University of Southampton

Faculty of Arts & Humanities

Department of Archaeology

The Early Neolithic Flint Mines of Sussex and Their Wider Environs (4000-3650 BC)

by

Jon Edward Baczkowski

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Abstract

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The study of Early Neolithic flint mining began in the late 19th century in Sussex with a series of seminal excavations at chalk downland sites, including Blackpatch, Church Hill, Cissbury and Harrow Hill. Over the next century further excavations and research on the Sussex mines contributed to the narrative of the Neolithic period in southern England. The Early Neolithic flint mines of Sussex remain one of the earliest forms of large-scale monument to be constructed in the British Isles and their products, mostly finely made bifacial axes, were widely distributed across the region. Numerous flint mines are also found across Northwest Europe, including extensive complexes in Belgium, France, Poland and the Netherlands, and the act of extracting flint from deep workings remains a defining element of the Neolithic. Research on the English flint mines has diminished in recent decades, with no new fieldwork carried out for over 30 years, in contrast to Continental Europe where numerous sites are still under excavation. This thesis combines archival research and reassessment of previous research with new fieldwork, radiocarbon dates and other data to question longstanding interpretations of the Sussex mines. It is proposed that flint mines were pivotal monuments to the creation, development and spread of nascent Early Neolithic practices and cultural identities from the very start of the period in southern England. The thesis develops the study of flint mining beyond the immediate mine workings and into the wider landscape. Finally, this thesis increases knowledge on the communities who extracted flint from deep beneath the ground from the start of the Neolithic, one of the most important periods in the prehistory of the British Isles

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Parts of this work have been published as:

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Chapter 1 Introduction; aims and objective

1.1 Introduction: why are flint mines significant?

On the southern coast of England in West Sussex (Fig.1.1) are flint mines dating to the Early Neolithic (4000-3300BC) that rank among the earliest archaeological monuments visible in the landscape of the United Kingdom. They are an important class of monument, recording the cultural interactions and practices of communities living at the start of the British Neolithic, the period identified with the first farming communities.

Since their discovery in the mid 19th century numerous antiquarians and archaeologists have investigated the mine complexes. Seminal excavations were undertaken by Augustus Lane Fox (1876) at Cissbury, West Sussex and by Cannon Greenwell (1870) at Grimes Graves, Norfolk. This fieldwork, some of the earliest archaeological excavations to modern standards, improved understandings of flint mining and the Neolithic. The deep extraction of flint from bedrock to produce material for fine polished axes would become viewed as a component of the 'Neolithic Package' (Clarke and Piggott 1933, Piggott 1965), a set of cultural characteristics fundamental to emerging Neolithic ideologies.

The study of the Sussex mines is crucial to furthering our understandings of the Early Neolithic, as they preserved the customs of communities living in a period of cultural, ideological and environmental change. Three factors make study of the Sussex mines of particular importance. Firstly, mining activity began close to the transition from the Mesolithic, c. 4000 cal BC, one of the most defining and significant events in British prehistory. Secondly the, Sussex mines are well preserved, offering the opportunity for new survey and fieldwork. Finally, the archives of nearly 150 years of excavations are extensive and relativity under researched.

Although previous excavations at flint mines have been intensive, there remain many unresolved questions on the character of extraction, including its chronology, at both individual complexes and as a group, the cultural significance of mining, the nature of the mining communities and, finally, the distribution of their products.

This thesis not only gathers new data on flint mining, but also on Early Neolithic lifestyles and cultural customs by developing connections between the mines, communities and the wider landscape across Sussex. This is achieved by archival research, production of new radiocarbon dates, new fieldwork survey and, finally, assessment of the last thirty years of developer and research led archaeological investigations both on the mines, and across Sussex.

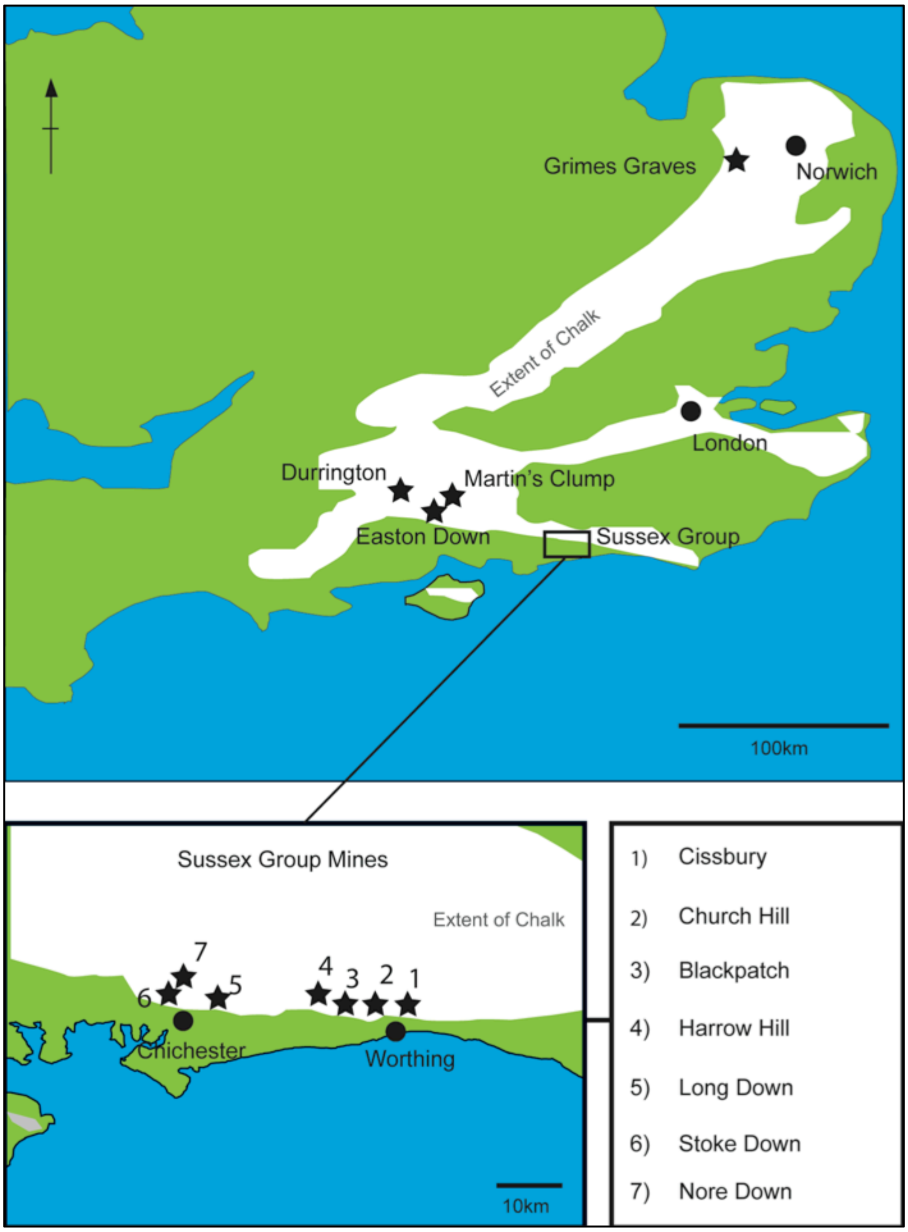

Fig. 0.1: Distribution of southern British Neolithic flint mines.

Research and survey undertaken in the course of this project resulted in the following new data:

- Archival research was undertaken, including the study of c. 37,000 pieces of flintwork,
- The unpublished excavations of two flint mines were bought to publication,
- The study of non-mining features located in the wider Sussex landscape, undertaken via a major assessment of the Historic Environment Record (HER), museum archives and grey literature, which resulted in the in-depth investigation of four Early Neolithic sites that could be connected to the flint mines,
- Eight new radiocarbon dates, obtained both from mining and none-mining features,
- Two flint mine complexes were recorded by geophysical survey.

The research to date has produced six journal publications (Baczkowski and Holgate 2017, 2018, Baczkowski 2019a, Edinborough *et al.* 2019, Baczkowski 2020), one book chapter (Baczkowski 2019b) in a monograph of European Neolithic extraction, co-edited with other researchers (Teather *et al.* 2019), two presentations at international conferences (UISPP Commission on Flint Mining in Pre- and Protohistoric Times, Mons, Belgium 2016 and Krzemionki, Poland 2019 (Fig.1.2) and finally the co-hosting and presentation at a conference held at the British Museum (Neolithic Studies Group 2017).

Core is the theme of connections, between place, people and objects. It is proposed that current interpretations of flint mining (Edmonds 1995; Barber *et al.* 1999, Russell 2000; Teather 2008; Topping 2019; Edinborough *et al.* 2019) are often based on historic archives from archaeological fieldwork that was often poorly documented or incomplete. This means that what is now considered as traditional narratives on flint mining, such as their placement at the margins of settlement, their dissociation with occupation and their short working lives, have been formed by incomplete data and without testing against recent archaeological records, such as those outlined in Chapter Three.

Fig. 0.2: Poster for the 9th International Conference UISPP Commission on Flint Mining in Pre- and Protohistoric Times, 19-21th September 2019, held in Krzemionki, Poland.

This does not undermine these previous studies, as analysis of flint mines is arduous and never complete, due to the incompleteness of their excavation archives and a corpus of unpublished material. Highly informative studies have been carried out over the last thirty years (Edmonds 1995; Barber *et al.* 1999, Russell 2000; Teather 2008), often drawing from non-archaeological literature (Topping 2004; 2011; 2019). Large scale studies, such as that carried out by Barber *et al.* 1999, and individual researchers (Holgate 1991; Edmonds 1995; Topping 2004; Teather 2008) are critical for moving the study of flint mining away from purely functional interpretations (Clark and Piggott 1933), to more cosmological and cultural based ones. A thorough account of recent research is outlined in Chapter Two, allowing for greater engagement with this literature.

Overall, it is hoped that by the end of this thesis the narrative of flint mining and the Early Neolithic of Sussex will be re-contextualised by the careful re-analysis of previous fieldwork and archives, alongside new data produced from a fresh programme of survey and field work. It will be possible to compare previous and more recent research against the data presented in this thesis and to also connect mines to the wider landscape of Early Neolithic Sussex. Mines will be re-imagined as part of wider lived landscape, rich in cultural activity and the seasonal patterns of communities settling and moving along the Sussex coast during the Early Neolithic.

1.2 The Project: Aims and Objectives

Central to this project is the requirement to improve data on key areas that are currently incomplete, and therefore problematic, for furthering understandings on the social and cultural forces influencing flint extraction from deep mines and connecting them to the wider Early Neolithic of Sussex.

It is a viewpoint of this thesis that the flint mines became isolated, both physically and theoretically, from other contemporary Early Neolithic sites in Sussex. It will be argued that this limits how the mines are understood, because previous interpretations have been based on assumptions drawn from historic excavations, which in turn were mostly confined to the mine workings, or ethnographic studies that are not directly relevant to Early Neolithic Sussex (an argument expanded on in Chapter Two). These factors have limited research and failed to connect mines to the wider landscape where the communities who mined settled. In short, mines fossilize the beliefs and practices of communities who worked them, but their study has also become fossilised by little re-appraisal of their archives, or current archaeological fieldwork.

This project attempts to move the study of flint mines forward from its dormancy, by recovering new data from archives and areas previously overlooked in the wider mining horizon and across Sussex. Through this process it was hoped to expand knowledge on the flint-mining communities, rather than just on extraction technologies. This in turn can be compared and contrasted with evidence from other

Early Neolithic sites across Sussex, therefore improving knowledge on communities who mined and temporarily settled in the region.

1.2.1 Aims

The project was focused, from its outset, on four main aims as follows:

1. **Re-interpret flint mining as core to the Early Neolithic in southern England,**

Interpretations of flint mining in southern England have ebbed and flowed since the late 19th century, between necessity and none-necessity, the industrial and the cosmological. These arguments will be engaged with and questioned, with an aim to drive interpretations forward by careful consideration of the evidence gathered during the course of this project. By the end of this thesis it will be possible to formulate a new understanding of Early Neolithic mining. This may question, support or develop previous interpretations, such as mines being separated from settlement and having no evidence of occupation (See Chapter Two). Attention will be maintained on European analyses of mining and quarrying, as it is the belief of this thesis that sites divided by the English Channel remained culturally connected.

2. **Define the wider environs of the Sussex mines.**

The southern English mines have become somewhat separated from other forms of sites and monuments in the archaeological record (See Chapter Two). Little is known about the margins of the mine complexes and a major aim of this project was to increase knowledge of both mining and non-mining activities in previously under-researched areas. Such research will increase knowledge of mining beyond the core of the mine complexes and help define associated activities that occurred alongside extraction, such as the finishing and sorting of lithic products. It will help form connections to other contemporary archaeological features in the wider mining landscape. This research was essential to support Aim D, the investigation of the wider landscape of Early Neolithic Sussex.

3. **Define the Early Neolithic of Sussex in the age of mining, enhancing its chronology and the implications that has for understanding the 'spread of the Neolithic'**

There remains uncertainty on the chronology of flint mining in Sussex and wider southern England, even despite recent dating programs (Edinborough *et al.* 2019). Equally, there are limited dates from archaeological features, such as pits, from the formative centuries of the Early Neolithic in Sussex. Such features can be considered as contemporary with the mines and therefore form part of the fabric of the Early Neolithic landscape.

Developing knowledge on the mining chronology is essential for understanding how mining spread across the region. Equally as important is enhancing our understanding on the extraction chronology of an individual mine complex. Although a full dating program was beyond the time and scope of this project, it was still possible to bring together radiocarbon dates from larger projects and offer a review of the mining chronology.

4. **Endeavour to resolve the question of mining and settlement**

Perhaps the biggest unresolved question on the nature of flint mining in Sussex is whether evidence of settlements exists near, or within, the mine complexes. This is a much-debated point (Edmonds 1995; Barber *et al.* 2011; Teather 2008) that has implications for understandings of wider Early Neolithic society.

It was a major objective of the research to search for any areas of activity, such as flint working floors, pits or structures that may exist in the surrounding landscape of the main mining area. Although such sites are separated by their geographic location to the mines, it is proposed that they are connected by the communities who moved between them, gathering seasonally and undertaking various activities, such as mining or cultivation of crops. Such evidence has been found at mines in Northwest Europe, including Spiennes where demarcated zones of lithic production and areas of habitation are recorded (Collet *et el* 2008).

1.2.2 Objectives

Aside from the core aims, a series of objectives were also developed, which advance aspects of the project and sought to answer specific research questions, as follows.

1. **Re-analysis of archive material to question traditional interpretations of flint mining by gathering new and/or reanalysis of historic excavation data**

A major component of the research carried out for this project was based on reviewing the extensive archives from nearly 150 years of excavations. To support the aims of the project, museum and other archives were visited and analysed in the prospect of gathering new data. This research helped support Aim 1, by allowing a reconsideration of material that, in some cases, had not been examined for upwards of 50 years. Engagement with this material also helped in establishing whether traditional interpretations of flint mining were based on assumptions, rather than direct analysis of the archaeological record. For examples, the analysis and discovery of pottery at three of the mines has formed a major component of this thesis and the questioning of previous interpretations.

2. **Identification of individual archaeological features that could be connected and compared to flint mines, therefore improving knowledge on the Early Neolithic narrative of Sussex**

To support Aim 2, it was decided to search for archaeological features located within the wider mining landscape that could be connected to the flint mines, by either similarity of material culture, or by geographic location. This task was carried out by a combination of new field survey and archival research. Any sites could then be case studied with the hope of recognizing material and customs that could be extrapolated outwards into the wider landscape of Sussex. This allowed for comparative research to be carried out between individual sites, and importantly, related back to flint mines.

3. **Obtain new radiocarbon dates from mining and non-mining contexts**

To develop and support Aim 3 and Objective 2 it was decided to identify new samples with the hope of obtaining radiocarbon dates from both mining and non-mining contexts. This was carried out on archival material and aided in developing understandings on the chronology of the Early Neolithic in the region, both on mining and non-mining sites.

4. **Bring together Early Neolithic sites across Sussex, using HER/Grey Literature**

To develop the narrative of the Early Neolithic in Sussex the HER was consulted to search for archaeological sites, such as lithic scatters and pits that were contemporary with mining activity. In consideration of the growth of developer funded excavations it was also decided to search the grey literature record, via the Archaeological Data Service (ADS) and the Online Access to the Index of Archaeological Investigation (OASIS). The findings from this exercise would expand knowledge of Early Neolithic Sussex in the mining period and support Aim 3.

5. **Geophysical survey of mines/search for non-mining features close to mines**

A major objective of the project was to carry out geophysical survey of a mine complex. This would answer two questions; how extensive were the mine complexes originally and how does a mine present itself in geophysical data? For example, it is known that areas of mine complexes have been previously destroyed/obscured by ploughing, such as on Church Hill. Establishing the size of the mine sites would help define the scale of mining activity and therefore the possible lifespan of a complex. Further, geophysical survey would help Aim 4, by identifying mining and non-mining features beyond the Scheduled Areas that could be targeted by excavation and that have related to occupation. The results of geophysical survey would also inform protection strategies for the sites by establishing their true size, rather than just relying on surface remains. This is of importance, as it may have been possible to establish if unscheduled areas of the mine complexes need further protection from cultivation.

6. **Surface survey: can more material be gathered/how are the mines being damaged/evidence of settlement?**

Alongside the geophysical survey, not possible at the majority of the mines, an extensive visual survey was carried. This exercise identified previously unknown axe workshops and material culture, such as axe roughouts. Expanding on Aim 3 it was hoped this exercise might also identify areas of activity that were not associated with mining. Also, by surveying surface remains, the findings of Objective 6 were expanded on, by allowing an assessment to be made on the condition of, and the damage caused, to the environs of the mines.

1.3 The pre-enclosure Neolithic

The project was born from a simple question: how has the account and chronology of the Early Neolithic changed since the dating of causewayed enclosures and other monuments in *Gathering Time* (Whittle *et al.* 2011)? This is relevant because the project was devised shortly after the publication of *Gathering Time* and the realisation that causewayed enclosures are now separated from the start of the Neolithic in Sussex, c. 4000 cal BC (Whittle *et al.* 2011. 257), by upwards of 300 years.

The re-dating of enclosures now left the first few centuries of the 4th millennium BC largely devoid of monuments, a central aspect of the Neolithic, and immediately illuminated the importance of the flint mines, long thought of as contemporaries with enclosures (Curwen 1937; Piggott 1954; Drewett *et al.* 1988). From the outset of this project it is proposed that there is a need to re-evaluate the beginning of the Neolithic in Sussex. Further, that the flint mines offer one of the best starting points, because of their Continental origins and pre-enclosure date.

Re-phasing the Early Neolithic had implications for the southern flint mines, as they are now isolated in the landscape, separated from other monuments by a noteworthy passage of time. This is especially pertinent, as Sussex is particularly rich in early monuments, such as causewayed enclosures and long barrows, and flint mines became defined by their perceived relationship to causewayed enclosures (Drewett *et al.* 1988). In *Gathering Time* discussion of the mines is limited to several paragraphs and the phenomena and chronological problem of mining is rationalised as a localised tradition situated on the margins of settled areas (Whittle *et al.* 2011, 255-56).

It will also be proposed that previous interpretations of mining, specifically those that view mining as culturally isolated, need to be revisited, because much of the traditional interpretations were based on the results from historic excavations (See Chapter Two). It is now time to reappraise these narratives through the results of this project and other recent research, including the wide scale radiocarbon dating of British and European mines (Edinborough *et al.* 2019).

Reassessment of European material is also crucial, because European flint mine research is undergoing a renaissance, with new episodes of fieldwork and research, most notably in France, Belgium, Poland, the Netherlands, Denmark and Spain (See Collet and Hauzeur 2019). This is not the case in southern England, with no new excavations undertaken since the late 1980's and only a small amount of research focused on the analysis of archival material or topographic survey (Holgate 1991; Edmonds 1995; Field 1997; Barber *et al.* 1999; Russell 2000, 2001; Teather 2008; 2016; 2019; Barber 2014; Topping 2004; 2011; 2019;).

There exists then a contrast between the studying of mining in Britain compared to Continental Europe, the former based on archival material, the latter on new fieldwork. This is vexing, as *Gathering Time* proved that causewayed enclosures can no longer be associated with the earliest period of the Neolithic, whereas flint mines are dated to the centuries shortly before the turn of the 4th Millennium BC and were certainly being worked by 3900 cal BC (Edinborough *et al.* 2019). These dates support the argument, as previously proposed (Baczkowski 2014), that southern English mines are an extension of a pan-European tradition of extracting flint and other rocks primarily for the production of axes.

Following on from *Gathering Time* (Whittle *et al.* 2011), this thesis will further the conclusion that the formulate years of the Early Neolithic in Sussex should be considered as pre-enclosure. Flint mines, along with other monuments of limited geographic range, such as the Medway monuments in Kent (Ashbee 1993; Hayden 2007; Healy 2008; Whittle *et al.* 2011.), are the only monuments present in large tracks of landscape (Fig.1.3). This acknowledgment allowed a hypothesis to be formed, as discussed below, that flint mines were nodal to the dissemination of

Neolithic culture and ideologies, rather than being peripheral, marginal and not associated with 'settlement' activities.

Fig. 0.3: The Coldrum, Early Neolithic mortuary monument, Medway Valley, Kent (Author 2018).

1.3.1 Limits to the research

It is worth outlining the limits of this project, as research on mine sites presents a unique set of challenges to an archaeologist. Researching any prehistoric mine is time consuming, problematic and invariably involves staggering amounts of material, a single mineshaft can produce upwards of 150,000 artefacts (Saville 2011; Hélène Collet pers. comm., September 2019). Artefacts recovered from mines, some of which are not contemporary with extraction, include flintwork, pottery, antler, charcoal, human burials, animal bone and occasionally preserved wooden objects. This figure does not include artefacts from the galleries, whose complex subterranean network can measure many hundreds of metres^2. In certain scenarios, artefacts recovered from the galleries, as discussed later, are not always contemporary with each other, or mining. The artefact density, combined with the scale of mine complexes, for example over 300 shafts at Cissbury, Worthing and upwards of 20,000 shafts at Spiennes, Belgium, makes the study of Neolithic mining a large and intensive task.

In contrast, the sheer volume of museum archives makes their study fruitful, as there is extensive material available and a range of analysis that can still be carried out. This is especially the case in England, where no new excavations have occurred since the late 1980's and therefore re-evaluation of archival material is essential and still profitable.

The scale of the material excavated from mines is not without archaeological bias, for example in Sussex all the excavations of flint mines, of varying standards and size, nearly always focused on the remains of the mineshafts. This improved knowledge on mining greatly, but not on activities beyond the mines, both in the immediate and wider landscape. Also apparent is the difficulty of identifying flint lithics to their original source, which makes understanding the wider influence of mines difficult (Sieveking *et al.* 1972).

Despite recent advances in identifying raw flint resources elsewhere in Europe (Allard and Denis 2015; Collet and Hauzeur 2019), no work has been carried on British material, an obstacle to establishing connections between flint mines and archaeological sites across the wider Neolithic landscape, especially when the profusion of flint extracted from natural resources is considered (Gardiner 1990). As will be discussed in Chapter Two (See Paragraph Three for current debates), much of the current flint mine research has relied upon well-trodden interpretations of historic excavations. Overall, this project will attempt to resolve shortcomings in the evidence of flint mining and problems in the interpretation of the wider Early Neolithic in Sussex.

1.4 Methodology of project and summary of chapters

The project is based on three primary methods, the re-examination of archival material, including reports and artefacts, a fresh programme of small-scale survey and a review of recent excavation 'grey literature' reports and other unpublished material. All approaches generated data that tested the core hypothesis, aims and objectives of the project. The methodology adopted to produce each chapter is discussed next, along with a brief synopsis of content and relevance to the core aims and objectives.

1.4.1 Chapter Two

The purpose of Chapter Two is to set the scene for the thesis by introducing the Sussex mine sites, outlining the brief history of their excavations and finally by examining how mining has been interpreted. The starting point of Chapter Two was a comprehensive literature review of material produced on flint mining, including the Sussex and Continental mines. This exercise was essential to review and reappraise all current literature on mining, thus meeting Aim 1 and Objectives 1 and 3. It was an exercise that also helped define the limitations of work mostly carried out over half a century ago, as although large areas were investigated, especially at Black Patch and Church Hill (Pull 1932, 1933a,b,c,d), the original survey work was carried out within the confines of the techniques available at the time.

Whilst researching Chapter Two, all the Sussex flint mines were visited and their current condition documented by photography and field notes (Fig.1.4). The results of this exercise are included as a gazetteer in Appendix 1. This exercise helped to identify areas in the wider landscape of the flint mines, often overlooked in previous research, that were suitable for survey.

Fig. 0.4: The Harrow Hill survey area, viewing south (Author 2019).

To carry out this 'soft' survey and field assessment it was necessary to first contact landowners and Historic England, the custodians of the Scheduled Monuments, with regards to gaining permission to survey and obtain the required documentation, such as Section 42 licenses for geophysical surveys. Through this initial process of contact, which proved lengthy and time consuming, it was possible to dismiss sites to which access could not be gained due to reluctant land owners, including Stoke Down and Blackpatch. It was also decided to dismiss Cissbury, as it is a large site with a multiple parties of interest, including the National Trust, Historic England and various landowners. Lastly, limited permission was granted for Church Hill, with only a walk over survey allowed.

It was established that the most accommodating landowners were on Harrow Hill, the Angmering Estate, and Long Down, the Eartham Estate. These two sites were chosen for field survey and further study, which proved to be advantageous because of previous fieldwork carried out on each site, and also other factors, as discussed below.

Finally, the chapter will research how the question of the Mesolithic to Neolithic transition has been researched, especially in Sussex. The relevance of the Mesolithic, if any, to the Sussex flint mines is also questioned. This was an important exercise, as it characterised the world within which the Sussex mines became established, a starting point for both the mines and this project.

1.4.2 Chapter Three

From early on it was realised that a considerable amount of archival material was circulated across numerous institutions, museums, private collections and libraries. Much of this material is comprised of short informal articles and unpublished field notes, rather than published archaeological reports.

Due to the considerable size of the archives it was quickly apparent that it was necessary to be selective and focus on those that would most help the project meet its aims and objectives. The archives of the large excavations, such as Cissbury, Harrow Hill and Blackpatch were quickly dismissed, as these are dispersed across multiple museums, including international institutions, were not complete and, due to their age, the field notes were poor with finds inadequately contexted. Much of the material would also have been difficult to locate within the time constraints of this project, as contacting museums and accessing archives also provided time consuming and often challenging. Finally, Miles Russell has published the extensive archives of John Pull's excavations of the Cissbury, Church Hill and Blackpatch mines (Russell 2000), and it was not felt anything would be achieved by replicating this research.

The process of archival research led to the discovery of two small sample excavations of Sussex flint mines that were yet to be fully analysed and only partially published (Holgate 1995a,b,c). The sample excavations, directed by Robin Holgate, were undertaken on Harrow Hill and Long Down in the 1980's. Permission was granted to finish the analysis and bring both excavations to publication. Chapter Three therefore outlines the findings of this analysis (See Appendix 2), which also provided the first publication from this thesis (Baczkowski and Holgate 2017).

To bring the excavations to publication it was necessary to draw on unpublished archival material, including artefacts and fieldwork records. This proved a relatively easy and fruitful task, because the excavations were carried out to modern standards and the records were complete and in excellent order.

This exercise also helped ground the project and helped give a clear indication of the type of material likely to be encountered during in a survey, or fieldwork phase. It also provided a valuable resource, contributing to the formation of a workable methodology that considered the time and management constraints likely to be encountered with the handling of a large amount of lithics. A rapid assessment methodology was adopted, based on size, weight and typology, which was used on c. 37,000 pieces of flintwork from both Long Down and Harrow Hill.

During museum visits to analyse the excavation archives, other material was also discovered and assessed. This material included an assemblage of Early Neolithic pottery from the 1984 excavation of Long Down, as well as large amounts of antler from an earlier excavation, conducted in the 1950's. This antler was catalogued and analysed, prior to the granting of permission to obtain eleven new radiocarbon dates from the material, the results of which helped meet Objective 3, to obtain new radiocarbon dates for the Sussex mines.

1.4.3 Chapter Four

Chapter four outlines the results of initial evaluation fieldwork. During this phase it was decided undertake a program of geophysical survey, combining data collected from both magnetometry and ground penetrating radar (GPR). The methods would allow rapid results from large areas and for identification of archaeological features that may have related to mining, or other forms of activity, therefore meeting Aims 1, 2 and 4, and Objectives 3, 5 and 6. For technical methodology for both surveys please refer to Appendix 4.

It was already established that Long Down and Harrow were the best candidates for fieldwork, due to approachable landowners. Aside from this obvious advantage, both sites offered other reasons that would prove beneficial to this project. Firstly, both had been excavated by Holgate, the results of which are outlined in Chapter Three, which would allow the results of the fieldwork to be compared with those of the new surveys. It was also possible to conduct the new surveys in areas that had not been investigated by Holgate, therefore allowing for a thorough understanding of specific area of the mines.

Secondly, each site is located in one of the two groups of mine complexes located to the east and to the west of West Sussex, namely Harrow Hill belonging to the Worthing Group and Long Down to the Chichester. This would allow for the comparison of results from two geographically separate mines. It was hoped that any data collected could be used to gauge if there are chronological or technical differences between the groups, most notably in the extraction methods, the products and finally the manufacturing practices.

Thirdly, both mines are located close to areas that have known Early Neolithic activity and monuments in their vicinity, namely a large pit discovered on New Barn Down, adjacent to Harrow Hill, and the Halnaker Hill Causewayed Enclosure, c.

900m west of Long Down (Fig.1.5). Their surrounding areas were also recognised as having good potential for the preservation of activity contemporary with mining, which may have been well preserved and identifiable in the geophysical surveys.

After gaining permission it was decided to survey small areas of the visible mine remains at each site, and then extend the surveys to areas away from the Historic England Schedules which would allow a degree of freedom with regards to any proposed fieldwork. It was also probable that the mine complexes were larger than the Historic England Scheduled Areas, as these only focused on the surviving, visible mine earthworks. Furthermore, it was felt that any disparate methods of extraction, such as quarrying, would be located in these areas, as had been previously discovered on Harrow Hill (See Chapter Three).

The geophysical surveys of Harrow Hill and Long Down were carried out over three seasons, in 2017, 2019 and 2020. On Long Down nearly 90% of the entire known mine complex was surveyed, along with a large field to the south of the mines, amounting to approximately 6.49 hectares^2. On Harrow Hill, some of the western mine complex was surveyed, alongside a large area to the south, a total area of approximately 5 hectares^2.

Fig. 0.5: Halnaker Hill in background, viewing west from Long Down mines, in foreground (Author 2019).

1.4.4 *Chapter Five*

After the geophysical survey it was proposed to carry out a small sample excavation in an area to the south of Long Down, which showed promising geophysical results. Unfortunately, due to the 2020 COVID-19 pandemic this fieldwork had to be cancelled. However, it was possible to carry out other forms of archaeological survey and analysis, most notably on Church Hill and Harrow Hill. Chapter Five is focused on presenting the findings from these surveys, along with research and analysis from other mines encountered during the project, including Cissbury flintwork from non-museum archives.

The main focus of Chapter Five is the results of surveying two previously unknown axe manufacturing workshops, discovered by surface investigation, on Church Hill and Harrow Hill (Fig.1.6). At both sites axe roughouts and debitage were recording *in situ*, using a methodology that combined survey by Global Position System (GPS) with photography and rapid assessment of lithics. This approach removed the need to collect material from Scheduled Areas and allowed rapid survey across large areas. The results of these surveys allowed Aims 2 and 4, alongside Objectives 1 and 6 to be met.

Fig. 0.6: Axe manufacturing debitage on Harrow Hill, viewing southeast (Author 2019).

With regards to the other material examined in Chapter Five, this was composed of assemblages of artefacts recovered during historic excavations and field collection, but not analyzed for many years, if at all. It was decided that little could be gained from examining the vast number of axes collected from the mines. Many are poorly published and would benefit from full analysis, but such work lies outside the scope of this project. Instead, evidence of non-mining activity was searched for in the archives with the purpose of expanding knowledge on practices that are not typical of mining or axe production, an under-researched area. Collections examined included an assemblage of flintwork, collected from Cissbury (Fig.1.7).

The results of Chapter Five follow on from those in Chapter Three and Four, by linking non-mining areas to zones of extraction and therefore increasing knowledge of activities that were carried out alongside extraction. It was also possible to document and assess plough damage on Church Hill, which is currently on the Heritage at Risk Register.

Fig. 0.7: Pitt River Museum archives, research in progress (Author 2018).

1.4.5 Chapter Six

For Chapter Six the thesis moves beyond the mines to search for evidence of other activities contemporary with mining that could be linked to the mines. This is grounded by an extensive review of more than 9000 entries on the Historic Environment Records (HER) of East Sussex, West Sussex and Chichester District, combined with searches of other databases, including The Archaeological Data Service (ADS) and Online Access to the Index of Archaeological Investigations (OASIS). By identifying non-mining evidence and archaeological features Chapter Six meets Aims 1 to 4, alongside Objectives 2, 3 and 4.

Chapter Six constitutes a major analysis of the Early Neolithic of Sussex, outlining and reviewing the results of academic research and developer funded archaeological excavations conducted in Sussex over the last thirty years. This helped to develop a narrative of Early Neolithic Sussex in the mining period, meeting the central aim of the project in furthering understandings on the cultural forces driving flint mining. Chapter Six also connected to current theoretical debates on the Early Neolithic of southern England, by expanding knowledge on the material culture and practices of communities that may have been associated with the flint mines.

From early on it was decided that there was little need to re-examine the large quantities of lithics from previous research. Julie Gardiner (1988; 2000) already documented much of this material and its re-assessment would amount to an entire research project. A decision was made to focus sites with sealed deposits, such as pits, which contained axes or similar flintwork that may have originated from the flint mines. A general cut off point for the mid 37th century BC was adhered to, as this marks the point where enclosures begin to be constructed and new styles of bowl pottery appear, signaling a developed phase of the Early Neolithic, rather than the mining period. An exception was made for sites that could share a relationship with specific mines with later episodes of extraction, such as on Long Down.

Relevant to Chapter Six are features that contained Carinated Bowl pottery, the earliest ceramic tradition in the British Isles, because of its discovery in mine contexts on Long Down and Cissbury. Therefore, a section of chapter Six is devoted to the analysis of Carinated Bowl pottery across Sussex, especially on features that could be related to mining communities, such as New Barn Down.

After reducing the entries on the HER, ADS and OASIS databases to the small number of sites that fitted the above criteria (as presented in gazetteer form in Appendix 6), two sites were chosen as case studies for further analysis. The case studies sites were as follows and graded in according order for their possible links to flint mines;

1. New Barn Down, West Sussex. A large pit, located close to the Harrow Hill flint mines, which contained axes, mined sourced flintwork and carinated pottery, and;

2. Bishopstone, East Sussex. One large pit containing a flint axe, provenanced to the Cissbury mines and a second pit containing Carinated Bowl.

Analysis of these sites was crucial to developing links between mining and non-mining activates, as well as expanding knowledge on communities who may have either mined, visited the mines or had connections to mining groups. Of significance to this project were the production of two new radiocarbon dates from New Barn Down, which expanded knowledge of the Early Neolithic in Sussex, thus meeting Aim 2 and Objectives 2 and 3. Funding was also obtained in late 2019 from the Natural Environment Work Council (NERC) for three radiocarbon dates from a pit at Bishopstone. Unfortunately, due to the 2020 COVID-19 pandemic these dates were delayed and it was not possible to include them.

1.4.6 Chapter Seven

The final chapter in this thesis focuses on a discussion of the results from the project. This begins with a discussion on whether the project successfully met its core aims and objectives, as laid out in this chapter. A notable part of the discussion will focus on questioning how the findings support, or revise, existing interpretations on flint mining, specifically on notions of mobility and occupation. The theoretical position of this project is discussed, and how it contributes to the wider themes of transition, contact, mobility and occupation.

1.5 Interpretive Position

Although the primary concern of this thesis is flint mining in Sussex, theoretically it engages with Early Neolithic research themes. In recent decades research has focused on settlement, mobility of people, artefacts, animals and more recently DNA (Clough and Cummins 1979, 1988; Whittle 1997, 2007a; Bradley and Edmonds 1993; Pollard 1999; Rowley-Coney 2004, 2011; Garrow *et al.* 2005; Edmonds and Davis 2011; Leary 2014; Anderson-Whymark *et al.* 2015; Leary and Kador 2016; Cummings and Morris 2018; Brace *et al.* 2018, 2019; Schauer *et al.* 2019).

The Mesolithic-Neolithic transition has dominated studies of the Early Neolithic in Britain and elsewhere in Northwest Europe (Sheridan 2004, 2010, 2011; Thomas 2003, 2004, 2007, 2008, 2013; Whittle *et al.* 2011; Garrow and Sturt 2017; Larsson, and Debert 2013; Sørensen 2014). This thesis does not wish to become weighed down by the transition debate, however, it does acknowledge that flint mines, in view of the dates produced in this study and other recent research (Edinborough *et al.* 2019), will invariably become entwined within it. This is because the mines are Continental in origin and span the critical period of 4000 cal BC.

Core to the study of the transition is a polarizing debate over models of cultural change. In one camp Julian Thomas argues for ‘indigenous adoption/acculturation’ driven by interactions and exchange of material culture, domesticated animals, cereals and possibly even intermarriage (Thomas 2003; 2004; 2007; 2008; 2013). In this model Mesolithic communities initially became Neolithic through a prolonged period of low-level contact with European visitors through choice. Then followed a wholesale shift in cultural identity around 4000 cal BC due to an increase in ‘movement of personal’ (Thomas 2008, 80).

Opposing the indigenous Neolithic is a direct ‘colonisation/immigration’ model, mostly championed by Alison Sheridan who argues that the appearance of Neolithic material culture and practices was due to the large-scale movement of people, customs and objects (Sheridan 2004; 2010, 2011). Sheridan states that the absence of imported Neolithic material culture in the British late Mesolithic indicates that no period of ‘acculturation’ occurred (Rowley-Conwy 2004; 2011). When the transition happened it was sudden, due to the mass arrival of divergent groups of Neolithic peoples arriving at different times in various parts of the British Isles, displacing Mesolithic communities.

1.5.1 Moving forwards

One of the more recent transition models, perhaps most relevant to flint mines, is offered by *Gathering Time* (Whittle *et al.* 2011), who proposed the spread of the Neolithic to the British Isles was fragmentary and varied in location, speed and chronology (Fig.1.8). After a preliminary period of immigration, probably beginning in Kent and the lower Thames Valley shortly before 4000 cal BC, there was influx of immigrant farmers along the southern coast of England. A northwards and westwards expansion followed, '*changing and accelerating in tempo as it extended to much of Britain and Ireland*' (Whittle *et al.* 2011, 853). During this initial 'contact Neolithic' monuments were largely absent (Whittle *et al.* 2011, 871), as colonialists and indigenous groups exchanged or integrated through a series of small-scale contacts (Whittle 2007b).

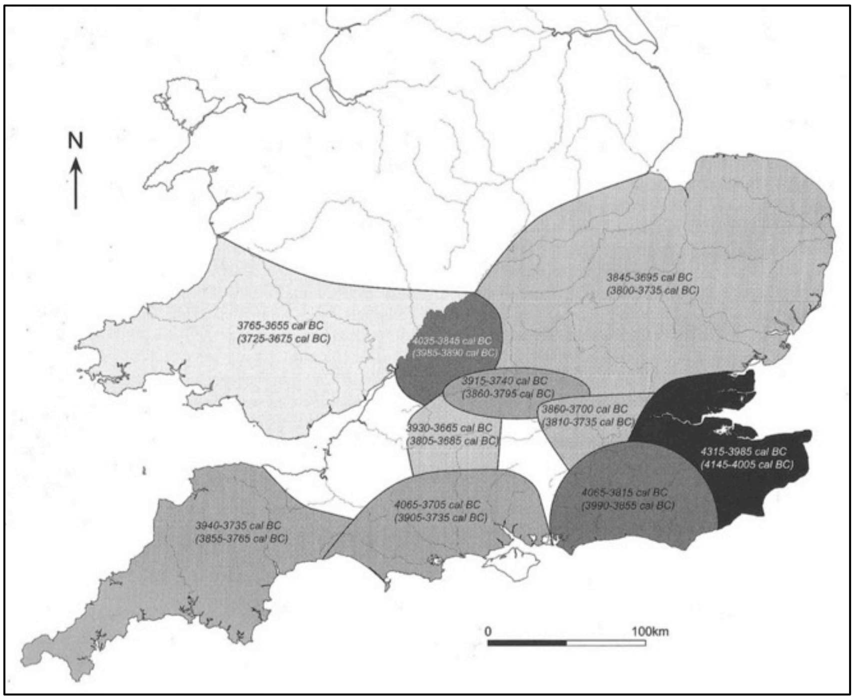

Fig. 0.8: Spread of the Neolithic, as proposed by Whittle *et al.* 2011 (Fig.14.48).

The dissemination and reproduction of Neolithic culture and practices in southern England therefore involved exchanges between 'incomers and indigenous people' (Whittle *et al.* 2011, 872). It is acknowledged that the mines are an early indicator of Neolithic customs and that polished axes held 'significance far beyond their area of production' (Whittle *et al* 2011. 261). Mining is recognised as significant but confined regionally to central southern England and associated with the customs of one particular cultural group (Whittle *et al.* 2011, 261; Healy 2008).

As will be discussed at the end of this thesis the flint mines appear to support the replacement of Mesolithic groups by Neolithic incomers, because they lack any features of Mesolithic practice or material culture, and were clearly already part of a mining culture in the Continental Neolithic (Baczkowski 2014). This may be considered problematic by researchers who, whilst largely acknowledging that mining was introduced from the Continent, argue that it was rapidly transformed due to 'indigenous acculturation' by Mesolithic communities (Thomas and Ray 2018; Teather 2019).

Support for the comprehensive replacement of Mesolithic groups by Neolithic communities has recently gained from genetic studies (Brace *et al.* 2018; 2019). Although, it must be noted that large-scale DNA studies are not without critique (Hofmann 2014; Eisenmann *et al.* 2018), with population modeling from a small, incomplete burial record likely to miss the nuances of transitional archaeology and the multiple movement of small groups (Vander Linden 2016). However, with regards to flint mining, the genetic studies confirm the most recent radiocarbon dating program of flint mines (Edinborough *et al.* 2019), including dates obtained in this research (Baczkowski and Holgate 2018), which show a high level of synchronicity in the chronology of mining across mines in Britain and Northwest Europe.

This thesis will propose that flint mines combine aspects of monumentality, material culture and expressions of worldviews and customs. The narrative of connectedness will be developed throughout this thesis and is an important theoretical standpoint. It will be proposed that flint mines are not associated with the Mesolithic-Neolithic transition, but instead part of a cultural shift in the European Neolithic that resulted in the adoption of deep mining and the large scale production of axes. This change coincidently corresponds to just after 4000 cal BC in Britain, the somewhat arbitrary start date of our Neolithic. It is further likely that, in the centuries after Neolithic communities arrived in Sussex, understandings of the landscape would have been re-worked to establish new meanings (Insoll 2006. 236).

1.5.2 Landscape and settlement?

A key theoretical objective of this project is to conceptualize Early Neolithic settlement and occupation, specifically with regard to flint mines. As detailed in Chapter Two, flint mines are still viewed as marginal sites where, if settlement did occur, it was temporary and only associated directly with miners (Edmonds 1995; Topping 2005; Barber *et al.* 1999; Thomas and Ray 2018). The project will study how these interpretations stand up against data collected during the fieldwork and survey phases. This is an important task, because existing interpretations are often based on archival material that is under-researched and has not been re-evaluated for many decades. It will further be tested against the wider archaeological record of Early Neolithic Sussex, which will help establish flint mines within a wider pattern of Early Neolithic settlement and landscape use.

Describing Early Neolithic settlement has long proven problematic, with no regional pattern and a lack of definable settlement evidence, such as field systems and structures (Whittle 1997). This has much to do with modern expectations of how settlement evidence should be presented in the archaeological record, i.e., houses, structures, field systems and solid domestic material. The archaeological record of the Early Neolithic does not easily meet this criteria and it therefore difficult to approach and define. Even when occupation evidence is discovered it is often not easily associated with settlement.

Houses are perhaps the most difficult to understand, being scarce, regionally limited to specific areas, such as the Thames Valley, London (Chaffey *et al.* 2016) and Medway, Kent (Hayden 2007) and northern England (Darvill and Thomas 2006), and not always clearly associated with occupation (Darvill and Thomas 2006). Better evidence of Early Neolithic occupation comes from pits and associated flint scatters, interpreted as middens or surface artefact spreads, which are widely distributed and can also be regional in their form and character (Garrow 2007; Anderson-Whymark and Thomas 2012).

In general, a consensus has been reached that understands Early Neolithic settlement as temporary and seasonal with semi-mobile communities, in keeping with a lifestyle based on mixed agrarian and pastoral economies (Whittle 1997; Leary and Kador 2016). Economies that may have been based on a mixed slash and burn, or swidden agriculture (Pollard 1999), mixed with the utilisation of natural, or creation of human made forest clearances (Allen and Gardiner 2009; Robinson 2014). This settlement model fits well with the Early Neolithic archaeology of southern England, with scattered communities living in temporary settlements located in a variety of landscape settings (Whittle *et al.* 2011, 866-71). It is likely that because of the role of cultivation and mixed farming in the Early Neolithic, communities practiced a higher level of sedentism than in the later Neolithic, when there is a shift to pastoralism and greater mobility, possibly because early agriculture failed (Stevens and Fuller 2012).

Further support for this form of occupation can be drawn from the environmental record, with the southern English landscape possibly comprising of a patchwork of woodland clearance undertaken to create areas for the cultivation of crops and the grazing of animals (Allen and Gardiner 2009, 2012; Robinson 2014). Although, it must be recognised that this model of landscape is regionally diverse and is still based on an incomplete environmental data (Bell and Noble 2012).

With regards to flint mines, they are largely worked in a landscape devoid of contemporary monuments in a pre-enclosure period of the Early Neolithic (Whittle *et al.* 2011, 257, 833-6). This makes understanding their relevance to furthering knowledge of early settlement especially important, as they represent one of the only, albeit regionally restricted, large landscape monuments.

Much about the settlement discussion is governed by contemporary cultural perceptions, both personal and collective, on what constitutes occupation. Such narratives have long concerned the interpretation of Neolithic houses for example, with distinctions drawn between a 'occupation' and 'ritual' division that relies on our preconceptions of social context, creation of space and of houses as structures (Parker

Pearson 1994; Clooney 1997). Instead, space can be understood, whether a house or a flint mine, as part of a wider landscape of social and cultural meanings that are perpetually being manufactured through experience, engagement and occupation (Ingold 2006; 2007).

Through engagement with themes of time, movement and practice, an account of landscape as a 'lived in' space can be proposed (Pollard 1999; Whittle 1997; 2003; Harris 2009). Through this space communities moved, settled and carried out activates that formed part of the experience of everyday life in the Early Neolithic (Ingold 1993; Pollard 1999). As Tim Ingold, states 'Knowledge of the world is gained by moving about in it, exploring it, attending to it, ever alert to the signs by which it is revealed (Ingold 2000, 55)'. This 'dwelling perspective' will be developed through a consideration of the temporal locale of the mines and dwelling spaces in the wider landscape, specifically with regards to the evidence presented by pits in Chapter Six.

It is acknowledged that previous interpretations (Edmonds 1995; Topping and Lynott 2005) of extraction activity have also focused on the *habitus* (Bourdieu 1977) of the mining experience. As Edmonds proposes, mines and mining were embedded 'in routines of movement through the landscape, the character and tempo of activities at the sources may have been keyed into broader conceptual schemes concerning patterns in the lives of the individuals, the community and the broader group' (Edmonds 1995).

This thesis will further Edmonds' argument, by the direct study and comparison of mining and non-mining contexts. It will be proposed that mines and the act of mining manufactured experience both personal and communal, meaning that the interpretation of mines cannot simply be divided into categorizations of industrial, functional, and cosmological. Further, mining performed an essential role in social networks for Early Neolithic communities in Sussex, which in turn is reflected and produced across a variety of archaeological sites across the wider landscape. Mining is not an activity that was separate to the everyday experience of the Neolithic; it was instead part of a set of developing cultural and social activities that formed part of the yearly cycle of movement, interactions and exchange. It will be proposed that locales within the landscape, such as flint mines, were not isolated and instead formed parts of larger 'temporal and spatial fields of relationships' (Bender 2001. 85).

These ontology narratives will be developed throughout this thesis and discussed in greater depth in the end discussion, Chapter Seven. The next chapter will summarize the archaeological history of the southern English flint mines and finish by outlining the theoretical themes produced from more than a century of research.

Chapter 2 More than a century of research

2.1 Introduction

This chapter presents an overview of the Sussex flint mines, covering their discovery and research. It is not a thorough narrative, as this been covered elsewhere (Barber *et al.* 1999; Russell 2000, 2001). The European mines will also be outlined, as the Sussex mines were the western-most expression of a tradition that may have been undertaken on the Continent for some 1500 years before arriving in southern England (Charraud 2019).

