flint from the nodular seam. Once extraction had finished, the mines were filled with chalk rubble that originated from the mining operation (Fig. 16), as evidenced

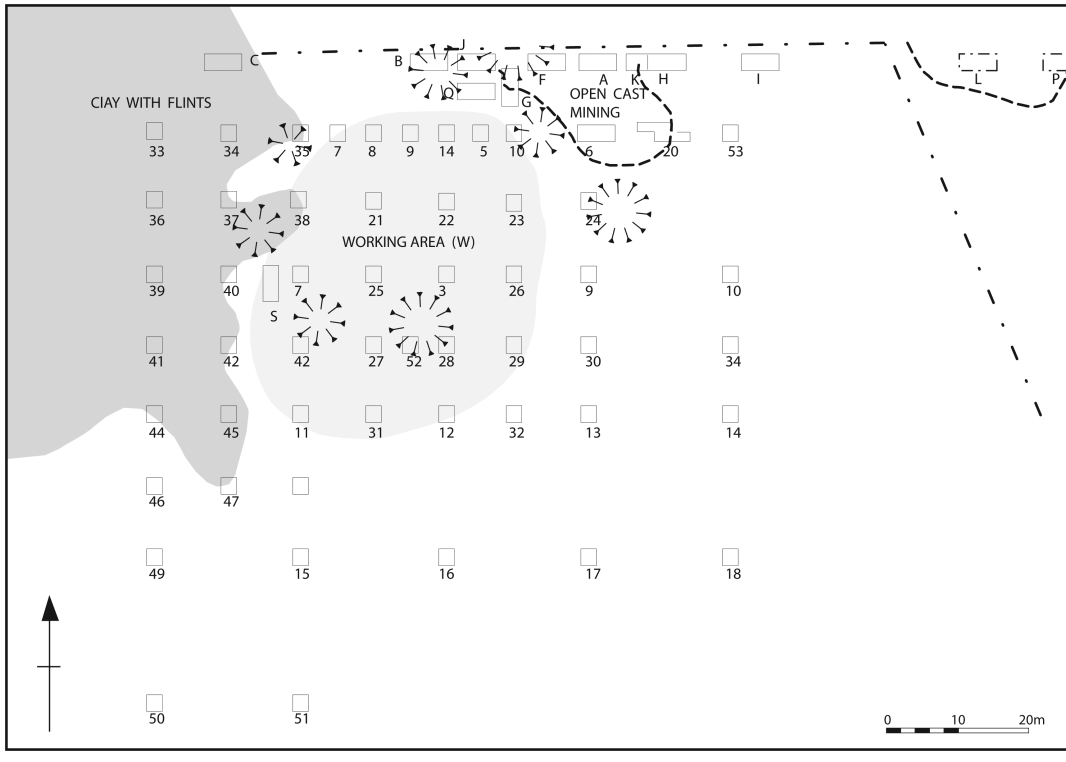

Fig. 15. Plan of trenches opened during 1986 fieldwork, Harrow Hill.

by the recovery of tested flint nodules and hard hammer-struck flakes in the backfill deposits.

Trench G

Trench G offered the best opportunity to record these workings, exposing two short mines cut into the chalk bedrock (Fig. 17). The two galleries were cut to a depth of almost a metre, with a supporting arch of natural chalk left between each aperture. These measured between 1–2m in width, a little over 0.8m in height and extended for around 1m into the hillside. Only one of the features, the left-hand gallery, was fully excavated, so it is possible that others may have been deeper than 1m.

The single fill of the galleries (20) was made up of various sizes of loose, blocky, chalk rubble with a silt matrix and an off-white appearance, indicating that the deposit had been open to the elements. Although (10) blocked access to the mines and was initially given a different context number, after further examination it was deemed to be the same as the backfill (20), located immediately outside the mines. This implies that backfilling did not occur immediately, but after a long enough period of time for weathering to occur to the material.