2.2 Pre-deep mining?

Before presenting the Sussex Neolithic flint mines, it is worth taking a brief chorological interlude into the Late Mesolithic. This is important to address because there is still debate on whether mining was a Continental introduction, or an indigenous development (Teather 2019). The Late Mesolithic is a long period, c. 3500 years, and has its own chronological nuances, such as variations in the location of hunting camps, with a shift towards coastal sites only occurring towards its final centuries (Holgate 2003).

With regards to the Late Mesolithic in Sussex a general uncertainty persists over defining and identifying the period in the archaeological record (Fig.2.1). There is no consensus on the form of Late Mesolithic lithics, with only rod microliths consistently dated to either side of 4000 cal BC elsewhere in Britain (Jones 2013; Griffiths 2014). Few assemblages containing rod microliths in Sussex have been dated, and where secure dates have been obtained they fall much earlier in the mid 7th millennium BC (Garland and Anderson Whymark 2016).

Separating Late Mesolithic and Early Neolithic flintwork can, at times, be difficult. In both periods cores were carefully prepared with a platform prior to the production of blades, albeit with a tendency for greater levels of platform preparation and regular blades in the Mesolithic and longer blades in the Early Neolithic. In an open deposit, such as surface flint scatters as is the Sussex norm, diagnostic Early Neolithic pieces including leaf-shaped arrowheads, serrated blades and the waste from bi-facial axe production offer the best opportunity for dating. If these forms are missing dating can prove difficult. This poses significant problems for interpreting the character of the transition from the Mesolithic into the Neolithic, especially as much of the evidence is derived from mostly undated 'open' flint scatters (Care 1982; Gardiner 1984; Pitts 1980).

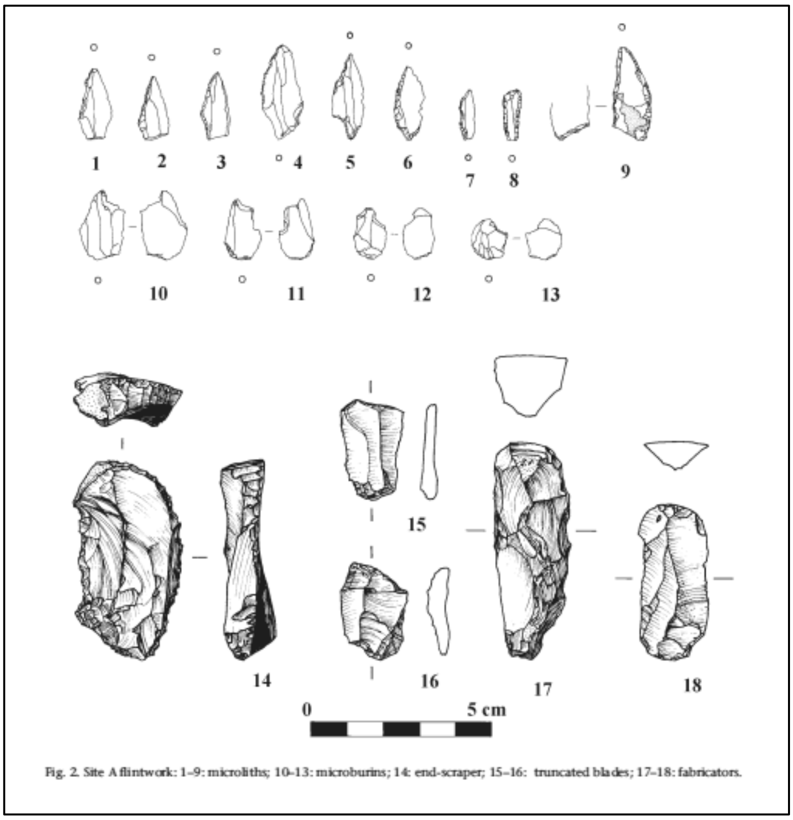

Fig. 2.1: Late Mesolithic lithics, Horsham area (from Butler 2008 Fig.2).

Most important to this thesis is limited evidence for an increase in the production of tranchet axes in the final phases of the Late Mesolithic in Sussex, which may have overlapped into the Early Neolithic (Care 1979; 1982; Gardiner 1990). Two locations have been identified as tranchet axe production sites: Red Hill (Butler and Holgate 2002) and West Hill (Butler 2001). Both are located on downland deposits of Clay-with-Flints, a residual deposit formed in the Pleistocene, c. 2,500,000 to 11,700 years ago from the 'dissolution, decalcification and cryoturbation of bedrock strata of the Chalk Group and Palaeogene formations' (British Geology Survey 2020). Why Clay-with-Flint was favoured in contrast to large nodules readily available from riverine, chalk and coastal locations across Sussex is unknown.

On Red Hill, one of the largest assemblages of Late Mesolithic flints in Sussex, a wide range of implements (Fig.2.2) were produced on flint extracted from Clay-with-Flints, including scrapers, cutting tools, piercers, burins and notched pieces (Butler and Holgate 2002). A large number of microliths of well-known Late Mesolithic geometric forms were manufactured here, alongside the evidence of tranchet axe production (Butler and Holgate 2002). A small amount of Early Neolithic flintwork was also recorded.

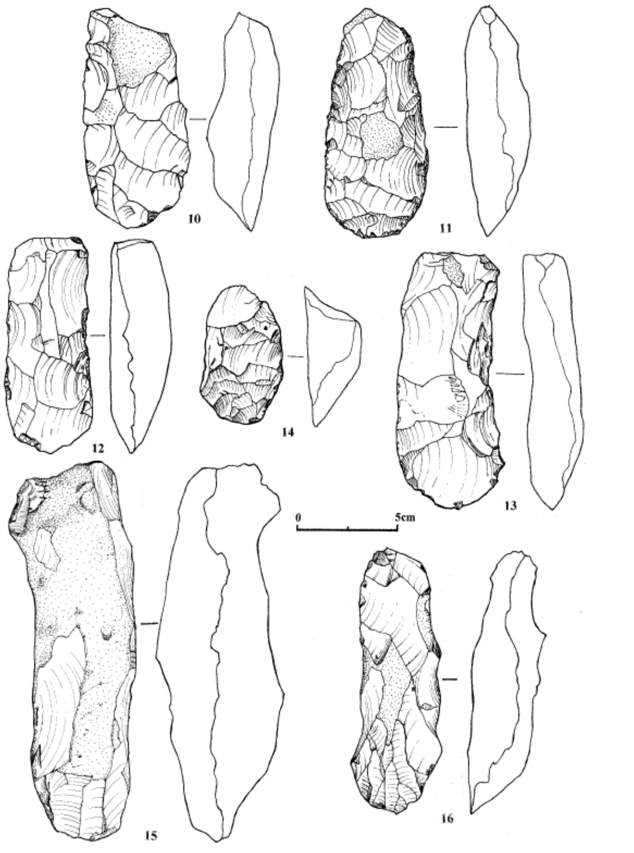

Fig. 12. Mesolithic flintwork. 10: tranchet axe roughout; 11: tranchet axe preform; 12–13: tranchet axes; 14: tranchet axe resharpening flake; 15–16: picks.

Fig. 2.2: Tranchet axes from West Hill (from Butler 2001 Fig.12).

A similar assemblage was also recovered from West Hill, with tranchet axe production occurring alongside the manufacture of microliths on flint extracted from a Clay-with-Flints deposit (Butler 2001). Exploitation of the Clay-with-Flint also continued into the Neolithic period, with 38 bi-facial axe roughouts and six preforms recovered during the fieldwork. The identification of five polished axes possibly produced from mined flint is of note, although it is unclear if these were contemporary with the production of the locally sourced axes (Butler 2001. 19).

Another site with possible extraction evidence was Falmer Stadium Brighton, where pits were found in association with an extensive Late Mesolithic to Early Neolithic flintwork scatter (Garland and Anderson-Whymark 2016). One large pit was proposed as a possible flint mine, although the lack of dating from the feature makes this interpretation problematic. The same chronological problem applied to the pits and the flint scatters, and it was conceded by the excavators that there could be considerable timespan separating phases of activity (Garland and Anderson-Whymark 2016).

2.2.1 Flint mines, Mesolithic origins?

The difficulty in defining the end of the Mesolithic and the first centuries of the Neolithic in Sussex are dominated by a lack of settlement evidence, a paucity of early human burials, and a poorly preserved environmental record. Red Hill, West Hill and Falmer purport to demonstrate continuity between the Mesolithic and Neolithic, but this is conjuncture because they have not been adequately dated. They only prove that good sources of flint have always been valued.

It is argued that the location of the flint mines was conditioned by earlier extraction from Clay-with-Flint deposits (Barber *et al.* 1999), as found on Church Hill and Harrow Hill. Although, as highlighted in this thesis, the presence of Mesolithic pieces in flint mining assemblages is minimal. Therefore, Late Mesolithic extraction on downland locations to produce tranchet axes is still markedly different in both location and character to Early Neolithic flint mining. In the case of Red Hill, West Hill and Falmer activity seems to be focused on hunting camps, with extraction of a raw material and manufacture of tools occurring *ad hoc*, during repeated, or interrupted visits over many centuries.

Obtaining flint from shafts and galleries denotes a defined and sudden shift from previous Mesolithic extraction activity based on surface collection, or from shallow 'scraps' or pits. As will be discussed below, Southern England does not have a long tradition of extraction from deep pits or shafts, as is the case in parts of Northwest Europe (Collet and Hauzeur 2019). Therefore, the Sussex flint mines represented an entirely new approach to winning raw flint that travelled with farming communities from the Continent. Mining began in a world that had shifted from Mesolithic practices and was immersed in Neolithic ones.

One word of concern can be expressed here with regards to the Late Mesolithic and Early Neolithic, the question of definitions. As Edmonds notes, the confusion surrounding understandings of the transition have been 'compounded by the fact that our definitions of the term "Neolithic" have been far from constant' (Edmonds 1995: 22). The search for Late Mesolithic and transitional material has been confused by an attempt to categorize material culture as either Mesolithic, Neolithic, or a combination of both. Continuation or replacement is therefore offered as the only two viable narratives of the transition. Whilst this contradiction may be true for many aspects of transitional material, in the case of deep mining the latter seems only applicable.

2.3 The British Flint Mines

2.3.1 What is a flint mine? The basics

Of the ten proven prehistoric flint mines in southern England, six are located in Sussex (Barber *et al.* 1999. Figs.1.1-2.3), Blackpatch, Cissbury, Church Hill, Harrow Hill, Long Down, Stoke Down and Long Down, along with one probable complex at Nore Down. The Sussex sites are currently the only mines dating from the Early Neolithic period, along with Martin's Camp, Hampshire and Easton Down, Wiltshire (Whittle *et al.* 2011, 261). At the early mines flint was extracted predominantly for the production of bi-facial implements, mainly axes. In contrast, the major mine complex at Grimes Graves, Brandon, Norfolk, is dated to the Late Neolithic and Early Bronze Age (Healy *et al.* 2014) and did not provide flint solely for axe production (Bishop 2014: 46-49).

Flint mines comprise of two components, shafts and galleries. Vertical shafts at southern English mines are between 2m to 19m in depth and link to subterranean networks of galleries, up to 20m in length and usually little more than 0.6m in height. Galleries follow the flint seams and were often paired, with a divisional wall of bedrock left *in situ* between them for structural support (Fig.2.4). Galleries from separate mineshafts within the same complex were often connected, forming an intricate, maze like basal system.

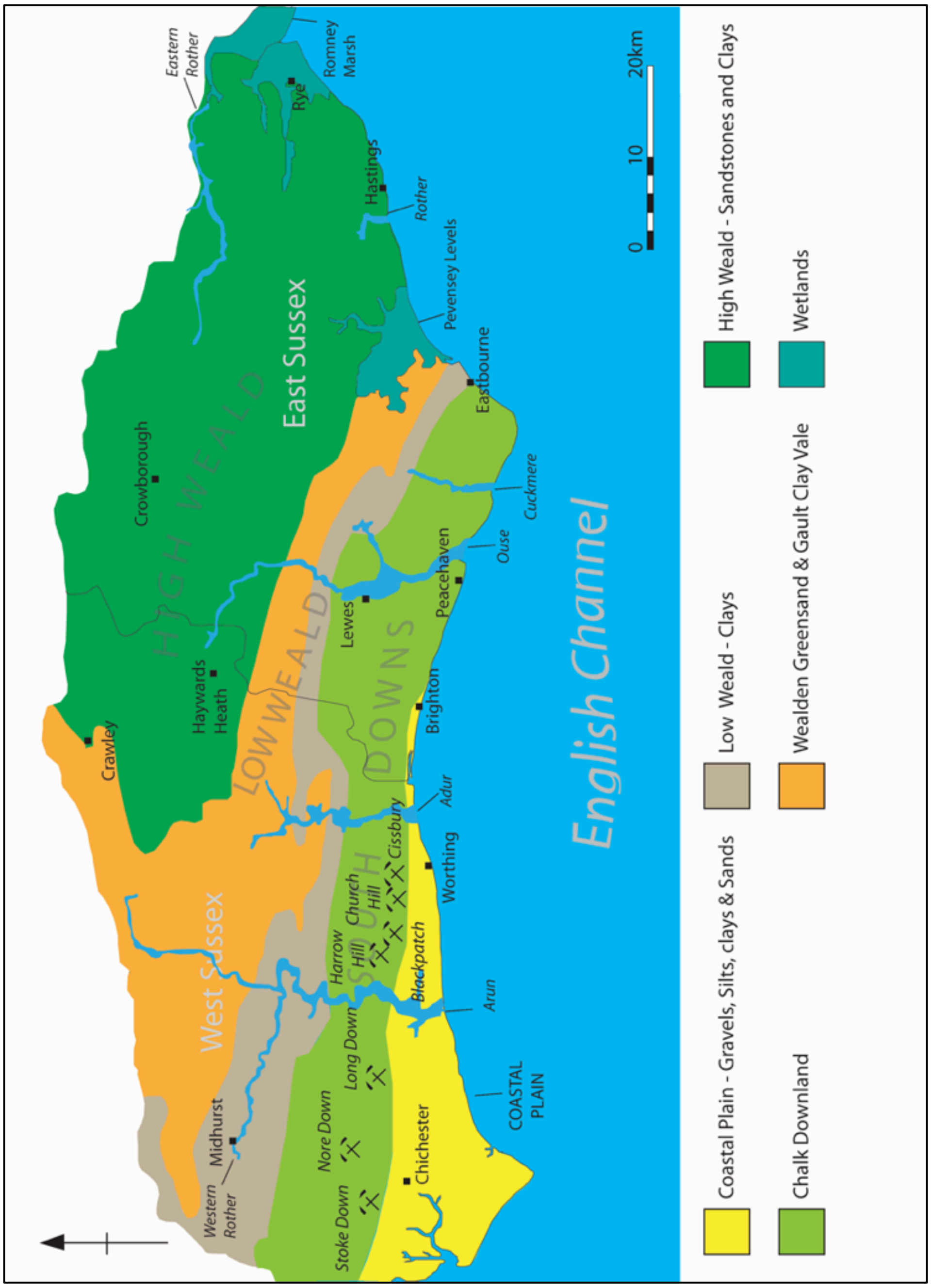

Fig. 2.3: Map of Sussex mines and bedrock geology (Author).

Connections were complex and not always contemporary, new galleries joined older ones and vice versa (Teather 2019). Windows and doorways were often inserted between galleries, which on occasion were intentionally blocked or left open. These apertures may have aided with the circulation of air and light around the basal system and may have also functioned in a symbolic way, by controlling movement around the mine (Teather 2016).

Nodular or tabular flint was extracted directly from a seam positioned at the working face of the galleries. The most common mining implement were picks fashioned from red deer antler, although flint picks, bone shovels and wooden levers were also employed (Russell 2001). The implements were used to break the chalk and prize flint from the chalk bedrock. A common technique used in the Sussex mines was use of the tine part of the antler as a short punch-like implement (Fig.2.5), which was hammered into the bedrock in a series of lines, helping to break the chalk into manageable blocks (Curwen 1937: 112).

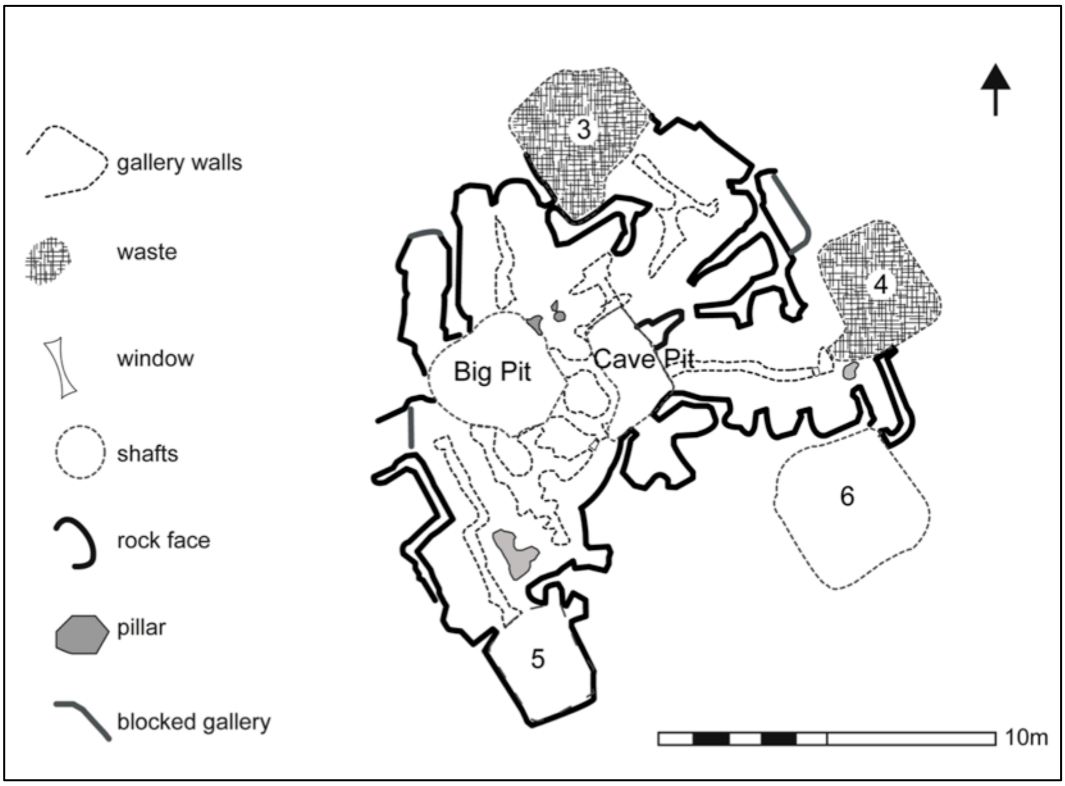

Fig. 2.4: Plan of Cissbury mines (Author, adapted from Russell 2000 Fig.34).

Once extracted, the raw flint was transported to the surface of the mine via the shafts, probably with ropes or wooden ladders (Curwen 1937: 112; Pull in Russell 2001: 180-81). Primary and secondary knapping activity then began, often very close to the shafts, with flint nodules reduced to axe roughouts and pre-forms. The final stages of knapping and polishing seems to have occurred off-site, although, this may not have always been the case (See Chapter Three and Five).

Fig. 2.5: Antler punches from Long Down (Author 2017).

2.3.2 The Sussex flint mines
(For gazetteer see Appendix 1).

The Sussex mines are broken into two groups by geographic location (Fig.2.3). To the west of the county the Chichester group consists of mines at Long Down, Eartham and Stoke Down, Funtington, along with a probable site at Nore Down, Compton. In the east of the county the Worthing Group comprises of four mines, the largest complex at Cissbury, Findon, its smaller neighbour at Church Hill, the now destroyed Blackpatch and the well preserved site on Harrow Hill, both near Patching.

The majority of the Sussex mines are located on either the Tarrant Chalk Member, or the Newhaven Chalk Formation chalk geology (See Appendix 1). Both sedimentary bedrocks were formed in warm shallow chalk seas in the Cretaceous Period, c. 72-86mya, and are 'biogenic and detrital, generally comprising carbonate material (coccoliths), forming distinctive beds of chalk' (British Geology Survey 2020). The precise geological process of flint formation is still debated, but in general terms it is a microcrystalline rock composed of silica (87%-99%) that formed shortly after the deposition of chalk, when silica replaced Chalk carbonate (Allyu *et al.* 2017). Flint takes on various morphologies, including nodular, sheet, tabular and tubular, and is found in seams at regular intervals and depths throughout the chalk bedrock (Clayton 1986). The Sussex mines are mostly focused on nodular flint seams, although tabular flint was also extracted at Long Down and Harrow Hill.

2.3.3 The Worthing Group

The four Worthing Group mines are located on chalk downland, between 6-8km north of the current Sussex coastline. These are the largest and most extensively excavated mines in Sussex. They are so close geologically and chronologically, with activity spanning between 4000-3600 cal BC (Barber *et al.* 1999: 81-82, Edinborough *et al.* 2019), it is likely that several different mining communities worked them at the same time.

Blackpatch

Blackpatch (NGR: TQ 09400 08786) comprises of around 20 shafts located in an area of downland on the westerly side of Blackpatch Hill. The only excavation of Blackpatch revealed wide shafts, up to 5.1m^{ø}, and an intricate basal system with between four to seven galleries originating from a single shaft (Pull 1932). A single large seam of nodular flint was mined, located between 2m to 3.2m of depth.

Church Hill

A mine complex of c. 35 mine shafts located below the eastern summit of Church Hill (NGR: TQ 11422 08277), on the western side of Findon Valley. A variety of mine features have been recorded on Church Hill, including shafts without galleries and short, curving galleries (Pull 1993a,b,c,d; 1953: Pull in Russell 2001). The deeper shafts passed through three flint seams, before extracting the fourth at a depth of c. 5.1m.

Cissbury

Cissbury (NGR: TQ 13953 07947) is the largest mine complex in Sussex, with upwards of 300 mineshafts. The main area of mining extends westwards below the eastern summit of Cissbury Hill. The excavations undertaken on the Cissbury mines proved that the workings are extensive and complicated, with flint extracted from several flint seams, including the sixth at a depth of 12.8m (Lane Fox 1876; Harrison 1877a, 1877b, 1878; Pull 1953, 1956; Pull in Russell 2002: 170-90).

Harrow Hill

Around 100 shafts are located below the summit (186m) of Harrow Hill (NGR: TQ 08162 09986), extending in a series of terraces down its eastern side. A dry valley separates Harrow Hill from Blackpatch, c. 1.4km to the southeast. The shafts on Harrow Hill were large, up to 6.1m^{ø}, and connected to complex basal system, much like Cissbury. Flint was extracted from multiple seams, with a focus on the third seam at 6.8m of depth (Curwen and Curwen 1926; Holleyman 1937; McNabb *et al.* 1996). In 1986 small-scale sample excavation revealed an area of drift mines (See Chapter Three).

2.3.4 The Chichester Group

The Chichester Group mines are located in downland areas to the north, northwest and northeast of Chichester, and are up to 15km from the current coastline. The Chichester Group mines are smaller the Worthing Group, and have not been subjected to the same level of archaeological investigation.

Long Down

A small complex of c. fifty known mineshafts is located on the southwestern spur of Long Down (NGR: SU 93138 09357). A capping of Clay-with-Flints covers the summit of Long Down, with an abundance of large pieces of nodular and tabular flint. None of the excavations undertaken on Long Down fully exposed the mineshafts and there is no knowledge on the form of deep extraction (Salisbury 1961; Baczkowski and Holgate 2017). Flint working floors have been excavated which increased knowledge on axe manufacture (See Chapter Three).

Stoke Down

Stoke Down (NGR: SU 83374 09555) is located on a northeast-facing escarpment overlooking the valley of the River Lavant. There may be up to 120 shafts in total on Stoke Down, unusually across two zones of extraction, an eastern and western group (Barber 2014). Three mineshafts and a number of undated pits were explored on Stoke Down (Wade 1922). The largest of the shafts measured 3.6m^{ø}, was 4.5m deep and possibly connected to two galleries that were not opened.

Nore Down

A probable flint mine complex is located on Nore Down (NGR: SU 77300 13100), c. 10km north of Chichester. The Nore Down complex appears to be a small extraction site with less than 20 mineshafts. A small excavation exposed the tops of seven possible mineshafts located within two parallel oval earthworks previously interpreted as a long barrow (Aldsworth 1983). Dating of the features was inconclusive and it was unclear how the oval earthworks related to the mineshafts. Oval earthworks within a mine complex are recorded at other sites, including Harrow Hill and Long Down, and could be the result of sinking successive shafts, or evidence of later quarrying of earlier mine workings, as discussed in Chapter Four.

2.3.5 Beyond Sussex, The Wessex Group mines

Two mines are located in Wessex, Martin's Clump, Over Wallop, Hampshire and Easton Down, Winterslow, Wiltshire. Both mines have only been subjected to small-scale excavations, none of which have been fully published, and their dating is unsatisfactory. However, the dates from both indicate an Early Neolithic date range (Barber *et al.* 1999 81-82, Edinborough *et al.* 2019). A single Early Bronze Age date at Easton Down is now considered as wayward, possibly recording later activity, and the mine complex is considered Early Neolithic (Edinborough *et al.* 2019).

Martin's Clump

Martins Clump (NGR: SU 25200 38800) consists of upwards of 1000 extraction features, although it is doubtful all of these are deeps shafts and many may be shallow pits dated to the Late Neolithic/Early Bronze Age (Ride and James 1989). Only a single mineshaft was opened on Martin's Clump (Watson 1955), measuring 3m^{ø} and 3m in depth with no galleries and containing Early Neolithic axe roughouts (Fowler 1987: Ride and James 1989).

Easton Down

Around 90 possible Early Neolithic shafts have been recorded on Easton Down (NGR: SU 23700 35900). Several shafts were opened by JFS Stone between 1930 - 34, recorded as 2-3m^{ø} and up to 3.4m in depth (Stone, 1930, 1933, 1935). None of these shafts appear to have definite galleries, although it is unclear if the bottoms of them were reached. Finds included red deer antler picks, an ox scapula and axe roughouts, all indicating an Early Neolithic date.

A third mine attributed to the Wessex Group is located in Wiltshire, composed of small group of extraction pits close to the Durrington Walls henge monument (Booth and Stone 1952). These are dated to the Late Neolithic and can be classed as opencast mines, being shallow 1-2m pits lacking galleries (Booth and Stone 1952). Similar shallow mine features were recorded close to the causewayed enclosure on Hambledon Hill, Dorset, and were dated to the Middle to Late Neolithic (Mercer and Healy 2008. 403). These extraction features are broadly similar to some of those documented on Martin's Clump (Barber *et al.* 1999. 34), possibly indicating that this form of mining developed in Wessex in the Early Neolithic and continued into later centuries.

2.3.6 The dating of mines

The radiocarbon dating of mines is not entirely precise, material excavated from mineshafts, such as antler implements only date individual mine workings rather than an entire mine complex. This problem is exacerbated because excavators focused specific areas on the mines, an approach that does not allow the establishment of an overall chronology for the complex.

Other issues are encountered in the providence of material recovered from galleries, as these workings often joined with earlier ones and artefacts may have passed between the two areas. Such activity possibly occurred to a fragment of antler in Blackpatch, which gave a much earlier date than other samples from the gallery (Teather 2019). This problem could even be the result of earlier material being carried into the shaft from the surface and therefore accounting for early pre-4000 cal BC dates from Blackpatch and Church Hill, although in general these dates are now considered as outliers (Edinborough *et al.* 2019).

Over the last decade the chronology of mining has been refined, partly due to dates obtained for the Neomine project (Edinborough *et al.* 2019) and this thesis (Baczkowski and Holgate 2018). These results indicate mining began shortly after 4000 cal BC in Southern England. Whilst these results have changed little from earlier studies (Barber *et al.* 1999), many pre 4000 cal BC radiocarbon dates can probably now be dismissed, removing much of the debate over mining beginning in the Mesolithic (Teather 2019). Interestingly, activity at the Cumbrian axe quarries, previously thought to date to the Middle Neolithic (Bradley and Edmonds 1993), is now proven to have begun around 3800 cal BC (Edinborough *et al.* 2019; Bradley *et al.* 2019).

A question remains on the end of mining. The Sussex dates demonstrate extraction activity peaked between c. 3900 – c. 3800 cal BC, although some, such as those from Cissbury (Teather 2019), indicate that limited activity continued until around 3600 cal BC. Of note are new dates from Church Hill that demonstrate the probable opening of a shaft in the mid-third millennium cal BC (Edinborough et al. 2019; Teather 2019). Some support for later mining is also found in the dates from Long Down (Baczkowski and Holgate 2018) for this project, with possible extraction activity occurring in the Late Neolithic and Early Bronze Age. The nature of this activity is far from clear, although it was probably focused on quarrying and reuse of mining waste (See Chapter Three).

Caution must also be expressed with regards to extrapolating the chronology of entire mine complexes from individual shafts, as it is not clear if the late dates, especially from Church Hill relate to the opening of individual shafts, coincidently the one dated, or even the re-opening of earlier shafts, one late dated shaft does not make the entire mine complex Late Neolithic. However, it is of note that at the end of the Neolithic mining began at Grimes Graves (Healy *et al.* 2014), and intensified at Spiennes, Belgium (Collet *et al.* 2008). It therefore appears that deep mining peaked in the Early Neolithic, waned though the Middle Neolithic and resurged at the end of the Neolithic into the Chalcolithic and Early Bronze Age.

At present, it is safe to propose that mining, specifically by deep shafts and galleries, was introduced to southern England shortly before, or immediately after 4000 cal BC. This date is also comparable across Northwest Europe and infers a notable augmentation of activity and a sudden need to increase flint extraction from deep mines for axe production. The chronology for the Sussex mines, starting around 4000 cal BC with activity waning towards 3600 cal BC mirrors the Continental model. Although in mainland Europe, as discussed next, an extraction tradition appears to have existed for at least a thousand years prior to being introduced into England.

2.4 History of research on the Sussex mines

2.4.1 The 19th century and beginnings

Flint mines came to the attention of the archaeological community in 1867 when the construction of a railway cutting, close to the Belgium village of Spiennes, sectioned around twenty-five mineshafts and galleries (Collet *et al.* 2006). The subsequent excavations by Baron Alfred de Loë (Collet *et al.* 2006) documented the subterranean workings of a large flint mine complex and led to the identification of other mines across Europe. One such site was Grimes Graves where in 1870 Canon William Greenwell excavated a landscape of circular depressions, previously interpreted as an army encampment for marauding Danes or an Iceni village. Greenwall discovered the shafts and galleries of a large mine complex (Greenwall 1870), comparable to Spiennes.

Fig. 2.6: Aerial view of Cissbury, showing mines and hillfort (Historic England).

Inspired by Grimes Graves, Major General Augustus Lane Fox (later Pitt Rivers) decided to return to his excavation of a similarly pitted landscape at the western end of Cissbury Hill (Lane Fox 1876; Fig.2.6), also the site of a large Iron Age hillfort. Although other archaeologists, notably Ernest Willett (Willett 1875) had excavated at Cissbury during the 1870's, it was Lane Fox 's excavation during 1875 and subsequent excavations by his assistant, James Park Harrison (1877-78), that would establish the site as a prehistoric mine.

Lane Fox was quick to compare Spiennes to Cissbury, commenting after visiting Spiennes, that '*It may be useful to note the most remarkable results obtained by this excavation in order to compare them with those of Cissbury*' (Lane Fox 1876. 363).

The excavations at Grimes Graves and Cissbury established the character of flint mining in prehistoric Britain, but dating the sites proved elusive. At Cissbury Lane Fox had established that the mines were of an early date, as the shafts underlie the Iron Age hillfort ramparts (Bowden 1991. Fig.2.7). Precise dating of the mines was more difficult, and it took almost half a century before the Neolithic date of mining was widely acknowledged. The debate centered on observations that many of the flint implements recovered were Palaeolithic in style, leading to several archaeologists, most notably Reginald Smith (Keeper of British and Medieval Antiquities at the British Museum) arguing for a Palaeolithic date (Barber *et al.* 1999. 10-11).

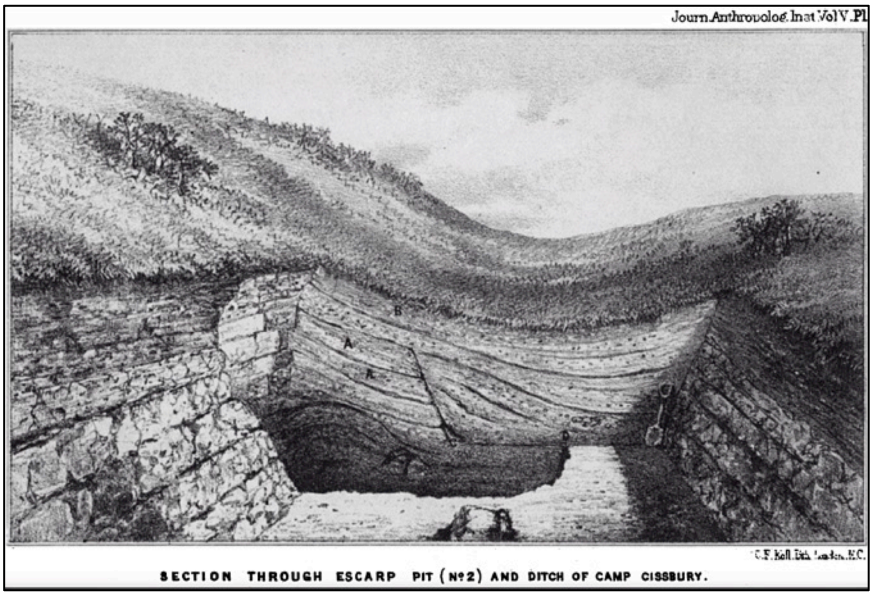

Fig. 2.7: Section through Cissbury rampart, with top of mineshaft (Fox-Lane 1876. 393).

The debate was largely resolved in 1933 with the publication of 'The Age of British Flint Mines' (Clark and Piggott 1933), which compared artefacts from mines, including pottery and flint axes, with those recovered from proven Neolithic monuments, such as causewayed enclosures. Doubt, however, persisted amongst some archaeologists (Armstrong 1934), and it was not until the 1950's that the mines were finally accepted as Neolithic.

2.4.2 The mine structures

During the early excavations of Cissbury several large shafts were opened including the Bear Pit and Shaft No 1 (Fig.2.4), both joining to a basal system of interconnected galleries. Whilst excavating this system Lane Fox recovered artefacts left *in-situ* that related to the mining process, such as implements fashioned from red deer antler and cattle bone. Also discovered was the fully articulated skeleton of a woman, prehistoric 'art' in the form of 'graffito' or tally marks, and an array of worked flint, ranging from debitage to 'nests' of axe heads (Lane Fox 1876; Harrison 1877a,b, 1878; Pull 1953, 1956).

Once the galleries were cleared of mine spoil, demonstrating how empty galleries were filled with waste from fresh workings, it was possible to observe the structure of the basal area. Of note was the use of chalk pillars and divisional walls left *in-situ* between galleries. Also discovered were small doorways and windows cut between galleries, either at points where they joined, because they were twinned and contemporary, or where they met previous workings. Many of the apertures were blocked deliberately, suggesting that they may have been to control physical movement around certain areas of the basal system (Harrison 1878: 4).

2.4.3 Artefacts and skeletons

During the Sussex excavations, red deer antlers, mostly manufactured into picks, were found in large quantities. The use of antler hints that mining took place in the spring or summer, as the best time for their collection is after the stags naturally shed them in winter (Clutton-Brock 1984; Barber *et al.* 1999). Many impressions were left in the soft chalk bedrock by the antler implements, giving clues to the extraction methods employed. For example, small circular holes systemically piercing the gallery walls documented where antler tines were used as punches to weaken the chalk and allow blocks to be removed (Lane Fox 1876).

Other discoveries in the Sussex mines suggest that mining may have served a less functional, more symbolic role. For example, marks, scratches and symbols were etched into the chalk in possibly significant places, such as above gallery entrances and at the bottom of shafts (Lane Fox 1876). Their discovery at other Sussex mines suggests that common beliefs and customs were practiced in the mines (Teather 2011, 2016).

Several human burials were found at Cissbury, including the fully articulated skeleton of a woman buried vertically, head downward in the backfill of a shaft. The interpretation was that the woman had fallen in an empty shaft (Lane Fox 1876: 375), although she was probably deposited in the shaft during backfilling and had slumped to its base, as found with a similar burial at Spiennes (Hélène Collet pers. comm., August 2016).

Other burials discovered included a crouched burial of a young male (Harrison 1878) and a fully articulated skeleton of a young woman found at a gallery entrance in Shaft 27. Pull concluded that the women had been killed when part of the mine's roof had collapsed (Russell 2000. 182), although there is doubt over this interpretation and it is suggested that the burial was intentionally placed (Holgate 1995a). The location of the body, across a gallery entrance, implies that access to this part of the mine had been blocked. It may be of no coincidence that this is a similar locale to where many of the graffito is found, further suggesting that entrances, or conversely exits, within the mines were considered special places (Teather 2016).

To date, no human remains have been found at other Sussex mines and it may be that Cissbury was a significant place for a specific Neolithic mining community. This may well explain its size, complexity and its prolonged period of extraction, staying in use into the 37th century BC (Edinborough *et al.* 2019).

Lastly, several potshards, including the rim of a Carinated Bowl vessel were found in a deposit in the Large Pit (Holgate 1995a. 133). It appears the deposit is contemporary with mining and was a placed in the shaft during its backfilling. This find has for the study of the Early Neolithic in Sussex, as discussed in Chapter Five.

2.4.4 Mid-20th century: Controversy in Sussex

The next period of excavations began in 1922, when Worthing postmaster John Pull began excavating a group of around twenty shafts at Blackpatch (Goodman *et al.* 1924; Pull 1932; Russell 2001), which became infamous for causing a public dispute between Pull and the Curwen's (Russell 2001). The fallout from the Curwen's criticism did much to stain Pull's reputation and for almost half a century archaeologists largely ignored his discoveries. Consequently, much of his material was printed in non-academic publications, such as the *Sussex County Magazine* (Pull 1933a,b,c,d 1953), and many artefacts, field notes and records were lost.

The Curwen's even published a report (Goodman *et al.* 1924) on Blackpatch using Pull's results, having never excavated there, revealing that the mine workings and artefacts recorded were similar to those excavated at Cissbury and Harrow Hill (Pull 1932). The excavations also revealed that the mines became the focus for Bronze Age burial monuments constructed long after mining had ceased, possibly by communities who were drawn to the visible remains of the mines (Russell 2001; Wessex Archaeology 2006).

Between 1924-5 Dr. Elliot Curwen led the Worthing Archaeological Society's (W.A.S) excavation at Harrow Hill (Fig.2.8), opening a large shaft (No 21), which was up to 6.3mø, 6.8m deep and joined six galleries (Curwen and Curwen 1926, Curwen 1937). They recovered 'nests' of flaked axes, various antler and bone tools, a hammer stone and another ox scapula 'shovel' (Curwen 1937: 112). They also recorded mine features, including a recess cut in the wall of the shaft indicating the position of a ladder (Curwen and Curwen 1926: 108) and further incised chalk blocks, similar to those from Cissbury (Curwen 1937: 112).

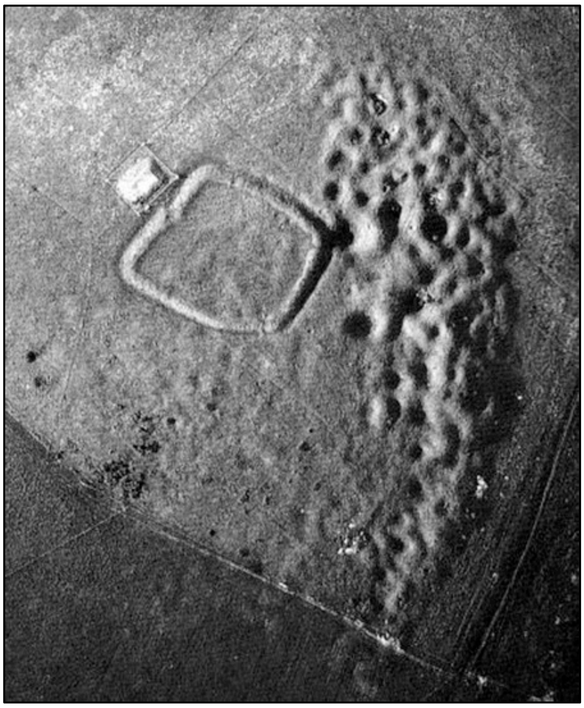

Fig. 2.8: Harrow Hill flint mines (Reproduced from original slide, Barbican House, Lewes, East Sussex).

George Holleyman and W.A.S opened a further three shafts and their associated galleries in 1936 whilst excavating a Late Bronze Age enclosure on the summit of Harrow Hill (Holleyman 1937). All the shafts were smaller that the large Shaft 21, only measuring up to 2.4mø and 3.5m in depth and with short galleries (Fig. 2.9). It was proposed that these workings were later than the surrounding large shafts and may have related to Bronze Age activity on the nearby New Barn Down (Russell 2000).

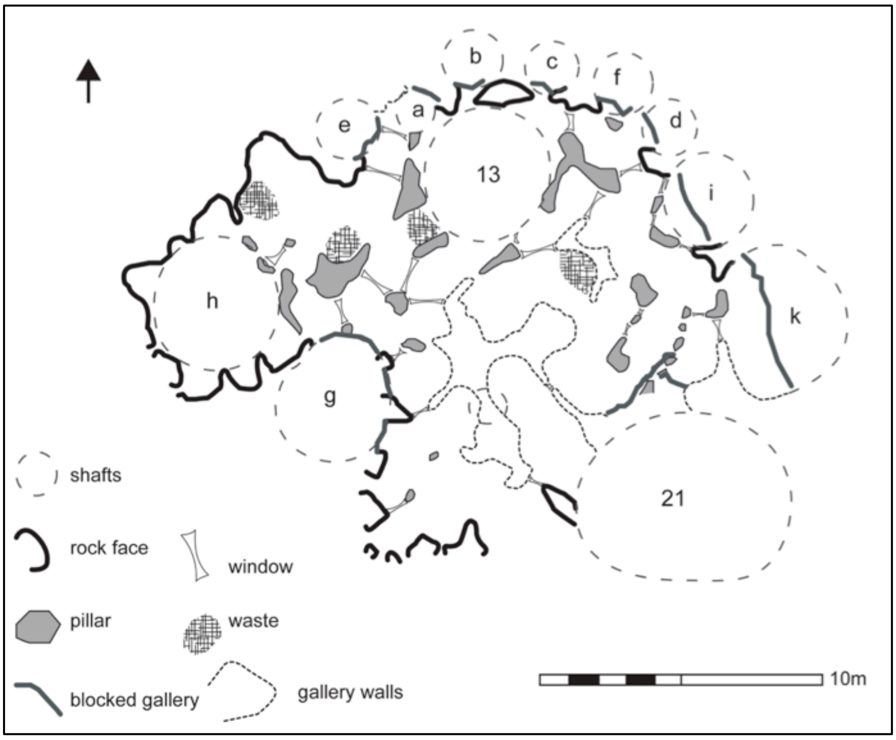

Fig. 2.9: Harrow Hill mine workings (Author, adapted from Barber *et al.* 1999 Fig.4.16e).

Starting in 1932 and continuing periodically until 1952, broken by the Second World War (1939-45), Pull excavated on Church Hill (Figs.2.10-2.11). Several of the shafts investigated documented the ability of the miners to adapt their basic approach, for example, Shaft No's. 1 and 2 did not connect to a basal system and flint was extracted from small under cuttings at their bases (Pull 1933a). It was reasoned that these shafts did not develop galleries due to their proximity to other workings, which Pull detected by using a sounding rod (Pull 1953).

Two unusual shafts, No's. 6 and 7 had been sunk together and divided by a thin partition wall. These 'twinned shafts' seem to be have abandoned in hurry, evidenced by a number of unused picks left behind and the lack of extraction. Pull concluded that the miners had sensed an imminent collapse and quickly evacuated the shafts

(Pull 1953: 18). Whether they had sensed instability, abandoned the mines for other reasons or had left the picks as placed deposits is impossible to know.

The galleries were much shorter and more curving on Church Hill than encountered at other Sussex mines. This may be, as Pull argued, because the galleries avoided pre-existing basal workings. The lack of knowledge on how the complex developed chronologically makes this difficult to support. A more likely reason is found in the geology of Church Hill, as the bedrock is softer than found at the other mines meaning that the shafts were kept compact to protect against collapse from overburden.

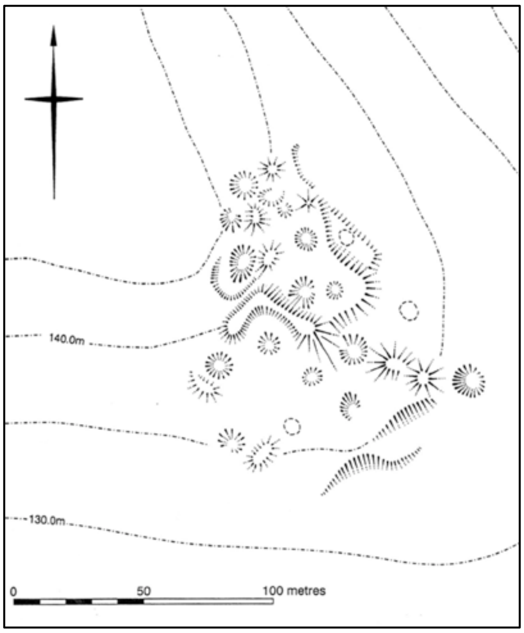

Fig. 2.10: Plan of Church Hill mines (from Barber *et el* 1999 Fig.4.7).

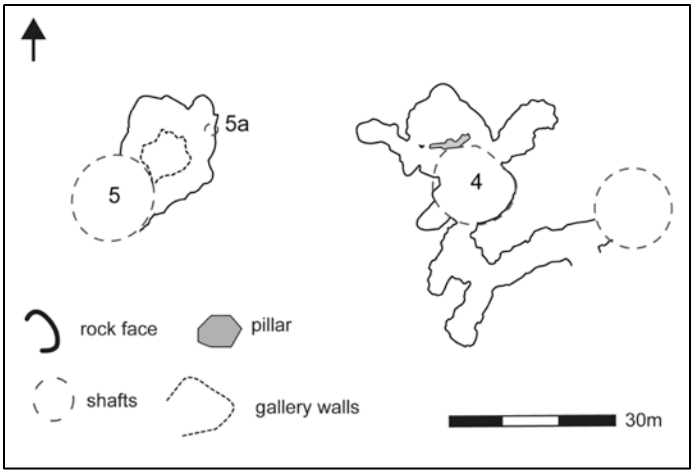

Fig. 2.11: Plan of Church Hill mines by Pull (Author, adapted from Russell 2001 Fig. 25).

Also investigated were several features close to the Church Hill mines, including surface knapping floors, pits and several Bronze Age round barrows. The knapping floors were most likely from episodes of mining, as they were covered with chalk debris from neighbouring shafts. Examination of the worked flint showed that only primary working took place next to the mineshafts and, unlike other mines, most of the tools manufactured were implements, rather than axes (Russell 2000. 133).

From 1952 to 1956 Pull excavated seasonally at Cissbury, supported by W.A.S. Three shafts and several galleries were opened by Pull. Shafts 24 and 27 both joined complicated networks of interlinking basal galleries. In total, Shaft 24 joined six galleries at a depth of 4.2m and Shaft 27 linked to nine, at a depth of 5.5m (Fig.2.12). The usual assemblage of flints and antler tools were recovered (Russell 2000. 174-90), and mining features, such as pillars, doorways and punch marks were recorded. Graffito, abstract carvings and representations of animals were also documented. Although there is doubt over the authenticity of the carved animals, the graffito is undoubtedly contemporary with mining and similar to that recorded at other mines (Teather 2011. 2015).

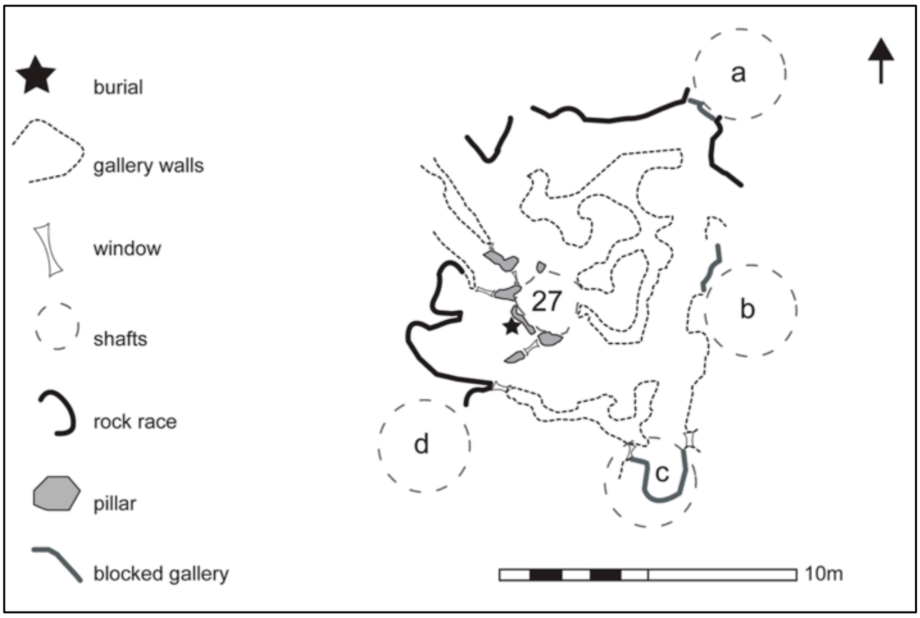

Fig. 2.12: Plan of Cissbury Shaft 27 (Author, adapted from Russell 2001 Fig.102).