Above (20) was (19), a friable layer of orange-brown clay, or loam, with small chalk fragments and chalky pea grit. The presence of a loamy pea grit layer indicates a relic plough soil, which had formed and subsequently been ploughed or had eroded downhill over the spoil heaps. The fact that, when viewed in section, this layer overlies (20) and extended into the short galleries, suggests they were only partially backfilled. It was apparant that waste was moved the minimal distance from the working face, so as not to interfere with the mining process, before being deposited back into the mine at a later phase of extraction. Other open-cast features, such as the mines recorded in W22 and W20, also demonstrated this casual backfilling approach.

This backfilling process is markedly different to the deep shafts on both Harrow Hill and Long Down. The fact that clayey soil had formed, either

Fig. 16. The blocked entrance to a drift mine.

by ploughing or soil creep, hints that the mining horizon in the area of the open-cast features was relatively static, with little or no disturbance by later episodes of mining activity. This is further inferred by the observation that the working floor largely respected the open-cast area, especially in the northern part of the site, only overlapping the mines in the area around W4 and W22.

It is far from clear how the spoil relates to each individual mine, and the waste may have been shifted during episodes of extraction. Spoil movement may have occurred in the immediate vicinity of the open-cast mines, as new mines were opened and worked. This process could well explain the weathered colour of the backfill, if it had been disturbed and moved around the minefield as neighbouring open-casts were worked.

No ceramic or organic dating material was found in the open-cast mines and their precise date is unknown, but the fact that the working floor overlaps the mines in some places and respects them in others implies an early neolithic date. However, this interpretation is tentative, as it is far from clear how waste was moved and redeposited in the mining horizon. It is also noted that their relationship with the deep mineshafts is unknown, making it difficult to place them within the overall mining chronology on Harrow Hill, as it is not clear whether they are contemporary, later or earlier than the deep mining period.

Geophysics survey

In February 1987, Andrew Smith and Rory Mortimore of Brighton Polytechnic conducted an electromagnetic survey using a Geonics EM31 instrument (*see* ADS supplement). A 250x60m area was covered in the survey, northwards from the working floor and up to the edge of the scheduled minefield. The survey did not discover any new mine shafts in this area, but did reveal that the surface undulations along the northern and eastern of the edge of the main minefield relate to drift mining activity.

The flint

The surface collection and the excavation produced a total of 7,250 struck flints (*see* Table 1, ADS supplement).

Surface collection survey

The survey recovered a mixture of flints, which could be divided into two groups based on the techniques used to work the flint (*see* Tables 1 and 2, ADS supplement). The first group, which includes at least 12 percent of the surface flints, consisted of debitage and roughouts or preforms resulting from the manufacture of bifacial implements; the second group comprised debitage and implements produced by detaching flakes and blades from cores using hard hammers. Most of these flints come from the north-western part of the area surveyed, that is, on or near the area of Clay-with-Flints, which is also the area where a large proportion of the later Bronze Age and Iron Age pottery fragments were found. Some of the scrapers and knives are typical of those found in later neolithic to earlier Bronze Age assemblages in Sussex, for example at Bullock Down (Holgate 1988), but there are also soft hammer-struck debitage and some implements fabricated on soft hammer-struck flakes or blades, which could date to the earlier neolithic period.

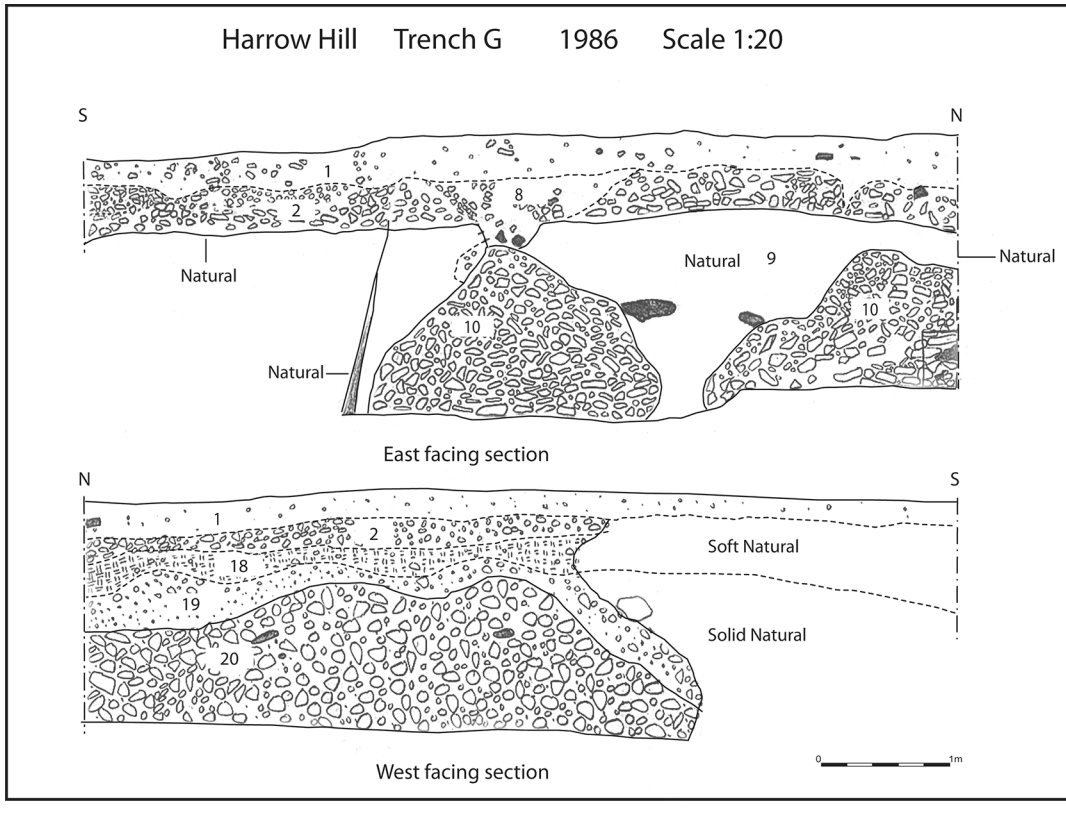

Fig. 17. Section of Trench G, showing the two blocked entrances to the drift mine.

Excavated flint. Working floor: W trenches

Excavation of the area of the working floor (the W trenches) produced 3,721 flints (*see* Table 11, ADS supplement). The majority of the flints are associated with manufacturing bifacial implements from the flint mined at the site (Fig. 18); the roughouts and preforms recovered during the excavations were predominantly for axes, but also included a sickle and an ovate preform.

Drift mines

The drift mines produced 1,128 flints (Table 11, ADS supplement), which almost exclusively resulted from producing bifacial implements. Most of the contexts associated with the areas of open-cast mining were either devoid of flintwork or contained a few flakes or blades, some of which were soft hammer-struck axe thinning flakes. However, contexts F2, F15 and K12 each produced more than 100 flints, including soft hammer-struck axe thinning and axe finishing flakes, tested nodules and axe roughouts.

DISCUSSION

The project was successful in revealing the extraction processes and axe production practices of neolithic communities. New questions on the nature of mining were highlighted, while problems, such as developing a mining chronology, were encountered. Many of the problems were due to excavating in a landscape that was in permanent flux, having been overturned by episodes of prehistoric extraction and subsequent periods of truncation by agricultural practices. The one clear conclusion that resulted from the project was the dating of mining, at both sites, to the early phases of the 'Neolithic Revolution'. In accordance with the excavations undertaken previously at the mines, it is apparent from the quantities of axe-thinning and finishing flakes and roughouts and preforms that were uncovered, that the mined flint was used almost exclusively for producing axes, although it may have occurred alongside small-scale production