Evidence of later use of the mines was also recorded, including a large array of worked flint dating to the Early Bronze Age lying in a shaft hollow (Russell 2000. 175). Similar recycling has been documented at Grimes Graves (Sieveking *et el*

1973), proving that the remains of flint mines themselves became sources for flint during the Bronze Age.

2.4.5 Late 20th century: New understandings

After Pull's death in 1960, the victim of a bungled post office robbery, no excavations took place in Sussex for the next few decades. The next period of fieldwork began in 1982 when P. J. Felder, having recently finished excavating at Rijckholt, in the Netherlands (Felder *et al.* 1998; Rademakers 1998), opened Shaft 13 on Harrow Hill (McNabb *et al.* 1996). Then in 1984, a team returned to Harrow Hill and excavated surface remains surrounding the mouth of Shaft 13. Both excavations were directed by Gale de Sieveking and undertaken for the 1983 Fourth International Flint Symposium held in Brighton (Sieveking 1986).

On Harrow Hill an area opened around Shaft 13 revealed shallow 'satellite' shafts (Fig.2.9), which only exploited flint seams just below the surface (McNabb *et al.* 1996). It was concluded that the 'satellite' shafts were earlier than Shaft 13, being filled with debitage from its sinking. Sieveking interpreted them as exploratory shafts sunk by the miners looking for an area of less resistance which, once found, resulted in the sinking of Shaft 13 (McNabb *et al.* 1996).

The last period of fieldwork was undertaken at Harrow Hill and Long Down conducted by R. Holgate in 1986 and 1985 respectively. Both were small excavations not fully published (Holgate 1995a,c. See Chapter Three). A forgotten collection of antler from a small-scale excavation conducted from 1955-58 by J. F. Salisbury (Salisbury 1961), was discovered in a museum archive during this project, from which it was possible to obtain five new radiocarbon dates (See Chapter Three).

2.5 Northwest Europe

The study of flint mining in Northwest Europe (Fig.2.13) has, unlike in Britain, continued since the 19th century with many flint mines excavated. Numerous excavations are currently underway and the following only summarises the most significant sites.

The most notable mine complexes across Northwest Europe include Spiennes, Hainaut Province, Belgium (Fig.2.14), composed of c. 10,000 - 20,000 mineshafts (Hubert 1978; Collet *et al.* 2008, 2016), Jablines, Seine-et-Marne, France, where a mine complex of c. 800 mineshafts was excavated in advance of a high-speed rail-link in 1989 (Bostyn and Lanchon 1992, 1995; Bostyn 2015), and lastly, Rijkholt-St. Geertruid, Limburg, the Netherlands, where a complex of c. 2000 shafts was excavated between 1964 to 1972 (Felder 1981; Felder *et al.* 1998; De Grooth 1998, 2015).

Fig. 2.13: Map of key flint mines in Northwest Europe (Author).

Recently investigated mines in central France include Flins-sur-Seine, Aubergenville (Bostyn *et al.* 2008), La Côte de Bussy, Meuse (Vincent 2019) and Les Marais de Saint-Gond and Côtes des Blancs, both close to Marne (Martineau *et al.* 2019). As discovered at Jablines, these mines often contain a variety of extraction methods within the same complex, including single pits, shallow bell shaped shafts, deep shafts with galleries and simple adits, or drift mines. At these sites axes were the main product in the Neolithic period, although long blades were produced, especially in mines pre-dating 4000 cal BC.

Outside of Northwest Europe mines are located across the Baltic region, including Poland, Denmark and Sweden. Notable complexes have been excavated at Krzemionki, Eastern Poland (Lech 2008; Babel 2008) and at Senonian in the Jutland area of Northern Denmark (Becker 1959; Jensen 2007). Flint mine complexes are also found on the Iberian Peninsula, most notably at two sites located in Spain, the earlier Casa Montero, near Madrid (Consuegra *et al.* 2019), dating to the Early Neolithic c. 5350-5220 cal BC, and the later Gavà Neolithic Mining Complex (Camprubí *et al.* 2003), close to Barcelona, dating to the later Neolithic, between 4200 BC and 3400 BC (Uncalibrated).

Fig. 2.14: Excavations underway, Spiennes 2016 (Author).

2.5.1 A long tradition?

The extraction of raw material by pits, shafts or open quarries, including chert (Vincent 2019), Jadeite (Pétrequin *et al.* 2008, 2011) and radiolarite (Valde-Nowak and Kerneder-Gubala 2019), dates back to at least the Lower Palaeolithic (De Labriffe *et al.* 2019). A mining tradition based on shafts may have origins in the earlier Neolithic and has been associated with at least one LBK settlement, at Espins, Western Normandy, France (Charraud 2019). At another site, Casa Montero, Spain, (Castañeda *et al.* 2019), extraction began c. 5350 cal BC, the early phase of the Iberian Neolithic. Notably, pottery bowls recovered from the Casa Montero mines share affinities with Cardial wares of southern France, implying the mines were linked to communities far from the site (Castañeda *et al.* 2019. 61). Extraction methods at Espins and Casa Montero were based on shafts up to c. 9.25m in depth, although occasional opencast quarries were also recorded at both sites. Unlike later mines, production at both sites was focused on long blade production from carefully prepared cores.

Although clearly earlier than the Neolithic mines elsewhere in Europe, based on axe production and dating to before 4000 cal BC, both Espins and Casa Montero are notable because of a common cultural trait with the later mines. This trait is the systematic exploitation and extraction of the same flint seams seasonally over many centuries by the same community. This would have involved the combined efforts of a single community, or many communities, and therefore resembles later deep mining in its organisation and methodology.

Whether these early mines did develop into later shaft and gallery extraction is unknown and probably unlikely. However, Middle Neolithic mines and quarries associated with the Chasséen Culture (c. 4500 – c. 3500BC) were based on methods, including shafts and galleries, recognizable in later mines at La Côte de Bussy (Vincent 2019) and at Vaucluse, the lower Rhone Valley, France (De Labriffe *et al.* 2019). What can be observed is that the concept of mining endured through the Continental Neolithic across many diverse and geographically separated cultures. For example, the largest mine complexes, most notably Spiennes and Rijckholt, are associated with the Michelsberg Culture (c. 4400 – c. 3500 BC) during a time when there was a sudden increase in shaft and gallery mining across Northwest Europe (Shennan *et al.* 2017). In contrast, sites in Eastern Europe, such as Krzemionki are associated with the Funnel Beaker Culture (c. 4300 BC - c.2800 BC). Therefore, mining on the Continent was carried out by different cultures, but based on the same common methodology and with the same outcome, a supply of raw material for mostly production of axes.

2.5.2 Methods

Extraction methods at the Neolithic Continental mines are broadly comparable with the southern English mines, being based on shaft and gallery mining. Variations encountered can mostly be explained by geological factors (Baczkowski 2014, 2019c); for example, the large size of the flint nodules at Spiennes meant that a different method, known as caving, was used (Collet *et al.* 2008). This approach resulted in large galleries (Fig.2.15), up to 2m in height, in contrast to the narrow galleries in southern England and at other Continental mines, such as Rijckholt (Fig.2.16).

At Jablines, due to localised variation in the stability of the bedrock conditions, a variety of extraction features were encountered dependent on the stability of the geology. The mines ranged from typical shaft and galleries (Figs.2.17-2.18) in stable bedrock areas, to bell-shaped pits and shallow galleries in less stable geology (Bostyn and Lanchon, 1992). The forms of mines are therefore governed by bedrock conditions.

With regards to shafts, at both Spiennes and Rijckholt they were kept narrow, c. $1\text{m}^{\varnothing}$, due to deposits of unstable sand, up to 5m in depth, that overlies the chalk (Fig.2.19). There was no point in developing wide shafts, as found at the Sussex mines, because there was little flint to extract from the walls and the purpose of the shaft was only to reach the chalk bearing bedrock. It has also been reasoned that narrow shafts would allow props and shuttering to be added through unstable overburden (Felder *et al.* 1998).

The large complex at Krzemionki is of particular note, comprising of c. 4,000 mines spread across a complex 4.5km long and with extraction activity beginning c. 3900 cal BC and continuing until 1600 cal BC (Bąbel 2008). The main method of mining at Krzemionki was by shafts, up to 8-9m deep and connecting to galleries, although where the flint seams were shallower in the limestone bedrock, bell-chambers and niche, or opencast mines were used (Bąbel 2008). The main product manufactured were bi-facial axes, produced from the distinctive banded flint, which were distributed for distances of up to 600km from the mines (Bąbel 2008). Notable features recorded at Krzemionki included evidence of wooden ‘sheds’ constructed over the shaft entrances to protect the mines from weather, many voids left by wooden props used in the mining process and finally evidence of temporary camps close to the mines.

2.5.3 Continental Influence

It is now widely recognised that the southern English mines are linked to the Northwestern European complexes, where a long tradition of deep extraction was practiced (Cunliffe 2008; Wheeler 2008, 2011; Whittle *et al.* 2011). Although little research has been carried out to explore this connection, parallels between the southern English and Continental mines have been noted, mostly on the mining methods, the production of axes and on a shared ideological motivation for deep mining (Wheeler 2008, 2011). This narrative of connectivity was the basis of previous research (Baczkowski 2014, 2019c) that demonstrated a common extraction methodology, known as ‘pillar and room mining’, was present throughout the deep mines in southern England and Northwest Europe.

The method of ‘pillar and room’ mining is based on the formation of galleries, led by a working face at the front of the gallery from which raw material is extracted (Adler and Thompson 1992). Whilst developing galleries, by following the flint seams, chalk pillars and walls are left *in situ* to support the weight of the overburden, in this case the gallery roof (Fig.2.20). Not only does this protect the basal area against collapse, but it also allows the maximum amount of material to be extracted by the development of large, stable areas within the galleries.

Another common theme is the systematic treatment of mine spoil produced in the extraction process (Baczkowski 2014). Exhausted galleries were universally filled with spoil from adjacent workings, not only avoiding the effort of transporting it to the surface, but also adding stability to the basal area. In the same fashion as English mines, tight ‘creep ways’ were often left between the top of the backfill and the gallery roof (Fig.2.21), along with apertures, ‘windows’ or ‘doorways’, between galleries (Fig.2.22). Although the precise purpose of these narrow passages and apertures is unknown, they exist in all European deep mines, from England in the west, Denmark in the north and Poland in the east.

It is unlikely that these methods and techniques developed independently across Northwest Europe at the same time without a degree of connectivity and movement of mining groups between sites. The method would also be learnt through direct experience of mining over successive generations versed in the skills necessary to safely and successfully extract flint from deep seams. Therefore, mining in southern England can be recognised as one of the primary Neolithic practices that has clear Continental origins, having spread coevally on either side of the English Channel at the same date (Wheeler 2008; Cunliffe 2008; Thomas 2013; Baczkowski 2014; Edinborough *et al.* 2019).

The arrival into southern England in the late 5th millennium BC of shaft and gallery mining is an expansion of these traditions and shows the continued 'power' of extracting and commodification of a prized raw material. At present, the southern English mines are perhaps best connected to the large-scale mine complexes at Rijckholt and Spiennes, as well as other sites across the Paris Basin, which are all associated with the Michelsberg Culture.

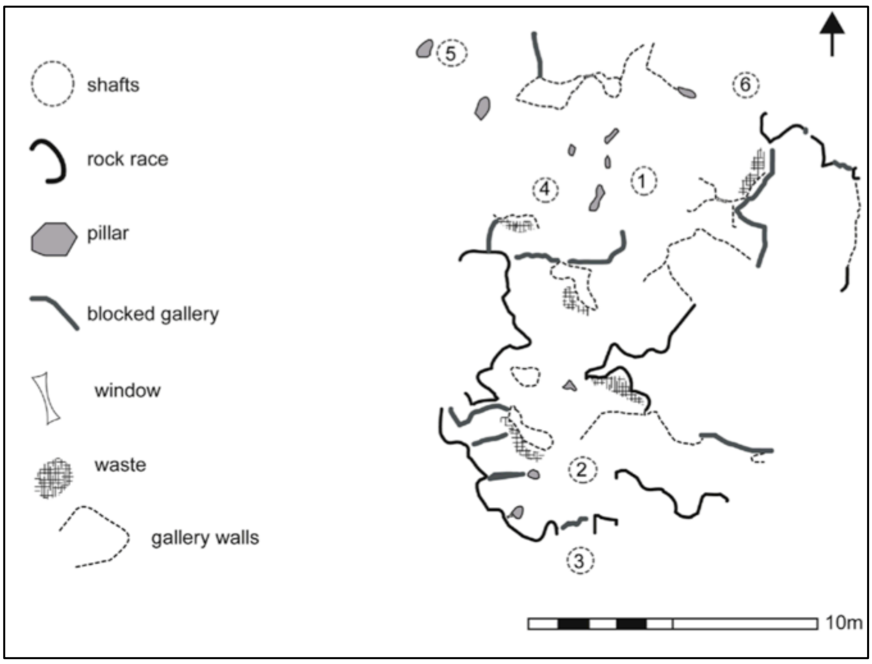

Fig. 2.15: Plan of Spiennes (Author, adapted from Collet *et al.* 2008 Fig.21).

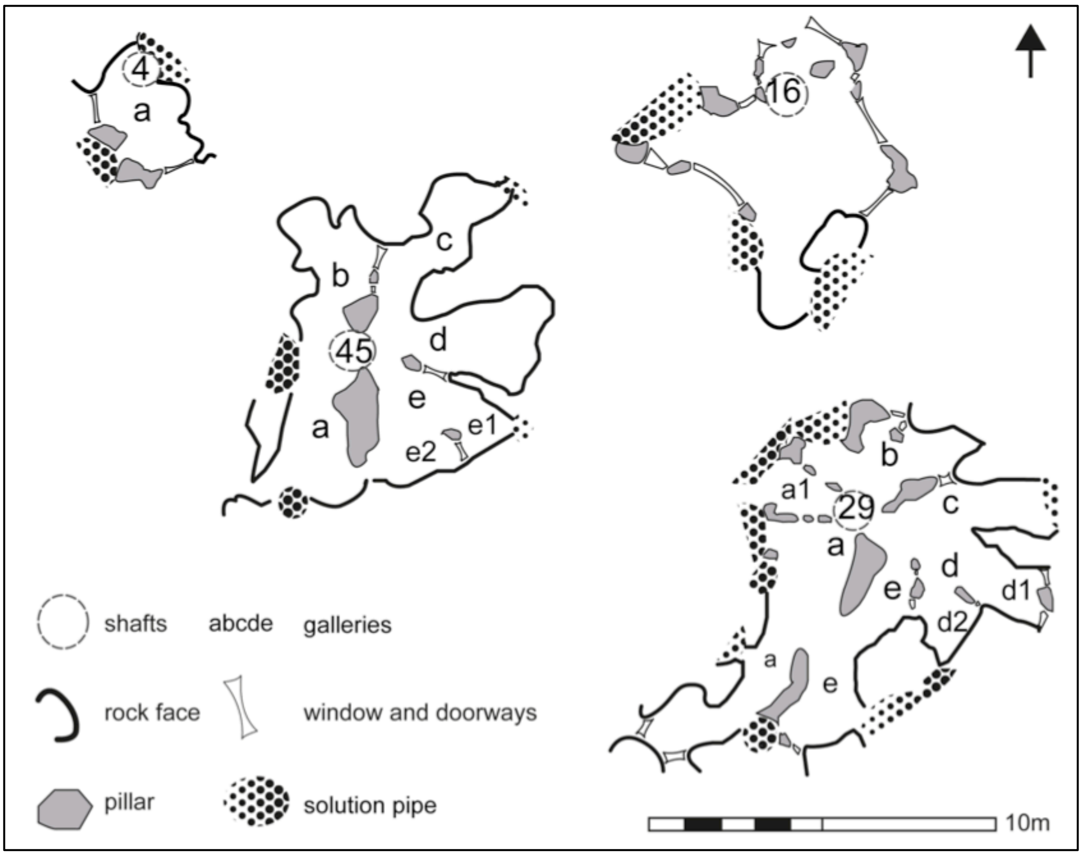

Fig. 2.16: Plan of Rijckholt mine workings (Author, adapted from Felder *et al.* 1998 Fig.20).

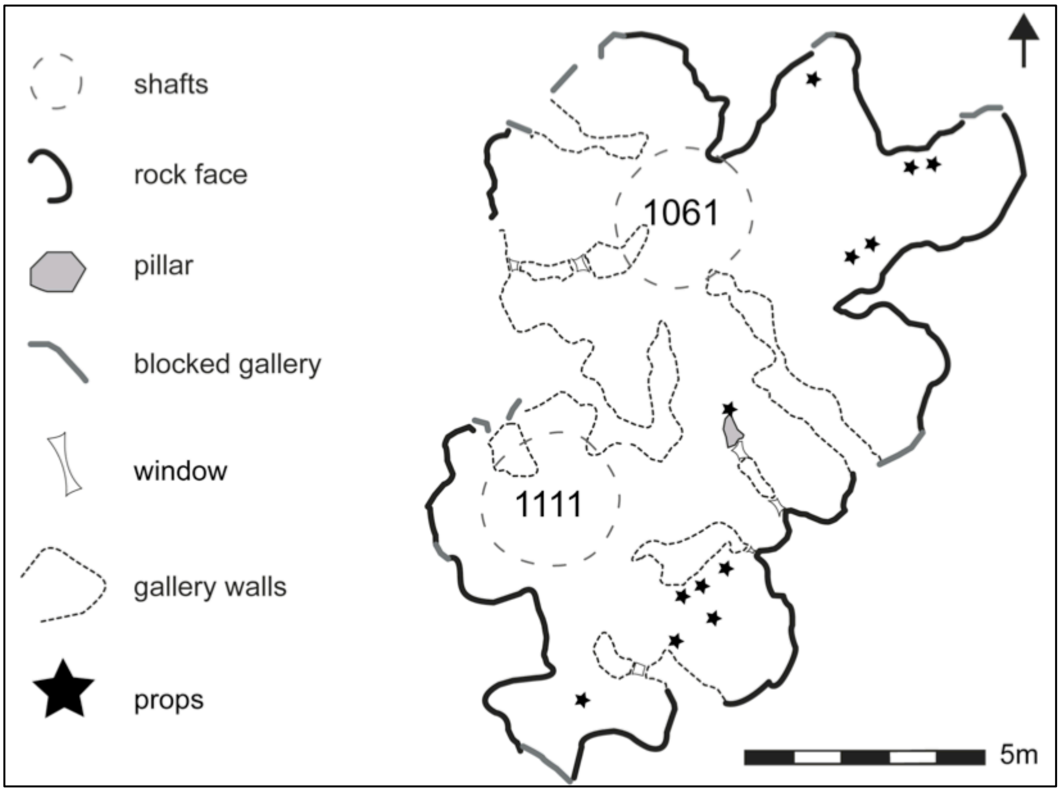

Fig. 2.17: Plan of Jablines galleries (Author adopted from Bostyn and Lanchon 1995 Fig.2).

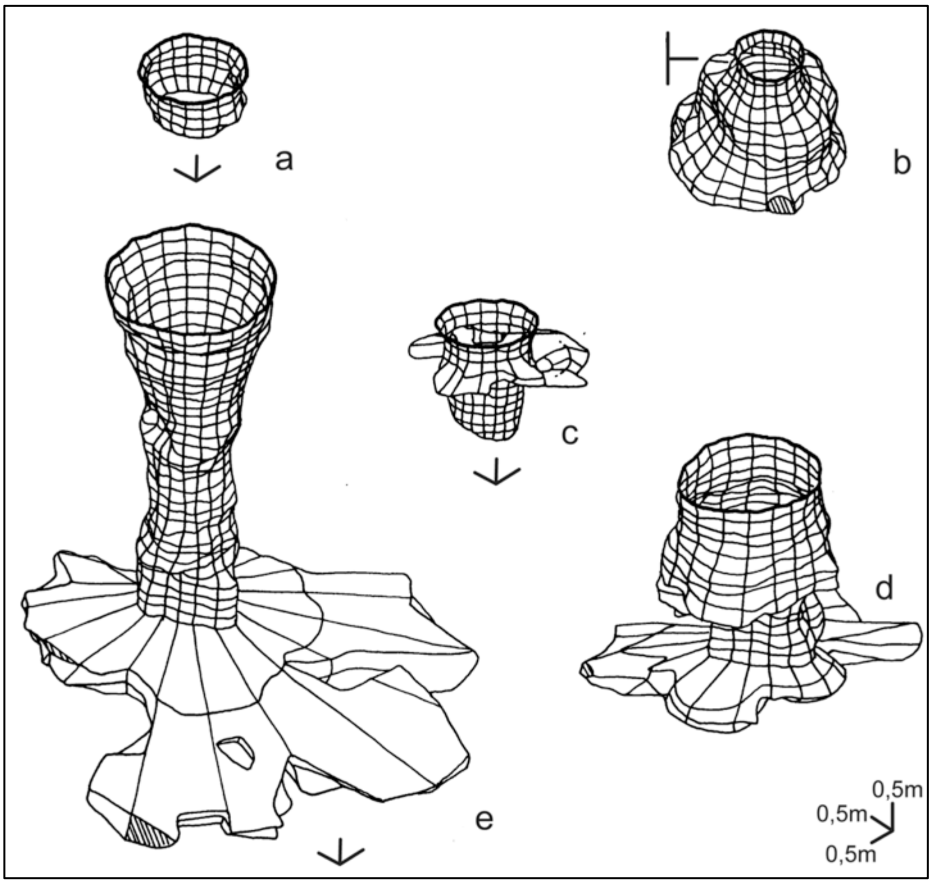

Fig. 2.18: Profiles of Jablines mines (Author adopted from Bostyn and Lanchon 1995Fig.3).

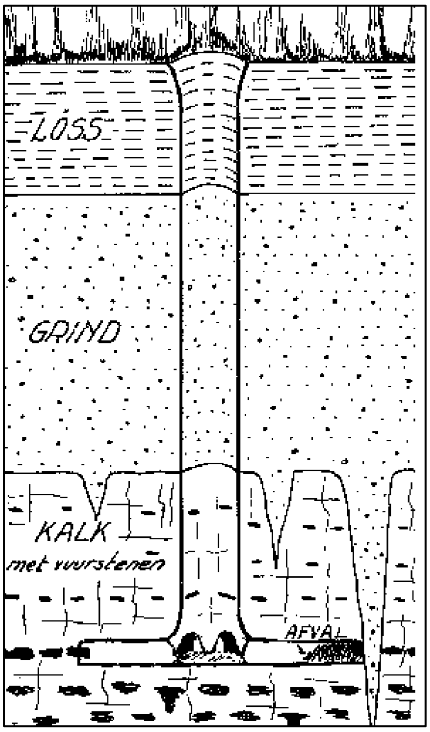

Fig. 2.19: Section of Rijkholt mineshaft (From Felder *et al* 1998 Fig.27).

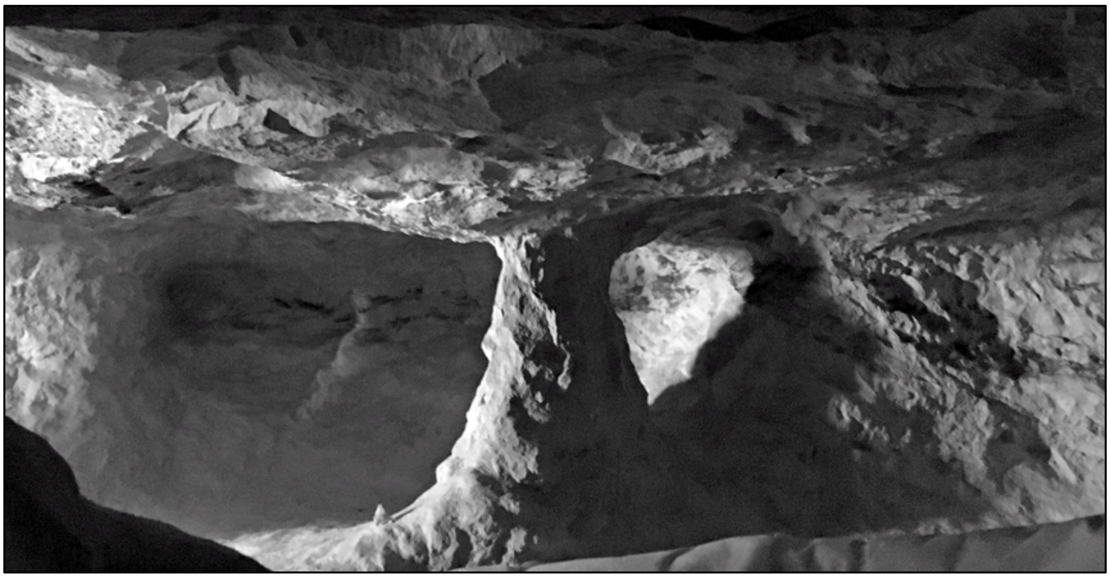

Fig. 2.20: Mine workings in Spiennes, showing a pillar (Author 2016).

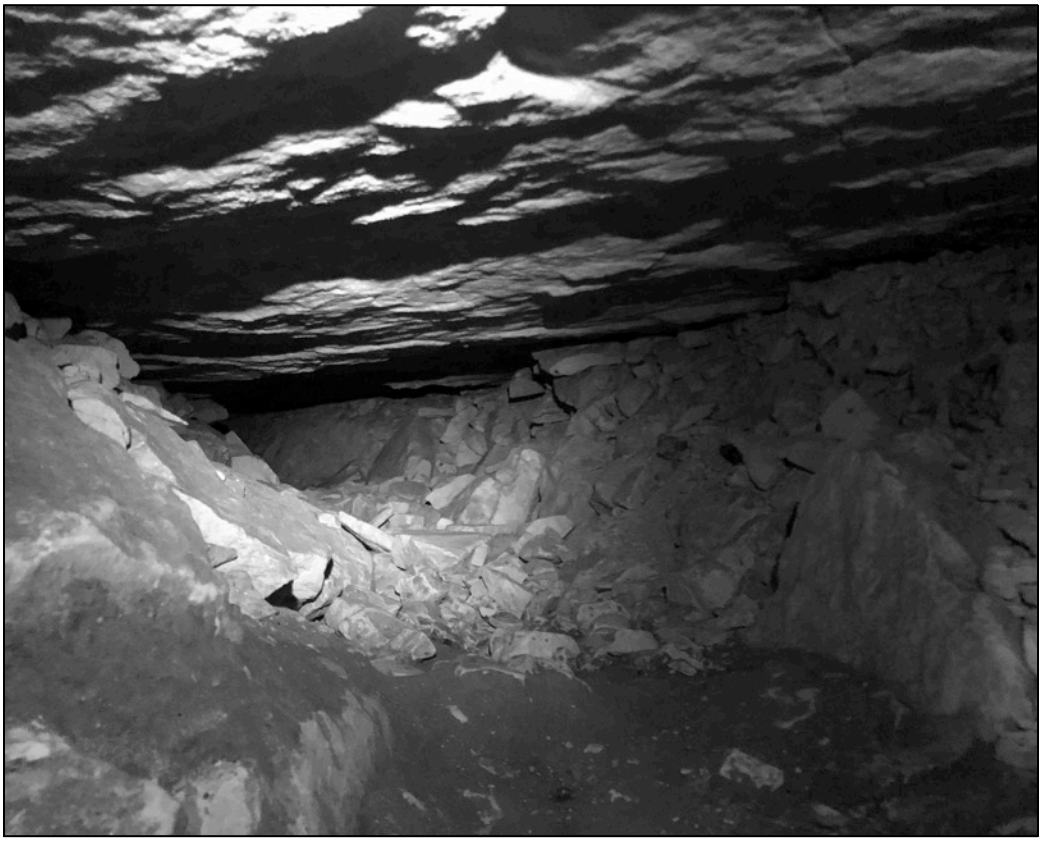

Fig. 2.21: Backfilled gallery with *in situ* creep way, Krzemionki mines (Author 2019).


Fig. 2.22: Partially blocked window/doorway, Rijckholt mines (Author 2011).

2.6 Summary of theoretical approaches

Early interpretation of flint mining was industrial in character. Mines were interpreted as necessary to supply flint for polished axes needed for the de-forestation of southern England (Childe 1958). It was also recognised that the production of axes was integral to the new Neolithic 'package' arriving in Britain around 4000 BC (Clark and Piggott 1933).

These early interpretations are largely a product of Victorian zeitgeist, as mining and extraction were viewed as intensive, industrial activities. Over the last three decades interpretations have shifted from the functional to the non-functional, the utilitarian to the symbolic, because deep mining is not easily explained in purely functional terms when compared to the much easier method of opencast mining from natural sources.

In Sussex, miners were not solely focused with looking for high quality flint, as there was an over-abundance of natural sources available from riverbed and coastal deposits, to naturally outcropping seams in hillsides and Clay-with-Flints deposits (Care 1982; Drewett 1982a; Gardiner 1988; 1990). These were easy to locate, exploit and probably supplied most of the material for lithic production before, during and after the age of flint mining in southern England (Care 1982; Gardiner 1988; 1990). In contrast, easily won flint seemed of minor concern at mines, with shafts, such as at Cissbury, often passing through and ignoring three to four high quality flint seams before galleries were developed at seams that may, or may not have been of superior quality (Barber *et al.* 1999).

It appears that the Sussex miners were looking for a quality in the flint that is difficult for us to perceive. These qualities are often more obvious at some Continental mines, such as Rijckholt and Krzemionki, where distinctive banded flint was obtained and traded over long distances (Borkowski and Budziszewski 1995; De Grooth 1998: 2015; Lech 2008). It is notable that the banded flint (Fig.2.23) from Krzemionki is still used for the manufacture of jewelry, demonstrating its aesthetic value. Such values in the Sussex flint are not so easily perceptible.

Fig. 2.23: Banded Krzemionki flint (Author 2019).

2.6.1 New interpretations

It was not until the latter half of the 20th century that the industrial narrative of flint mining began to be re-interpreted, beginning with research on the sources and distribution of both stone and flint axes. These studies had varying degrees of success, with much better results identifying stone resources than flint (Sieveking *et* *al.* 1973; Craddock *et al.* 1983), due to the similarity of flint across seams many miles apart. They also tended to focus more on the products, rather than mining as a cultural and social phenomenon. It was not really until the study of the Langdale greenstone axe quarries in Cumbria that the narrative of mining was progressed beyond being considered only in a purely functional activity (Bradley and Edmonds 1993).

The Cumbrian quarries are located in one of the most remote and mountainous areas of the Lake District, with extraction sites placed in difficult to reach locations (Bradley and Edmonds 1993). This made quarries, already at the limit of accessibility, hidden places from which access, and production could be controlled. It was argued that this inaccessibility would have added an atmosphere of removal and otherness, further imbuing the already exotic greenstone with an enhanced value (Bradley and Edmonds 1993).

A comparison between the Cumbrian quarries and the Sussex mines was made, with Edmonds (1995. 59) noting that both extraction sites were removed from settled areas, although it is recognised that the distances with regards to the latter were relatively small. Similar arguments were pursued in Barber *et al.* (1999. 73), who stated that the '*complexity of the extraction process*', combined with socially controlled access to the mines, enhanced the symbolic value of the mined flint. Richard Bradley further observed that the Sussex mines were located in 'isolated positions', beyond settled areas (2007. 37).

Distance, restriction and control also appear to be evident at the Sussex mines and became dominant themes in flint mine research (Edmonds 1995). It is certainly apparent that the hidden, most difficult to access flint seams, were favoured and that the mines appear to be located on the periphery of settled areas (Edmonds 1995, Topping 2011a,b). The restricted, cramped galleries would have also enhanced a sense of removal from the 'everyday' normality of the surface world. These aspects of deep mining could have added cultural 'value' to flint from the deep mines, as they originated from a place that was different, inaccessible and restricted. This may explain, in part, why there is no easily observable aesthetic value to the Sussex flint.

2.6.2 *The influence of Barber, Field and Topping*

A major contribution to the study of flint mining was made in the late 1990's with the publication of *The Neolithic Flint Mines of England* (Barber *et al.* 1999), a Royal Commission on the Historical Monuments of England (RCHME) survey of all known and probable prehistoric flint mines in England. The project, led by Martyn Barber, David Field and Peter Topping, focused on field, aerial surveys, and the reappraisal of archival material (Barber *et al.* 1999). Although no new excavations took place during the research, the project did much to document and survey all definite and probable flint mines and also question traditional interpretations of flint mining. The publication was noteworthy in reinterpreting flint mining as a small-scale activity, driven by non-functional processes.

Most importantly, the project obtained new radiocarbon dates from previously excavated material, mostly red deer antler, confirming the date of the southern flint mines. This allowed for an overview of the chronology of mining between sites along the southern English coast and proved that flint mining belonged to the very earliest part of the Neolithic.

2.6.3 *Mining as ritual?*

Since the publication of Barber *et al.* 1999 research has focused on the cosmological and ritual aspects of mining. Practices, such as the graffito and deposition of human remains (Fig.2.24), have been used to support a ritualistic, symbolic element to the processes of deep flint mining (Teather 2011, 2016). The deposition of ritual artefacts, such as antler picks, carved chalk objects and human burials, along with chalk 'graffito' appears to reflect the nonfunctional role of mining (Topping 2004). Teather (2016a. 102) has argued that depositional practices, including chalk 'art', are mirrored in other Neolithic structures, such as long barrows and chambered tombs (Teather 2011. 245), and whilst differences exist between monuments, mines may not be as separate as previously thought.

Fig. 2.24: Crouched burial with a flint axe (Reproduced from original slide, held by Barbican House, Lewes, East Sussex).

Teather argues that the construction of structural features, such as blocked doorways and windows, created possible symbolic spaces within the mines (Teather 2011, 2016). However, it must be noted that so far many of these features, and human burials, have only been found in the Cissbury mines. It may also be problematic to separate functional aspects from ritual ones (Bradley 2005), as it is highly probable that mining served an important role in both social spheres and may have been an expression of their combination. Mining was certainly an activity that blended a functional need for flint to produce axes, with cultural traditions and more abstract symbolical beliefs (Brück 1999), as will be discussed at the end of thesis.

2.6.4 Settlement and mining?

Other aspects of the flint mines are proposed to further the narrative of mining as an act separate from the 'everyday' worldview of the Early Neolithic. For example, the lack of structures, domestic activity and the periodic, often rapid backfilling of shafts appear to infer that mining was an activity that was episodic in character, perhaps representing the yearly routine of small social groups supplementing a semi-mobile lifestyle (Edmonds 1995, 1999; Holgate 1995a; Barber *et al.* 1999; Collet *et al.* 2008).

The question of mining and settlement is a theme that will be discussed in greater detail throughout this thesis. For now it is important to stress that the notion of mining seems to compare favorably with an interpretation of Early Neolithic lifestyles as semi-mobile (Whittle 1997; Bradley 2007; Edmonds 1995). It may be the case that, in the Early Neolithic, social groups were mobile and visited seasonal locations throughout the landscape, such as flint mines (Whittle 1996, 1997, 2007b; Pollard 1999; Rowley-Conwy 2004, Pluciennk 2008, Sheridan 2010; 2011).

2.6.5 Ethnography

One discipline that has consistently been drawn on to assist in the interpretation of flint mining is anthropological studies of cultural groups who traditionally quarried stone to produce axes. Topping has long highlighted the symbolic and cultural role of mining, drawing from the ethnographic literature (Topping 2004, 2011a,b). Edmonds has also drawn on ethnographic material to highlight the power of the axe to transmit cultural meaning (Edmonds 1995; Davis and Edmonds 2011), echoing the role of mines to symbolically charge raw material.

The ethno-historical studies of societies, who in living memory ceased extraction, revealed intricate, nuanced and highly governed belief systems based on the significance of rock sources and polished axes (Burton 1984; Brumm 2004, 2010, 2011). For example, much research on the distribution of polished stone axe heads in Britain and Europe has drawn from ethnographic studies of trade and exchange systems, specifically of products, such as axes, over large distances through complex networks (Phillips 1979; Topping and Lynott 2005; Allard and Denis 2015; Bostyn 2015). Of interest to these researchers was ethnographic work carried out within the indigenous Aborigines of Australia, and especially the Kulin, who extracted stone from Mt Williams, Central Victoria, to produce polished axes.

The Kulin tightly controlled access to the greenstone sources on Mt Williams (Brumm 2004, 2010, 2011) and exerted influence over the trade of axes. Petrological analysis revealed that they were exchanged over a large region (McBryde 1984). Axes were valued as both functional and cosmological objects, and their exchange was complex and governed by group relationships, including factors such as social relations, cultural customs and political motives (Paton 1994). Axes were also empowered because their sources were located in places regarded as sacred and associated with ancestors (Paton 1994). The ancestors theme is recorded in many ethnographic studies of indigenous axe-producing societies, from North America to New Guinea. Ultimately there is a duality to the meaning of axes, and they also served as commodities for maintaining long distance relationships between disparate groups who may have met periodically. Their true worth is measured by this set of transformative values, rather than as purely functional objects.

Finally, through the study of anthropological literature on exchange and gift systems, it is also possible to glimpse how the axes themselves may have been transformed into empowered objects. It has long been observed by anthropologists that objects become imbued with significance and commodified through social processes, including exchange and gifting (Appaduri 1986; Ingold 2007). Eventually, through this act they form their own histories and become powerful objects capable of transmitting information and maintaining relations across large distances and through numerous communities (Bradley 1990). The power of an axe, combined with their sourcing from special ancestral locations, may go a small way to understanding the social reasons for Early Neolithic deep mining (Topping 2019). Whether the Sussex flint mines were thought of in these terms is impossible to know, but it may be no coincidence that after the mines stopped producing flint they were still considered significant places in the landscape, possibly associated with ancestral beliefs (Barber *et al.* 1999).

2.6.6 Landscape and environment

Environment data on the Sussex mines is scarce, as pollen does not survive well in calcareous soils and when present is difficult to study (Macphail and Goldberg 2018). This lack of data is in keeping with a general ambiguity on the environment in the Early Neolithic across southern England (Ellis 1986; Allen *et al.* 2007; Allen and Gardiner 2009; 2012: Farrell *et al.* 2019), with debates on the extent of post-glacial wildwood ongoing (Bush 1989; Thomas 1989; French *et al.* 2007; Allen and Scaife 2007).

Research focusing on the environmental setting of flint mines has proposed that the landscape around mines was left wooded, due to the presence of the mines, or to hide their locations (Topping 1997; Barber *et al.* 1999). Possibly the best environmental data originates from mollusca preserved in buried soils, spoils heaps and the fill of shafts. Analyses of molluscs collected from mine spoil heaps indicate that mining occurred in a wooded environment, evidenced by the presence of shade-loving species (Barber *et al.* 1999, Field 1997). Caution must be expressed when relying on mollusc species, as they can be localized to specific environments and may not be representative of wider environs (Evans 1972).

Recent research has 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 2012). But in consideration of the patchwork nature of woodland clearance on the South Downs in the Early Neolithic (Allen and Scaife 2007) it is likely that the landscape surrounding the mines was deforested at varying times and at differing rates, with no set regional pattern.

With regards to the landscape setting of the mines, it has been argued that their placement was concerned by symbolic significance (Russell 1999; Barber *et al.* 1999; Topping 2004). Topping considers that mines were positioned in locations already thought of as ‘special’ and removed from settlement (2005. 84). In this scenario, it is tempting to conclude that piles of freshly dug white chalk may have been seen in the surrounding landscape as a focal point. Although, this is somewhat contradicted by the aforementioned landscape data, which indicates that the mines were hidden in a scrubland or wooden environment (Allen and Gardiner 2012). The exact character of the mining environment, and the mines relationship to the wider landscape is therefore largely unknown, contradictory and under researched. It is unfortunate that this limited project can contribute little to this intriguing avenue of research.

2.6.7 Recent research

The origin of mining in the British Isles has been recently researched, with connections to Continental sites being explored (Baczkowski 2014, 2020, Wheeler 2008, 2011, Whittle *et al.* 2011). Although a Continental origin for southern English flint mining has long been recognised, current research has demonstrated direct connections between the sites, especially with regards to extraction methods (Baczkowski 2014, 2020; Wheeler 2008). However, there is still debate over the nature of the Mesolithic to Neolithic transition in extraction practices, with some researchers arguing that southern English deep mining was an amalgamation between indigenous methods and Continental influences (Thomas 2013; Teather 2016).

Following on from the large-scale radiocarbon dating of causewayed enclosures (Whittle *et al.* 2011), one of the biggest contributions to recent studies of flint mining has been the Neomine project (Edinborough *et al.* 2019), resulting in twenty new dates from the British mines. Overall, the project has tightened and improved our understanding of the chronology of Early Neolithic mining in southern England, although little has changed with regards to the findings of previous studies that established mining as beginning close to 4000 cal BC (Barber *et al.* 1999). Perhaps the most notable finding of the Neomine project was the re-dating of the Cumbrian stone axe quarries to the Early Neolithic (Edinborough 2019; Bradley *et al.* 2019). This is significant, and demonstrates that the extraction of both flint and stone was integral to Early Neolithic communities across the British Isles.

As will be discussed at the end of this thesis, in many ways the Neomine project echoed earlier mid-20th century interpretations of flint mines, by arguing that extraction began and increased exponentially because of a population growth and the requirement for more axes needed to clear wildwood. This hypothesis remains problematic and is at odds with the findings of this project and other researchers who argue that mining was small-scale and seasonal, because it was motivated by non-functional cultural, symbolic factors, such as the production of axes for exchange networks.

These cultural and symbolic reasons for mining are currently explored by both Topping and Teather, who, as well as this Author, are the main researchers of Early Neolithic mining in Britain. Topping has continued to draw heavily from ethnographic studies to highlight the cultural and social reasons for mining, stating that extraction sites were '*engendered or mythologised as a means of explaining the origins of the cultural landscape and humankind's place within it*' (Topping 2019. 221). Teather has recently expanded on the chronology of individual mineshafts and continues to argue that mining may pre-date the Neolithisation of southern England and is therefore an indigenous innovation (Teather 2019).

In contrast to the small amount of research on British mines, the sizeable amount of work being carried out on European sites focuses on very different themes. Here, the tendency is to focus less on the social and symbolic, but more on the functional aspects of mining, the typologies of mine products and finally their movement and distribution to communities through complex trade networks (See Kerig and Shennan 2015; Collet and Hauzeur 2019; Schauer *et al.* 2019). These approaches are not without their merits, however in southern England there are notable research barriers to forming precise connections due to the long standing problem of provenancing flintwork to mines and other sources (Sieveking *et al.* 1972).

2.6.8 Concluding remarks

This chapter has outlined the excavation and research of flint mining across Northwest Europe, albeit briefly. This work is still very much underway at scale in mainland Europe, but is somewhat static in Britain. At times the study of mining has reflected wider research themes in prehistory, for example defining the Neolithic in the late 19^{th} century and early 20^{th} century. Over one hundred years later they are now reflecting an increased focus on chronologies, specifically of the Early Neolithic and led by *Gathering Time* (Whittle *et al.* 2011).

It is now imperative to move this thesis forward by looking in detail at the largely unpublished results of archaeological investigations conducted at two Sussex mines, which, until this project, were forgotten.

Chapter 3 The tale of two unpublished flint mine excavations

3.1 Introduction

This chapter focuses on bringing to publication two small excavations of Sussex flint mines, which took place a little over thirty years ago. This was a unique opportunity, which would allow engagement with the material and artefacts excavated from a flint mine, many of which had never been fully reported on. The publishing of two historic excavations also increased knowledge of under researched aspects of Early Neolithic flint mining in Sussex, including different forms of mining, the nature of working floors, the wider mining horizon and the discovery of pottery.

The process of researching two historic excavations was challenging, including numerous museum visits, re-examination of archival material, such as field records, and the examination of c. 37,000 pieces of flint debitage. The archive material is held by two museums, Worthing Museum and Art Gallery and The Novium, Chichester. Some of this material had been subsequently loaned to other museums across Sussex, including Barbican House in Lewes and Bognor Regis museum. The pottery was still held by the original excavator, Robin Holgate.

It was not possible to locate all of the small finds from both excavations. Luckily, these small finds, mostly axe roughouts had been fully illustrated in preparation for publication. Although the archive and field records were largely complete, work was still needed to complete the publication, including digitalization of sections and plans, reconstruction of stratigraphic sequences and the consultation of a specialist for the pottery report. The results of this work were published as an extended report in the Sussex Archaeological Collections (Baczkowski and Holgate 2017) and a short article for PAST (Baczkowski and Holgate 2018).

Chapter Three bridges two major parts of this project, between the wider landscapes of mining in Sussex, as outlined in Chapter 6, and the study of the immediate mining horizon. This chapter also links the archival component of this project, summarised in

Chapter Two, with new research undertaken during this research, outlined in Chapter Four and Five.

3.2 Background to project

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 Sussex flint mines. The project, directed by Robin Holgate and supplemented by funding from the Margary Fund of the Sussex Archaeological Society and the David Thomson Charitable Trust, involved surface artefact collection/recording surveys, geophysical surveys, earthwork surveys and excavation at four sites between October 1984 and September 1986 that were under cultivation.

Surface collections surveys were then carried over the mines at Long Down, Harrow Hill, Blackpatch, Church Hill and Stoke Down. Of these sites, two were chosen for further investigation, Long Down and Harrow Hill. The main objectives of the project were:

- To determine the limits of the flint mining and flint-working areas on the sites under cultivation.
- To recover a sample of flintwork in order to determine the range of implements being manufactured.
- To obtain ceramic and organic material which could be used to provide dates for the activities taking place at the sites.
- To establish the relationship between working areas and the immediately adjacent flint mines.
- To take soil samples for palaeoenvironmental analysis.
- To assess the condition of these sites as a preliminary to outlining the scope for improving their management and visitor presentation.

The surface collection surveys are only discussed where relevant to the fieldwork, as the results served mainly to identify areas for subsequent sample excavation.

3.3 Long Down, 1984

(Appendix 2)

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-Flint deposits overlooking a dry valley that runs north from the downs and south to the Sussex Coastal Plain (Fig.3.1). Extraction methods on Long Down appear to have focused on winning flint from a single seam of large tabular flint (Holgate 1995b: 350).

Long Down was partially excavated between 1955-58 by E. F. Salisbury (1961). During these excavations the top of one mineshaft was opened and two workshop floors were excavated. The findings from the excavation were not fully published and much of the archive, except for the artefacts, including a sizable amount of antler, is lost. It was possible to obtain five new radiocarbon dates from the antler, discussed below, which show that mining at Long Down began sometime around the mid 39th to 38th century BC, slightly later than the beginning of mining at other Sussex mines, especially within the Worthing Group.

In view of the limited scope of the excavations undertaken on the Long Down mineshafts, little is known about the mining practices used, such as the depth of the shafts, the form of the extraction features and whether galleries were developed. The extent of the mine complex is also unknown, as much of the area has been subjected to virtually continuous agricultural activity, since the Bronze Age.

3.3.1 1984: field survey

(Appendix 2.1)

In October 1984 a surface artefact collection and earthwork survey was undertaken by Holgate on the eastern part of Long Down in an area under cultivation. This survey identified the location of a flint working area, measuring around 25m^{ø}, which contained axe roughouts and axe-thinning flakes (Fig.3.2). To the north and east of this area four depressions were recorded, measuring c. 6m^{ø}. Similar to the earthworks of the main mine complex, they were interpreted as the hollows left by mineshafts.

Fig. 3.1: Location of Long Down (Author).

The density of the worked flint was highest along the western boundary of the area, close to where the earthworks are located. Here the number of flints reached over 31 pieces per m^2 and included soft hammer struck axe-thinning flakes, axe roughouts and a small number of discoidal knife roughouts. 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 relationship between the working floor with the surrounding mines was not clear, its dating was established on analysis of the struck flint and pottery found in association with it (See below). It is likely that the working area was largely contemporary with episodes of mining, although the presence of discoidal knife blanks, typical of the Late Neolithic, hints at re-use of mine debitage in a later phase, as recorded at other Sussex mines (Barber *et al.* 1999). This may also be supported by the find of a fragment of Peterborough Ware (3400 – 2900 cal BC) pottery from the surface of the site in the early 1980s (Drewett 1983). It is possible that linear depressions across the mine spoil heaps are the remains of quarries dated to the later periods of the Neolithic and were created to exploit mining debitage (See Chapter Four).