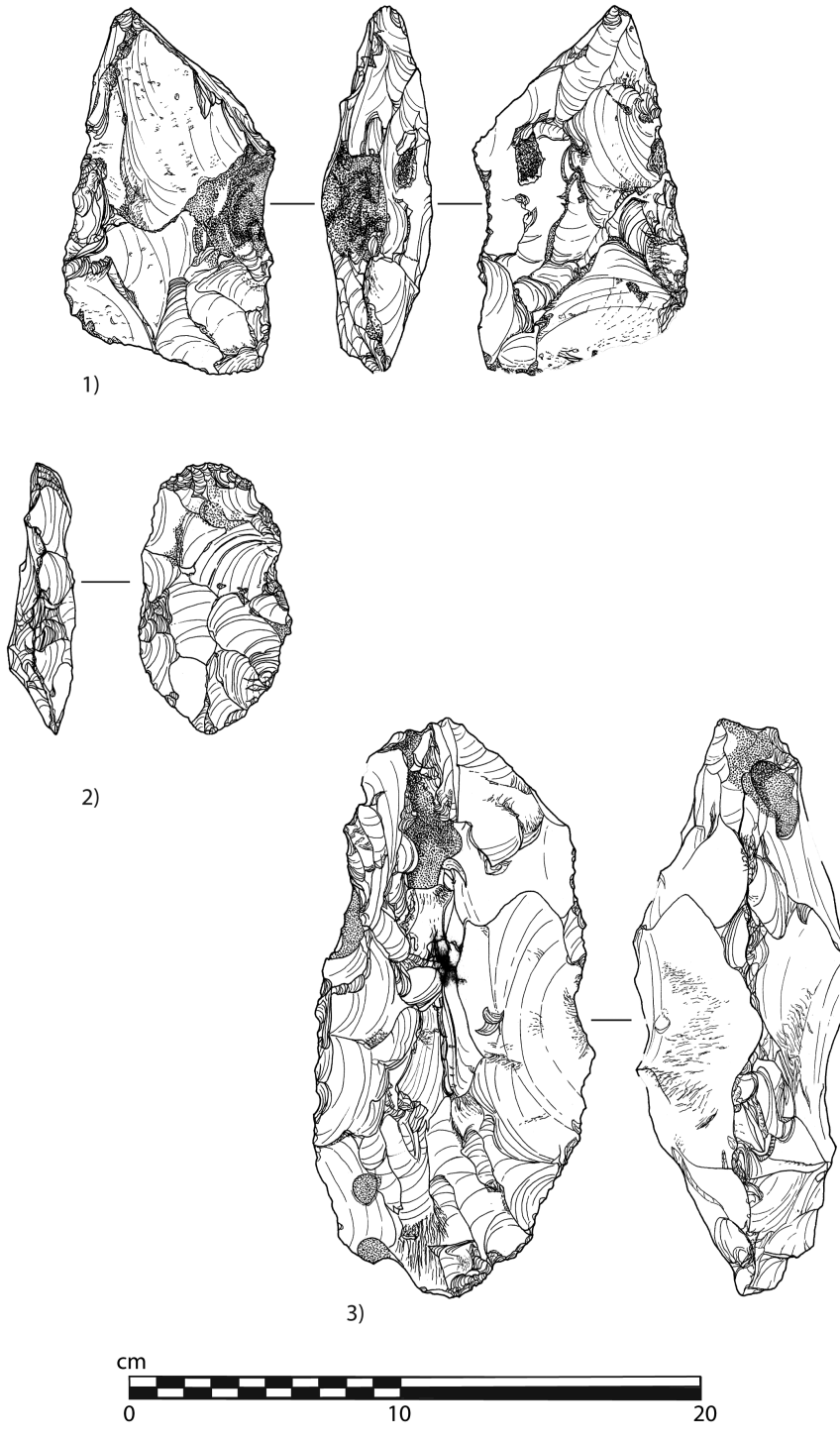

Fig. 18. Harrow Hill worked flint. 1) and 3) axe roughouts; 2) ovate roughout. (Drawn by Lys Drewett.)

of other implements, such as the sickles from Harrow Hill. Testing of flint nodules from both sites proves that the raw flint was, overall, of good quality for the production of axes, although some flaws were observed (*see* ADS supplement), so we are again left with the question of why communities went to great lengths to mine deep flint.