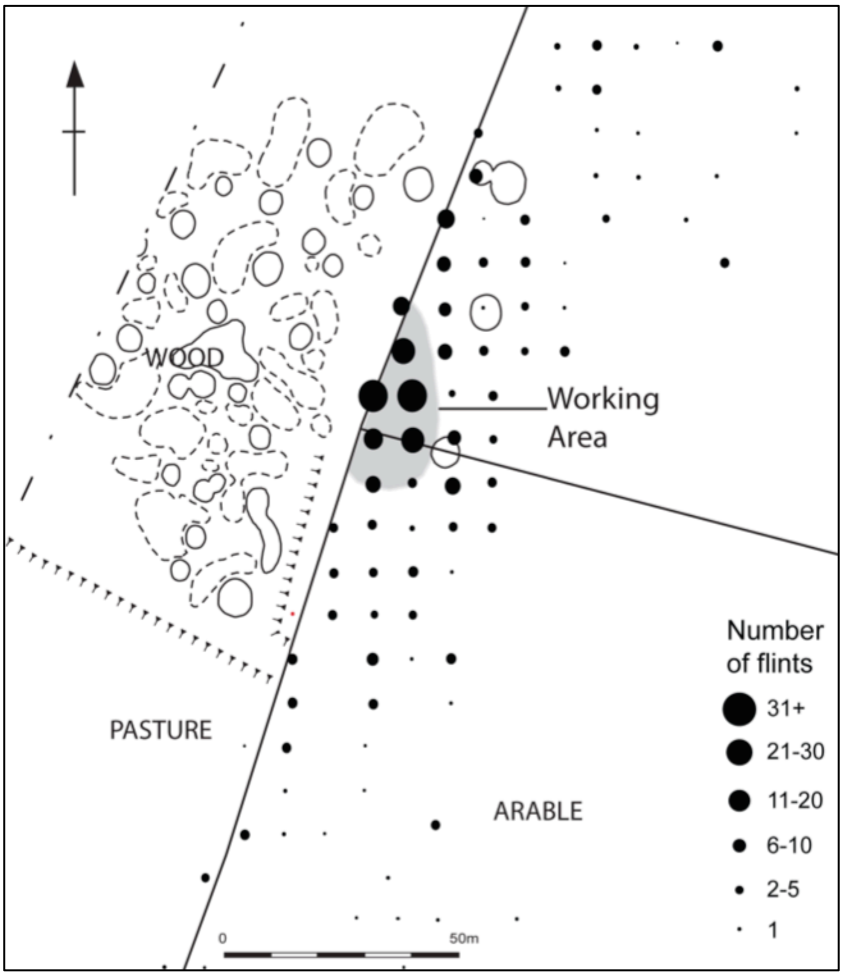

Fig. 3.2: Results from surface collection survey(Author, adapted from original, Holgate 1985).

3.3.2 1985: excavation, methods

Prior to the fieldwork Andrew David of the Ancient Monuments Laboratory (AML) carried out a geophysical survey using a EM16 Fluxgate gradiometer over 120 x 60m 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 working floor. 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 and retrieval of dating evidence, such as pottery or mining implements.

Three areas were targeted for excavation (Fig.3.3), first, two 3x1m trenches, Trenches A1 and A2 were placed across the known mine shaft encountered by Salisbury. 35 1x1m test pits (grouped into Trench B) were opened across the flint-working floor, which had an estimated total area of 630m^2. Finally, two of the four isolated circular depressions were investigated by 3 x 1m trenches and allocated as Trenches C and D.

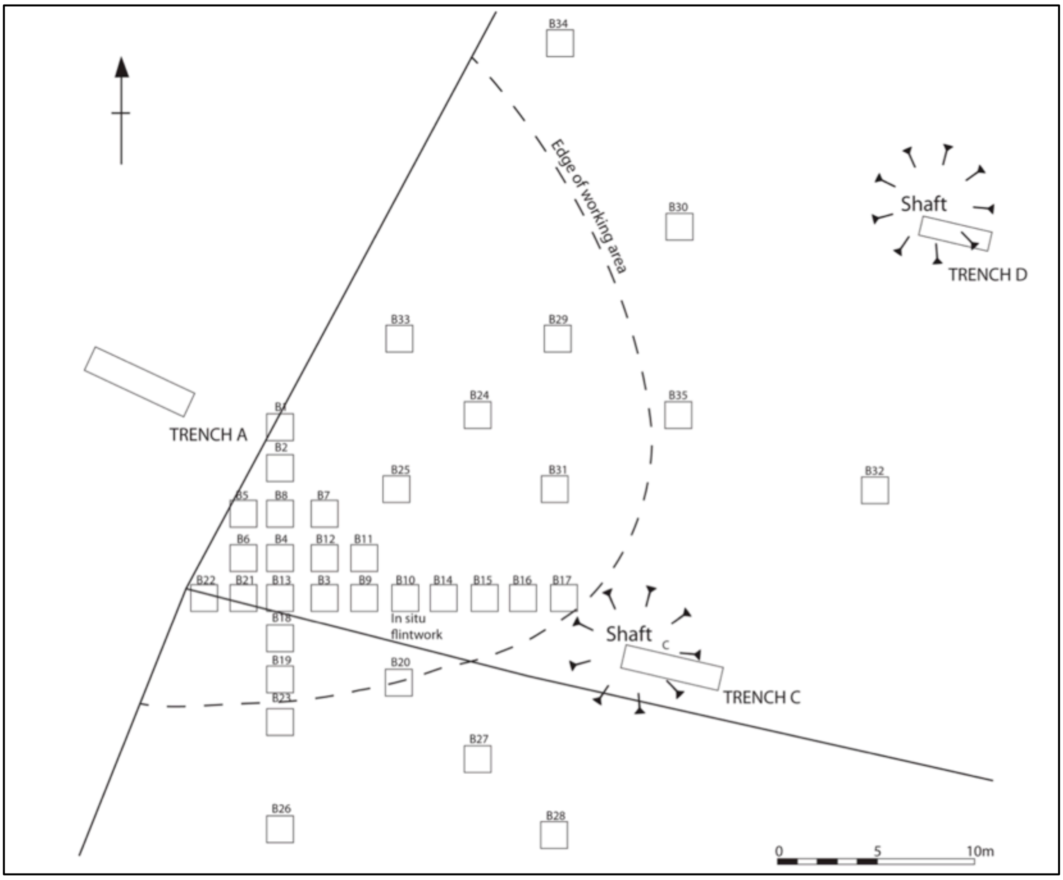

Fig. 3.3: Location of test pits and sample trenches on Long Down (Author, adapted from original, Holgate 1985).

3.3.3 The test pits; Trench B

Good results were obtained from test pits numbers B9 (Fig.3.4) and B10; both located c. 5m uphill and to the east of the western boundary. These two pits revealed *in situ* struck flint 0.3m below the topsoil (Deposit **57**) in Deposit **54**, a layer of chalky rubble, chalky pea grit and loam, interpreted as a relic surface contemporary with mining. Crucially, Deposit **54** overly Deposit **53**, a chalky pea grit soil, which had formed just above the natural. This soil represented a rendzina soil dating to before the commencement of flint mining. Many of the flint flakes were recovered from the base of Deposit **54** at its interface with Deposit **53**, which were also interpreted as *in situ* and associated with mining.

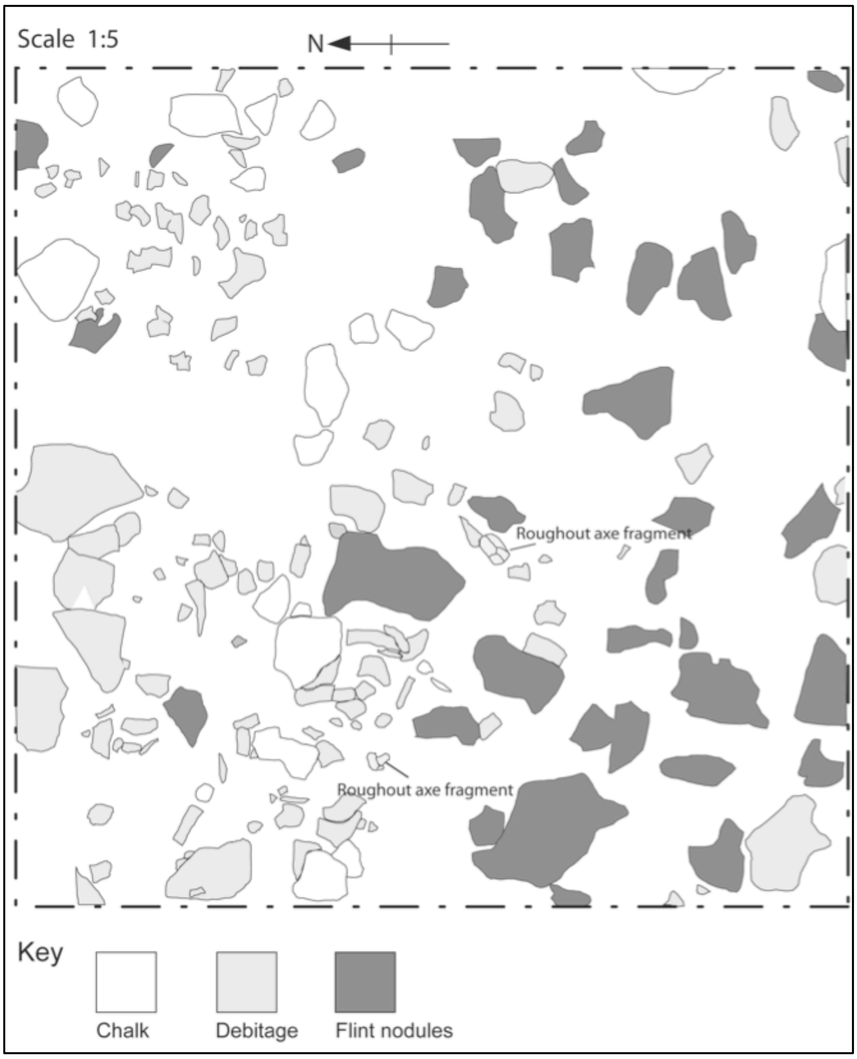

Fig. 3.4: Plan of Test Pit B9 (Author, adapted from original, Holgate 1985).

Of significance was the discovery in Trench B10 of 3 fragments of Early Neolithic pottery (See below). These were found in Deposit **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 Deposit **54**, at the interface with Deposit **53**, indicating two phases of knapping. A similar density was found in B9, with 127 pieces of worked flint found *in situ*, including one core, in the interface between Deposit **54** and **53**. These scatters survived because Late Bronze

Age/Iron Age and/or Romano-British ploughing formed protective colluvial layers, as evidenced from potsherds recovered from heavily plough sorted Deposit **52**, a dark brown loamy soil above Deposit **54** and **53**.

The remaining test pits produced quantities of struck flint, which were not *in situ,* possibly due to cultivation, as plough scars were found penetrating up to 0.05m into the sub-soil. It is unclear if any working scatters, or other features, survived outside this area, but due to the variable depth of the soil and the formation of lynchets, it seems likely that pockets of Neolithic activity persist elsewhere on Long Down, as demonstrated by test pits B9 and B10.

3.3.4 Trench A

(Appendix 2.2)

Trench A began as two trenches, A1 and A2, opened in the area where Salisbury had discovered the top of a single mineshaft. Trench A1 was extended into a single 11 x 1m trench, renamed Trench A and excavated to a depth of 2.2m. The trench successfully located Salisbury's 5x10m trench, and the top of the 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 that contained axe roughouts, potsherds, and antler and bone tools.

The stratigraphic backfilling sequence of the original mineshaft was recorded in Trench A (Fig.3.5). The main deposit, Fill (**15**), was recorded at an average depth of 1.8m and was of similar composition to backfills at other Sussex mines (Barber *et al.* 1999; Russell 2001). Fill **15** contained large un-weathered chalk blocks, loose in composition and representing the re-deposition of mining spoil from the sinking of a neighboring shaft. The edge of the shaft was located in the northern side of the trench and consisted of a vertical edge cut into to the chalk bedrock.

Finds recorded in Fill **15** included a cluster of worked flint, two axe roughouts, a large flint point, a cluster of flint flakes, part of an antler pick (Fig.3.6) and a cattle scapula.

The upper parts of the layer also contained a large quantity of flint nodules and flakes. Many of the nodules were quartered into blocks and others showed signs of being tested for their knapping suitability. This indicates that much of the primary working of reducing flint nodules was carried out close by, before becoming mixed with the mine spoil and backfilled into the open shaft.

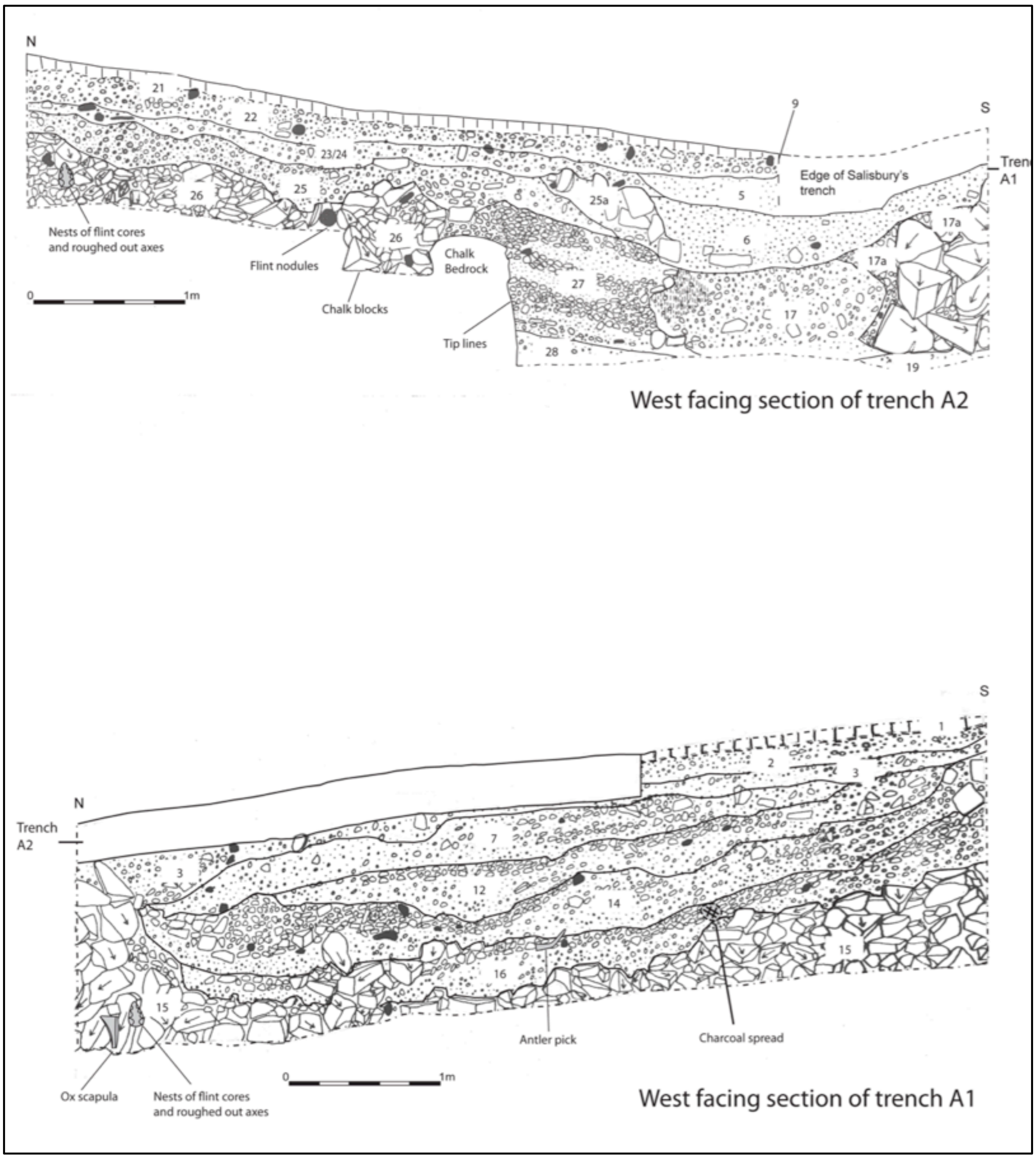

Fig. 3.5: Section of Trench A (Author, adapted from original, Holgate 1985).

Cut against Fill **15** in the middle section, around 1m to the south of the northern side of the Trench A shaft, was Fill **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 Fill **15** into the northern side of the mineshaft, close to the original cut of Salisbury’s shaft. It is directly below Fill **6**, a deposit of small pieces of chalk, which had been truncated by Salisbury's shaft (Cut **9**), and filled with Fill **5**, a loamy orange and loose soil. That *in situ* artefacts were found in Fill **17** almost certainly indicates that Salisbury did not excavate this layer. The truncation of Fill **15** must have therefore occurred after the shaft had been backfilled and could represent either later prospecting or a non-mining feature, such as a pit.

An important deposit was Fill **18**, composed of friable light yellow layer composed of small pieces of chalk and soil and interpreted as a wind-blown soil. The yellow colour of the chalk indicates that weathering had also occurred to this layer, confirming that the upper section of the shaft must have stayed open long enough for this deposit to accumulate. As this weathered layer is below Fill **15**, it must have covered the original backfilling of the shaft, which was left open for an unspecified period before Fill **15** was deposited on top of it. Therefore, the blocky mining waste Fill **15** cannot have originated from the sinking of the excavated shaft and must have originated from the later working of a neighbouring shaft.

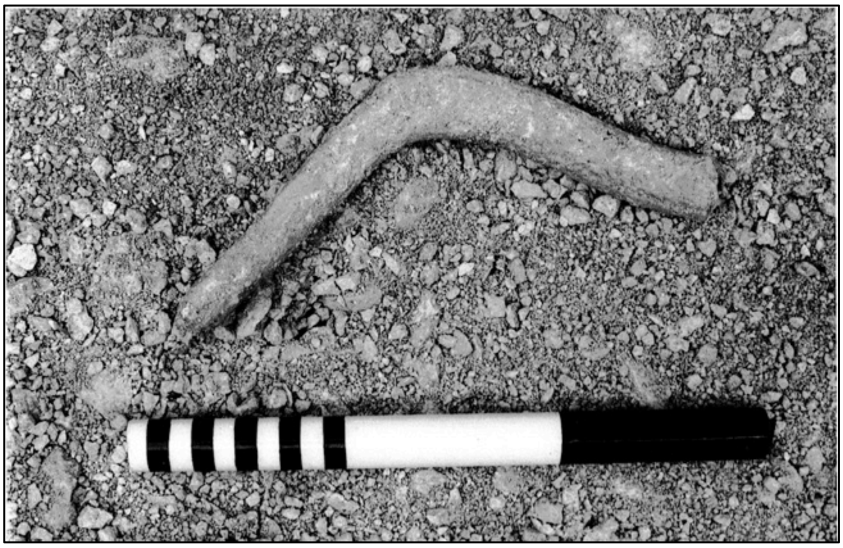

Fig. 3.6: Antler pick, Long Down (Holgate 1985).

The order of backfilling explains why the large blocky chalk of Fill **15** occurs high in the backfill sequence, as material comprising of large chalk blocks is associated with the working of deep shafts. The discovery of Fill **15** as originating from a neighboring shaft means that the artefacts from this layer, or above, date to the working of a neighbouring mine, almost certainly located uphill to the original shaft.

3.3.5 Trench C
(Appendix 2.3)

Trench C was located to confirm that the two hollows observed in the field survey related to Neolithic mining. The trench targeted the southern-most hollow and measured 5x1m and was 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^{ø} (Fig.3.7).

The stratigraphy of Trench C was clear, with the upper fills of a single mineshaft exposed down to the characteristic blocky chalk layer. The upper deposits of loamy Fill **102**, overlay lenses of chalky pea grit, flint nodules and chalk lumps. Fills **101** to **104**, were formed by cultivation activity. These upper fills were probably originated from post-1st millennium BC ploughing, indicated by the presence of Iron Age and/or Romano British potsherds.

Eventually, after a deposit of loamy, humus rich soils, Fill **104**, and washed-in chalk blocks, Fill **105**, a layer of fresh chalk rubble, Fill **109**, was located 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 shaft backfill, composed of chalk blocks and occasional broken flint nodules.

3.2.6 Trench D
(Appendix 2.4)

This trench was positioned over the northern-most hollow observed in the surface collection survey. Measuring 3x1m and excavated to a depth of 1.9m, the trench successfully located the possible side of a single mineshaft (Fig.3.7).

The upper deposits of Trench D were similar to Trench C. In Fill **114** Iron Age and/or Romano-British pottery was noted, indicating that the upper layers were derived from post-1st millennium BC ploughing. Under Fill **114** was a loose chalk layer, Fill **115**, containing inclusions of chalk rubble deposited above Fill **116**. It is unknown if this layer of spoil related to the shaft within which it was deposited, or from a neighbouring shaft.

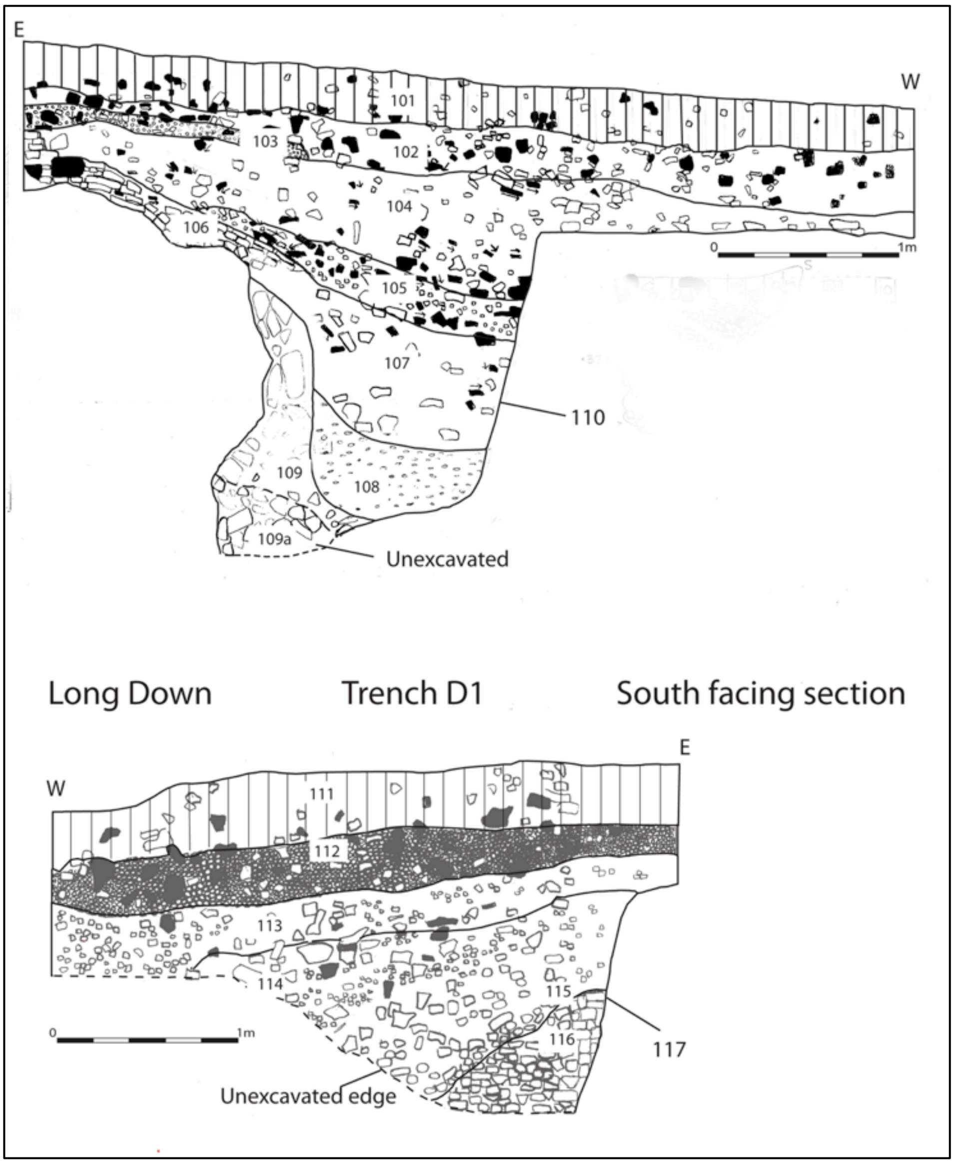

Fig. 3.7: Sections of Trench C and D (Author, adapted from original, Holgate 1985).

There was a notable lack of finds from the lower fills in Trench D, thus dating of the shaft was not possible. Its gentle-sloping profile indicates that if it was a shaft, only its very upper portion was exposed and it was also difficult to calculate the diameter of the shaft. It is likely to be a Neolithic mine general, as its profile and backfilling was similar to the other excavated examples.

3.3.7 Flintwork

In total, 29,817 humanly struck flints were recovered from the surface collection survey and the excavations. The assemblage was predominately composed of debitage, along with four axe roughouts/performs and three implements (Fig.3.8), all associated with a working floor. The implements and some of the debitage, including hard-hammer-struck flakes and the cores, date to the Neolithic period and are associated with production of bifacially worked axes. The flintwork was rapidly assessed using for the project (See Appendix 2.5).

The majority of the assemblage is patinated white, or light blue in colour. Cortex, where present is thick, white or buff and rough, typical of flint extracted from chalk bedrock. All of the assemblage has been sourced from chalk bedrock, and there is nothing to suggest it does not originate from mines close to the working floor.

3.3.8 Excavated flint: Trench A

The excavation of Trench A produced 5,709 flints. The debitage is crude and from primary knapping, such as the reduction of large nodules. Of the flakes, 48% were hard-hammer-struck, a higher proportion than that of the flakes recovered from trenches B (30%) and C (38%). Although soft-hammer struck axe thinning or finishing flakes comprised 75% of all the flakes and blades, this was a lower proportion than for Trenches B and C (both c. 90%). There was also a higher proportion of tested nodules (i.e. with only one or two flakes detached from them), quartered pieces and shattered pieces from Trench A (7% compared with 0.3% and 0.01% 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, finishing flakes (64% of the flints from Trench A), and roughouts indicate the production of bifacial implements was taking place in this area. Also recovered were flint ‘nests’, composed of discrete clusters of knapping waste, including flakes and an axe roughout, which were located within the backfilled shaft.

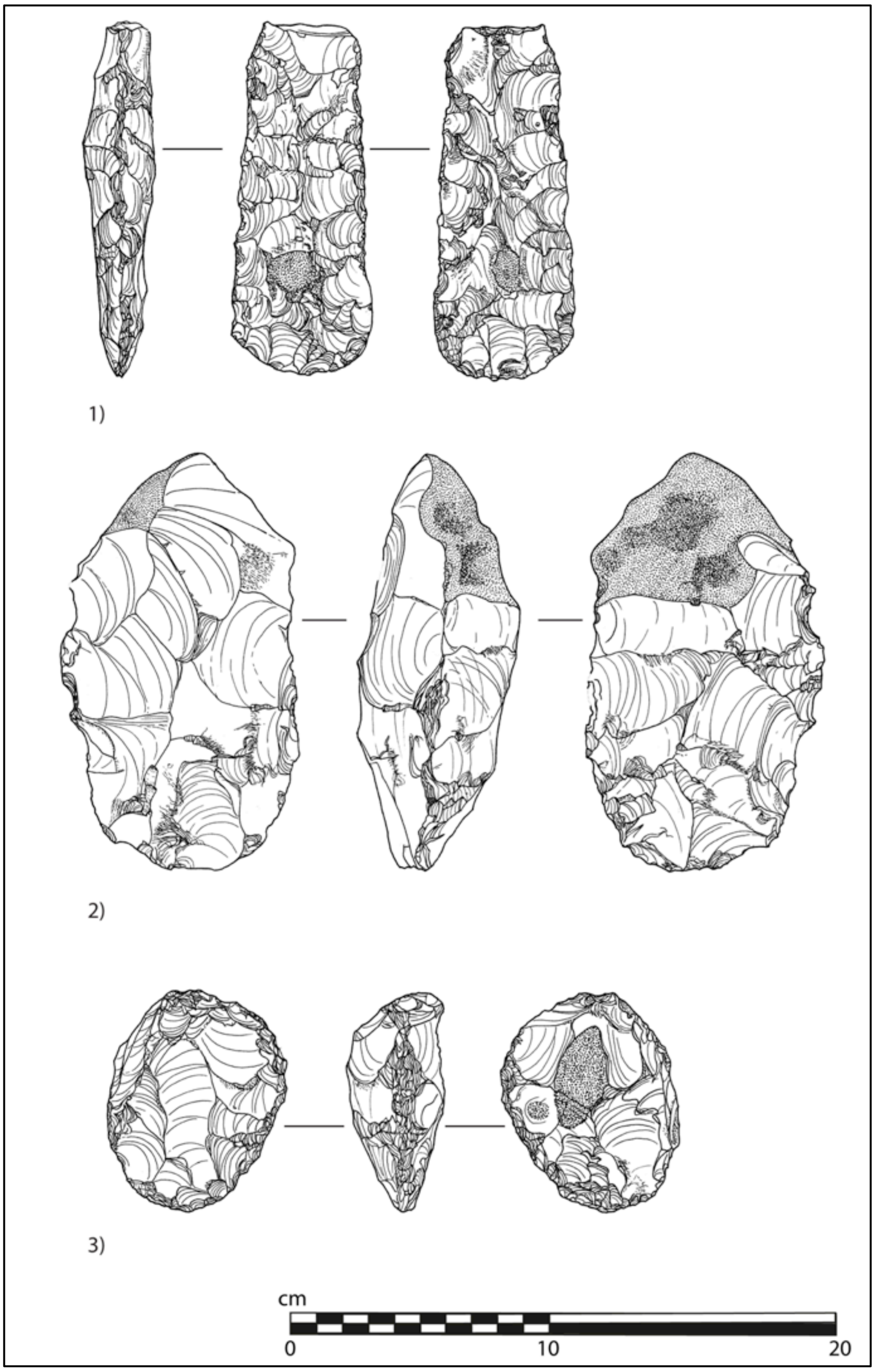

Fig. 3.8: Long Down flint work (L. Drewett 1992).

3.3.9 *Trench B*

The test pits yielded 21,597 flints, almost all resulting from the production of bifacial implements, probably axes, from the mined flint. The test pits amounted to a 4.2% sample of the flint-working floor. A small portion of the assemblage is probably dated to the Late Bronze Age (<1%), although the majority of the pieces (>94%) date to the Early Neolithic, with some later Neolithic forms present (5%<).

The assemblage was mostly composed of the waste from the production of bifacial implements, most likely axes, and included 51% soft-hammer thinning flakes, 39% finishing flakes (<30mm in size) and 3% chips (<10mm in size). Early Neolithic implements recovered included six axe roughouts. Additionally, three ovate roughouts were recovered, which probably represent discoidal knife blanks and relating to later recycling of mining debitage in the Late Neolithic, or Early Bronze Age.

The pieces recovered from the *in situ* knapping floor totaled 2,066 flints, comprised of 26% hard-hammer struck flakes, 60% soft hammer-struck thinning flakes and 5% chips. Two axe roughouts were also recovered, along with fragments of Early Neolithic pottery. It appears that the working floor was contemporary with mining activity at one of the neighbouring mineshafts.

It is notable that all stages of axe production, except for polishing, was undertaken close to the mines, in contrast to similar floors recorded at other Sussex mines (Barber et al. 1999; Russell 2001). Whether this is the result of archaeological bias due to the preservation of the scatter having been covered by a later prehistoric lynchet is unknown. The recovery of pottery from the *in situ* scatter may also hint at a more settled approach to mining and axe production on Long Down.

3.3.10 Trench C and D

The Trench C and Trench D excavations produced 2,088 flints. Just over 90% of the flints recovered were soft hammer-struck axe thinning or finishing flakes from the production of bifacial implements and largely identical in form to the waste from the Trenches A and B. A smaller portion (38%) from Trench D were flakes from the crude reduction of large nodules, almost certainly mine flint. Implements recovered included three axe roughouts and a discoidal knife.

3.3.11 Small Finds
(Appendix 2.6)

In total thirty small finds were identified during the excavation, ranging from axe roughouts, Early Neolithic pottery, charcoal, antler and animal bone.

Of 63 potsherds recovered from the field surface artefact collection and sample excavations, 28 derive from Early Neolithic pottery forms, the rest date from the Middle Bronze Age to the Romano-British period. It is only necessary to report on the Early Neolithic pottery here (refer to Appendix 2.7).

3.3.12 Early Neolithic pottery
(Appendix 2.8)

The Early Neolithic pottery (Fig.3.9) was examined by Professor Andrew Jones, who confirmed the date and form of the assemblage. Although the collection was small, and virtually all of the sherds lack clear features diagnostic of form, the overall fabric type and thinness of the pot walls, combined with their context within mining contexts clearly demonstrate that they belong to the Early Neolithic.

The potsherds (23 pieces) of one, or possibly two Early Neolithic vessels, Pots 1 and 2, were recovered from Test Pit B9. The potsherds showed no sign of a profile, but both can be identified as belonging to neutral bowl forms of probable Carinated Bowl (Cleal 1992, 291-92). Three potsherds were found in Trench 1 from the same vessel, Pot 3. The fabric of potsherds is sandy, either brown or black in colour and was either with calcite, and/or, burnt flint. Given the commonality in fabric across the group of sherds (all sherds are tempered by calcite or possibly burnt flint), and the variability of firing in prehistoric pottery in general we may be only looking at two or conceivably a single vessel represented here.

The collection, albeit small, is significant as all the potsherds were found within Early Neolithic mining, or flint working, contexts. They demonstrate that the communities active on Long Down were clearly using pottery and possibly may have been settled close to, or within, the mining landscape.

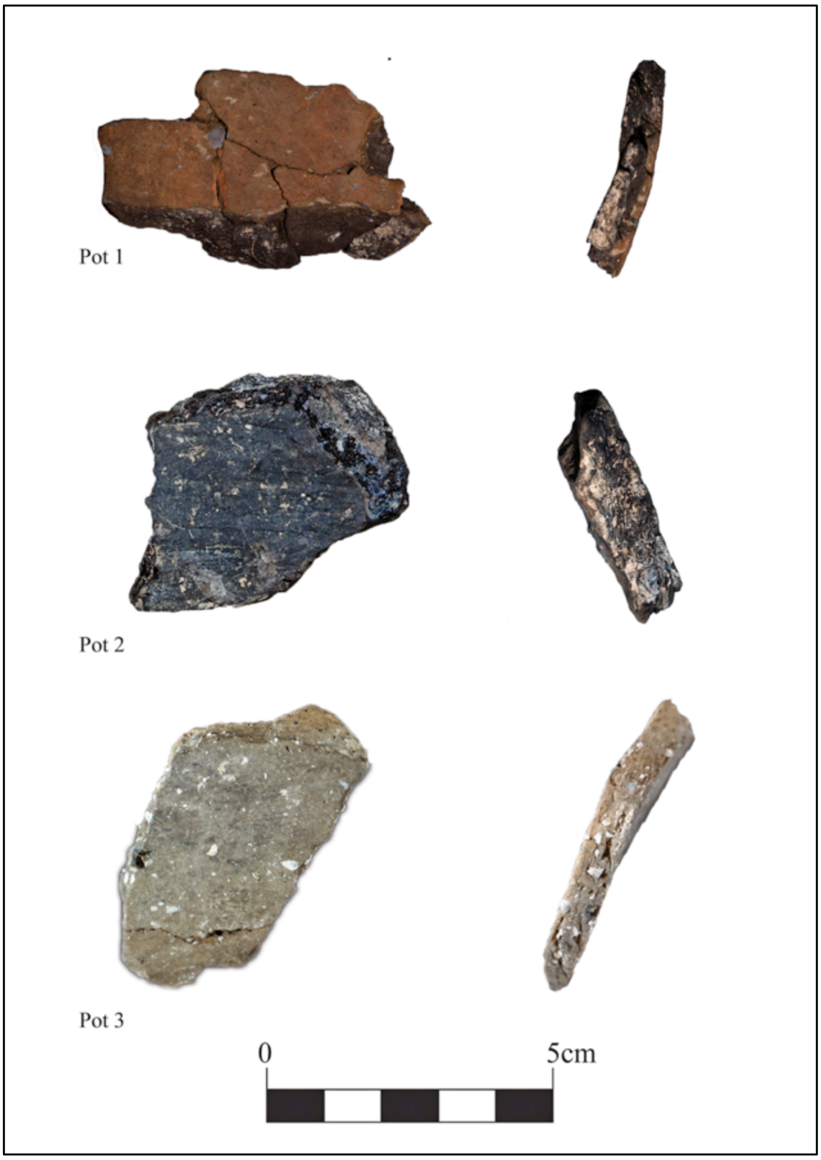

Fig. 3.9: Early Neolithic pottery from Long Down (Author).

3.3.13 Other artefacts

Miranda Armour-Chelu examined two artefacts, an antler tine and a cattle scapula (See Appendix 2.9). The antler was from a Red Deer (Cervus elaphus) and was part of a pick and the scapula 'shovel' belonged to the right hand side of a domestic Ox. A similar scapula was found at Cissbury during Fox-Lane's excavations and was interpreted as a shovel (Lane Fox 1876). However, as there was hardly any abrasion along the proximal edge of the Long Down example it is unlikely that it had been used as a shovel.

3.3.14 Radiocarbon dating
(Appendix 2.10 – 2.11)

Four dates were obtained from material recovered from the 1984 fieldwork, two from charcoal fragments, one from the antler pick and one from the cattle scapula. The samples were analysed by the Oxford University Radiocarbon Accelerator Unit in 1987 and further calibrated for this report using the OxCal program (OxCal Version 4.2). All the samples came from chalk fill, 1m below the current ground level, in the top of the shaft in Trench A.

The charcoal produced a mid to late 2^{rd} millennium BC date range and the tools an early 4^{th} millennium BC date range (Fig.3.10). The charcoal is 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 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 the pre-enclosure/Plain-Decorated bowl horizon.

3.3.15 Further Radiocarbon results
(Appendix 2.12)

During this project a further eleven samples were submitted for radiocarbon dating, ten from antlers and one from bone. These samples were obtained from material located in the Novium Museum archives, Chichester, on material excavated between 1955-58 from the Long Down flint mines (Salisbury 1961). Although the excavations were poorly documented, with only a summary report (Salisbury 1961) and Salisbury's handwritten notebook as reference, the material located in the Novium archives almost certainly originates from the excavations. However, the material is from somewhat mixed stratigraphic contexts, with some artefacts recovered directly from within mineshafts, as is the case with the cattle scapula, and some from working floors surrounding the mines.

Unfortunately, it was not possible to providence any of the material to their original archaeological contexts, with the exception of the cattle scapula. With this issue in mind, it was decided to sample pieces that clearly showed signs of being used as picks, and also to sample as many as possible within the budget, including the cattle scapula.

Six of the eleven samples failed to produce enough collagen for dating, possibly due to the environment they had been stored in. However, five of the samples were successful and gave an interesting and broad range of results (Fig.3.11). One late date was obtained, Sample 3, ranging from 1899-1699 cal BC (95.4%), which could be considered an outlier or evidence of Early Bronze Age exploitation of mine spoil. A second date of 3366-3104 cal BC (95.4%) from Sample 7 may also relate to later exploitation of the mine spoil, or even the terminal period of mining on Long Down.

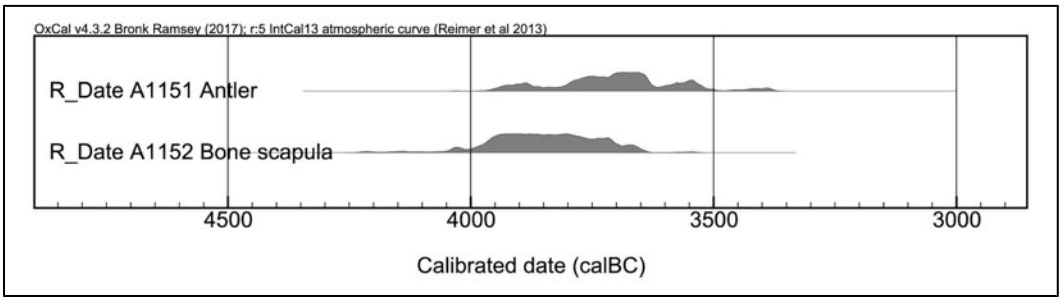

Fig. 3.10: Radiocarbon dates from the 1984 excavation of Long Down.

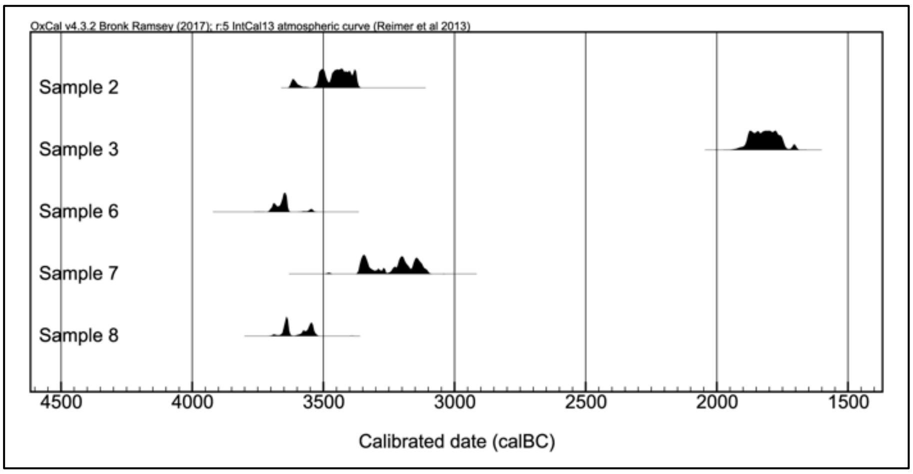

Fig. 3.11: New radiocarbon dates for Long Down.

Three samples were broadly contemporary, all falling between 3700-3300 cal BC and included Sample 2 with a date of 3625-3368 cal BC (95.4%), Sample 6, with a date of

3706-3539 cal BC (95.4%) and Sample 8, with a date range of 3693-3526 cal BC (95.3%). Modelling of the dates undertaken for the Neomine project indicate very wide (95% intervals) for both the beginning and end of activity, starting in 4319-3543 cal BC at 95% with a median of 3741 cal BC, and an end phase of between 3484-2584 (95%), with a mean date of 3195 cal BC (Edinborough *et al.* 2019. 14). The probability for a start date of mining on Long Down is in the interval 4000-3500 cal BC, with an end phase between 3484-2584 at 95% with a mean date of 3195 cal BC.

The dates suggest that mining on Long Down may have begun early in the 38th century BC and carried on into the 35th century BC. This has significant implications, as discussed below, for how the mining may have developed and spread across Sussex.

3.4 Fieldwork results; Harrow Hill, 1984

(Appendix 3)

Around 8km northwest from the mine complex at Cissbury Hill, is the prominent, bowl-shaped Harrow Hill (Fig.3.12). On its eastern flank are the remains of around 160 mineshafts (TQ 08162 09986). Extraction on Harrow Hill was focused on four flint seams, two sheet and two nodular, located in the Campanian aged (83.6 to 72.1 Mya) Newhaven Group chalk bedrock (Mortimore 1986).

Harrow Hill has c. 245 known shafts (Oswald 1994), has been subjected to several excavations, firstly by E. Curwen and E. C, Curwen (Curwen and Curwen 1926), followed 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), the last time that a mine shaft of a Sussex flint was excavated to its full depth. These revealed that it was a large, complex mining site with shafts connecting to a deep network of intricate basal galleries. The main mining area on Harrow Hill is well preserved and still visible as earthworks. However, the landscape surrounding the core mine complex suffered from heavy ploughing, especially during World War II (See Chapter Five). Modelling of the radiocarbon dates for Harrow Hill indicate that mining started on Harrow Hill as early as the mid 43rd century BC and continued until the early 38th century BC (Whittle *et al.* 2011, 256; Barber et al. 1999,88).

Fig. 3.12: Location of Harrow Hill (Author).

3.4.1 1984: field survey
(Appendix 3.1)

From October to November 1984 a surface artefact collection and earthwork survey was undertaken upon the cultivated field on the south side of Harrow Hill (Fig.3.13). A large flint working area, c. 50mx100mø in size, and consisting mostly of axe rough outs and axe-thinning flakes was discovered (Fig.3.14). Two circular depressions were recorded within this area and initially interpreted as the remains of mines located outside the main complex. The flintwork recovered, comprising mostly of roughouts, axe thinning flakes and cores, was similar to the flintwork recorded on Long Down. There was also evidence of sickles being produced.

The northwestern end of the survey area was an area of Clay-with-Flints deposits. 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 Appendix 3.2) 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, probably dating to the Bronze Age, was sourced from the debitage of the Neolithic mines (Barber *et al.* 1999).

3.4.2 1986: excavation
(Appendix 3.3)

After the field survey it was decided to target the main flint working area and a series of circular depressions located in the northeast of the survey area. In total, 69 1x1m trenches were hand-dug, with all soil dry-sieved through a 5mm mesh (Fig.3.15). All the test trenches in the area of the working floor were given the letter W as a preface and numbered between 1-51.

Close to the southern end of the main minefield two trenches, measuring 3x1m, were opened along the northern boundary of the research area. These were positioned to investigate the possibility of mine features. The trenches were given a letter pre-text, starting with A and ending with S.

Many of the trenches recorded plough marks at an average of 0.05m in depth, which in six trenches (W8, W22a W25, W27, W34 and W44) had scored the subsoil. The plough soil averaged between 0.1 - 0.22m in depth, with deeper soils found towards the bottom of the hill at the eastern limits of the survey area.

3.4.3 The flint working floor

The 24 trenches located with the 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. Examination of the flint, detailed below, demonstrated that axe roughouts, and other core tools, were being produced.

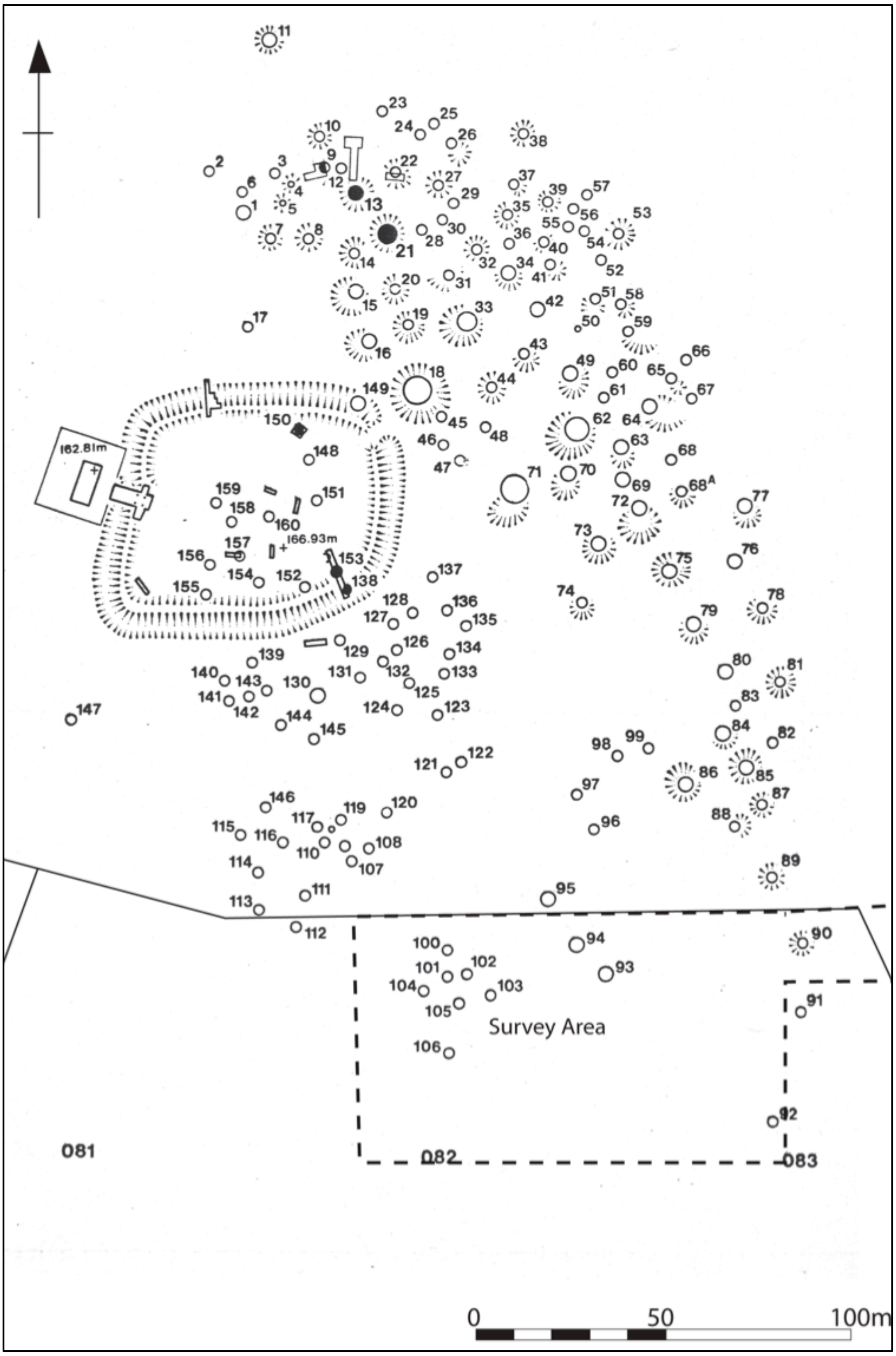

Fig. 3.13: The survey area and the main complex(Author, adapted from original, Holgate 1986).