THE HARROW HILL DRIFT MINES

Perhaps the most significant discovery of the project were the drift mines on Harrow Hill. Their discovery raises an important question as to why flint extraction techniques varied within the same mining horizon. A simple explanation may be that they were the only practical form of mining needed to exploit the single seam in this area. However, this seems an inadequate hypothesis when the complexity of the deep mines, situated only a few metres to the north, is considered.

It is probable that they are contemporary with episodes of deep mining, as the gallery of at least one deep mine excavated by the Curwens possibly linked with an open-cast mine on the northern side of the hill (Curwen and Curwen 1926,109). However, it is still problematic to place them in a chronological model, as they remain undated and only partially excavated.

Understanding where drift mines fit into the mining chronology has important implications for how the sites are interpreted. For example, if the mines are earlier than deep mining, does this imply that drift mining preceded, and developed into, the deeper form of mining? Alternatively, if they are later than deep mining, why was deep extraction abandoned and drift mining started? Finally, if the mines are contemporary with episodes of deep mining, why switch between the two disparate techniques if the deeper mines undoubtedly produced a greater volume of raw flint? Without being certain of their place in the chronology of mining on Harrow Hill, it remains difficult to further improve knowledge on the development of extraction.

The working floors

A second major finding of the research was the discovery of *in situ* flintworking areas, which were well preserved in places on Long Down and less so on Harrow Hill. Their discovery is notable, as they link the surface activities to those occurring underground. Excluding the investigation of small-scale flintworking areas situated between mine shafts, mainly by limited excavation at Blackpatch, Cissbury and Church Hill, little is known about these zones of production and activity. This is because the majority of previous research focused on the mine workings, rather than areas external to the main minefields. At both Long Down and Harrow Hill, only one large flintworking area has been discovered, to date, lying adjacent to the main mining areas; whether this pattern is replicated at other mining sites in the British mines is unknown, although parallels have been observed at continental sites, such as the specialised production zones observed at Rijkholt-St. Geertruid (Felder *et al.* 1998, 66–7) and at Spiennes (Collet *et al.* 2008).

The working floors are important, as they link into studies on the cultural practices of early neolithic communities occupying the southern coast of England shortly after the start of the 4th millennium BC. Depending on how the data from the working floors and mines is interpreted, varying hypotheses can be developed. For example, neither site had evidence for the final axe polishing process, with production predominantly focused on the primary and secondary manufacture of roughouts and preforms. At Harrow Hill, only the primary working, secondary thinning and the production of roughouts and preforms appears to have occurred on site, implying that the miners visited periodically and took preforms away with them. However, the same hypothesis is not wholly compatible with the evidence from Long Down, as finishing flakes were present and therefore the final stages of axe production, except for polishing, did take place on site. Their discovery demonstrates that a different approach may have been adopted at Long Down. The fact that more time appears to have been devoted to completing axes, along with finds of pottery from the knapping floors, could imply a more settled mining event on Long Down, rather than simply subtle differences in the way bifacial implements were finished at the site. However, without further evidence from Long Down, this is a difficult hypothesis to expand upon.

The pottery

The fragments of early neolithic pottery, including a possible Carinated Bowl, recovered from the *in situ* working area on Long Down, are significant. They provide a tentative link between flint extraction

sites and other early neolithic sites in Sussex, mostly consisting of pit assemblages, such as those found at Drayton Quarry, Chichester (Seager Thomas 2010), Bishopstone, Newhaven (Bell 1979) and New Barn Down, close to Harrow Hill (Curwen 1934). The New Barn Down pit is of interest, as it is located within 500m of the Harrow Hill mines and its assemblage (Baczkowski, Pollard and Jones, in preparation) included at least three Carinated Bowls, two plain bowls, a polishing stone, a fragment of a polished axe and, interestingly, two flint, sickle-like knives produced from axe-thinning flakes.