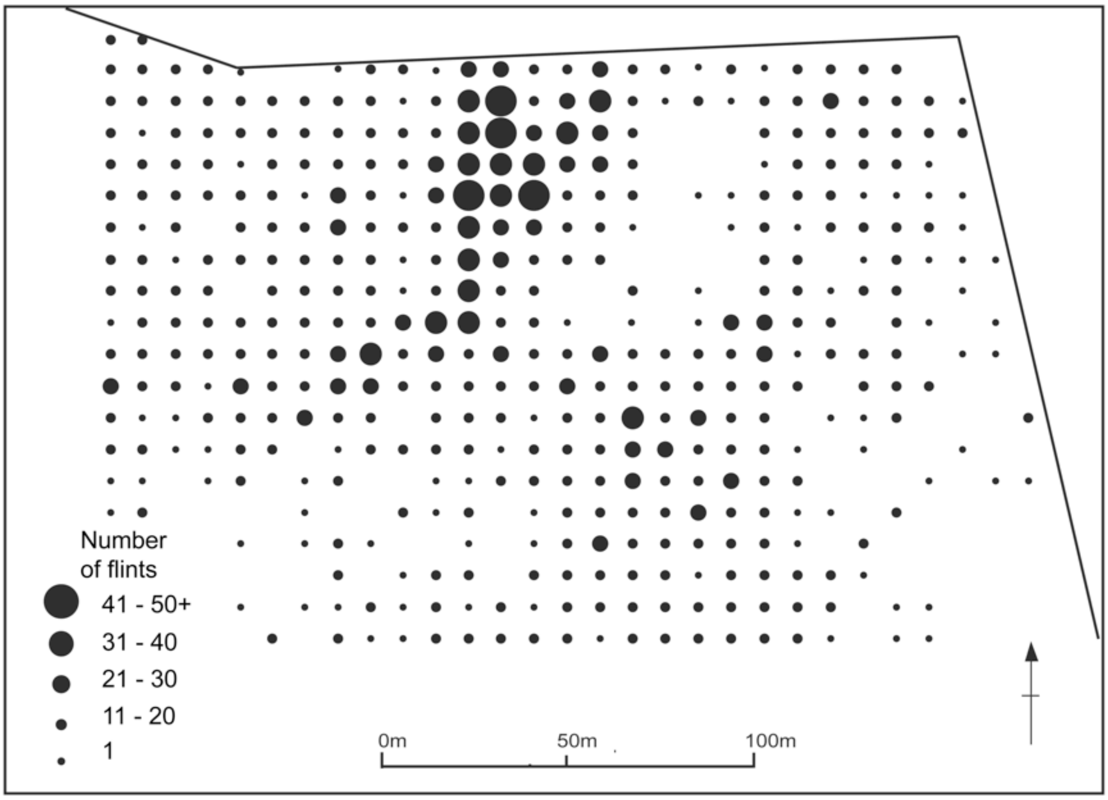

Fig. 3.14: Results of field collection survey (Author, adapted from original, Holgate 1986).

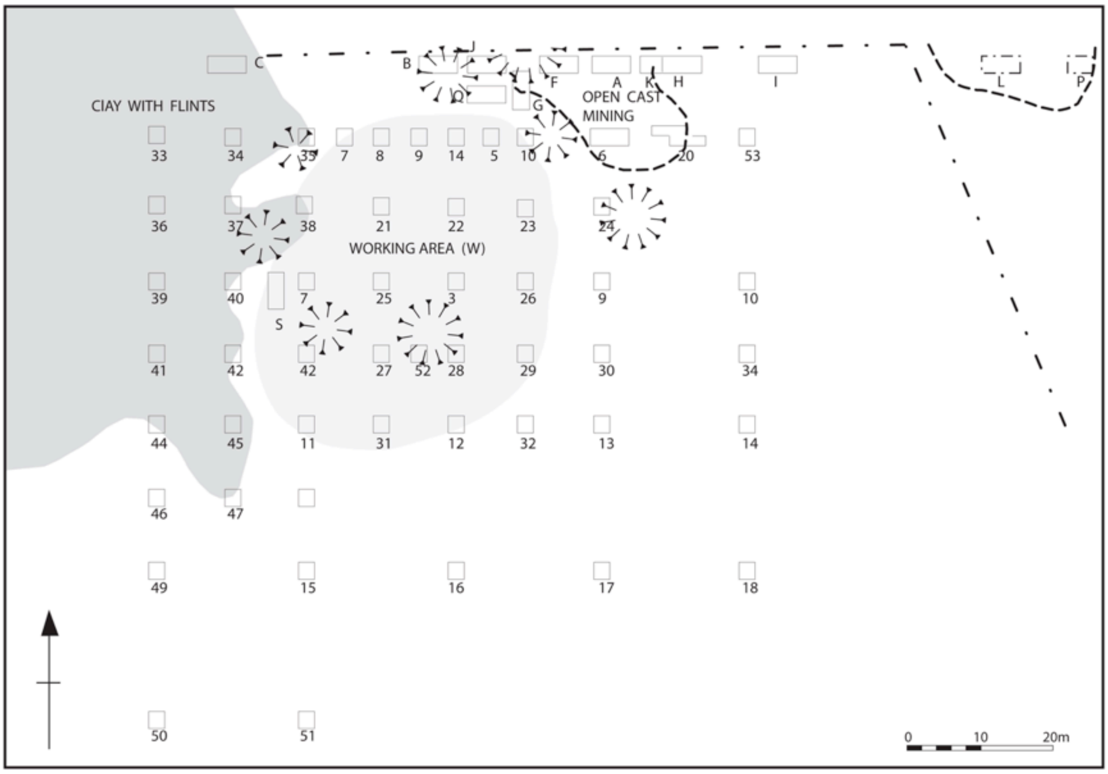

Fig. 3.15: Location of test pits, Harrow Hill 1986 (Author, adapted from original, Holgate 1986).

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

No ceramic or organic remains were recovered, making absolute dating of the flint scatter impossible. However, examination of the flintwork placed the working floor in the earlier centuries of the Neolithic, fitting 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 drift mines described below.

3.4.4 The drift mines
(Appendix 3.4)

At the northern end of the site, close to the field boundary, trenches F, G, J, K Q, W4, W20, W22 and W52 encountered the remains of drift mines in the form of small niches, known as adits, cut into the chalk bedrock. Their discovery is significant, as to date they are the only prehistoric mine site in southern England where this form of mining has been discovered.

The drift mines exploited thin nodular flint seams that outcropped along the southeastern flank of Harrow Hill. The 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 (Fig.3.16). Once extraction ended, the mines were filled with chalk rubble that originated from the mining operation, as evidenced by the recovery of tested flint nodules and hard hammer-struck flakes in the backfill deposits.

3.4.5 Trench G

Trench G exposed two drift mines cut into the chalk bedrock (Fig.3.17), each sunk to a depth of almost 1m with a supporting arch of natural chalk left between each working. Each adit measured between 1-2m in width, a little over 0.8m in height and extended for around 1m into the hillside. Only the left adit was fully excavated, so it is possible that others may have been deeper than 1m. A single deposit in the adit (Fill **20**) comprised of various sized inclusions of loose blocky chalk rubble within a yellow silty matrix, indicating that the deposit had been open to the elements.

A deposit of chalk rubble (Fill **10**) blocked access to the mines and was initially given a different context number. After further excavation it was deemed that the chalk rubble (Fill **10**) was the same in composition as the backfill (Fill **20**), located immediately outside the mines. This infers that backfilling did not occur immediately after the end of mining activity and took place at least long enough for weathering to occur to the material.

Above Fill **20** was a second deposit, Fill **19**, composed of 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 was ploughed, or eroded downhill over the spoil heaps as a colluvial deposit. When viewed in section this layer overlies Fill **20** and extended into the galleries. This suggests that the short galleries were only partially back-filled because the colluvial material was also present behind the backfill within in the galleries. It appears that waste was only moved a short distance from the working face, so as not to interfere with the mining process, before being deposited back into the mine.

Whether the spoil backfilled in each quarry originated from the same working is unknown. Spoil could well have been moved horizontally across the slope as one quarry was opened, and its neighbour backfilled. This would be a similar process as sometimes recorded at deep mines in Sussex, where the waste from new shafts was backfilled into adjacent earlier workings. This may explain the weathered colour of the backfill, if it had been moved around the minefield as neighbouring adits were opened and previous workings sealed.

No dating material was found in the drift mines and their precise date is unknown, but the fact that the sampled working floor overlaps the mines in 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 re-deposited 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, it is therefore unknown if they are contemporary, later or earlier than the deep mining period.

Fig. 3.16: West facing entrance of drift mine (Holgate 1986).

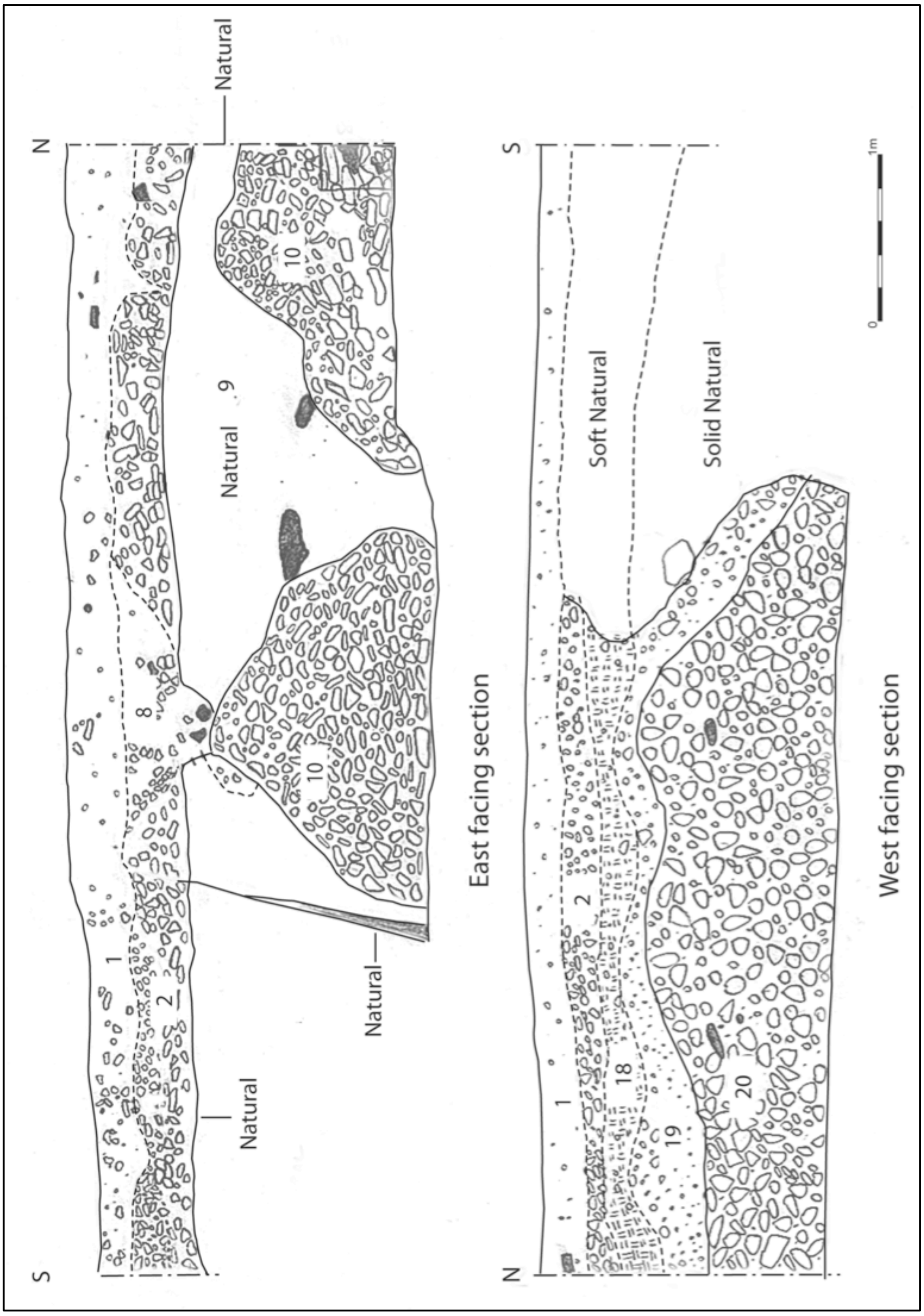

Fig. 3.17: Sections of drift mines (Author, adapted from original, Holgate 1986).

3.4.6 Geophysics survey
(Appendix 3.5)

In February 1987, Andrew Smith and Rory Mortimore of the Brighton Polytechnic conducted an electromagnetic survey using a Geonics EM31 instrument. 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 may relate to drift mining activity.

3.4.7 The Flintwork

The surface collection and the excavation produced a total of 8,100 humanly struck flints (See Appendix 3.6). The survey recovered a mixture of flints, which could be divided into two groups based on the techniques used to work the flint. The majority of the pieces were patinated white and cortex, where present, was thick and white, entirely in accordance with flint sourced from chalk bedrock. A smaller component of the assemblage, mostly from Trench 37, was unpatinated and dark brown to black colour, with red to brown cortex. Trench 37 was located on the edge of the Clay-with-Flints towards the top of Harrow Hill and the flints recovered from it are almost certainly sourced from the Clay-with-Flints. These flints were noticeably un-abraded and were probably Late Bronze Age in date.

At least 12% of the surface collection flints consisted of debitage and roughouts/preforms, from the manufacture of bifacial implements. 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 from their place of deposition.

3.4.8 Excavated flint: Working floor – W trenches

Excavation of the working floor (the W trenches) produced 3,721 flints, an estimated 1.4% of the total size of the scatter. The majority of the flints are waste from the manufacturing of bifacial implements on mine-sourced flint (Fig.3.18). The assemblage was comprised of robust soft hammer-struck thinning flakes (31%) and a small amount of finishing flakes (2%) and chips (8%).

Implements recovered included 14 axe roughouts, three preforms, including sickles and ovates (See Appendix 3.7). The sickle roughouts are a rare Early Neolithic form, as discussed further in Chapter Five. The axe production waste, axe roughouts and the sickles are undoubtedly contemporary with the Early Neolithic mines. In contrast, the ovates possibly date to the later Neolithic or Early Bronze and similar to Long Down, probably represent later recycling of axe debitage.

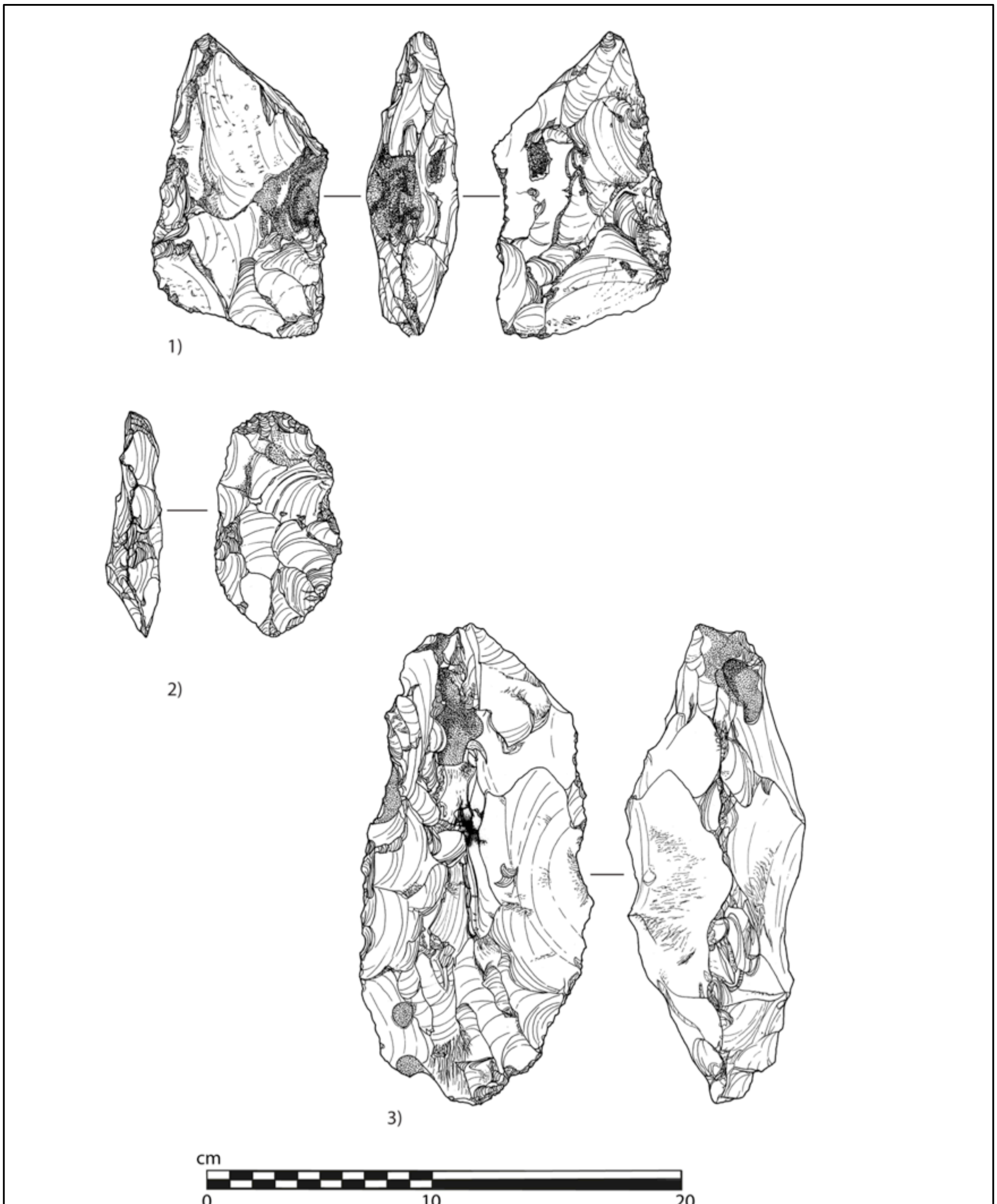

Fig. 3.18: Flint work (L. Drewett 2016).

3.4.9 Drift mines

The drift mines produced 1,128 flints, which almost exclusively resulted from producing bifacial implements, including soft- hammer-struck axe thinning flakes (41%) and a small amount of hard hammer-struck flakes, including large crudely knapped tested and quartered pieces. Implements recovered included five axe roughouts.

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, the backfill of the two most northern drift mines (Contexts **F2**, **F15** and **K12**) each produced over 100 flints including soft hammer-struck axe thinning and axe finishing flakes, tested nodules and axe roughouts. These accounted for single axe production events, as they were clearly associated with single large nodules, presumably excavated from the drift mines.

Similar single event knapping axe production activity was recorded on the north side of Harrow Hill by Bell, in an area adjacent to a mineshaft (McNabb *et al.* 1996, 28). This form of axe production is in contrast the large knapping floor recorded by Holgate in Harrow Hill. The reason for these singular axe-manufacturing events is unclear.

3.5 The results; their wider implications for the other Sussex mines

The excavations of Long Down and Harrow Hill were successful in revealing extraction and axe production practices. New questions on the nature of mining were highlighted, whilst problems, such as developing a mining chronology, were encountered. Many of these difficulties were due to excavating a landscape that has been continuously overturned by episodes of extraction, recycling of mining debitage and finally truncation by agricultural practices.

One conclusion was that mining at both sites dated to the early phases of the Neolithic in Sussex. The quantities of axe-thinning, finishing flakes, roughouts and preforms recovered prove that mine flint was used almost exclusively for producing axes. There was small-scale production of other implements in the later Neolithic or Early Bronze Age, mostly ovates (Fig.3.19), based on the recycling of mining debitage. 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. This raises questions on why communities went to the effort to mine deep flint, a problem that is present throughout this research and denotes why flint mining should be considered as an exception, rather than a norm.

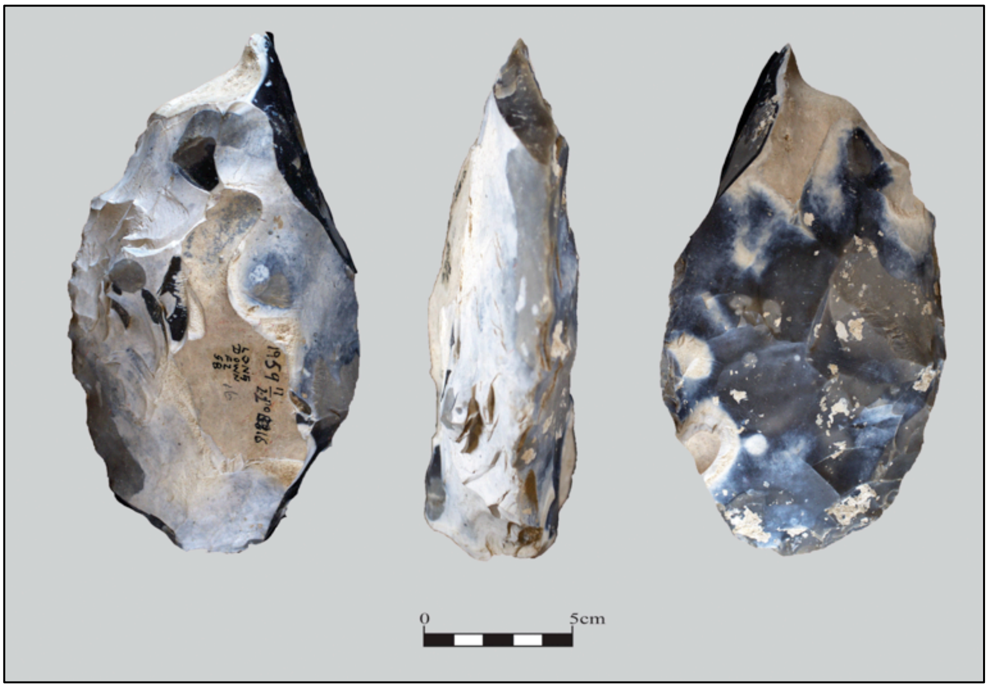

Fig. 3.19: Ovate from Long Down (Author 2016).

3.5.1 The dating of Long Down

Perhaps the most significant finding were new radiocarbon dates obtained from Long Down. The previous results from the 1984 excavation indicated that mining ranged from between the 39th century BC until the 35th century BC, with a probable peak around the mid 38th century BC. This mining chronology was further supported by three of the five the dates obtained for this project from antler picks excavated in the 1960's (Fig.3.20), which extended extraction activity on Long Down into the 36th century BC (Edinborough *et al.* 2019). Two of the dates also indicated later activity on Long Down, dating to the Late Neolithic and Early Bronze Age, supporting the evidence of ovate production noted in the flint assemblage.

Several observations are drawn from these dates, perhaps the most significant of which is the high probability that mining on Long Down was contemporary with at least the earlier phases of activity at the neighbouring causewayed enclosure on Halnaker Hill (Whittle *et al.* 2011. 249-50). It is also apparent that, on probability, mining appears to have commenced on Long Down after the Worthing Group mines (Fig.3.21). Extraction may have commenced on Long Down as activity waned at the Worthing Group mines, with the possible exception of Cissbury (Edinborough *et al.* 2019; Teather 2019). This gives perhaps the first indication of a chronology of Early Neolithic mining for Sussex (Fig.3.22), with an earlier sequence in the east of the county, followed by migration of mining to the west of the county, a point which will be returned to in Chapter Seven.

Fig. 3.20: Antler pick from Long Down (Author 2016).

Finally, the date of extraction on Long Down proves that mining was contemporary with other sites in the Chichester area, outlined in chapter Six, ranging across both the coastal plain and the South Downs. Therefore, it is now possible to view mining on Long Down as a component of a set of practices, customs and monument building that was being practiced in the Chichester area broadly between 4000-3500 cal BC, rather than as an isolated practice, not connected with the wider landscape.

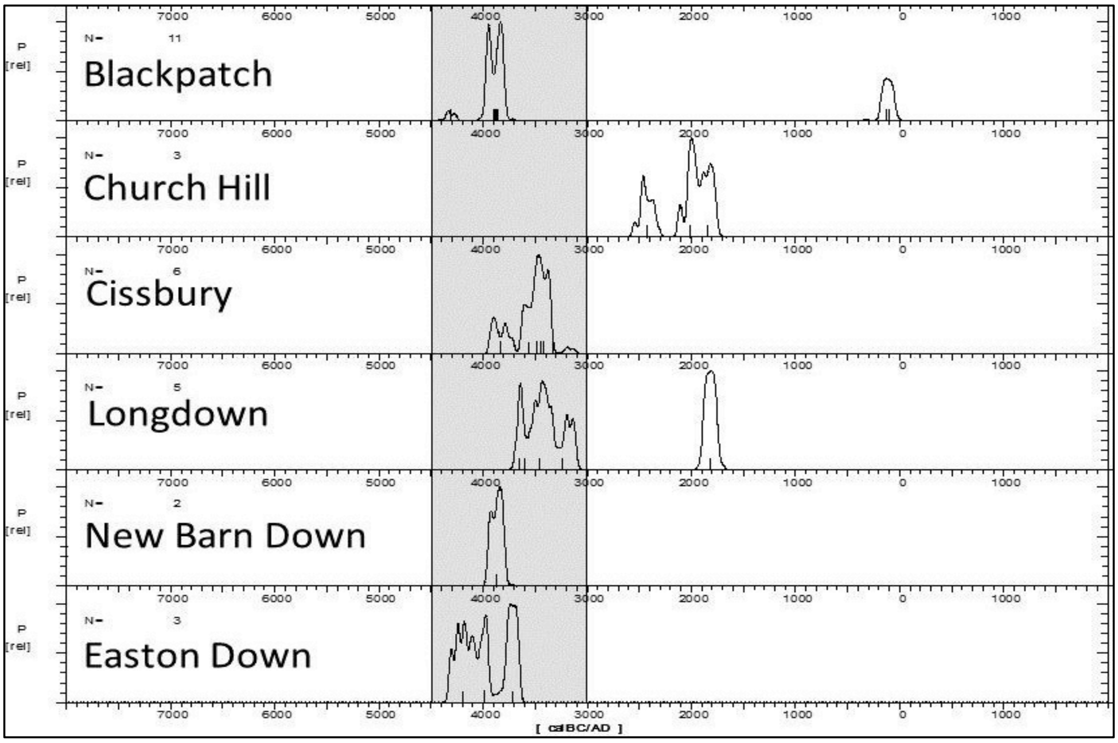

Fig. 3.21: Working life spans of the Sussex mines (Edinborough *et al.* 2019 Fig.9).

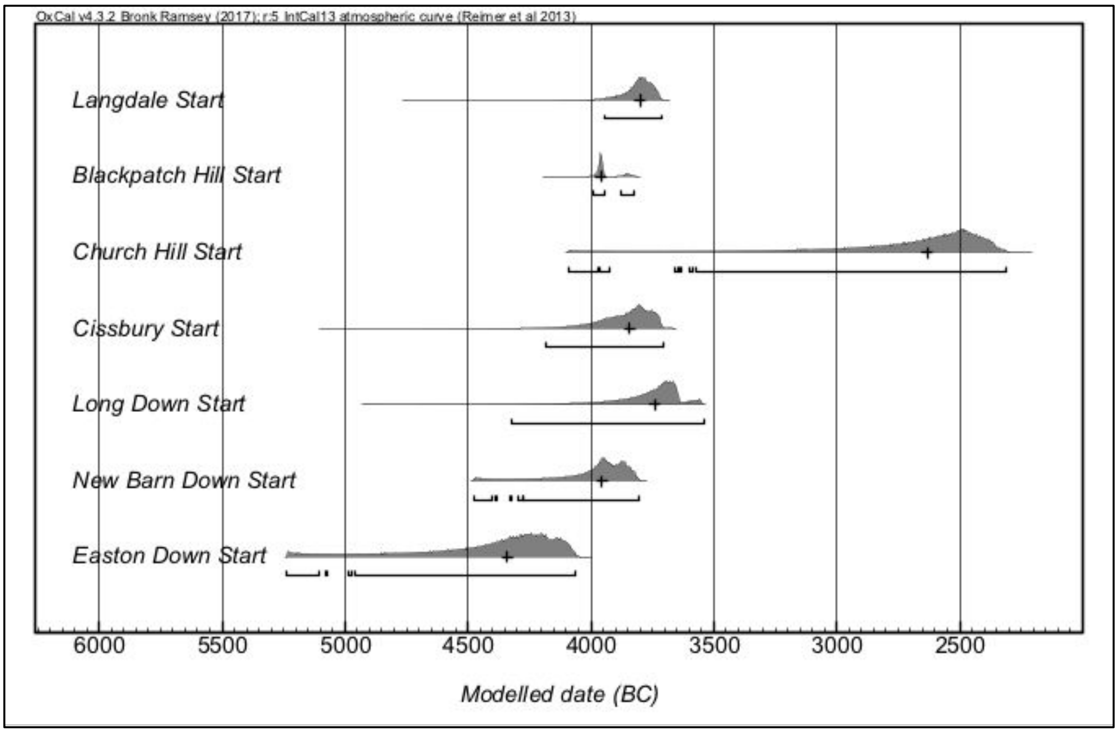

Fig. 3.22: Start date of the Sussex mines (Edinborough *et al.* 2019 Fig.10).

3.5.2 The Harrow Hill drift mines

The discovery of the Harrow Hill drift mines is important and questions what should be considered as 'normal' extraction in the Early Neolithic, as quarrying occurred alongside deep mining and appears less formalised. It may be that the drift mines were the only practical form of mining needed to exploit the single flint 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. Therefore, a dichotomy exists between 'normal' extraction, such as quarrying, and 'exceptional' mining activity, represented by the deep mines.

It is likely that the drift mines are contemporary with episodes of deep mining. The gallery of one deep mine was discovered to possibly join a drift mine on the northern side of the hill (Curwen and Curwen 1926: 109). Also, the spoil from deep mining covers, and is covered by, the waste from the drift mines. However, it is still problematic to place them in a chronological model, as they remain undated and only partially excavated.

Understanding the dating of the drift mines has implications for the chronology of mining of Harrow Hill. For example, if drift mines are earlier than deep mining, does this imply that it preceded and developed into the deeper form of extraction? Alternatively, if they are later than deep mining, why was deep extraction abandoned and drift mining adopted? Finally, if the mines are contemporary with episodes of deep mining, why alternate between the two disparate techniques if the deeper mines undoubtedly produced a greater volume of raw flint? Without knowing their place in the chronology of mining on Harrow Hill it remains difficult to answer these questions.

3.5.3 The working floors

A second major finding of both excavations was the discovery of flint working areas, *in situ* on Long Down and truncated on Harrow Hill. Their discovery is notable, as they link the surface activities to mining and expand knowledge of under-researched zones of production and activity, because the majority of previous research at the

Sussex sites focused on the mine workings. Their discovery also ties into the findings of the surveys conducted for Chapters Four and Five.

The presence of singular large flint working floors at Long Down and Harrow Hill adjacent to the main mine complex parallels findings on Continental sites (Holgate 2019), such as specialised production areas at Rijkholt (Felder *et al.* 1998. 66-7) and Spiennes (Collet *et al.* 2008. 2016). It is also notable that individual knapping events were also undertaken on Harrow Hill (McNabb *et al.* 1996). Whether such activity is contemporary with mining is unknown; it could simply be interpreted as individuals returning out of the mining season to manufacture axes.

Depending on how the data from the working floors and mines is interpreted, varying hypotheses can be developed. 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 it appears that knapping was focused on primary working and secondary thinning, with the finishing of axes taking place away from the mineshafts, possibly along the edges of the main complex, as discussed with the regard to the walk over survey, outlined in Chapter Five. The working floor on Long Down was different, as a higher percentage of small, fine finishing flakes were present and the final stages of axe production was closer to the mineshafts. This could partly be explained by the preservation of the scatter on Long Down, protected by a lynchet.

It is possible that a different more settled production method was employed on Long Down, with communal working floors active while mineshafts were opened and worked. It seems unlikely in such a scenario that the mining groups would settle far from the site, as such activity would have been prolonged over a few weeks, or even months, during and possibly after the mines were worked. This type of knapping is similar to evidence found at Spiennes, with distinct zones of flint working undertaken during, and possibly after a reasonable short and intense mining season (Collet *et al.* 2008, 2016).

If the working floors are the remains of re-deposited middens, as previously argued (Teather 2008), then the presence of *in situ* knapping appears to contradict this hypothesis, as the flintwork would be mixed. However, the recovery of pottery could support the midden hypothesis and it maybe the case, as discussed in Chapter Five, that *in situ* knapping floors have been covered and preserved by middening activity. Such reworking and re-depositing of waste is also not entirely out of character within a mining horizon and reflects the management of spoil, both within the galleries and on the shafts.

3.5.4 The pottery

The fragments of Early Neolithic pottery, possibly Carinated Bowl, from the *in situ* working area on Long Down are significant. Aside from the presence of axes, the Long Down pottery provides a tentative link between extraction sites and Early Neolithic contexts across Sussex, as outlined in Chapter Six. The chronology of Carinated Bowl, the earliest pottery tradition in the British Isles, and Plain bowl pottery, fit well with the proposed dates of mining on Long Down, ranging from between c. 3900/3700 to 3600/3500 cal BC, respectively (Cleal 2004; Whittle *et al.* 2011, 755-62).

The context of the pottery within the mineshaft is of note, as it was in a feature that truncated into the backfill of a mineshaft. It is difficult to interpret this cut feature, but it is unlikely to represent the re-working 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, as observed at Harrow Hill (McNabb *et al.* 1996). Although, it seems improbable that this would take place within a backfilled mine that remained visible on the surface. It may also represent a pit, excavated into the top of the mineshaft and backfilled after items were deposited in it. Certainly, the presence of pottery and a cache of axe roughouts would be in keeping with other items deposited in pits, as outlined in Chapter Six. The fact that the only previous example of pottery from a mine in Sussex is from a midden like deposit in a mineshaft at Cissbury (Lane Fox 1876; See Chapter Five), may also favour a pit interpretation.

It is also of note that the same ceramic vessel may have been broken and distributed between the working floor and the mineshaft. If this is the case then it may evidence a practice whereby the backfilled shafts are being treated like pits, being opened after their backfilling and having items deposited within them. Such votive offerings of deliberately broken pottery are known from other Early Neolithic sites, including the Sweet Track in Somerset (Coles and Orme 1976; Bond 2003, 2004, 2007) and possibly also the Cissbury example (Lane Fox 1876).

Alternatively, the potsherds may have travelled into the shaft during in its backfilling. This process may also support previous suggestions that the working floors are the remains of middens containing waste, such as quantities of pottery and animal bone, from occupation and axe manufacture, (Teather 2008). Such a finding could infer that the miners settled close to the mines, as pottery was unlikely to have been carried far from settlements to be casually lost on a mine. Whichever scenario is correct, the presence of Early Neolithic pottery both in more than one mining context is of note, and shall be discussed further in Chapter Six and Seven.

3.5.5 Conclusion

The differences of chronology, production and practices outlined in this chapter between Long Down and Harrow Hill provide for the first time a concise and in depth study of two flint mine sites which were for a long time presumed to broadly the same.

The chapter has shown that, through a combination of archival research and the production of new data, it is possible to question, re-interpret and re-define traditional narratives on flint mining and Early Neolithic practices in Sussex. This not only highlights the urgency for new research, as undertaken in Chapters four and five, but also the need to re-evaluate previous evidence and data. The rest of this thesis will now focus on the production of new data by fresh fieldwork.

Chapter 4 The geophysical survey of two flint mines

4.1 Introduction

As a major objective of this project, geophysical surveys were completed at two flint mines, Harrow Hill and Long Down. Both sites are in good condition with landowners who were willing to grant permission for the surveys. Due to the research carried out by Holgate, forming Chapter Three, a good level of knowledge existed on the mining landscapes that would be expanded on, and tested by further surveying.

Originally it was proposed to carry out three seasons of surveys, across 2017, 2018 and 2019. Unfortunately, the 2018 survey was abandoned due to a heat-wave making field conditions hazardous. However, it was possible to complete a full survey of the upstanding remains of the Long Down mines and a meadow located to their south in 2017 and 2019. On Harrow Hill, an area of the upstanding mines was surveyed, alongside an open area to their south in 2019. It was proposed to return to Harrow Hill in 2020 to complete the southern area, however, this was not possible due to the COVID-19 pandemic. Proposed test pitting on Long Down scheduled for 2020, targeting anomalies identified in the geophysics survey was also cancelled.

Both surveys were successful in identifying probable mineshafts no longer visible as surface remains outside of the main upstanding complexes. Additional features related to mining or other activates were recorded, including pits and possible structures. During the course of the survey other aspects of the mining horizons were also recorded, including a surface scatter on Harrow Hill, described in Chapter Five.

Prior to the surveys, landowner permission was sought for both sites, followed by the submission of two Section 4 applications to Historic England, which should be referred to for technical data, methodologies, raw data and grid plans (See Appendix 4).

4.2 Harrow Hill

(Appendix 4.1)

It was decided to initially conduct a magnetic survey on Harrow Hill, because it was hoped that mineshafts would give clear geophysical signals as they are cut into bedrock and have differential filling in their upper layers, composed of washed in silts and clays. Magnetometry would also allow quick collection of results across a large area. After the results of the magnetometry survey were reviewed and possible mineshafts identified, it was decided to sample a small area with Ground Penetrating Radar (GPR). This would allow mineshafts to be clearly identified, as GPR can penetrate the ground up to a depth of 6m and may confirm the existence of galleries.

The survey of Harrow Hill was conducted over a week in mid June 2019 during warm and sunny weather. In total 27 30x30m grids were surveyed, amounting to c. 24,300m^2 of the initially proposed 40,000m^2 survey.

4.2.1 Background to survey

Archaeological interest in the flint mines on Harrow Hill is longstanding, with previous historic excavations of mineshafts (Curwen and Curwen 1926; Curwen 1937; Holleyman 1937; McNabb *et al.*1996) and parts of the wider mine complex (Baczkowski and Holgate 2017), as outlined in Chapter Two and detailed in Chapter Three. Of importance to the selection of Harrow Hill was the discovery of a large Early Neolithic pit on New Barn Down, c. 650m to its south, which contained material connected with the mines (See Chapter Six).

These investigations meant that knowledge already existed on three aspects of the flint mines on Harrow Hill: firstly on the immediate mining horizon, both within the galleries and the mining surface (Curwen and Curwen 1926; Holleyman 1937; McNabb *et al.* 1996); followed by the broader mining environment, represented by drift mines and flint working floors (Holgate 1995a; Baczkowski and Holgate 2017; Holgate 2019; See Chapter Three); and finally on the wider landscape in the form of an Early Neolithic pit (Curwen 1934; Backzowski 2019a; See Chapter Six).

It was therefore possible to develop background knowledge on areas of the landscape surrounding the mines using previous data with that collected for this project. This would also enable the development of a targeted methodology for surveying and interpreting the results from specific areas of a mining horizon, which would prove vital to the much larger survey of Long Down.

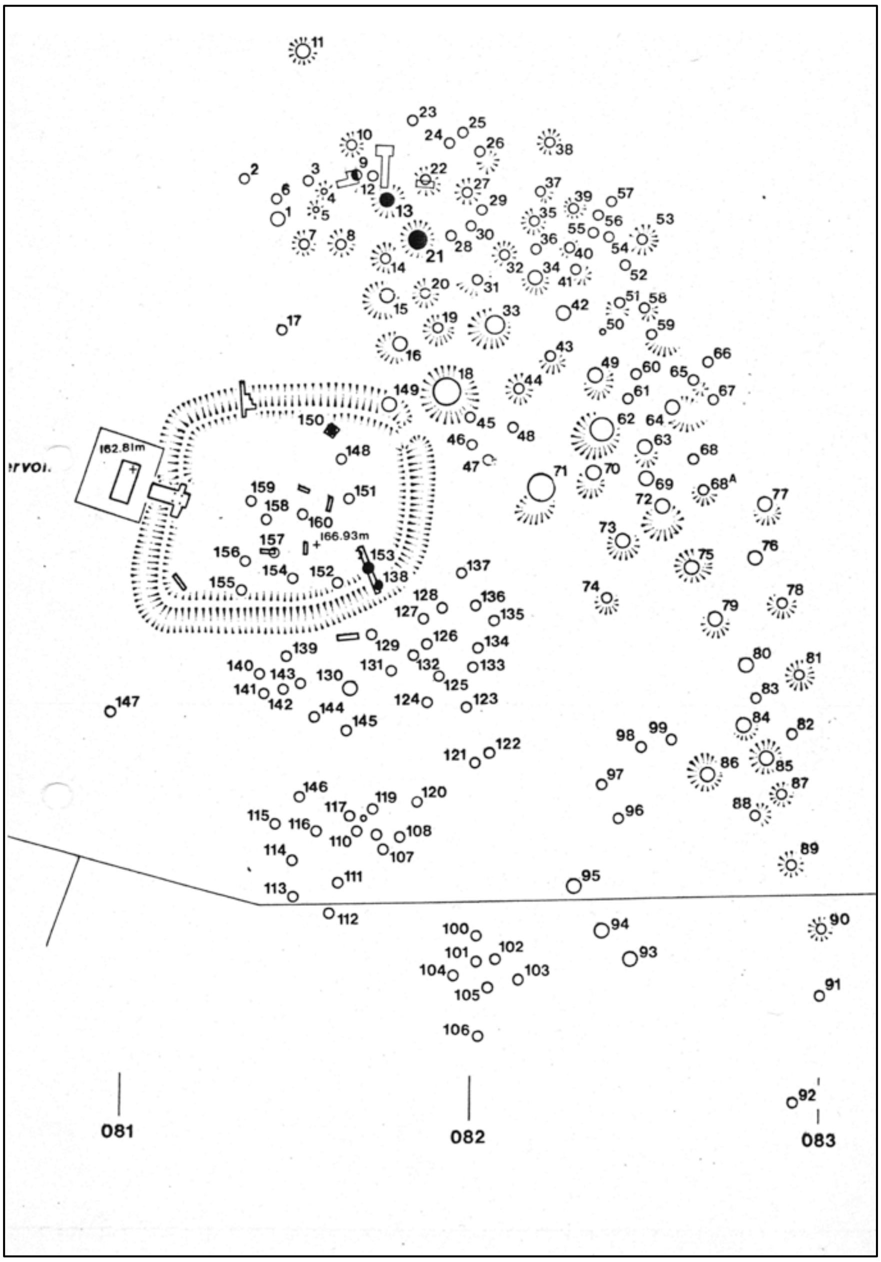

Fig. 4.1: Plan of Harrow Hill shafts by Curwen 1937 (adapted by F. E Aldsworth).

For this survey two primary plans of the flint mines on Harrow Hill were used, firstly a plan by Fred Aldsworth (Fig.4.1) based on a survey undertaken by Curwen, who surveyed 161 mineshafts (Curwen and Curwen 1926. 104). Holgate adapted this original plan for the 1986 fieldwork and (Fig.4.2). Sieveking and Bell also adapted this plan for their excavations carried out in 1982 and 1984, respectively (McNabb *et al.* 1996).

The Royal Commission on the Historical Monuments of England (RCMHE) produced the definitive plan of Harrow Hill in 1994 (Oswald 1994; Fig.4.3), which was re-produced in the English Heritage monograph, *The Neolithic Flint Mines of England* (Barber *et al.* 1999). This survey of the upstanding remains added an additional 84 shafts, making a new total of 245 shafts. The upstanding remains were divided into four different types (Oswald 1994. 7), a useful exercise for this project's survey, as follows:

- Single shafts, generally sub-circular and independent from other workings, although possibly connected to other shafts by galleries. Their spoils heaps were located close by.
- Single shafts with an adit-like access channel, sub-circular and mainly found in the eastern end of the mine complex. A spur of spoil has been pushed downhill of the shaft and turned into a channel up to 0.5m deep by dumping either side. The spoil often overlies earlier workings and shafts.
- Multiple shafts occurring in density. It is unclear if single shafts were independent of adjacent shafts and where relationships are distinguishable, it may be that shafts are located around a central spoil heap. It was not ascertained if shafts were paired, as found at other mines.
- Multiple shafts excavated sequentially, similar to type 2 in plan. These are presented as long channels excavated upslope. A proposed methodology for their formation is that a single shaft was sunk, followed by another upslope in a linear arrangement, with spoil backfilled into the former downslope workings. Up to four shafts may have been sunk like this and connected by a single access channel. These occur mostly on the steep slope on the eastern part of the mine complex.

Although this typology is based on interpretation of earthwork remains with minimal input from the excavated mineshafts, all Type 1 workings, it was helpful in the interpretation of shafts recorded in the data without visible surface remains. This categorization also raised several questions that could be investigated within the geophysical results. For example, do the elongated ovals and linear trenches, proposed as Types 2 and 4, have mineshafts beneath them, or are they evidence of a different form of extraction, such as quarrying?

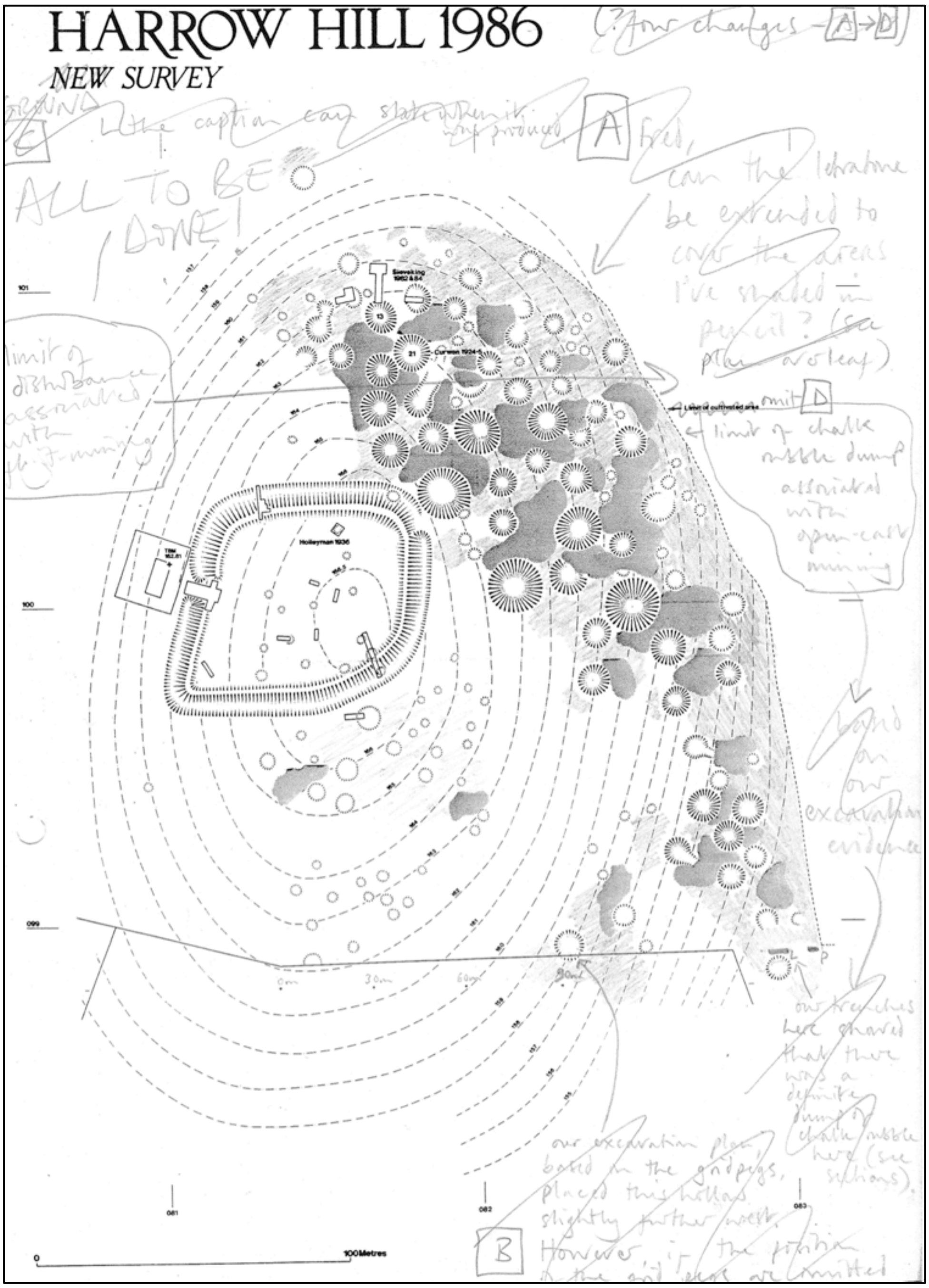

Fig. 4.2: Plan of Harrow Hill shafts by F. E. Aldsworth with notes by Holgate 1986.

Fig. 4.3: Plan of Harrow Hill by RCHME (Oswald 1994 Fig. 10).

4.2.2 The Landscape

Aside from the flint mine, Harrow Hill is crowned by a Late Bronze Age Martin Down style enclosure (Hamilton and Manley 2001) and is surrounded by lynchets and field-systems, many of which are probably Romano-British in date (Oswald 1994). Historically, little agricultural activity appears to have occurred on Harrow Hill and it largely escaped emergency ploughing in World War II, in contrast to the neighbouring Bronze Age settlement on New Barn Down that was destroyed c. 1940-45.

The first Ordnance Survey (OS) map of Harrow Hill, dated to 1876-77, shows the hill as open and lightly covered in scrub (Fig.4.4). The Bronze Age enclosure is marked as a 'camp'. There is no reference to the flint mines, beyond a few dotted symbols. Little changes until the 1960s when a reservoir is present in the southwest of the mines (Fig.4.5). By the 1970s OS map Harrow Hill has taken its current layout, with a boundary running east to west and dividing the mine remains from arable fields to the south (Fig.4.6). A second reservoir has been built surprisingly close to the western edge of the Bronze Age enclosure, presumably to replace the other reservoir now marked as 'disused'.