The pottery could suggest that the miners settled close to the mines, although exactly where, and what form the settlement took, remains elusive. If the pottery is not directly from domestic activity, another explanation may be that it relates to votive offerings, as observed at other flint mines, such as fragments of a large Carinated Bowl found in a backfilled shaft at Cissbury (Lane-Fox 1876). Deposited offerings of deliberately broken pottery are also known from other early neolithic sites, including the Sweet Track in Somerset (Coles and Orme 1976; Bond 2003, 2004, 2007). The fact that the potsherds may have all originated from the same bowl could further indicate its intentional breaking and simultaneous deposition within the working floor, in mine spoil and in the backfill of a shaft. Naturally, this is difficult to expand on with such a small, largely non-diagnostic sample but, considering the fine-walled potsherds have survived well through constant truncation of the ground surface during mining episodes, it is likely that they remained *in situ*.

The mining techniques

A key finding of the project is the contrasting mining methods used at both sites. This is expected with sites that are separated by distance and chronology, but, as both sites are broadly contemporary, the subtle differences in extraction techniques are intriguing.

The most obvious difference, apart from the presence of the drift mines on Harrow Hill, is the scale of both sites, with Harrow Hill containing nearly 130 more known shafts than on Long Down. Why is unclear, since both sites produced reasonable quality flint (*see* ADS supplement), but for some reason communities repeatedly returned to Harrow Hill, probably for a longer period.

Also relevant is the observation that the Chichester mines, namely Long Down, Stoke Down and the unconfirmed site at Nore Down, follow a different form of mining than at the Worthing Group. The layout of Long Down is similar to Stoke Down, as both mine complexes follow tight contour lines on steep scarp slopes, and different to that of the Worthing mines, which worked tight areas and developed both uphill and downhill. This may be partially explained by differences in the geology between the Chichester Group and Worthing Group; however, this is a difficult hypothesis to develop without greater knowledge on both the depth of the mines in the Chichester Group, and the extant of the underlying flint seams.

There may be many explanations for the variations between mine sites, such as changes in the requirements for mined flint, population density and the shifting focus of communities expanding across southern England. Whichever interpretation is correct, and it is likely that none are mutually exclusive, there are important implications for understanding the wider social and cultural customs of mining communities in southern England.

Wider settlement evidence

Where mining communities settled during episodes of extraction is unknown, in accordance with a paucity of evidence for early neolithic settlement in Sussex. It is currently argued that communities are likely to have been semi-sedentary during the early neolithic period, with communities gathering at communal monuments, such as causewayed enclosures and long barrows, at certain times of the year (Whittle *et al.* 2011). However, the fact that the West Sussex flint mining sites are, along with the Medway megaliths, among the earliest neolithic monuments in southern England, dating back to the early 40th century BC (Healy 2008; Whittle *et al.* 2011, 267), means they belong to a period where even less is known about settlement patterns than the causewayed enclosure period.

If early neolithic settlement in central southern England is understood as dispersed and small-scale, the mining sites may have provided an element of permanence in the landscape from which technological and other cultural knowledge was transmitted, exchanged and dispersed when groups gathered for the mining season. It is clear that the mine complexes would have been known

locales during the first major period of monument building in Sussex, which started around the late 39th century BC with long barrows and continued to the late 38th century BC with causewayed enclosures (Healey 2008, Whittle *et al.* 2011). The mines seem to have been avoided, or respected, during the early period of monuments, as evidenced by a lack of long barrows or causewayed enclosures, with the exception of Halnaker Hill at Long Down. They may have remained important cultural and ancestral markers, the memory of their importance to previous generations persisting long after the termination of mining.

Long Down offers probably the best evidence of activity in the later part of the early neolithic period, with a possible overlap of dates with the neighbouring causewayed enclosure on Halnaker Hill. The enclosure is currently undated (Whittle *et al.* 2011, 249–50), making any connection between the sites speculative. It is also unclear if any new mining occurred on Long Down after the 38th century BC, or if old mine spoil was being recycled during the causewayed enclosure period. The stray finds of Peterborough Ware and discoidal knifes found on the surface at Long Down (Drewett 1983) relate to later neolithic activity rather than any form of structured mining. This activity would also certainly post-date the date range for other enclosures in Sussex (Whittle *et al.* 2011, 207–62).