The area of Harrow Hill, including the mines themselves, were also used for military exercises during the World War II being part of the much larger South Downs training area (S. Angell pers comm. 2019). Surface finds of mortar shells are still present around the mines and complex, indicating that a firing range may have been located close by, or that the hill was used for informal exercises.

On the earliest known aerial photo of Harrow Hill, dated to the late 1950s, the mine complex is in excellent condition (Fig.4.7). In recent decades ploughing has damaged areas of Harrow Hill and has truncated the southern part of the mine complex, and it is clear that the mineshafts surveyed in 1994 are no longer discernable (Fig.4.8). Ploughing also appears to have levelled spoil heaps associated with mineshafts and drift mines recorded in the 1986 fieldwork (Fig.4.9). More recently, an east to west boundary along the south flank of the hill had also been moved southwards by c. 100m and the area within set-aside for grazing (Fig.4.10). This former arable field would form a considerable part of the survey area.

The visible remains of the mine workings and the Martin Down enclosure are protected as a Scheduled Monument (List Entry Number: 1015239), being managed as open chalk grassland. The majority of the southern flank of Harrow Hill, which also includes New Barn Down, is currently used for seasonal grazing and as arable land. The remaining areas of Harrow Hill, including the steep slopes of the northern, western and eastern flanks, and the surrounding fields fluctuate between open grasslands used for grazing and areas of scrub, used seasonally for game bird shooting.

On the whole, apart from the ploughing on its southern flank, the mines on Harrow Hill survive well and measure between 3m-20mø (Fig.4.11). Harrow Hill experiences little footfall or bike use, as with other areas of the South Downs, due to a lack of public access and in contrast to Cissbury which is open access land and popular with the general public. This relative isolation means that on Harrow Hill it is still possible to find abundant surface finds relating to mining, such as debitage and axe roughouts (See Chapter Five), and these have not been collected idly by the general public or purposefully by lithics collectors, who are known to have removed material from Cissbury for decades.

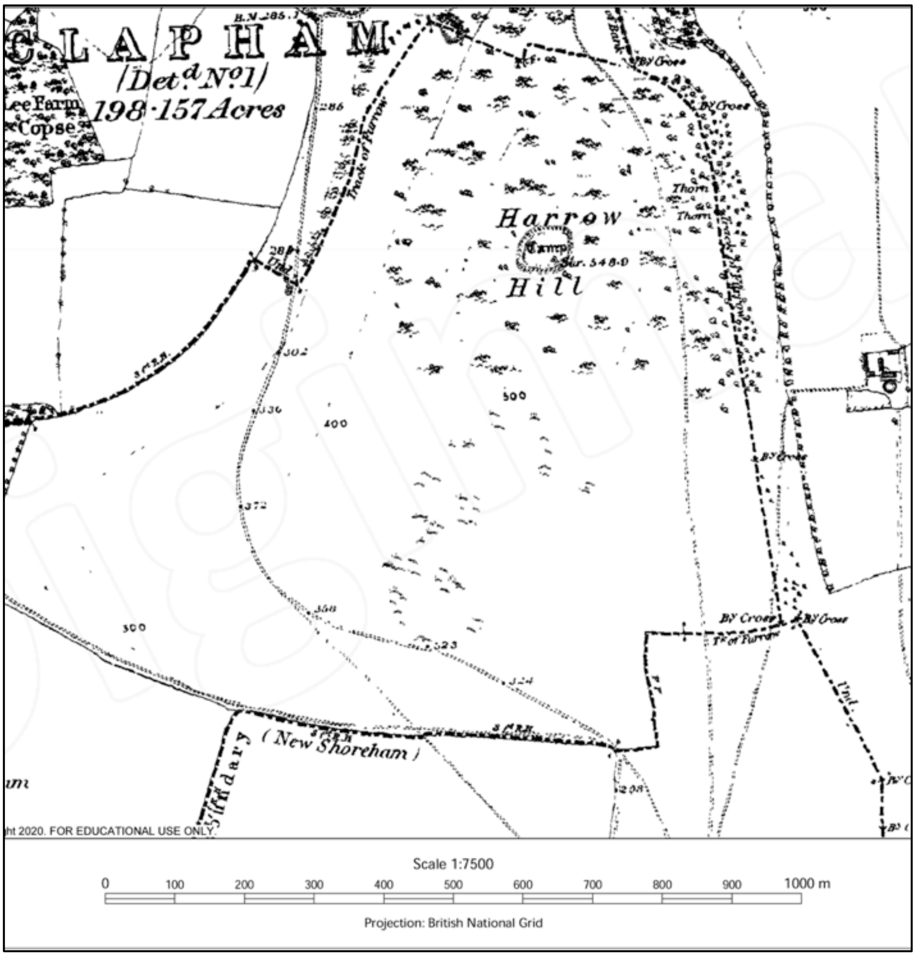

Fig. 4.4: OS map of Harrow Hill, 1876-77
(Crown copyright and database rights 2020 Ordnance Survey 100025252).

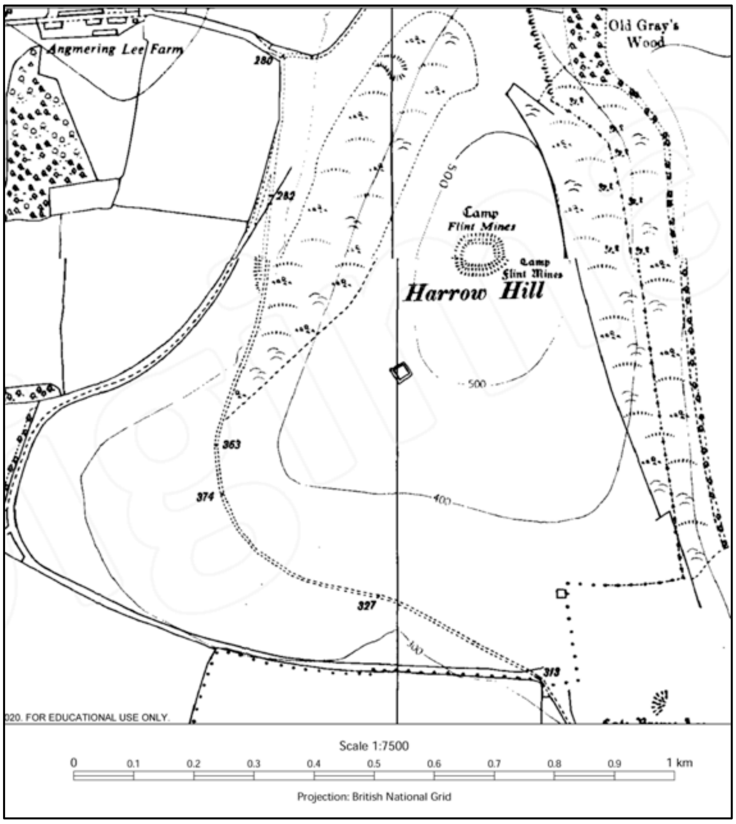

Fig. 4.5: OS map of Harrow Hill, 1960
(Crown copyright and database rights 2020 Ordnance Survey 100025252).

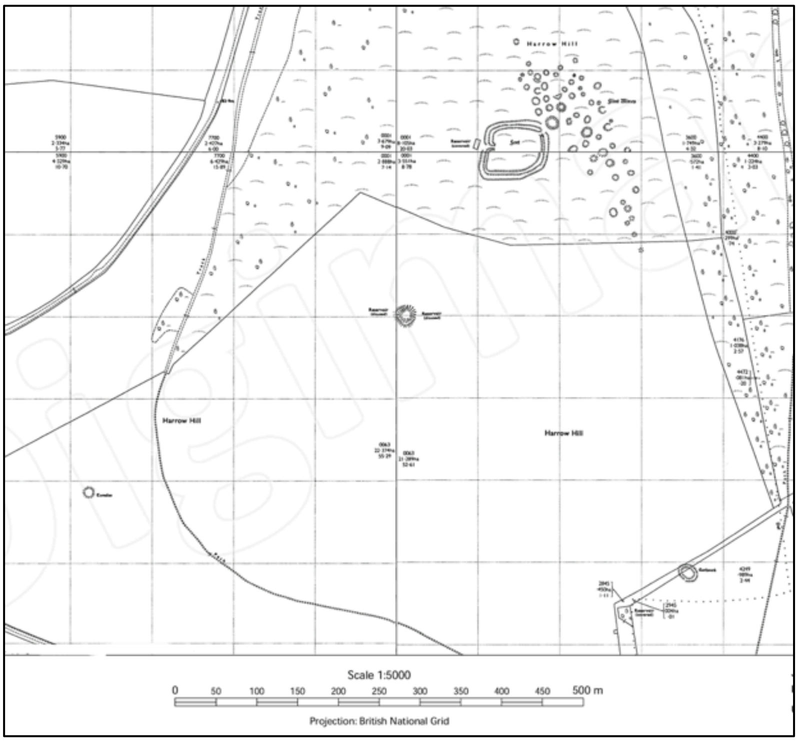

Fig. 4.6: OS map of Harrow Hill, 1970
(Crown copyright and database rights 2020 Ordnance Survey 100025252).

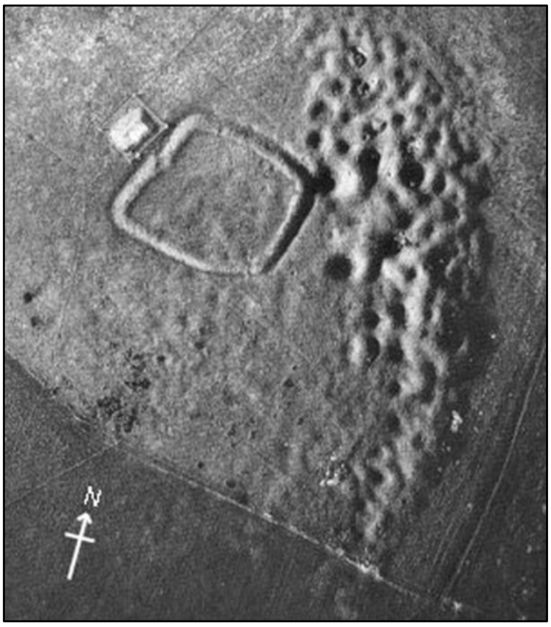

Fig. 4.7: OS map of Harrow Hill, 1970 Aerial photograph of Harrow Hill c. late 1950's (Lewes Barbican House).

Fig. 4.8: Harrow Hill in 2019, viewing south across a former area of mines (Author 2019).

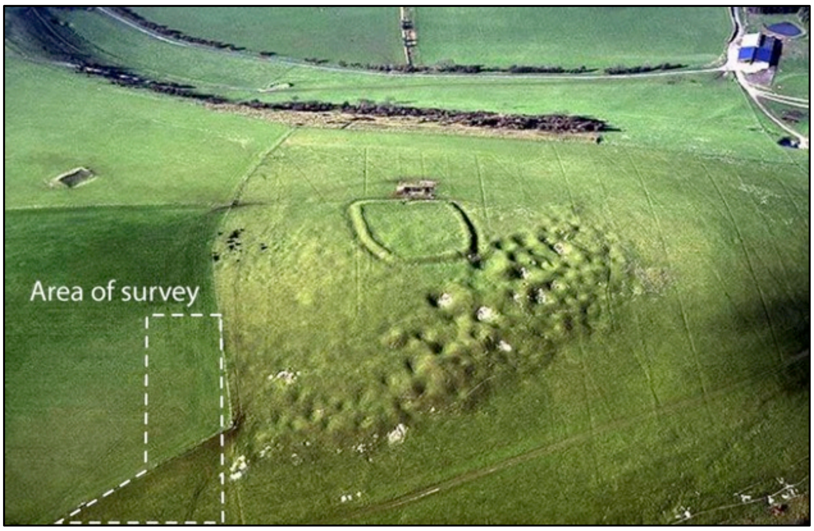

Fig. 4.9: Harrow Hill in 1995, viewing west
(1995 © Crown copyright. Historic England Archive ref: nmr 15209/31).

4.2.3 *Focus of Survey*

Once permission had been granted by the land agents of Harrow Hill, the Angmering Park Estate, it was decided to focus survey on an area to the south of the mines (Fig.4.10). This is now an open area of grassland, but previously contained the upstanding remains of mine workings located at the southern end of the main mine complex. The survey area was suitable for geophysics, being flat and free of scrub. It was also one of the few areas of Harrow Hill, apart from the Bronze Age enclosure and upstanding mine remains, which is free from cultivation or activities associated with game bird shooting. Until recently the southern half of the survey area had also been cultivated and the mine workings were no longer visible as surface remains and would therefore only be revealed by geophysics.

The area chosen for survey overlaps with the southern part of the mine investigated by Holgate, containing drift mines and working floors. Holgate had also commissioned a limited geophysical survey in this area that, despite its time (being conducted in 1990), managed to relate the surface remains to anomalies probably representing mineshafts and possible galleries (See Appendix 3.5). Therefore, the survey area extends southwards from both the Scheduled flint mines and the area investigated by Holgate. It was also decided to extend the survey to the east and south into an area that connects Harrow Hill to New Barn Down (Fig.4.12). Unfortunately, it was not possible to return to this area to complete the survey in 2020 due to the COVID-19 pandemic.

By choosing this area it was hoped that the now levelled mineshafts, previously mapped by English Heritage as surface remains (Barber *et al.* 1999), would be picked up in the data (Figs.4.3). It was also hoped that more drift mines would be visible in the data. The gathering and analysis of such information would allow flint mines to be characterised in geophysical data, which in turn would aid in their identification to assess areas of mining landscapes destroyed by ploughing. It was reasoned that this characterisation would aid in differentiating between mineshafts and other features, either mining or non-mining. It would also be possible to compare the new results against those collected in the previous fieldwork and geophysical survey, as areas of both surveys overlapped and in particular the earlier geophysics results were largely non-conclusive in identifying mineshafts (See Appendix 3.5).

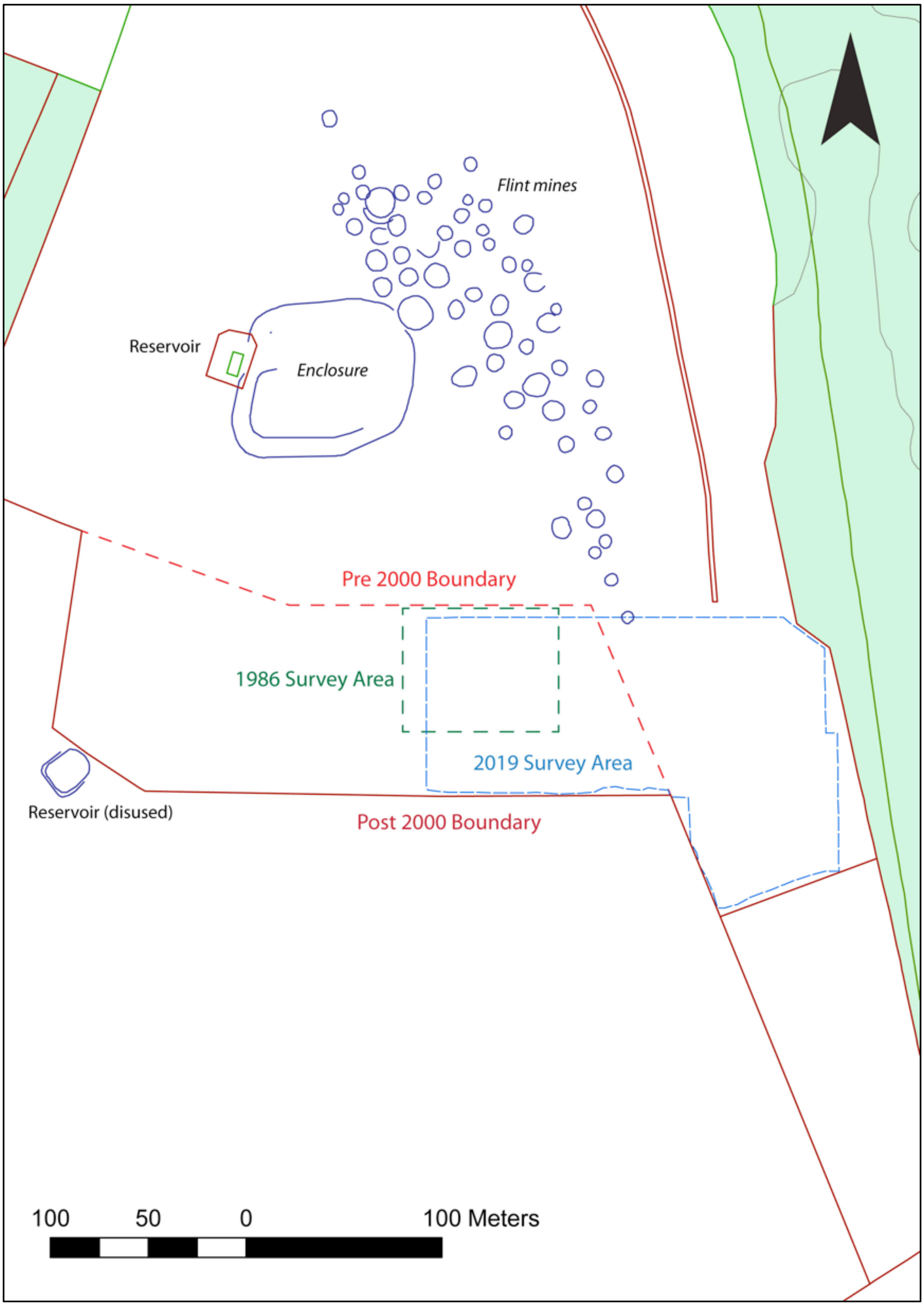

Fig. 4.10: Harrow Hill, showing relocated boundaries, plus 1986 and 2019 survey areas (Author).

Fig. 4.11: Harrow Hill, showing current condition of mines and enclosure, viewing southwest (L. Fisher 2017).

Finally, it was proposed that the geophysical survey, combined with a visual walkover survey, would allow assessment of damage to the flint mines recorded in 1994 by the RCHME (Oswald 1994; Barber *et al.* 1999). The assessment of plough damage is important in establishing how the original scale, form and character of flint mines have been changed historically and more recently by agricultural activates. The findings of this assessment were included in the report issued to Historic England and are discussed in Chapter Five.

4.2.4 Aims

The key aims of the geophysical survey on Harrow Hill were:

- To develop knowledge on a blank part of the Early Neolithic mining landscape by surveying a small area to the south of the main mine complex and an area investigated in 1986; and,
- To reveal the size and extent of the flint mines and reveal any features related to mining that are not visible on the surface, such as test shafts or evidence of structures; and,
- To investigate the presence of any archaeological features, such as pits or structures, which maybe associated with mining activity and located in the wider extraction landscape; and,

- To progress knowledge of Neolithic mining practices on Harrow Hill by allowing the boundary of the mines to be mapped, thus aiding in future assessment of the scheduled area of the mine complex.

Fig. 4.12: Harrow Hill, showing intended survey area and New Barn Down, Pit X (Author).

4.2.5 Methodology

With regards to Harrow Hill the data was collected north to south across the angle of the slope, as it was hoped this would give clearer readings than collecting with the slope, from east to west. All grids were staked out using non-invasive markers with a

Global Positioning System (GPS) and Global Navigation Satellite System (GNSS) Rover Receiver. The magnetometer survey was carried out with a Geoscan Research FM256 fluxgate gradiometer, and the resulting data was processed in Geoscan Research Geoplot 3 (Geoplot). The fluxgate gradiometer survey was conducted using 30mx30m grids with readings taken at 0.5m intervals along traverses spaced 1m apart at a resolution of 0.1nT.

The GPR survey was carried out within the area of a grid that contained a notable magnetic anomaly, assumed to be a mineshaft. The GPR data was collected with a Radiodetection LMX 100 mounted on a handcart. The survey was conducted across a 30x60m grid with scans collected at 0.0295m along traverses paced at 0.25m intervals. The collected data was analysed using REFLEX software, with each traverse analysed as an individual profile to allow a manual abstraction of archaeological features. Ground conditions made collection of the GPR data with a handcart difficult, as a great deal of large flint nodules associated with mining still litter the surface and the ground is rutted.

A cautious approach was used to interpret the geophysical anomalies, which were carried out with the following parameters;

- ‘Shafts’, any oval or sub-circular positive anomaly over 3m^{ø}
- ‘Shaft/Pit’, any oval or sub-circular positive anomaly between 2-3m^{ø}
- ‘Pit’, any oval or sub-circular positive anomaly up to 2m^{ø}
- ‘Gully’, any curving linear positive anomaly under 5m of length
- ‘Quarry’, any sub-oval or amorphous positive anomaly over 2m in length.

Due to the World War Two activity on Harrow Hill dipolar anomalies were dismissed outright, in case they represent shrapnel fragments or buried metallic material, such as food tins. The majority of the metallic dipolar signals were filtered out in the processing software, however several large dipolar anomalies remained in the data and may relate to high amounts of metallic material buried in the top of mineshaft depressions. The former boundary runs across the centre of the survey area and also contained a mass of dipolar signals (Fig.4.13), which may represent shrapnel and other metallic material deposited by a plough as it turned along the edge of the boundary.

4.2.6 Results
(Table 1)

A total of 304 clear geophysical anomalies were recorded in the 2019 survey (Fig.4.14). Of this total the number of ‘shaft’ like anomalies was 84, along with 37 possible ‘shafts/pits’ (Table 1). A total of 162 circular or oval features measuring under 2m^{ø} are classified as pits. The survey was successful in recording geophysical anomalies clearly relating to known mineshafts (Fig.4.15). In total seven mineshafts known to previously exist as surface remains in the survey area, Numbers 90, 92, 93, 94, 102, 103, 105 (Oswald 1994), plus an additional three numbered shafts surveyed by Holgate (Holgate 2019).

At the central northern part of the survey area two large negative anomalies align perfectly with the locations of shafts Number 93 and 94. Both mineshafts give clear indications in the data and can be used in the identification of others. Smaller shafts, pits or open quarries also seem to surround these large mineshafts.

Table 1: Harrow Hill totals

Type	**Number**
Shaft	84
Shaft/Pit	37
Gully	2
Pit	162
Quarry	19
Total	308

Of particular note were a group of three shafts, Numbers 102, 103, 105, in the northwest corner of the survey area that clearly aligned with large positive anomalies (Fig.4.15). These are surrounded by a further three anomalies of similar size and form interpreted as mineshafts. Another group of 14 probable mineshafts are located south of this group.

Towards the centre of the survey area shaft Number 92 is clearly visible in the data as a large geophysical anomaly. This is surrounded to the west by three other shafts and as possible quarry to its east. Shaft Number 92 is clearly a large isolated mine, which appears to be part of a line of five similar sized shafts, running upslope to the south of the main complex. Tentatively, it is proposed that these singular mineshafts are the southern most extension of the mine complex (Fig.4.15).

A further 37 ‘Shaft/Pits anomalies are mostly scattered amongst the large shafts and may be smaller shafts, test shafts or drift mines (Fig.4.15). Also present within the area of large mineshafts are 19 large curving linear, or elongated, pits that may represent quarries. One of these features measures c. 8m long and is located close to the central area of the northern boundary. The form of this feature is hard to distinguish and it may represent a series of intercutting pits, or a quarry. It is however located immediately south of the drift mines discovered by Holgate (See Chapter Three) and is possibly a continuation of the drift mine. Other similar anomalies, interpreted as quarries and presented in the data as an elongated features cut across the slope, may represent drift mines.

Other anomalies recorded in the survey include gullies and pits, which are more difficult to interpret (Fig.4.16). Some could be small shafts or large pits associated with extraction. This is particularly likely with those located close to the probable mineshafts. However, others may be the remains of pits of unknown dates or function, such as alignment in the southwest corner of the survey area and several small groups in the southeast area (Fig.4.16). A pair of curving gullies is difficult to interpret and could be tree-bowls, simple extraction features or associated with structures, such as roundhouses, or even date to World War II.

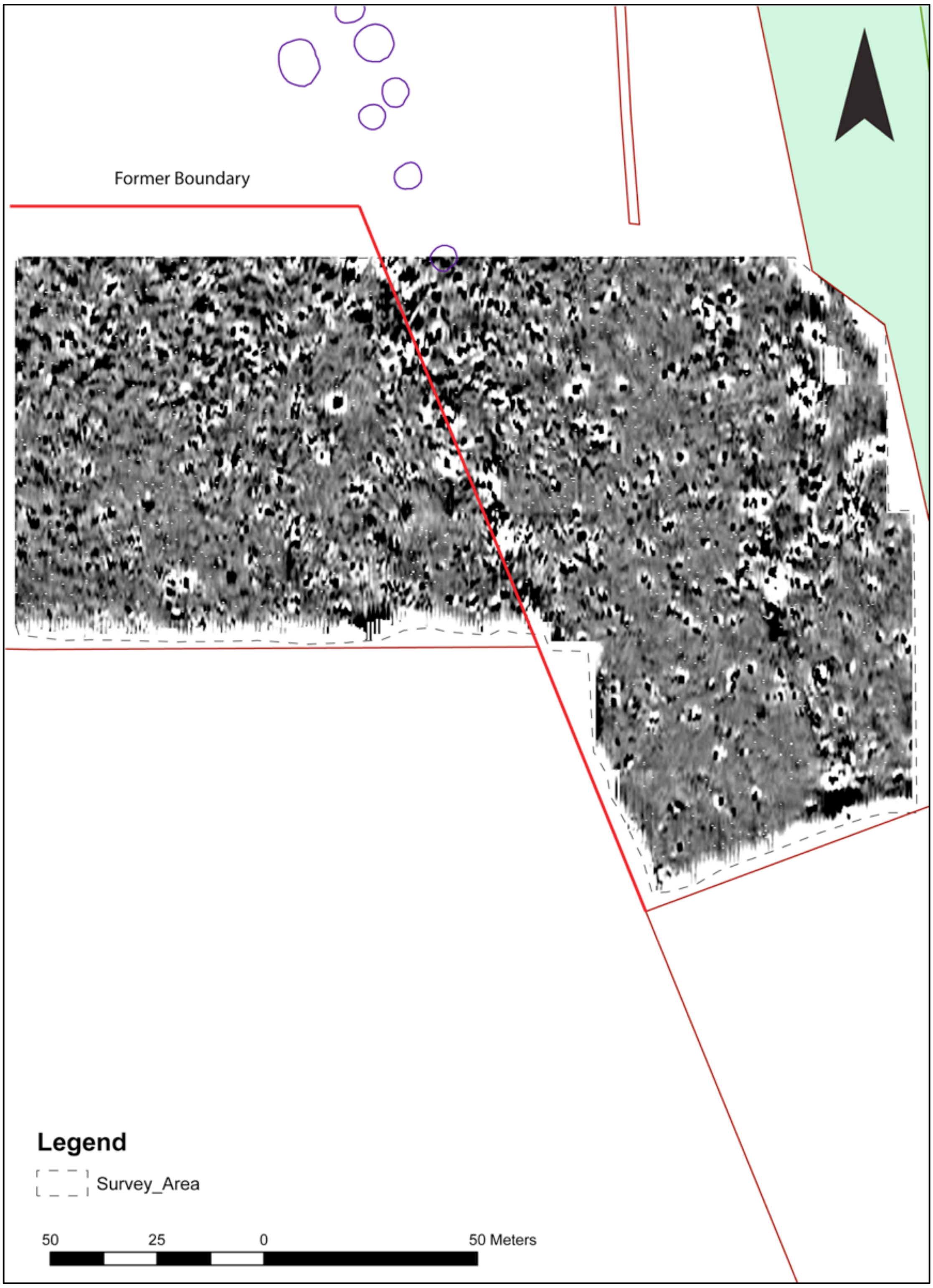

Fig. 4.13: 2019 Magnetometry survey results (Author).

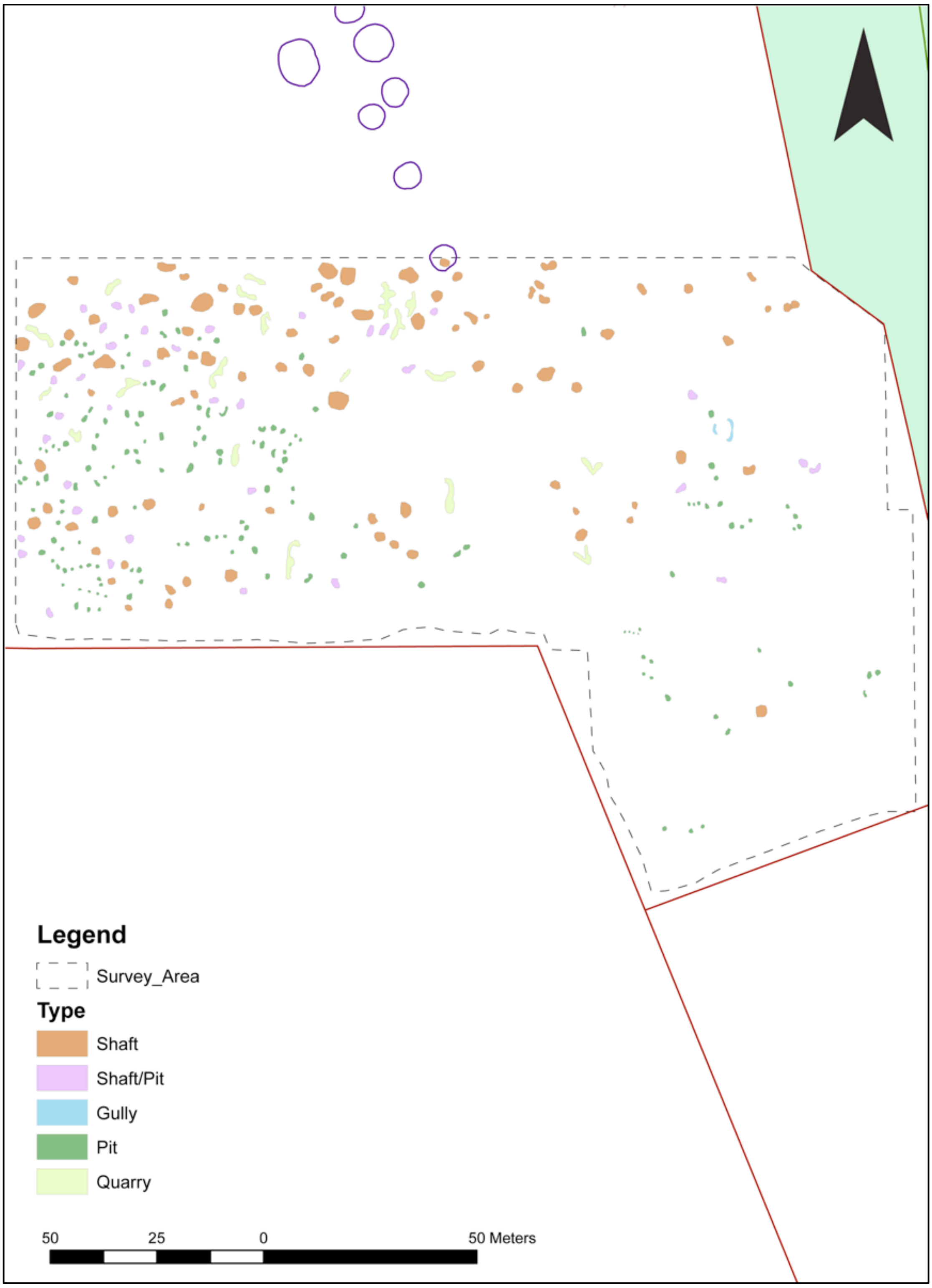

Fig. 4.14: 2019 Magnetometry interpretation, all features (Author).

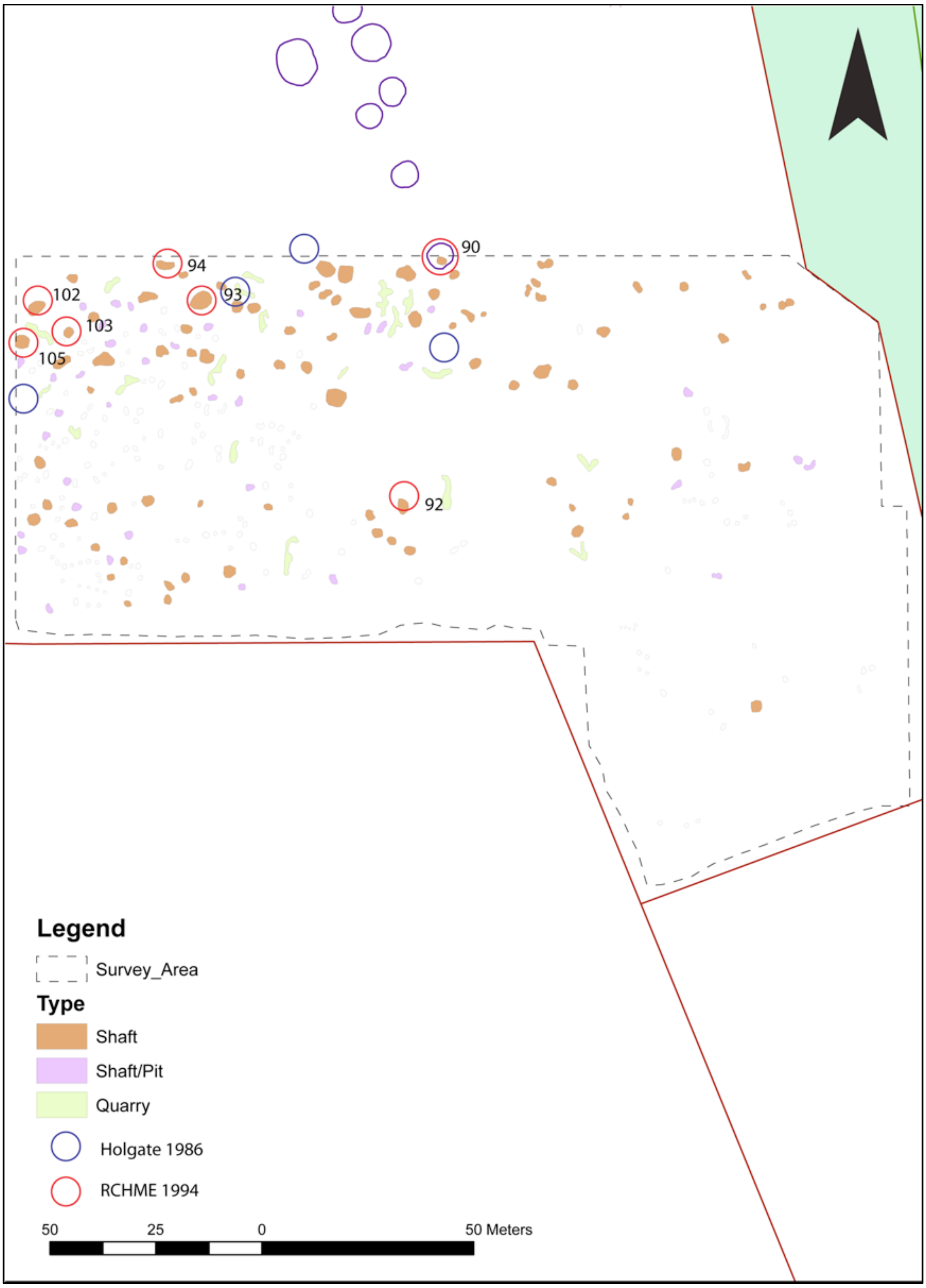

Fig. 4.15: 2019, showing 'Shaft', 'Shaft/Pit' and 'Quarry' (Author).

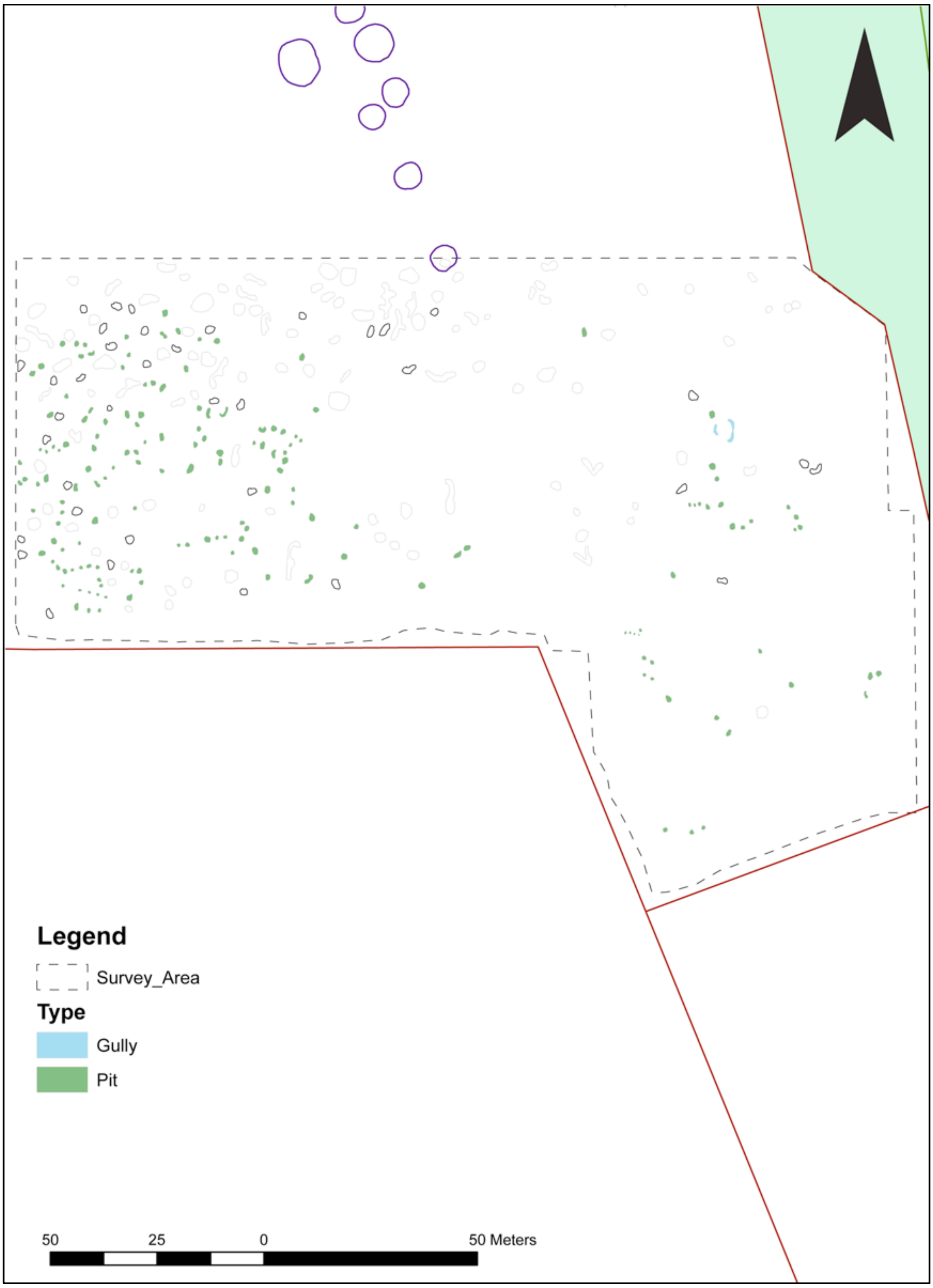

Fig. 4.16: 2019 showing 'Gully' and 'Pit' (Author).

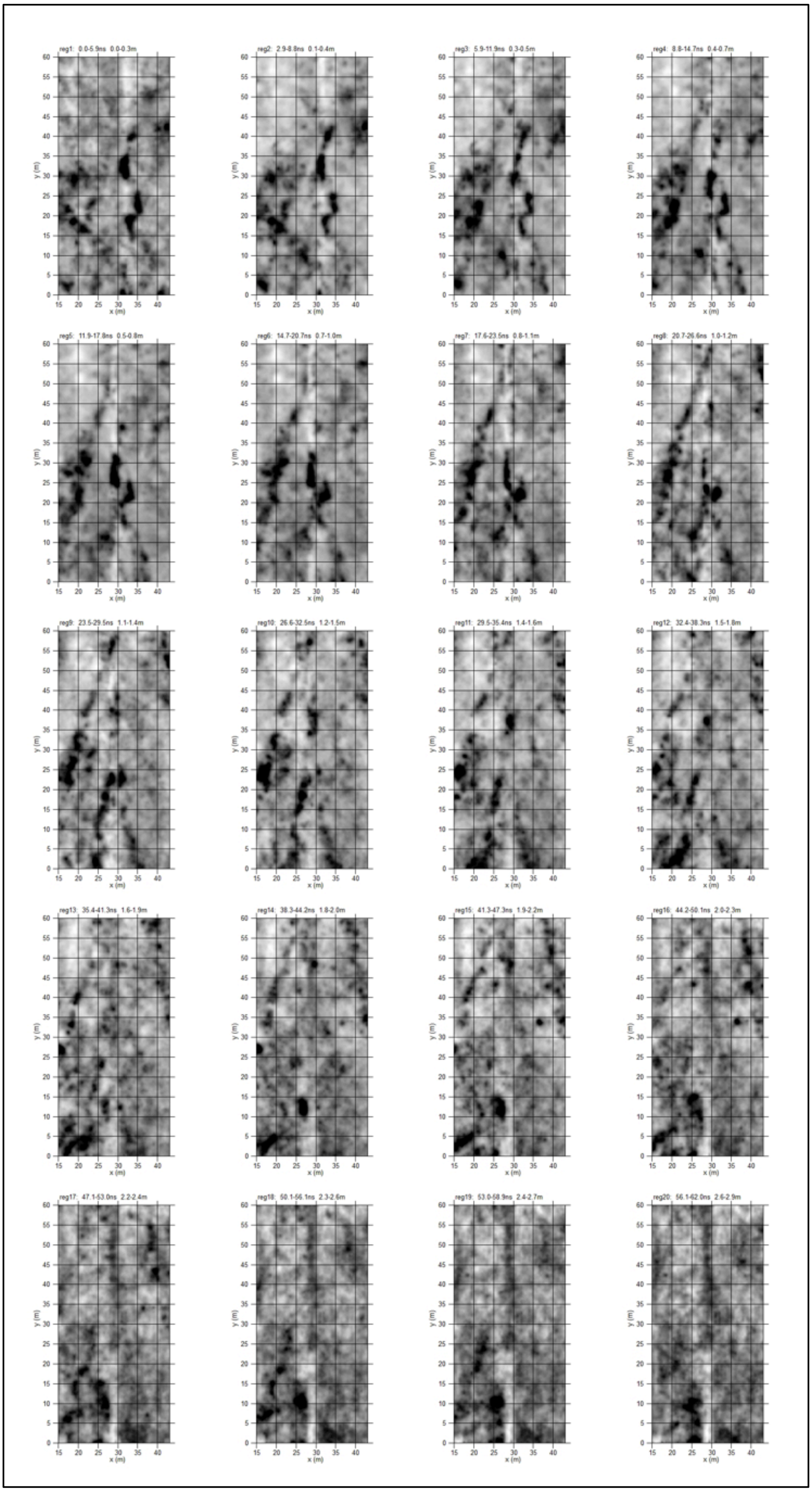

Fig. 4.17: 2019 Ground Penetrating Radar survey results.

4.2.7 *The GPR Results*

The results of the GPR survey (Fig.4.17), placed to investigate shaft Number 92 are of note. Within the data a series of large linear and oval structures begin on the surface and are still visible at depth (See Appendix 4.1). Several amorphous linear features continue until c. 2m of depth. They appear to relate to faint anomalies present in the magnetic data and it is perhaps notable that they run parallel to the slope in roughly the same location and alignment as the confirmed drift mines located c. 60m to their north. It is therefore considered possible that these features represent drift mines.

Several circular features are visible in the data that continue until depths of 4m. One large anomaly in the southern end of the sample grid is still visible at 6m of depth. Unless these features are geological in origin, such as solution pipes, which infrequently develop on chalk bedrock in Sussex (Nowell 2007), although none are known in the area of Harrow Hill.

4.2.8 *Discussion of results*

The survey successfully recorded c. 40-70 probable mines, of which seven were previously known. The large negative anomalies undoubtedly relate to mineshafts and not to World War II activity. The negative anomalies are too large for craters left by mortar shells, which would probably not penetrate chalk bedrock, and they do not have strong dipolar signals that would be expected if numerous fragments of shrapnel were present from any other forms of ordnance. It appears that much of the World War II material has been re-deposited by ploughing along the line of the former field boundary.

With regards to the findings of the RCHME survey (Oswald 1994), the only mineshafts present in the survey data are Type 1, singular shafts, and Type 3, multiple shafts. It is expected that these forms of mines would join to basal galleries. There is also evidence of paired mineshafts, or workings that were sunk very close together. There is no evidence of Type 4 mineshafts, proposed as multiple sequential mineshafts joined by channels, as no linear features were present in the data. As no surface remains are visible in the survey area it is unknown if any mineshafts could be classified as Type 2, shafts with surface adits, although again, there were no clear linear quarries recorded in the data, as found on Long Down (See below). Overall, most of the shafts are large, singular and surrounded by smaller shafts or pits, or smaller, but within denser areas of mining features.

The arrangement of some of the large shafts is similar to those recorded by Sieveking (McNabb *et al.* 1996), consisting of a central shaft surrounded by smaller ‘satellite shafts’, described at Type 3 mines in the RCHME survey (Fig.4.18). This implies these mines are almost certainly contemporary with the known excavated examples and are Early Neolithic in date. Other probable shafts are more isolated and singular, more typical of Type 1 mineshafts. Most notable are several located in the southeast end of the survey area. These are likely to be mineshafts, due to their size and form, although their date is unknown and they could represent earlier, or later episodes of mining.

The probable extension of the drift mines to the south of where they were excavated is of note and indicates that these may well extend along the south flank of Harrow Hill. Their dating is still problematic, as discussed in Chapter Three, although it is notable that they do not appear to either cut, or are cut by any mineshafts, indicating, as previously proposed, that they are contemporary with deep mining.

A line of possible large mineshafts along the southern edge of the survey area, including shaft Number 92, could represent the limit of deep mining on Harrow Hill to the south of the main complex (Fig.4.15). Other possible shafts do exist south of this line, although these are isolated and could represent outliers to the main complex. Similar features interpreted as outlying mineshafts are also located to the north of the main complex (Oswald 1994).

Mining debitage and axe roughouts were recorded on the surface of the survey area. These will be detailed in Chapter Five but, as they were located in the western part of the survey area, they most likely originate from a working floor located close to, or in-between, the mineshafts. This is a pattern repeated elsewhere on Harrow Hill (Baczkowski and Holgate 2017) and at other Sussex and Continental mines (Holgate 2019).

Aside from the probable mines, other features, such as the pits and gullies, hint at non-mining activity occurring on Harrow Hill if they are not natural in origin.

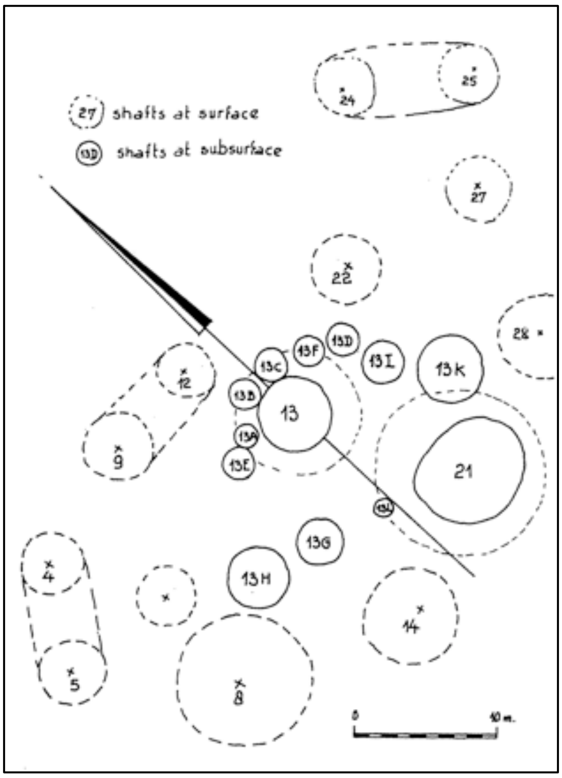

Fig. 4.18: Plan of main shafts and satellite shafts
(From McNabb *et al.* 1996 Fig. 7).

Unfortunately, it is not possible to date any of these features by geophysics alone and it is noted that there may be activity associated with the Bronze Age enclosure in the survey area or even military activity during World War Two. Although, it should be noted that their location on a moderately sharp southeast facing slope is not overly typical for Bronze Age occupation, especially when the prime location of the significant settlement at New Barn Down is considered, being located less than 450m south of the survey area and placed upon a natural plateau on a gentle south facing hill. It is unfortunate that it was not possible to complete the survey to the south of the survey area to establish if more of these features exist between Harrow Hill and New Barn Down.

The survey successfully met its objectives by developing knowledge of the mining landscape on Harrow Hill and in the characterisation of flint mines in geophysical data. The survey also indicated the existence of probable prehistoric features possibly not related to mining, such as pits and gullies, which could tentatively be proposed as evidence of occupation. Finally, the limit of the mine complex appears to have been mapped in the survey, with the majority of the mineshafts located in the northwest of the survey area and running thin towards the south. The main mine complex therefore appears to turn southwest along the southern flank of Harrow Hill, making it even larger than previously proposed by some 40-70 shafts (Fig.4.19).

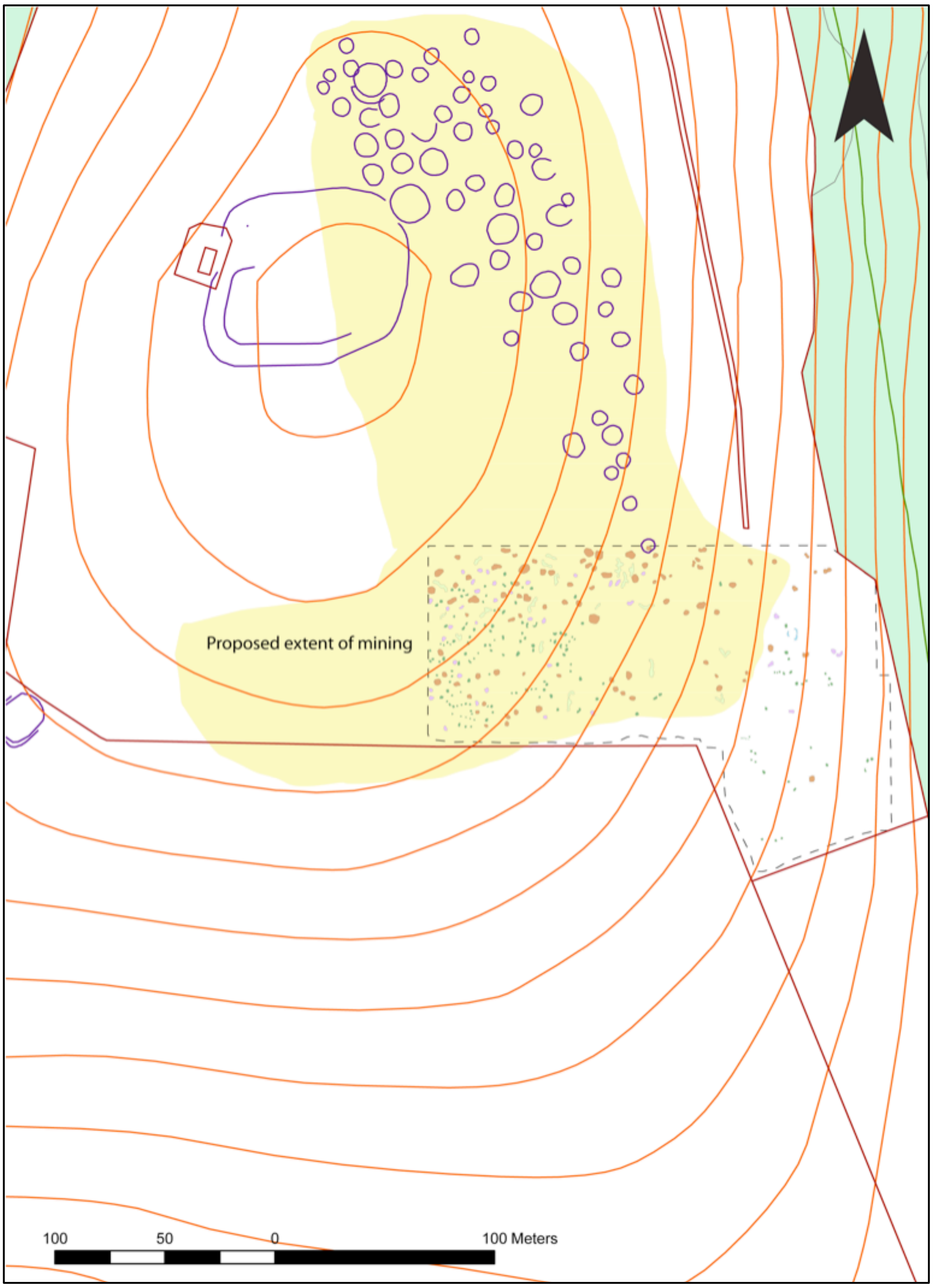

Fig. 4.19: Proposed extent of the mine complex of Harrow Hill (Author).

4.3 Long Down

(Appendix 4.2)

It was decided that the second survey be carried out on one of the Chichester Group mines, as this would provide good comparative data for the Harrow Hill results. Once it was established that permission to survey on Stoke Down was unlikely to be granted, Long Down became the obvious choice. Due to the background work carried out by Holgate, whose complete archive was obtained to produce Chapter Three, it was decided that much could be gained from a survey of Long Down, with many unanswered questions on the nature of extraction and the wider landscape. The recovery of pottery from an *in situ* working floor also hinted at the possible presence of occupation on Long Down, evidence of which may be presented in the geophysical survey.

The geophysical method chosen for survey was magnetometry, which allowed for the quick collection of data from a large area of landscape and also for comparative data with the Harrow Hill survey. Due to the difficultly of accessing the mines, involving a long walk, and also the uneven nature of the ground, containing many anthills, it was decided not to use GPR.

The survey was carried out in May 2017 and May 2019. The results of the 2017 survey, which focused on the upstanding mine remains, were mixed due to the difficulty of the uneven and overgrown terrain. It was originally proposed to extend this survey to the south of the mine complex in 2018, then survey Harrow Hill in 2019 followed by a return to carry out sample excavation on Long Down in 2020. Unfortunately, the 2018 heat wave forced the abandonment of the survey and meant that it had to be completed in 2019. The 2020 COVID-19 pandemic ended the proposed sample excavation. Nonetheless, it was possible to complete a full survey of the upstanding mine remains and the entire field to the south of the mines, a total of 46 30x30m grids amounting to c. 41,400m^2. This makes Long Down the first complete survey of a flint mine, together with a significant area of adjoining landscape, to be undertaken in the British Isles.

4.3.1 Background to survey

In contrast to Harrow Hill, little archaeological fieldwork or survey has been carried out on Long Down. An initial excavation carried out in 1956 by Salisbury (1961) did little to improve knowledge of mining on Long Down, beyond confirming the surface remains as mineshafts and recovering numerous artefacts, as discussed in Chapter Three. The subsequent excavation carried out by Holgate in 1985, as outlined in Chapter Three, did much to advance knowledge on the immediate mining horizon on Long Down, where flint-working floors were located. Also confirmed were several mineshafts to the east of the main complex that were being ploughed. However, no knowledge of the wider mine field and landscape was known, meaning there were many unanswered questions on the true extent of the mine complex, the character of the mines and also on the archaeological potential of the wider landscape.

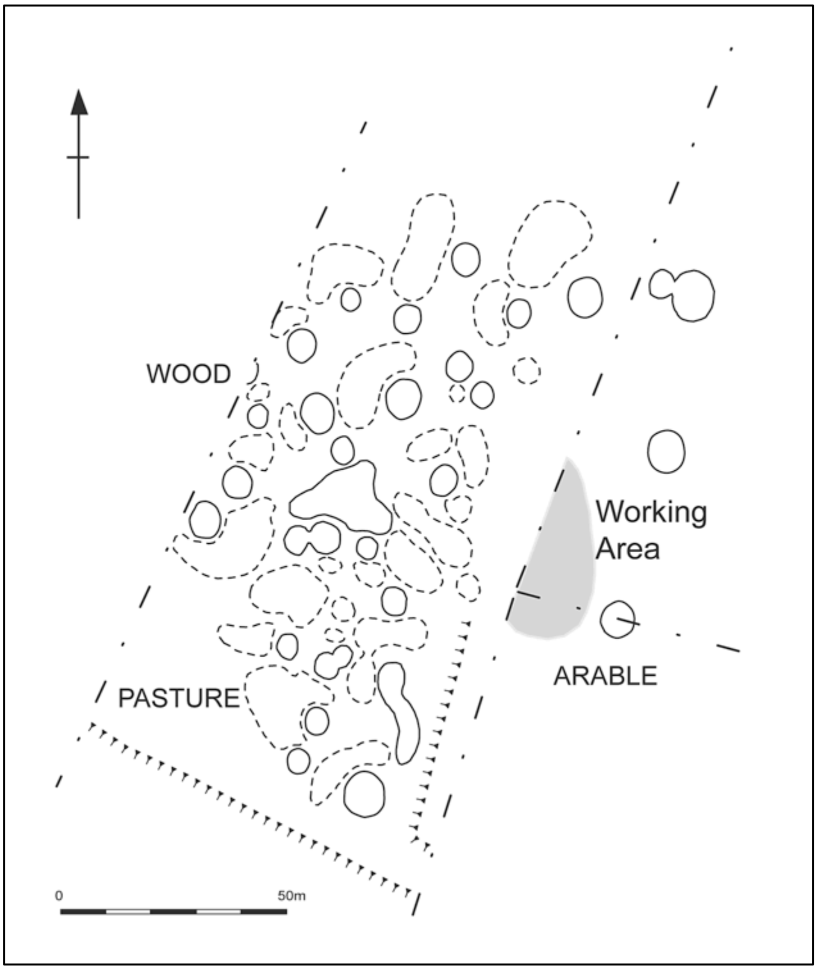

Fig. 4.20: Proposed extent of the mine complex of Long Down (Holgate 1985)

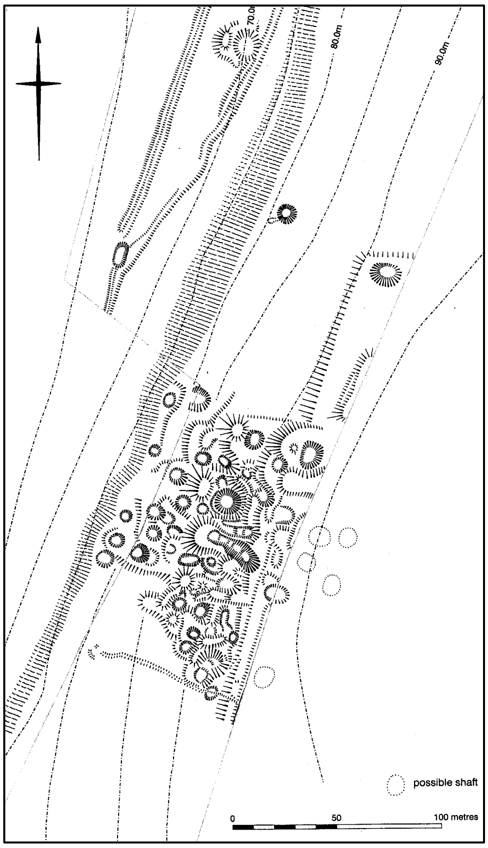

Fig. 4.21: Plan of Long Down, flint mines (Barber *et al.* 1999 Fig. 4.11).

It was decided that little could be gained by investigating the form of the deep mines on Long Down without extensive excavation. A better approach would be a large-scale magnetometry survey focusing on as much of the surrounding landscape along with the mines, which would allow the relationship between the mine complex and the wider landscape to be assessed. It was hoped that characterising the mineshafts in the geophysical data should be easier due to the work carried out at Harrow Hill across known mineshafts.

Few previous plans exist for Long Down and those that do focus on the upstanding mineshaft remains. Two plans were used, one by Holgate in 1984 (Fig.4.20) and the other produced by the RCHME that detailed the surface remains of upwards of 30 mineshafts, associated features and field boundaries (Barber *et al.* 1999; Fig.4.21). Other probable mineshafts are also shown to the north, west and east of the main complex. It is not known if mines extend to the south of the main mine complex.

4.3.2 The Landscape

Long Down hill has been heavily affected by agricultural activates since the Bronze Age, and through the Iron Age and Roman periods. This was evidenced during the 1985 fieldwork, when quantities of Bronze Age, Iron Age and Roman pottery were recovered from colluvial deposits within the upper layers of the mineshafts (Baczkowski and Holgate 2017; See Chapter Three). No traces of activity relating to these later periods can be seen today on Long Down, as ploughing has continued unabated.

On the earliest OS map of the hill, dated 1876-77 (Fig.4.22), the flint mines are not marked and the whole of Long Down appears to be an open arable field, with the exception of a clump of trees in the centre of the hill. Apart from the addition of a 'water tank', marked on the 1950s OS map (Fig.4.23) and visible on an aerial photograph (Fig.4.24). On the same photo the survey area is clearly under heavy ploughing and the southern end of the preserved mines is marked by a large lynchet, or boundary.

By the 1970s OS map the water tank has been removed and Long Down has been divided into three separate fields by a boundary running southwest to northeast, which cuts across the east side of the flint mines (Fig.2.25). A second boundary starts east of the flint mines and runs northwest to southeast across the centre of Long Down, passing close the clump of trees on its summit. The two boundaries are clearly marked on the RCHME plan and show that at least five mineshafts are located east of the southwest to northeast boundary, two of which were confirmed by Holgate, and a further two mineshafts to the north (Fig.4.21). A series of lynchets running both north to south, and east to west are also marked on the RCHME map. It was beneath the large north to south lynchet that Holgate recorded the *in situ* working floor.

The date of these lynchets is unknown, although Historic England proposes they are Medieval in origin. A comparable set of field boundaries and enclosures have also been mapped and excavated at Selhurst Park, less than 1km northwest of Long Down and which dated the Iron Age and Roman periods (Anelay 2019), more in keeping with the pottery recovered during the 1985 fieldwork (See Appendix 2.7).

Two constant features on all OS maps are the woodland to the west of the mines, called Wide Ham Beeches and Thicket Beeches, and the clump of trees on the summit of Long Down. The woodland is located at the base of very step scarp slope below the flint mines and is retained for the breeding and shooting of game birds. The clump of trees on the summit of Long Down is present on OS maps from the 1880s onwards, but could be much older.

One feature of Long Down that the maps do not give an impression of is the steepness of the scarp slope that the flint mines are located on, by far the steepest of any of the Sussex mines with only Stoke Down comparable. Although the majority of the mineshafts themselves are on reasonably flat ground, the slope falls sharply along the western edge of the flint mines where a boundary separates the mines from the woodland. It is not known if or how far down the slope the mines extend, the RCHME survey does show some mine workings in this area. The woodland is thick and impenetrable, although large flint nodules and occasional pieces of debitage can be observed along the slope. It is unknown if this material has eroded onto the slope from the mines, or relates to undiscovered mines.

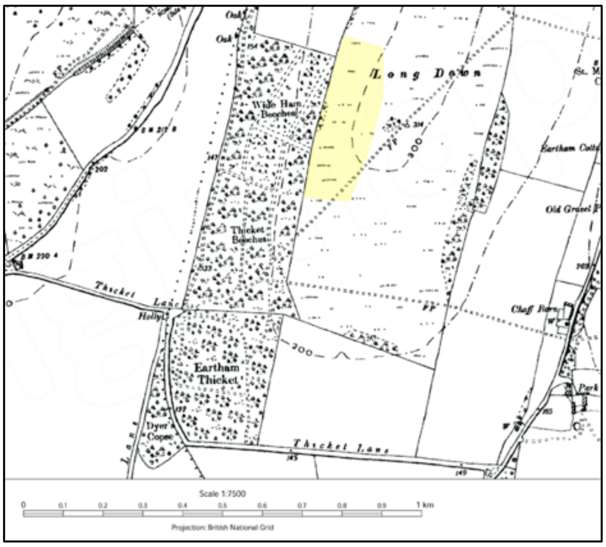

Fig. 4.22: OS map of Long Down 1880, extent of known mines highlighted
(Crown copyright and database rights 2020 Ordnance Survey 100025252).

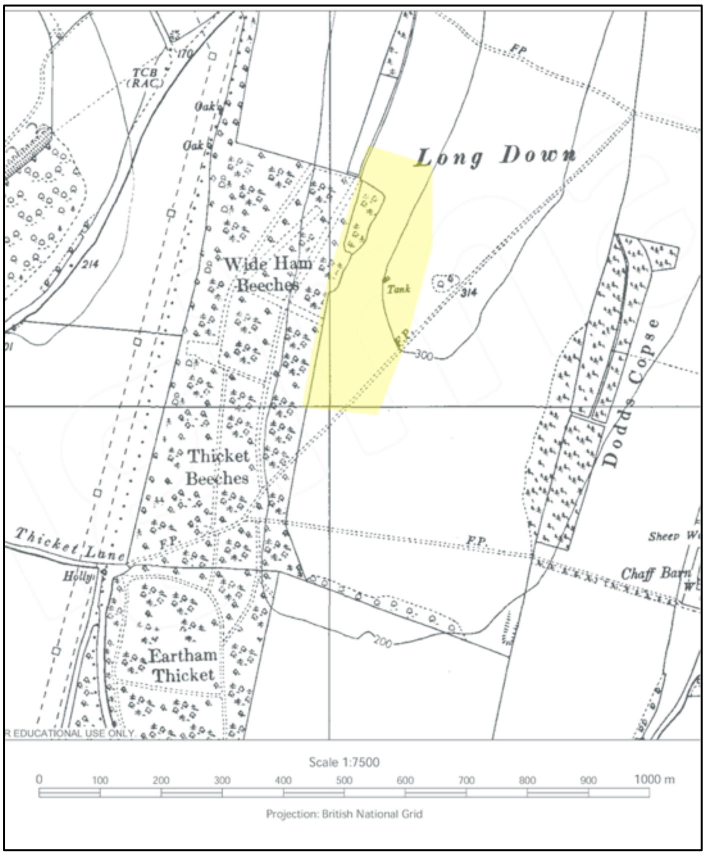

Fig. 4.23: OS map of Long Down 1960, extent of known mines highlighted(Crown copyright and database rights 2020 Ordnance Survey 100025252).

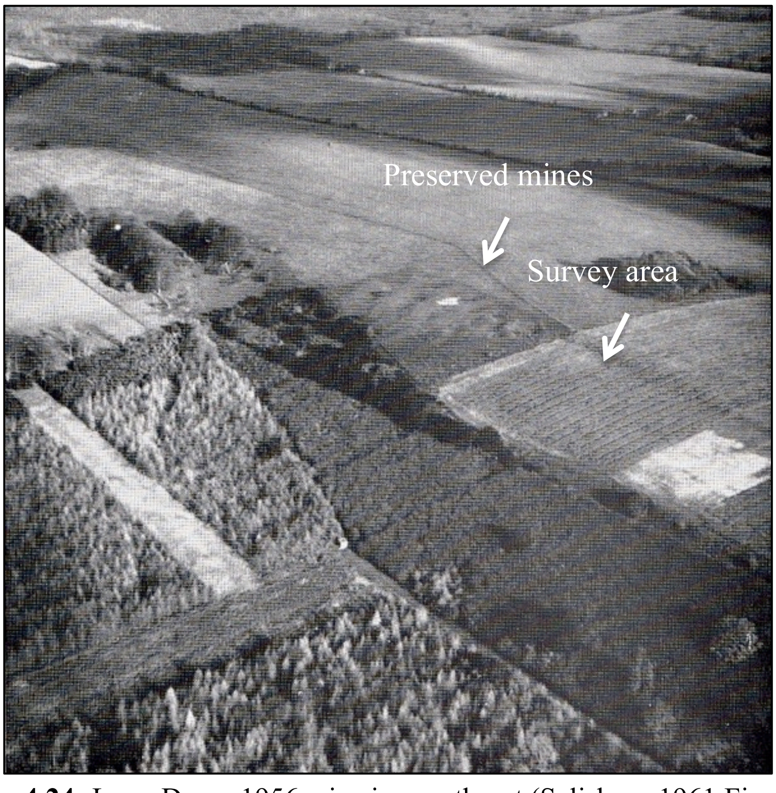

Fig. 4.24: Long Down 1956, viewing northeast (Salisbury 1961 Fig. 1).

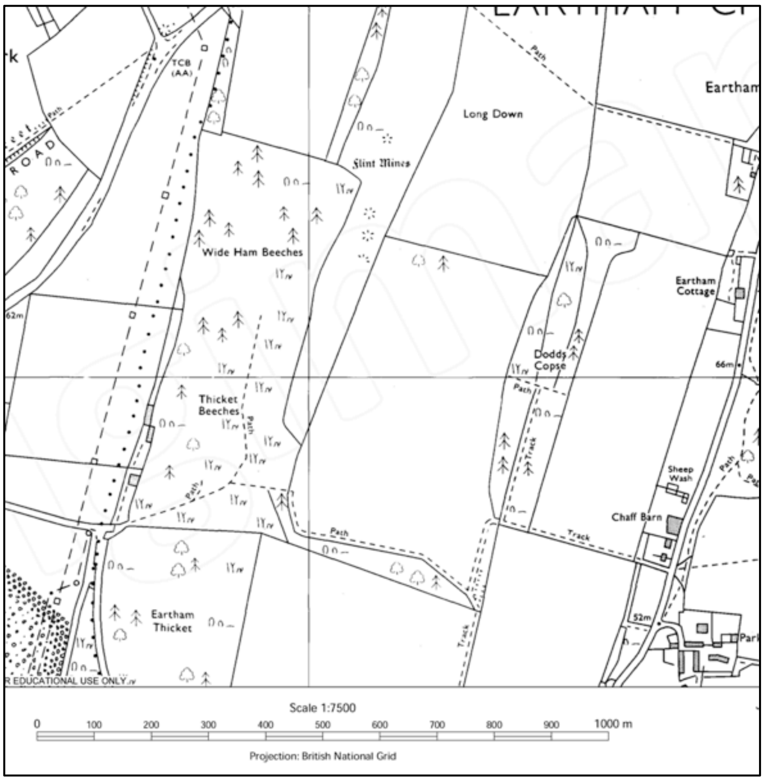

Fig. 4.25: OS map of Long Down 1980
(Crown copyright and database rights 2020 Ordnance Survey 100025252).

The flint mines themselves are located in a narrow strip of grassland, between c. 70m wide at its north end and tapering to c. 45m wide at its southern end. The remains of the flint mines (List Entry Number: 1017521) are located at the northern end of this area and survive well as earthworks measuring between 20m$^{\varnothing}$ and in places 3m of depth. The area of the surviving mines has obviously never been ploughed, although it has been proposed that ploughing has reduced the size of the mine complex to the north and east (Barber *et al.* 1999; Baczkowski and Holgate 2017). Nothing is known about the long field to the south of the mines, which was previously ploughed (Fig.4.24) and then set-aside possibly in the 1970s (Fig.4.26).


Fig. 4.26: The southern field of the survey area, viewing south (2019).

4.3.3 Focus of Survey

Once permission to conduct the survey was granted by the landowners, the Eartham Estate, it was quickly realised that the most suitable area for survey was the strip of land to the south of the mines, along with the mines themselves (Fig.4.27). A short patch of land to the north of the mines was also considered, especially as mineshafts had previously been recorded here, however, this is a small area on a very steep overgrown slope. The southern field was suitable for survey, comprising of fairly flat grassland.

4.3.4 Aims

The key aims of the geophysical survey on Long Down were:

- To develop knowledge on a blank part of the Early Neolithic mining landscape by surveying a large area to the south of the main mine complex; and,

- To reveal the size and extent of the flint mines and reveal any features related to mining that are not visible on the surface, such as test shafts or evidence of structures; and,
- To investigate the presence of any archaeological features, such as pits or structures, which maybe associated with mining activity and located in the wider extraction landscape; and,
- To progress knowledge of Neolithic mining practices on Long Down by allowing the boundary of the mines to be mapped.

4.3.5 Methodology

The only method used on Long Down was magnetometry, which allowed a large area of ground to be covered quickly. The total number of grids was 47, although many of these were partial, due to the narrowing and widening of the survey area (See Appendix 4.2). Several large blanks in the data are due to obstacles, such as tree or thickets of shrubs and undergrowth that grow in the remains of the mineshafts. As on Harrow Hill the magnetometer survey was carried out with a Geoscan Research FM256 fluxgate gradiometer, and the resulting data was processed in Geoplot. The survey was conducted using 30m by 30m grids with readings taken at 0.5m intervals along traverses spaced 1m apart at a resolution of 0.1nT.

Ground conditions were difficult across much of the site due to thick undergrowth, presumably because the area has not been grazed for over 30 years. The area of the mines was particularly challenging, due to a combination of brambles, nettles, rabbit burrows, shrubs and the nature of the mining horizon, being large hollows and uneven ground. Results from the area of the mines have suffered somewhat due to the uneven ground, and anomalies representing mineshafts are not as clear in comparison to where the ground is more stable to the south. Although, even conditions in the southern part of the survey area were challenging due to undergrowth and several large rabbit burrows.

Interpretation of the geophysical anomalies was carried out with the same methodology as Harrow Hill, with the addition of long linear features, named 'Ditch/Boundary'.

Table 2: Long Down totals

Shaft	291
Shaft/Pit	39
Gully	13
Pit	62
Quarry	13
Ditch/Boundary	1
Total	419

4.3.6 Results
(Table 2)

A total of 419 positive geophysical anomalies were recorded, many of which are difficult to interpret (Fig.4.28). In total 291 'Shafts' are recorded in the data, composed of sub-circular or oval anomalies that measure between 3-9m$^{\o}$, along with 39 'Shaft/Pits' (Fig.4.29: Table 2). There were also 61 smaller pits and 13 possible quarries recorded, alongside 13 gullies and a large boundary. Anomalies in the main complex at the north end of the survey, large and small, have much reduced signals. This is presumably a combination of the difficult ground in this area affecting the results, or because the features are buried by spoil from later workings.

Beginning at the northern end of the study area, where the main mine complex is located, c. 60 large anomalies are found, some of which align well with previously surveyed recorded mineshafts, which number c. 30 (Fig.4.30). The larger features, some up to 12m$^{\o}$, appear grouped, but spaced apart enough so that they do not intercut. The largest grouping is in the north end of the survey area where numerous earthworks have been previously recorded. In places, the large features appear to form alignments across the contours of the slope.

Along with the shafts, many smaller anomalies are observed, measuring between 2-3mø, and interpreted as 'Shaft/Pits'. Like on Harrow Hill these often appear clustered around the larger shafts, or in their own spatial groups. These features are difficult to interpret and could represent smaller shafts, large pits or other forms of extraction features, such as small quarries. They could even be interpreted as test shafts, as found on Harrow Hill, sunk to assess the bedrock or presence of earlier shafts (McNabb *et al.* 1996).

South of the second group of probable mineshafts the central area of the survey area is less dominated by large anomalies (Fig.4.30). Some of the anomalies in this area align with rabbit burrows. However, it is not clear if the rabbit burrows are located in the loose fills of mineshafts, as observed elsewhere at other Sussex mines. On balance, it seems likely that these large features are mineshafts, due to their similar size and form to the confirmed examples.

At the southern end of the survey area another group of large anomalies are shown in the data (Fig.4.30). A tentative interpretation of these anomalies is that they represent a second area of mining, as they are of very similar arrangement, form and size to the confirmed mines. Surrounding the group of large anomalies are small signals of high resistance that may (Fig.4.28) be flint nodules associated with mining waste and debitage, if the larger features are mineshafts.

Mostly located at the north end of the site a series of linear or elongated oval features, up to 20m in length and 10m wide, are and orientated slightly across the slope and are interpreted as quarries. Some of these are still visible as surface remains (Fig.4.30) and were mapped in the RCMHE survey (Fig.4.21). Similar features were surveyed on Harrow Hill and interpreted as Type 4 mines, composed of sequentially excavated mineshafts (Oswald 1994). No evidence of underlying mineshaft is evident in the survey results, although they may be so close to give a continuous signal.

On Long Down the quarries appear to truncate the spoil heaps of the Early Neolithic mines. They may therefore have been excavated to extract mine waste material from the earlier spoil heaps. They are undated, but as discussed in Chapter 3 may relate to Late Neolithic or Early Bronze Age activity on Long Down based on the recycling of earlier material, as indicated by the radiocarbon dates obtained during this project and lithics collected during the 1984 surface collection.

In total, 62 negative anomalies measuring below $2\text{m}^{\varnothing}$ are present in the data, interpreted as 'pits' (Fig.4.31). These features are difficult to interpret in isolation, or without clear alignments. Their interpretation could range from pits, tree-bowls or small extraction quarries. There are almost certainly more sub $0.5\text{m}^{\varnothing}$ anomalies in the data that are not perceivable.

In three places the pits possibly form alignments. Towards the centre of the site seven uniform pits form an L-shaped arrangement. Other pits appear to be also associated with the group. Some 30m east of the L-shaped feature a further 8 small pits form an arc within an amorphous group of gulley like features. This feature could relate to a roundhouse, either Bronze Age or Iron Age in date.

A further group of small pits is located in the southern part of the survey area in an area devoid of large anomalies. Here seven pits from a circular arrangement, c. $12\text{m}^{\varnothing}$ around a central area lacking any other features. To the south of this a further five small pits appear to form an alignment. Such features are difficult to interpret without further fieldwork, but such alignments could hint at the presence of a structure, not visible in the geophysical data, that is surrounded by pits. These may belong to any prehistoric period, from the Early Neolithic onwards.

Several small anomalies in the southern part of the survey area are penannular in plan, comprising of opposing pairs of gullies measuring c. 2-3m in length. Such features could be interpreted as evidence of small structures, or alternatively be tree bowls or animal burrows.

Other anomalies presented in the data include a long linear feature along the northeast edge of the survey area (Fig.4.32). This is part of the large southwest to northeast boundary surveyed as an earthwork by RCHME and connected to the lynchet that sealed the *in situ* knapping workshop recorded by Holgate during the 1984 fieldwork (See Chapter Three). The RCHME survey (Fig.4.21) maps this boundary as earlier than the smaller northwest to southeast boundary presented in the survey data. The boundary is broken by the former location of the 20th century water tank at its eastern end, of which only a concrete base remains. It appears that the boundary marks the point that ploughing ceased, with only the mine remains visible to its north, meaning that all possible mines to the south have been truncated. The boundary begins again north of the main mine complex when the remains of the large quarries stop. It seems likely that the second group is in fact part of the main group, but only appears separated due to the boundary and water tank causing a break in the results.

Fig. 4.27: Long Down, 1985 and 2019 survey area (Author).

Fig. 4.28: Long Down 2019 Magnetometry survey results (Author).

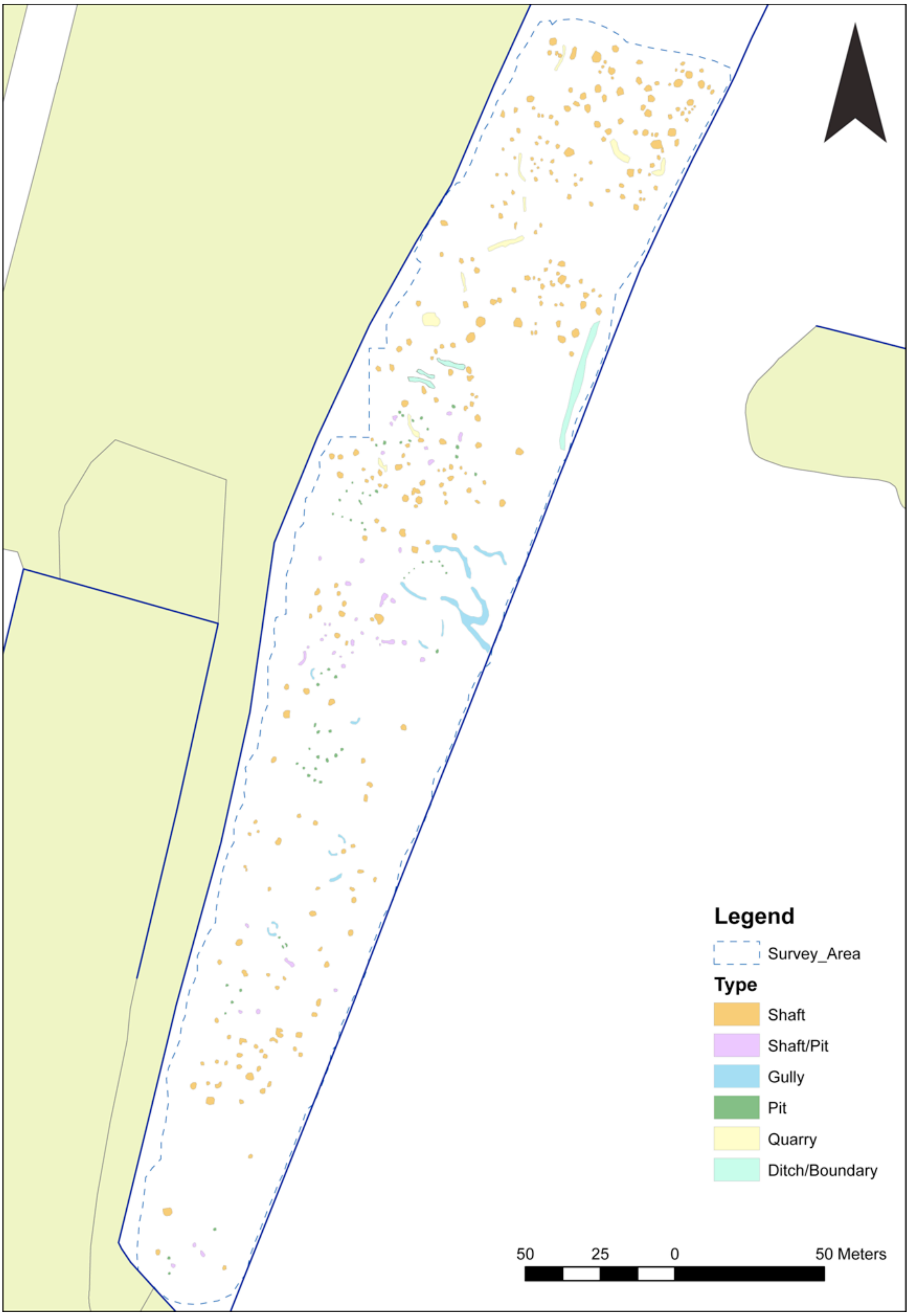

Fig. 4.29: Long Down 2019 Magnetometry interpretation, showing all features (Author).

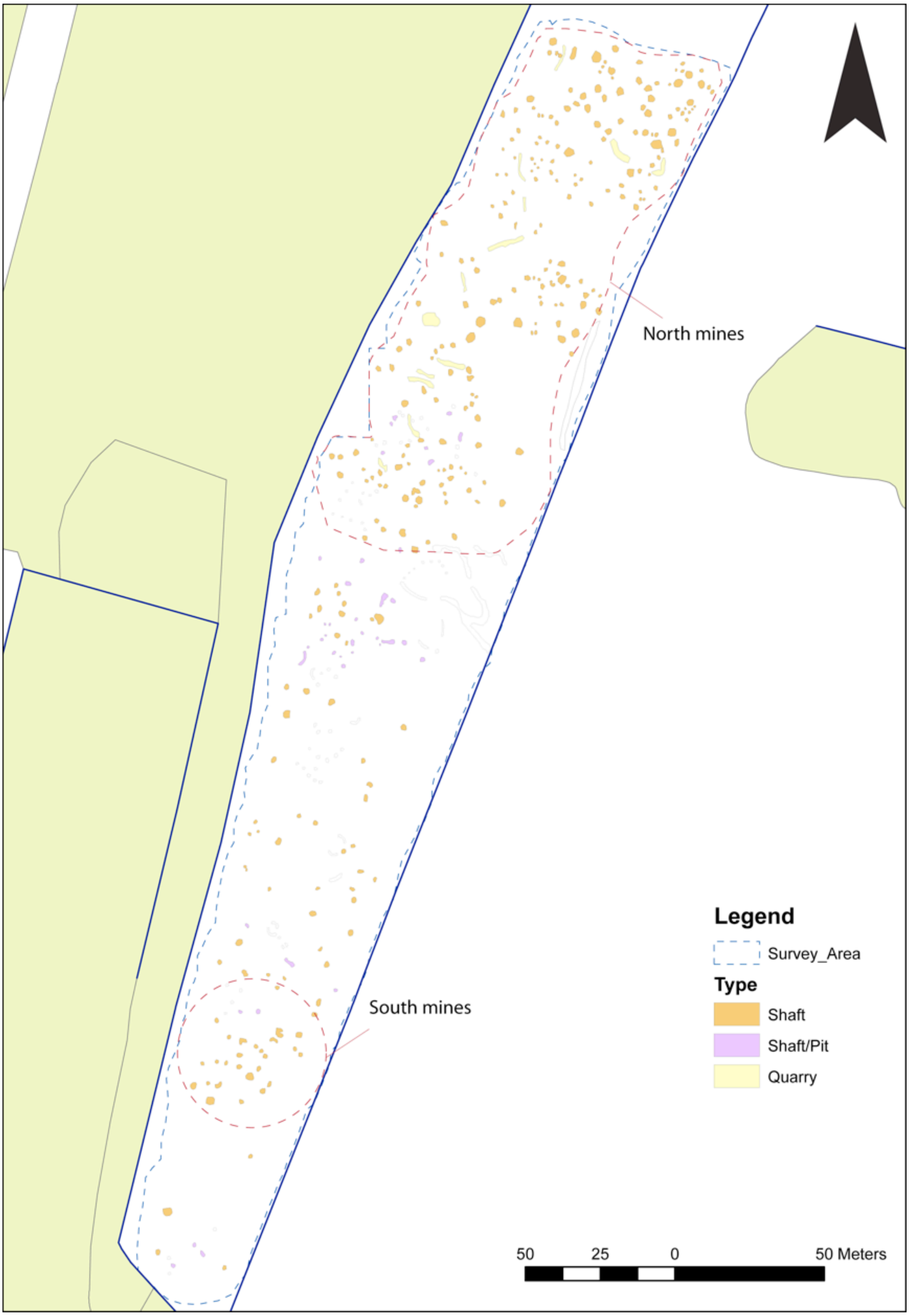

Fig. 4.30: Long Down 2019, showing 'Shaft', 'Shaft/Pit' and 'Quarry' (Author).

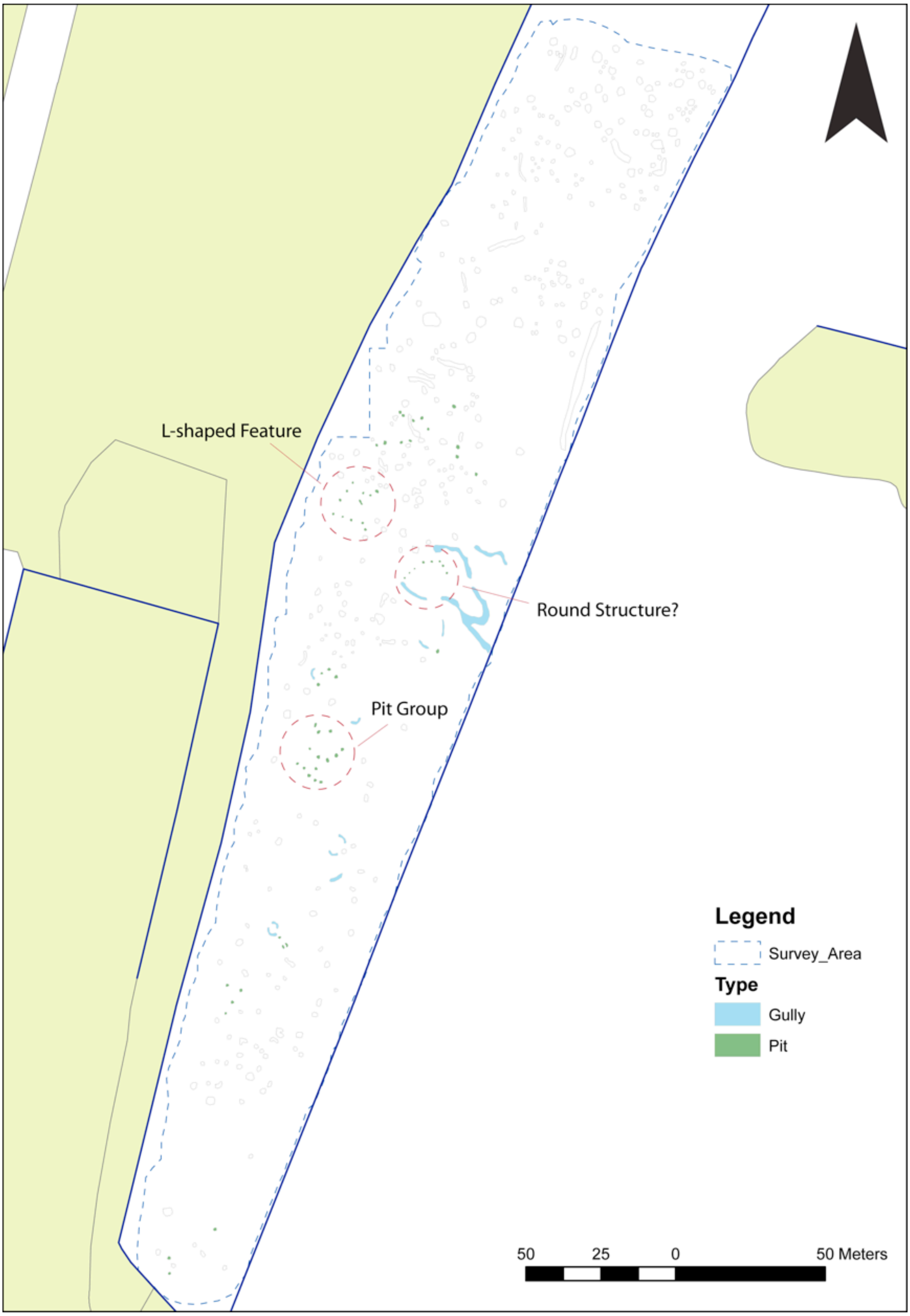

Fig. 4.31: Long Down 2019 showing 'Gully' and 'Pit' (Author).

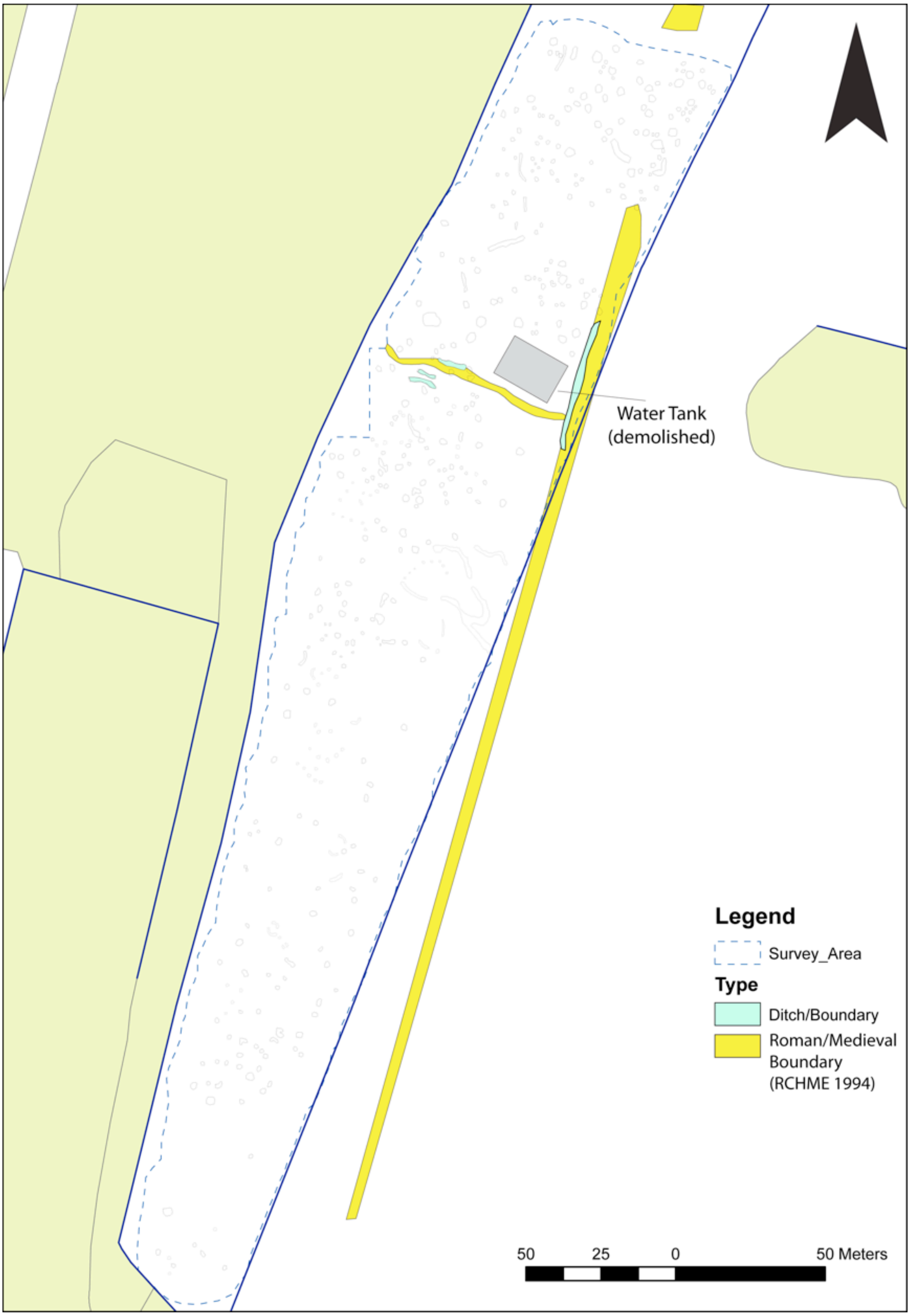

Fig. 4.32: Probable Roman Medieval boundaries on Long Down, as surveyed by RCHME (Author).

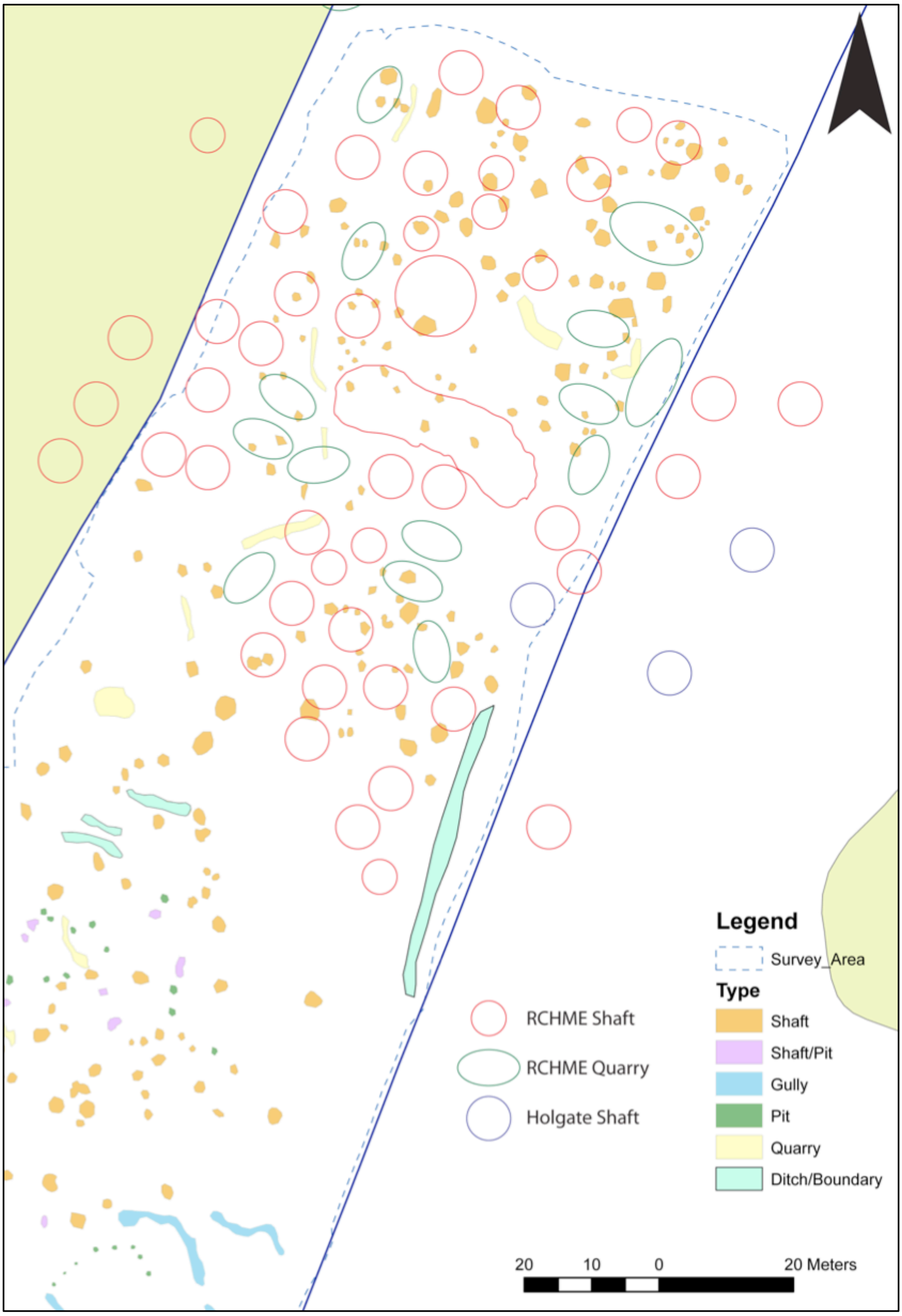

Fig. 4.33: Detail of main complex on Long Down, with Holgate and RCHME shafts.

4.3.7 *Discussion of results*

The number of anomalies recorded in the survey was unexpected. Interpreting the data is difficult, due to the volume of features and their density, particularly in the main part of the mine complex where numerous large anomalies, many over 4m^{ø}, are located. These features are almost certainly mineshafts, some of which align with surface remains (Fig.4.33). Such density of mineshafts is both unsurprising, but also revealing because it is clear that the visible surface remains are not an accurate guide to the size and density of the mines. Naturally, some of the anomalies may not be related to mining, but the fact they are focused along the same contours, appear to be arranged into groups, and do not truncate each other strongly suggests that the majority are.