The environmental evidence

Little environmental data was produced in the course of the research, making it difficult to add any information on the landscape the mines were worked in. This lack of data is in keeping with a general ambiguity on the environment in the early neolithic (Ellis 1986; Allen and Gardiner 2012), with debates on the extent of post-glacial wildwood ongoing (Bush 1989; Thomas 1989). Recent research has, however, indicated with some degree of certainty that much of the post-glacial chalkland area had developed extensive woodland cover by the early neolithic, and it seems highly probable mines were worked in a wooded environment (Allen and Scaife 2007; Allen and Gardiner 2009).

Was mining a seasonal activity?

Understanding mining as seasonal is a solid interpretation, especially when looking at the evidence obtained by this project. At present, the data gathered during the project confirm some findings from previous research conducted on early neolithic mining, much of which has focused on the temporal, seasonal character of extraction activity (Edmonds 1995, Holgate 1995a, Barber *et al.* 1999, Barber 2005, Topping and Lynott 2005, Topping 2011b). For example, it has long been an observation that at most of the previously excavated West Sussex mines the shafts were quickly backfilled (Barber *et al.* 1999, 62). This practice was encountered in this project, especially at Long Down, where fresh blocks of chalk had been deposited in the unweathered shafts, indicating that the mines were not open for long before being filled with freshly mined chalk spoil. However, there was also evidence of silting in Salisbury's Shaft, at Long Down, prior to the introduction of mine waste, documenting that the upper sections of the mineshaft may have been left open for a short while before backfilling, but not long enough to weather the chalk bedrock. A new mining episode close by then resulted in the backfilling of its upper section with chalk waste. Overall, this project reinforces the stratigraphic complexity and variation encountered in understanding the backfilling of shafts, and highlights that there is no predominant narrative.

The discovery that only the production of roughout and preform axes occurred close to the mines supported later research on the seasonal nature of mining (Gardiner 1990, McNabb *et al.* 1996, Topping 2011b). The most likely explanation for this practice is that it was only necessary for the axes to be made into preforms for transportation to other locales, where they could be completed into polished axe heads or traded in their unfinished forms. However, without further knowledge on the amounts of axes produced and the wider areas of the flint mines, this is a difficult hypothesis to develop and the tentative evidence for settlement at Long Down does, in small part, question the assumption that all mining may have been exclusively transient in nature. Further to this, little is known about the wider landscape at all mine sites, where activities peripheral to mining may have occurred and where the miners may have settled during periods of extraction. Recovery of data from these areas may swing the debate either way.

CONCLUSION

In conclusion, the excavations of Harrow Hill and Long Down prove that the establishment of a full

narrative of early neolithic mining in West Sussex is still problematic and that these sites, which have been investigated from the beginning of modern archaeology, still hold valuable information on one the most defining periods of prehistoric Britain. Therefore, some aspects concerning the exact nature of mining and the subsequent settlement patterns of the mining communities are still open to debate and dependent on new research.

The artifacts and archive from Long Down were deposited at The Novium, Chichester.

The artifacts and archive from Harrow Hill were deposited at Worthing Museum and Art Gallery, Worthing.

A supplementary report can be found on the Archaeology Data Service website at http://archaeologydataservice.ac.uk/archives/view/sac/. Follow the link to Sussex Archaeological Collections Volume 155.

ADS SUPPLEMENT CONTENTS

1. Geological background; 2. Flintwork: Long Down; 3. Long Down: pottery assessment; 4. Other artefacts: Long Down; 5. Environmental reports: Long Down; 6. Radiocarbon dates for Long Down; 7. Flintwork: Harrow Hill; 8. The pottery: Harrow Hill; 9. The working properties of the flint at the mining sites in Sussex; 10. Geophysical investigation of ancient flint mines, Harrow Hill; 11. References.

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