What is clear in the data is that many shafts, or smaller workings such as test pits or trial shafts, have been covered by spoil from later workings. This means that the surface remains observed today are only produced by the final episode of extraction and do not account for the full story of mining. The results from this survey indicate that the main complex on Long Down, where c. 30 shafts have been previously counted, may actually contain a minimum of 50 shafts and a maximum of just over a 100. Taken as median average, this infers that the main mining area on Long Down is twice the size previously proposed. This finding has important implications for how we consider the scale and interpretation of mining, not only on Long Down but at all Sussex sites, a point that shall be discussed further in Chapter Seven.

The density of probable mineshafts in the surviving mine complex was expected, given the dynamic nature of mining and the apparent need to continuously extract from the same narrowly defined bands of flint. The most significant finding in the results was the volume and extent of other probable mineshafts to the south of the main complex, with a total of almost 250 features. Naturally, it is impossible to interpret all of these features as mineshafts and many could be natural hollows, such as tree bowls, or solution pipes. However, given the similarities in the size, form, arrangement and distribution it seems likely that many of these large anomalies are mineshafts, or are related to mining.

The discovery of a possible second group of mineshafts in the south part of the survey area is of note. A similar arrangement is also recorded on Stoke Down with separate east and west mining areas (Barber 2014). It is possibly of no coincidence that Stoke Down has previously been compared to Long Down in character, both sites being located along steep scarp slopes in contrast to the Worthing mines, which are more focused on hilltops (Barber *et al.* 1999; Barber 2014).

It is recognised that this survey has not added any knowledge on the form of the extraction on Long Down, only that it appears based on shafts. It cannot be proved either way if the shafts develop galleries, or remained simple extraction features as recorded on Stoke Down and the Wessex Group mines. It also cannot be proved if the mine features in the south of the survey area represent a different of form of mining to those in the north, such as the interpretation of mine remains on Harrow Hill (Oswald 1994).

One aspect that hints at a developed form of deep mining involving galleries is the possibility that some of the shafts appear to be paired, or at least sunk close together (Fig.4.30). The paring of shafts is a method observed at virtually all deep mines in Southern England and the Continent, as discussed in Chapter Two, and strongly infers that the shafts were connecting to a gallery system, a requirement that allows the flow of air and light around the basal area.

Dating of the possible mining features is problematic. Secure radiocarbon dates obtained from the mines located in the north of the survey area, as outlined in Chapter Three, certainly prove that these mines are Early Neolithic in date. But no such evidence can be used to date the other features south of these mines. It must be noted that other forms of flint and chalk extraction do occur on the South Downs, some of which can be of similar appearance to prehistoric flint mines. Perhaps the best example are flint quarries located on Windover Hill, East Sussex, long interpreted as Neolithic flint mines and are still listed as such (List Entry 1014631), but are now recognised to be Medieval in origin (Barber *et al.* 1999; Carpenter *et al.* 2013).

It could be reasonably argued that some of the large anomalies, in particularly the most northern group in the survey area, are later extraction features. However, several factors suggest this is not the case. Firstly, the Medieval boundary cuts across the some of the probable mineshafts and also the later prehistoric lynchet (Fig.4.32), dated in the 1984 fieldwork. The Medieval boundary is not cut by any of the large anomalies and neither does it appear to respect the northern mine complex, clearly cutting across its southern half. There is no evidence of track ways, or ramps leading to the mines, as found on Windover Hill (Carpenter *et al.* 2013). There is also a question of scale, as the Medieval quarries are large, with the majority over 8m^{ø} and many up to 20m^{ø} on Windover Hill and many with ramps for access by carts (Carpenter *et al.* 2013. 80-81).

Other features north of the mine complex on Long Down may well relate to Roman or Medieval chalk or flint extraction. These large oval features appear towards the base of the scarp slope, close to the remains of a probable Roman or Medieval track way, a typical location for loading carts. They also appear to be respected by, or align with the later field system. The same cannot be said of the probable mineshafts, which are more randomly scattered between the 90-75m contours and continue on both sides of the earlier northeast to southwest boundary, and the later northwest to southeast one.

On balance, it seems reasonable to interpret many of the large anomalies south of the north mine complex as probable mineshafts, or extraction features. This is a significant finding and demonstrates that mining on Long Down is more extensive and complex than previously thought. Even a conservative estimate, based on the known upstanding mines, and those to the north, west and east of the main complex, and finally the newly discovered examples, would put the total number of mines of Long Down at c. 100-150. An even higher estimate could be closer the 250 mark. If either of the proposed estimates is remotely correct, then Long Down could be one of the larger Early Neolithic mines in Sussex.

The most notable anomalies, aside from the probable shafts, are the large linear features interpreted as probable quarries. These are still observable as surface features and appear as long oval shaped depressions, up to 15-20m long, some 10m wide and 2-3m in depth. The fact that they are visible in the geophysical data infers that they are also cut into the chalk bedrock as negative features. It is considered that these large anomalies probably represent open cast quarries. Their dating is problematic, but the fact they possibly truncate the mine spoil from earlier deep mines indicates they are later than the Early Neolithic mines.

Similarities between the surface remains of the quarry features on Long Down and Harrow Hill have previously been observed, and it was supposed to be because neighbouring mineshafts were excavated in succession (Oswald 1994). This could be the case of Long Down, except that the geophysics does not entirely confirm a linear arrangement of shafts. From the surface they appear to be linear cuts with spoil heaped at either side (Fig.4.34). Some comparison can also be drawn with the possible Neolithic mining features excavated at Nore Down, West Marden, c. 16km west of Long Down. Here, large long oval features, measuring 30-50m in length and 9m wide were investigated and found to contain the tops of possible mineshafts (Aldsworth 1983). These possible mineshafts were not properly dated and the relationship between the quarry like features and the shafts was not established. However, it would be difficult and impractical, due to spoil slippage, to excavate shafts within such features, making it likely that the shafts pre-date quarries. Although, caution should be expressed here because Neolithic mining does not always seem concerned with what we perceive as the most practical methods.

The similarities between Nore Down and Long Down are therefore striking, in that long quarry like features appear to be cut across the top of earlier mineshafts. Could the features on Harrow Hill also do the same? Unfortunately, little more can be commented about these features without firm dating and excavation. But their assessment by geophysical survey on Long Down indicates that they may be more complex than their surface remains suggests, or there may be more than one form of extraction feature. Ultimately, their presence proves how little is actually known on mining practices, aside from the deep well excavated shafts.

As previously discussed in Chapter Three there is limited evidence of later Neolithic and Early Bronze Age use of mining spoil to produce lithics, some of which were collected in the 1984 excavation, including ovate pre-forms. Two of the radiocarbon dates collected during this project, which were taken from fragments of antler implements, also date to the Late Neolithic and Early Bronze Age. Finally, the stray surface find of the rimsherd from a Peterborough Ware bowl close to the mines also hints at later use of the site (Drewett 1983). Overall, it is almost certain that extraction, either based on the recycling of earlier material or renewed mining, did occur on Long Down and that features, such as the quarries, should be considered as possible evidence of these practices. As will be discussed in Chapter Seven, there is growing evidence of renewed interest and resumption of mining and extraction beginning in the Late Neolithic at other Sussex mines.

Fig. 4.34: Large oval feature, a probable quarry, viewing southwest (Author 2019).

There was a plethora of features recorded in the survey that do not appear to be related to mining, which are difficult to interpret and date. Perhaps the most intriguing features are the numerous pits, some which appear to form alignments, and the gullies. The pits could be tree bowls or natural hollows, but others appear to form alignments and could relate to human activity.

Three of the pit groups are of particular interest, the circular alignment, the L-shaped alignment and the pit group (Fig.4.33). The circular feature may relate to a structure, such as a roundhouse, from the Bronze Age, Iron Age or even the Roman period. It is certainly similar in plan to the Middle Iron Age banjo enclosure excavated on the opposing side of the valley from Long Down, at Selhurst Park (Anelay 2019).

The L-shaped alignment is more intriguing as similar arrangements of pits, or large postholes, are known to be related to Early Neolithic houses, such as Whitehorse Stone (Hayden 2007; Ashbee 2014) and Horton (Barclay and Chaffey 2014; Chaffey *et al.* 2016). An arrangement of L-shaped gullies was recorded within the mine complex on Easton Down, which measured 10m long and was interpreted as a possible Early Neolithic house (Stone 1933. 232). Further interpretation of this feature is impossible without fieldwork.

The pit group surrounds a roughly circular area empty of any obvious features. Such arrangements of pits are known to surround probable Neolithic dwellings, such as those found at Kilverstone, Norfolk (Garrow *et al.* 2005), which do not leave any archaeological trace. It is noted that these pits are located in an area devoid of large anomalies roughly between the northern mining area and the new, probable southern one. These pits would have been targeted for excavation by sample trenches in the fieldwork phase of this project.

The presence of pits in the survey is intriguing and hints at activities, such as occupation, which may have occurred alongside Early Neolithic mining. Obviously, they could belong to any archaeological period, or even be natural in origin. But due to their overall distribution, form and apparent placement away from zones of mining they are possible candidates for evidence of Neolithic activity not associated with mining: a significant discovery.

To summarize, the geophysical survey of Long Down successfully met its main objective in characterizing the area of mining and its surrounding landscape. It is a notable discovery that the mines appear to continue to the south of the main complex, but have been truncated by ploughing. The reason the main complex survived is probably due to the high spoil heaps and deep troughs left by the quarries, only found in this part of Long Down, which made ploughing impossible. Support for this hypothesis can be drawn from the large northeast to southwest lynchet, or former boundary, which stops south of the main mine complex and begins again to its north. The later Medieval boundary also cuts across the southern part of the complex where the large quarries appear to stop. This means that the main complex has been well preserved, but all other areas have been ploughed.

The evidence of occupation on Long Down is long, reflected by surface finds hinting at activity from the Neolithic through to the Medieval period. Therefore, except for the large probable mineshafts, it is impossible to accurately date any of the pits, gullies and other anomalies. However, on consideration of the size of the mining area and the recovery of Early Neolithic pottery it is quite probable that some of the features are contemporary with mining and could represent other forms of activity, such as occupation. Unfortunately, without the excavation component of this project this will never be proven.

4.4 Conclusion

Additional discussion of the results from the geophysical surveys will be presented in Chapter Seven. At this point it is worth recognizing that both surveys met their main objectives, by characterising flint-mining features and expanding knowledge of the wider mining landscape of both sites. Further fieldwork, if it had been possible, would have enabled sampling of these features to support or disprove their interpretation.

The interpretation of the geophysical anomalies was made with a high degree of caution. Despite this, the exercise was successful in establishing that both sites are likely to be more complicated and larger than previously assumed. It is also apparent that previous surveys of the surface remains help in gauging the current size of a mine complex, but tell us little about their true size, nor the character of mining features. This finding has implications for how flint mines should be interpreted moving forwards, as will be discussed in Chapter Seven.

Finally, the research was successful in proving that geophysical survey of the surrounding landscape is important to establish the mines within a wider setting. Defining the signature of mineshafts was key in to achieving this objective and helped in identifying mining and non-mining features. Not only does this help develop knowledge of Early Neolithic extraction activities, but it also aids in developing the narrative of the sites in later periods, from probable Late Neolithic quarrying to the relationship between mines and features, such as the Medieval field boundaries, they all contribute to the flint mine narrative.

It is considered that this exercise was successful and necessary for expanding knowledge of the mine complexes. It can further be proposed that the methodology developed for the surveys, a combination of surface survey and geophysics based on magnetometry and supported by detailed GPR, was successful in producing rigorous and rapid assessment. Unfortunately, it was not possible to ground truth the results, a process that would have supported, or disproved the results of the surveys. For example, further investigation of the anomalies could be undertaken by coring, test pitting and, or small scale-sample excavation.

Overall, the methodology developed for this project has broader potential and application for the rapid archaeological investigation of large monuments, such as flint mines, through low impact survey followed by small-scale and targeted fieldwork.

Chapter 5 Surface survey and archival material

5.1 Introduction

This chapter outlines the results of two field surveys, and also additional research carried out on flint mine assemblages from archive material (See Appendix 5). Originally, this chapter would have detailed the results from the proposed fieldwork programme to investigate the results of the geophysical survey, as outlined in the last chapter. As previously stated, this fieldwork was not possible to due to COVID-19 restrictions in place during 2020. Nonetheless, the results of this chapter inform on the spatial distribution and organisations of practices in the wider environ of two mine complexes, and the complexity of investigating and understanding flint mines.

The first case study outlines the surface survey of scattered flint from working floors on Harrow Hill, following on from the results of the geophysical surveys and illuminating activities marginal to the main mine complex. The second case study, using the same survey methodology as employed on Harrow Hill, details a series of flint working areas on the Church Hill mines, improving knowledge of the development of mining. Finally, the results of analysing flintwork held in archives reveals the complexity and variety of lithics produced from mine flint. Such lithics hint at other activates occurring at the mine complexes that were not purely based around the production of bifacial axes.

5.2 Case Study One: Harrow Hill

5.2.1 Background
(Appendix 5.1)

In 2018 whilst scoping areas for a geophysical survey, an area of flint working debitage, axe pre-forms and axe roughouts were observed along the southern flank of Harrow Hill (Fig.5.1). It was decided to survey this scattered flintwork in 2019 after the geophysical survey. This would complement the results of the geophysical survey and allow for comparison between surface scatters and possible mine workings.

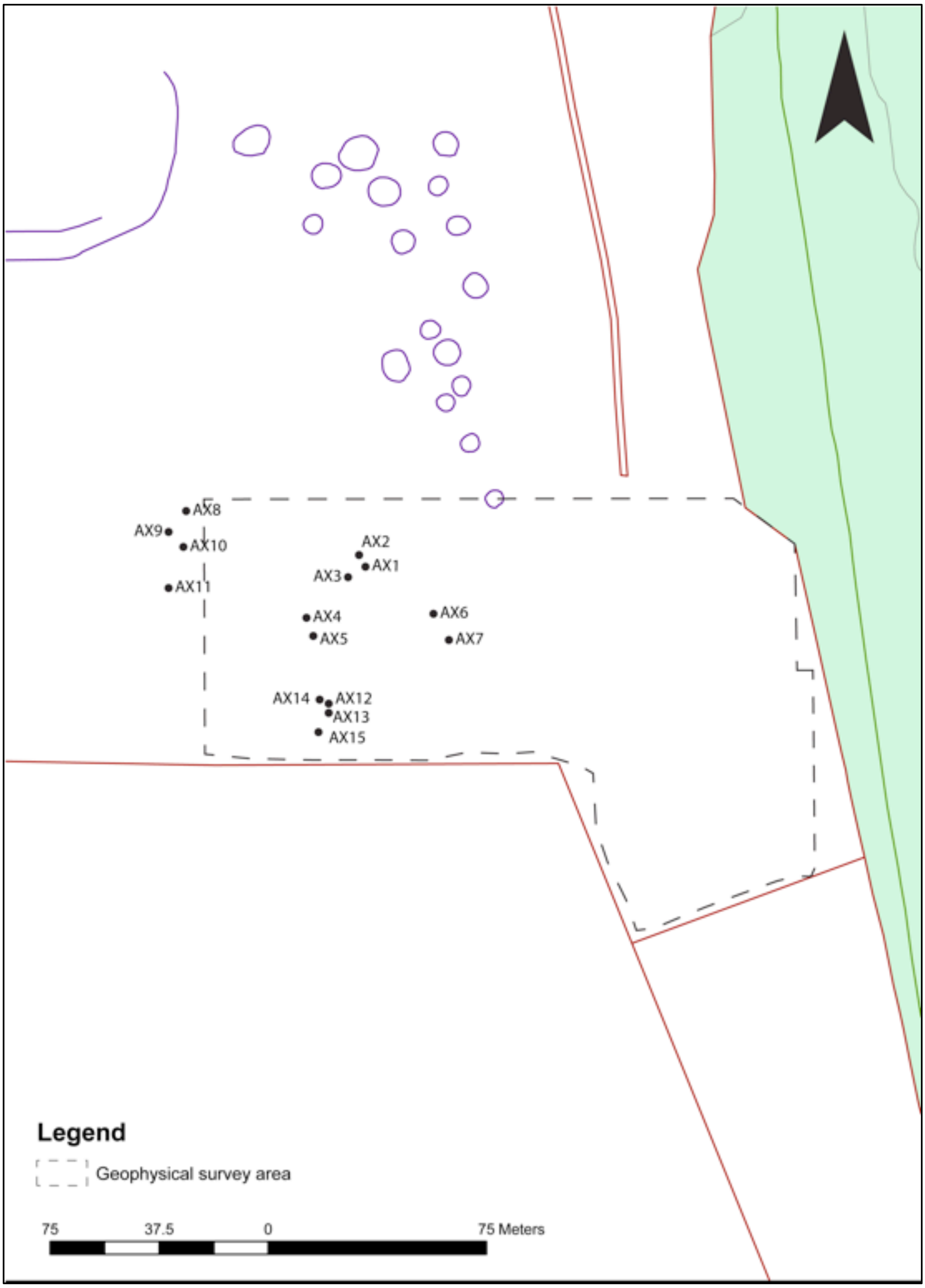

Fig. 5.1: Harrow Hill surface survey area with flintwork find-spots (Author).

Although the area of the waste material had been historically ploughed until the early 2000s, it was observed that it still formed groups and had not moved far from its original place of deposition (Fig.5.2). Although not considered *in situ*, the material was in relatively fresh condition with little observed damage from plough strike. As demonstrated, with regards to Church Hill (See below), the material probably derived from working floors, which were covered with spoil from adjacent mines. As mining continued, the spoil heaps grew and this material became sealed beneath them. Once ploughing began in the area of the mines, in the 1940's due to emergency wartime cultivation, the spoils were flattened, with some debitage dispersed and the working floors eventually re-exposed.

The spoil heaps in this area of Harrow Hill have not retained any height, in contrast to the main mine complex where they are over 1m tall. Therefore, the surveyed material informs not only the location of working floors, and the organisation of the mining landscape, but also the formation and erosion of spoil heaps. Their survey before further disturbance is of upmost importance for advancing knowledge of the formation, development and truncation of the mining landscape.

Fig. 5.2: Debitage in the survey area (Author 2019).

5.2.2 *Methodology*

A simple method was used for surveying the waste material. It was decided to only survey axes, either preforms or roughouts, any notable pieces of waste and any other lithics observed. General debitage was too numerous to survey in the limited time available. It was also noted, as on Church Hill (See below), that axes were often grouped together in denser concentrations of waste material. The location of each piece was plotted with use of a Leica rover GIS handheld receiver. The pieces were then photographed with minimal disturbance and notes were taken on their form, condition, size and weight. Observations were noted which might inform on the reason for their disposal, such as hinge fractures resulting from flaws within the nodule.

An area totaling c. 18,000m² was inspected, located almost entirely within the geophysical survey area (Fig.5.1). Little debitage was observed outside of this area, except in the spoil heaps of the main complex and along the edge of the Bronze Age enclosure where it had truncated the earlier mine workings.

The north area of the survey area had been previously field walked by Holgate in 1984 whilst it was still under cultivation (Holgate 1989). Holgate had recovered over 2475 pieces of struck flint and waste material (Chapter Three. See Appendix 3.1). This is of note, because it is probable that the material surveyed in 2019 was not exposed during the 1984 fieldwork and must have come to the surface during the last period of ploughing.

5.2.3 *Results*

(Figs. 5.3 - 5.5. Appendix 5.1)

In total 15 pieces of struck flint were surveyed (Table 3). Prefixed with AX, these can be divided into roughouts (8 pieces), preforms (3 pieces) and miscellaneous pieces (4 pieces), including an implement, core, blade and sickle blank. Numerous pieces of debitage littered the survey area as well, but were not surveyed. The pieces are discussed next according to their classification. All pieces are patinated white and cortex, where present, is thick, white and pitted, consistent with flint nodules sourced from chalk bedrock. They are all in surprisingly good condition with few fresh breaks, indicating they suffered little plough damage. It is noted that some faces were beginning to develop a off yellowish patina, presumably from exposure to direct sunlight.

Table 3: Harrow Hill surveyed flint work.

AX No.	**Type**	**Length** mm (L x W)	**Weight**	**Comments**
1	Roughout	138 x 27	467g	Medium size roughout, which has been lightly exposed to heat. A large deep flake has been removed from its butt end, probably the reason for its discard.
2	Roughout	123 x 24	265g	Small roughout. No obvious signs for its discard
3	Roughout	108 x 29	208g	End of a roughout, possible post-deposition fracture. It is also lightly burnt.
4	Roughout	117 x 18	221g	Small complete roughout. Deep overshot flake scar probably the reason for discard.
5	Roughout	141 x 18	448g	Medium sized complete roughout. Large overshot flake scar probably the reason for discard.
6	Pre-form	163 x 58	520g	Large preform. Minimal secondary flaking. A large hinge fracture at its tip is probably the reason for discard.
7	Roughout	129 x 21	412g	Medium size roughout. Has a large right-angled truncation at its butt end, almost like preparation for re-use as a core. No flakes removed.
8	Preform	107 x 35	306g	A preform that has been snapped and discarded. Some evidence of secondary working.
9	Roughout	113 x 22	295	Small fine roughout with deep flake scar, probably reason for discard. Could have been a miniature axe in its final form?
10	Roughout	1173 x 31	513g	Large complete roughout, quite

				thin for size and well worked. Clear flaw in the nodule, it is unclear why this was not spotted and the piece was still worked into a roughout.
11	Preform	142 x 23	249g	A prefrom, partially developed, but was possibly discarded due to flaw in the nodule.
12	Implement	146 x 19	241g	A large piercing implement produced from a primary flake. Retouch along its tip. Early Neolithic in date.
13	Blade	94 x 16	72g	A large blade that has been utilized as scraper. Unclear if it is an axe thinning flake, or produced from a core. Similar to examples from Pit X, on New Barn Down.
14	Core	71 x 41	216g	A large core produced on a piece of mining waste with thick cortex. Single faced with a well-developed platform and some signs of platform preparation. Several flakes have been removed, which would have been large, c. 70mm in length. Typical of Early Neolithic technologies.
15	Sickle	158 x 24	320g	A probable sickle blank. Compete and has a deep flakes scar at its butt, which was probably the reasons for its discard. A rare type and clearly Early Neolithic.

5.2.4 Roughouts (AX1, 2, 3, 4, 5, 7, 9, 10)

The most common type in the survey were bifacially worked axe roughouts, characterised by almost complete axes close to their finished form and clearly date to the Early Neolithic. The roughouts vary in size, between 108mm to 173mm in length and 18mm to 31mm thick, and are similar in form, with butt ends splaying out to a wider cutting edge.

Few natural flaws, such as frost fractures, are observed in the roughouts. The majority, such as AX1, AX5, AX6, have obvious knapping errors, such as step or hinge fractures, which probably accounted for the discard. Two roughouts, AX5 and AX10, both have natural flaws, probably from fossils within the nodules. AX 10, the largest roughout recorded, has an obvious flaw that would have been noted early on in the preparation of the nodule. It is unclear why AX10 was subsequently finished and then left in the working area. Two of the roughouts, AX3, AX7, have been snapped in production, as the breaks are not fresh and are patinated. These fractures are either due to natural flaws, or errors by the knapper, such as overshot removals resulting in breaks.

The roughouts are of a size and type well documented at the Sussex mines, historically classified as either 'Cissbury' Type 1a axes, or Type 1b (Gardiner 1988. 29; Barber *et al.* 1999; Butler 2005), all over 130mm in length and, if not discarded, were intended to be worked into fine polished axes. Two axes, AX2, A9, are less than 123mm in length and are small for Sussex mine examples. Both are within the upper size for miniature axes, which were a product of the Sussex mines, in particular, Cissbury (Gardiner 1988. 104). The purpose of miniature axes remains enigmatic, although there appears to be an association with flint mines and other Early Neolithic contexts, as discussed below.

The roughouts are typical of flint mines products, being large and worked to a basic form ready for polishing. Working appears to have been carried out quickly, as the intention appears to be to produce a basic roughout. This method of working may be the reason for so many discarded roughouts, as presumably the supply of raw flint was not a concern.

The quality of the knapping also reflects a rapid production method using hard-hammer percussion, as the majority of the roughouts are relatively crude. AX 1 is the most complete and showed clear evidence of soft-hammer percussion on one side, and larger flake removals more typical of hard-hammer on the other. Such variation in technique was recorded in the debitage examined during this research and previously by Holgate (2019), which shows that primary reduction was carried out by hard-hammer and secondary reduction carried out by both hard and soft-hammer. Finally, the size of the roughouts and associated debitage indicates that large good quality nodules were used, easily over 350mm^2 if 70% of the nodule is considered as waste during production (Bush and Sieveking 1986), entirely consistent with raw material sourced at depth in a flint mine.

Fig. 5.3: AX No's 1-6 (Author 2019).

Fig. 5.4: AX No's 7-12 (Author 2019).

Fig. 5.5: AX No's 13-15 (Author 2019).

5.2.5 Preforms (AX6, 8, 11)

A total of three preforms were recorded in the survey that are defined by pieces that lack any secondary working, or clear form as an axe, and were probably discarded early in their manufacture. Preforms are typical finds on flint mines and are indicative of the manufacture of axes from a steady supply of raw material, being associated with the primary reduction of nodules prior to production of a roughout. Preforms appear to be universally discarded due to knapping errors or natural faults in the flint, and represent the step in axe production between a tested nodule and roughout.

5.2.6 Other pieces (AX12, 13, 14, 15)

Four final pieces, all produced from mine knapping waste, document other lithics being produced, and presumably used, in the mining landscape. Detailed in Appendix 5.1 and Table 3 they include a large piercing implement (AX12), a scraper produced on a probable long blade (AX13), a long blade core (AX14) and a sickle roughout (AX15).

The piercing implement (AX12) is notable due to is size and is comparable to an example recorded as a surface find from New Barn Down, held in Worthing Museum (Fig.5.6). Both the scraper (AX13) and core (AX14) are all of well-known Early Neolithic types (Butler 2005). The scraper is comparable to examples from Pit X, New Barn Down (See Chapter Six, Paragraph 6.5) and Cissbury (See below).

The probable sickle roughout is noteworthy (AX15). Whist it appears to have been produced in the same manner as a bifacial axe roughout, its crescent shaped profile is more in keeping with a single piece sickle. An unusual and rare piece, a comparative example in size and form is recorded from Sewerby, Yorkshire by Clark (Clark 1932). Although AX13 is almost 100g heavier than the Sewerby piece, both examples are not completed implements, having no evidence of re-touched edges. Once finished, its final form would have put it within the scale of other recorded single piece sickles (Clark 1932; Gardiner 1988. 94). A large step fracture at its butt end is almost certainly why it was never completed. Other examples of sickles are known from flint mines, including one from Long Down (See below), and it is likely they were occasionally produced from mine flint.

Fig. 5.6: New Barn Down scraper (L. Fisher 2018).

5.2.7 Distribution

The surveyed pieces all fall within the area of the probable mineshafts presented in the geophysical survey. Although caution is expressed, because ploughing has disturbed them, their distribution no doubt records the general location of working floors within the southern extent of mining on Harrow Hill.

None of the roughouts are particularly grouped, but it was noted during surveying that they were located within denser areas of debitage, presumably representing a working floor. At others flint mines, where working floors have been excavated, such as Long Down (See Chapter Three and Holgate 2019), Church Hill (See below) and also elsewhere on Harrow Hill (See Chapter Three and Holgate 2019), these working floors on average measure c. 20m^{ø}. Through a rudimentary exercise of extending a circular area of 20m^{ø} around the main grouping of surveyed axe roughouts, a crude estimate has been made of where the working floors were located (Fig.5.7). Further comparison with the geophysical survey indicates that the presumed position of the working floors lies within an area largely clear of mineshafts, but very close to many workings located further north. On balance, it is more than likely that a total of three working large working floors are located in this area, the southern margins of the main mine complex.

With regards to AX12, 13, 14, 15, none of which were roughouts, these were grouped in the south edge of the survey area. It is notable that this area had much fewer large geophysical anomalies, assumed to be mineshafts, but a concentration of smaller features that were interpreted as possible pits (Fig.5.8). Such pieces, a core, blade, borer and sickle are much more typical of lithics associated with pits, rather than mining contexts. This finding suggests that this area of Harrow Hill may be associated with some level of activity not solely associated with mining. Alternatively, this area may have been subject to smaller, more informal extraction practice, such as the quarry features recorded by Holgate (See Chapter Three).

5.2.8 Discussion

This exercise was successful in recording the location of probable working floors located along the southern edge of main mine complex on Harrow Hill, a liminal area that little previous data has been gathered on. The lithics recorded during the survey, mostly axe roughouts, are typical of Early Neolithic axe production. Overall, the results of the survey support those of the geophysical survey and prove that not only was mining carried out in this area, but also that axes were produced in defined working floors.

The lithics examined and surveyed in the field support the findings of previous research on Harrow Hill, most notably by Holgate (1985c, 2019. See Chapter Three) and Sieveking (McNabb *et al.* 1996), which helped characterise the nature of axe production. It is clear that axes were produced rapidly using large nodules, reduced into preforms and then roughouts. The primary reduction was carried out with hard-hammer percussion, with soft-hammer being used for the final stages of secondary reduction to produce roughouts. Any flaws observed in the nodules, or errors by the knappers, resulted in discard. This sort of rapid knapping possibly indicates fairly short and sustained periods of axe production undertaken during, or after mineshafts were being worked.

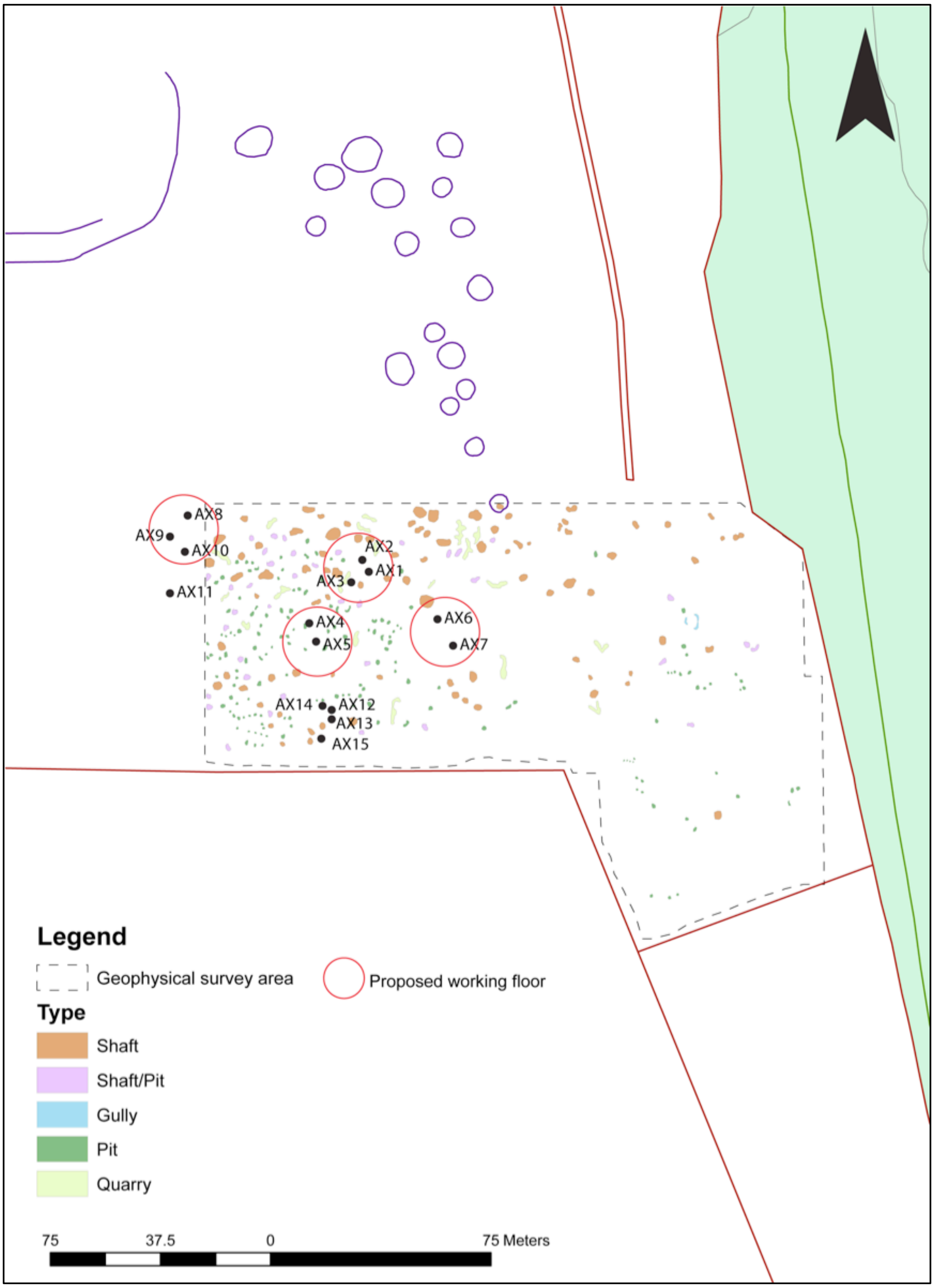

Fig. 5.7: Working floors over geophysical survey results (Author).

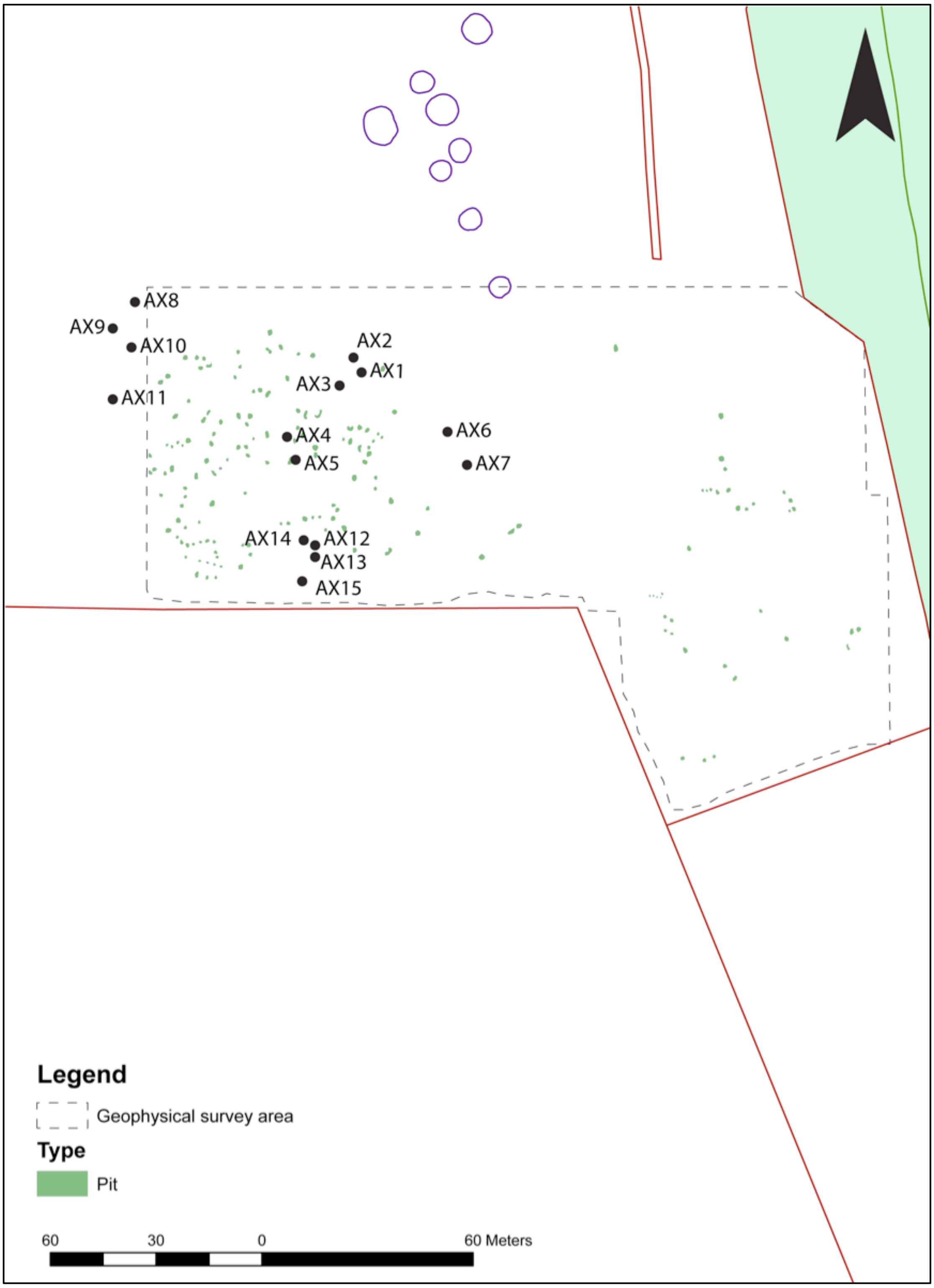

Fig. 5.8: Flintwork find-spots and possible pits (Author).

The location of the mines and the working floors at the margins of the southern limits of the main complex on Harrow Hill is of note. The geophysical survey indicates the presence of several large mineshafts in this area and also possible quarry features and smaller pits (See Chapter Four). The lithics almost certainly come from working floors associated with one or more of these mine features, although the chronology between the working floors and the mines is impossible to establish. The working floors could be contemporary with the mines and located around the shafts. Or, they could be later than the mines, overlying their remains or even carried out in the shelter of their depressions. Finally, the working floors could be earlier and truncated by later mines. Expanding knowledge on the relationship and stratigraphy between working floors and spoil heap formation would be crucial in understanding the chronology of mining, because it is possible that earlier knapping and mining horizons were covered by later episodes of both. This is a problem explored further with regards to the Church Hill survey.

On balance, the distribution of the mines does not indicate an overworking of the seams in this area, as they are spatially separated and not overlapping. This strongly suggests that the working floors are contemporary with mines and that material was not carried far from its place of extraction. This supports the findings on working floors at other Sussex mines (Holgate 2019) and indicates a fairly rapid approach to axe production and mining, with material being initially worked close to the mines and then secondary working carried out on the margins of the complex. As will be discussed in Chapter Seven, this contrasts with some Continental sites, such as Spiennes, and possibly also on Long Down, where more established working floors and areas of production may have developed. Although the character of one area of working floors may not apply to the whole of the complex, especially as mining probably continued for well over a century.

The survey area is of interest as it borders the edge of the Harrow Hill mine complex and New Barn Down to the south, where Pit X is located and is clearly associated with an episode of occupation contemporary with mining (See Chapter Six). A small collection of non-mining related lithics, the borer, core, and scraper, certainly indicate that other forms of activity were carried out in the survey area, at the edge of the mine complex. Scrapers and borers in particular are indicative of occupation activity and despite the fact the examples in the survey are produced from mine waste, they nonetheless indicate that not all activities carried out at the mines were focused on extraction and production of axes.

It is perhaps of significance that a series of possible pits were recorded in the same area as the implements in the geophysical survey, although it is recognisable that without further fieldwork their interpretation as pits, or their date, cannot be proven. But taken together, both the domestic lithics and the potential presence of pits hint at the possibility that other activities, including settlement, may have been carried out at the margins of a mine complex. Finally, the sickle roughout proves that not all products from the mines were axes.

5.3 Case Study Two: Church Hill
(Appendix 5.2)

5.3.1 Background

Whilst identifying potential flint mines to survey, an approach was made to the Church Hill landowner, who was not willing to permit any sustained fieldwork on the mines. However, in 2018 the opportunity arose at Church Hill to rapidly collect and survey axe roughouts that had been exposed by recent ploughing. The survey was carried in collaboration with James Sainsbury, Archaeological Curator at Worthing Museum and Art Gallery. Aside from the excavations of mineshafts, including 12 working floors, carried out by Pull in the 1940s (Pull 1933a,b,c,d, 1953; Russell 2001), the only additional fieldwork was surface artefact and ground surveys carried out by Holgate in 1984 (Holgate 1989; 2019).

These scatters are defined as chalky patches, the upcast from the mines, mixed with dense concentrations of struck flint from the working floors (Fig.5.9). The results of the survey carried out for this project supported previous studies, but also examined *in situ* flint working freshly exposed for a short while prior to be being destroyed by subsequent ploughing. Also recovered were a series of axe roughouts and picks, as detailed below. The survey added knowledge on the formation of spoil heaps and their spatial relationship with the main mine complex on Church Hill. It was a successful exercise that recorded aspects of an important Early Neolithic mine complex that is rapidly being lost by plough damage.

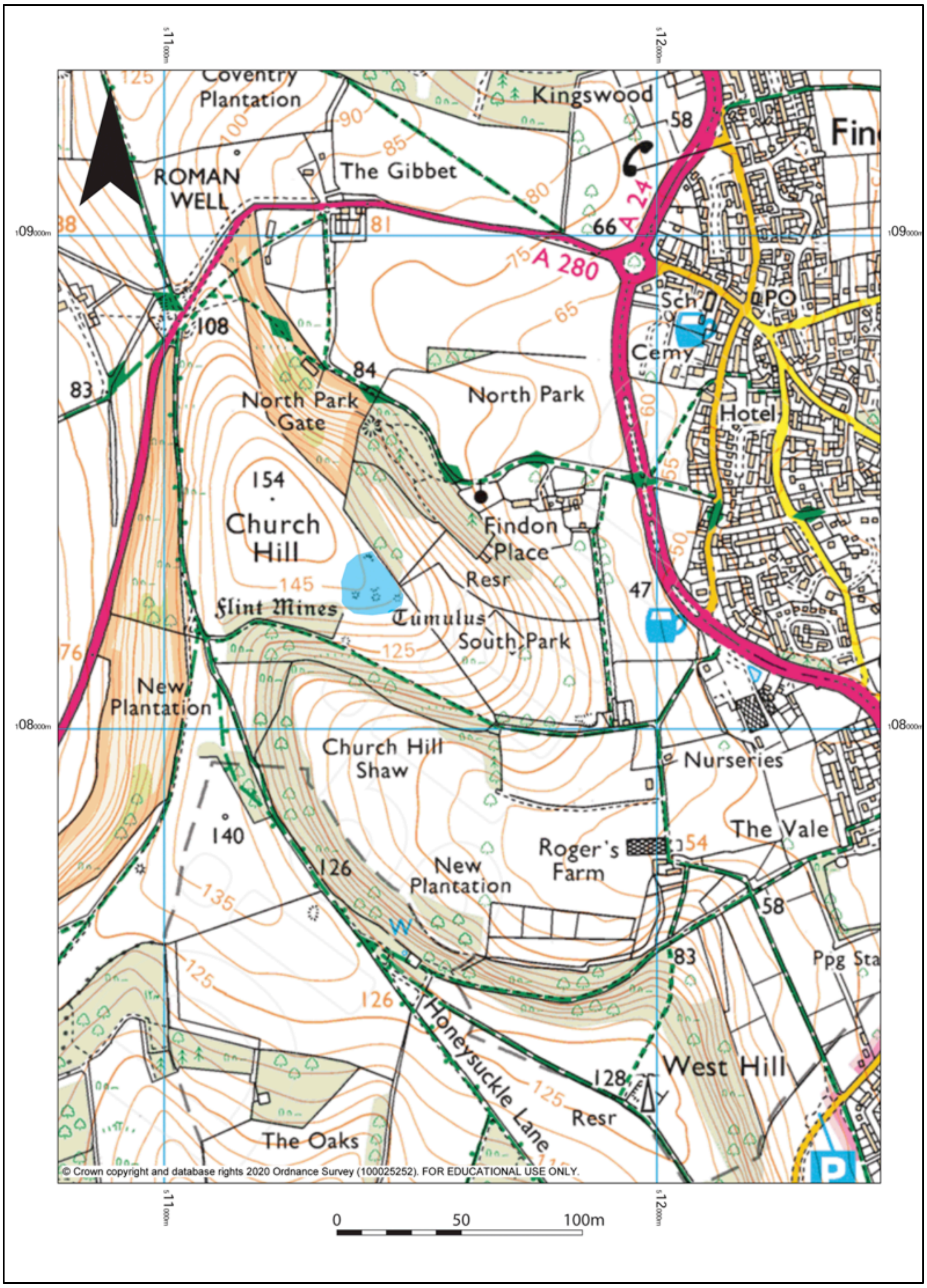

Fig. 5.9: Church Hill mines.
(Crown copyright and database rights 2020 Ordnance Survey 100025252).

Church Hill is a prominent hill overlooking Findon Valley to its east and Worthing and the Sussex Coastal Plain to the south. The mines at Cissbury Hill are located c. 2.5km to the east of Church Hill on the opposing east flank of Findon Valley. In total c. 35 mineshafts have been recorded, which are grouped tightly together on the southeast flank of Church Hill on a false crest. A large deposit of Clay-with-Flints caps and erodes downhill off Church Hill on it southeast flank, which is recorded on the British Geological Survey as a superficial Head deposit of clay, silt, sand and gravel. The mines cut through this deposit to the underlying bedrock, comprising of Tarrant Chalk Member and also Newhaven Chalk Formation at the southeast edge of the mine complex, whose white spoil is easily visible against the brown Head deposit (for further details See Chapter Two, Paragraph 2.2.3).

Fig. 5.10: Aerial photo of Church Hill showing mine spoil (Author).

The results of the 1984 surface artefact and ground surveys recorded 13 dense concentrations of mostly axe-thinning flakes and tool roughouts, representing the remains of working floors (Holgate 1989) that matched 12 surveyed by Pull (See Russell 2001). The working floors are located along the southeast edge of the main mine complex, but are still located within areas of several mineshafts (Fig.5.10). It was concluded in the 1989 report that due to ploughing, which has been carried out on Church Hill since the mines were listed as a Scheduled Ancient Monument by English Heritage in 1935, the working floors, spoil heaps and upper portions of the mineshafts were at high risk of further damage (Holgate 1989). It was recommended that the area be taken out of cultivation or, failing that, sample excavation should be undertaken to record the extent of the plough damage and the nature of the relationship between the working floors and neighbouring mineshafts.

Since 1984 no further work has been carried and the Church Hill mines remain on the Heritage at risk register. The results obtained for this project, although punitive, may represent one of the last chances to record the working floors before they are destroyed. An attempt was made to undertake a more thorough programme of fieldwork and survey, which won the approval of Historic England, but the current landowner would not permit this to be undertaken.

5.3.2 Methodology

Following on from the Harrow Hill survey, the method employed on Church Hill was also simple, comprising of a walkover survey whilst collecting GIS data with a mobile GNSS total station. The working floors were individually photographed and surveyed, as were find spots of notable lithics. Unlike Harrow Hill, the lithics were collected by James Sainsbury (Worthing Museum) and recorded with a hand held GPS, as they were susceptible to removal by collectors. Therefore, it was not possible to document artefacts *in situ*, although their locations are presented with the survey data. Each piece has been individually numbered, beginning with Flint Work 1 (FW1), measured, weighed, photographed and illustrated for this report and a pending article for the *Sussex Archeological Collections*.

Due to limited time, it was decided not to survey the extensive working floors previously recorded by Holgate, although few signs of these remained, and to only focus on those that contained *in situ* knapping waste. A total of four new working floors were surveyed, along with a total of nine notable pieces of flintwork. Each working floor was numbered, beginning with Working Floor 1 (WF1), and surveyed, photographed and described.

5.3.3 Results

A large area of struck flint was observed along the southeast edge of the main mine complex on Church Hill. Within this area, four small patches of intense knapping waste were recorded. Each patch measured c. 3-5m^{ø} and appeared to be the remains of *in situ* working floors. The flints were present within a deposit of loose grey to white calcareous rich silt with abundant inclusions of small chalk fragments, and overlying a deposit of friable brown clay, and occasional natural flints, up to 200mm^2 in size. The calcareous deposit is almost certainly a chalky silt formed from washed and eroded chalk. Similar deposits are recorded within flint mine shafts, including on Long Down (See Chapter Three), and probably originated from eroded chalk spoil heaps close by. The brown clay deposit is the natural Head deposit, which, in places, has become re-deposited and mixed with mine waste. Unusually, no large chalk blocks typical of flint mines were observed, although weathering and ploughing may have fragmented these.

Inspection of these working floors revealed them to be composed, c. 70-80%, of a mix of hard and soft hammer flakes (Fig.5.11). The material appeared in fresh condition and varied in colour between unpatinated blue grey, to patinated white. Cortex, where present was thick, white and pitted, consistent with chalk sourced raw material from a mine. Much of the debitage comprised medium to large fine axe-thinning flakes, typical of Early Neolithic axe production recorded at all flint mine sites.

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The debitage was clustered and probably originated from individual knapping events (Fig.5.12). There was not an abundance of waste from the primary reduction of large nodules and much of the material appeared to be thin secondary waste. This indicates that the floors in the survey area are based on the secondary production and finishing of axes, rather that primary production of mine extracted nodules.

The working floors are located close to a number of depressions assumed to be the remains of mineshafts. The main complex is located to the northwest and is littered with more numerous large pieces of debitage, although the abundance of material noted by Holgate in the 1984 survey was not observed. Therefore, the working floors recorded for this survey are not as extensive as those previously documented, because they have been ploughed away.

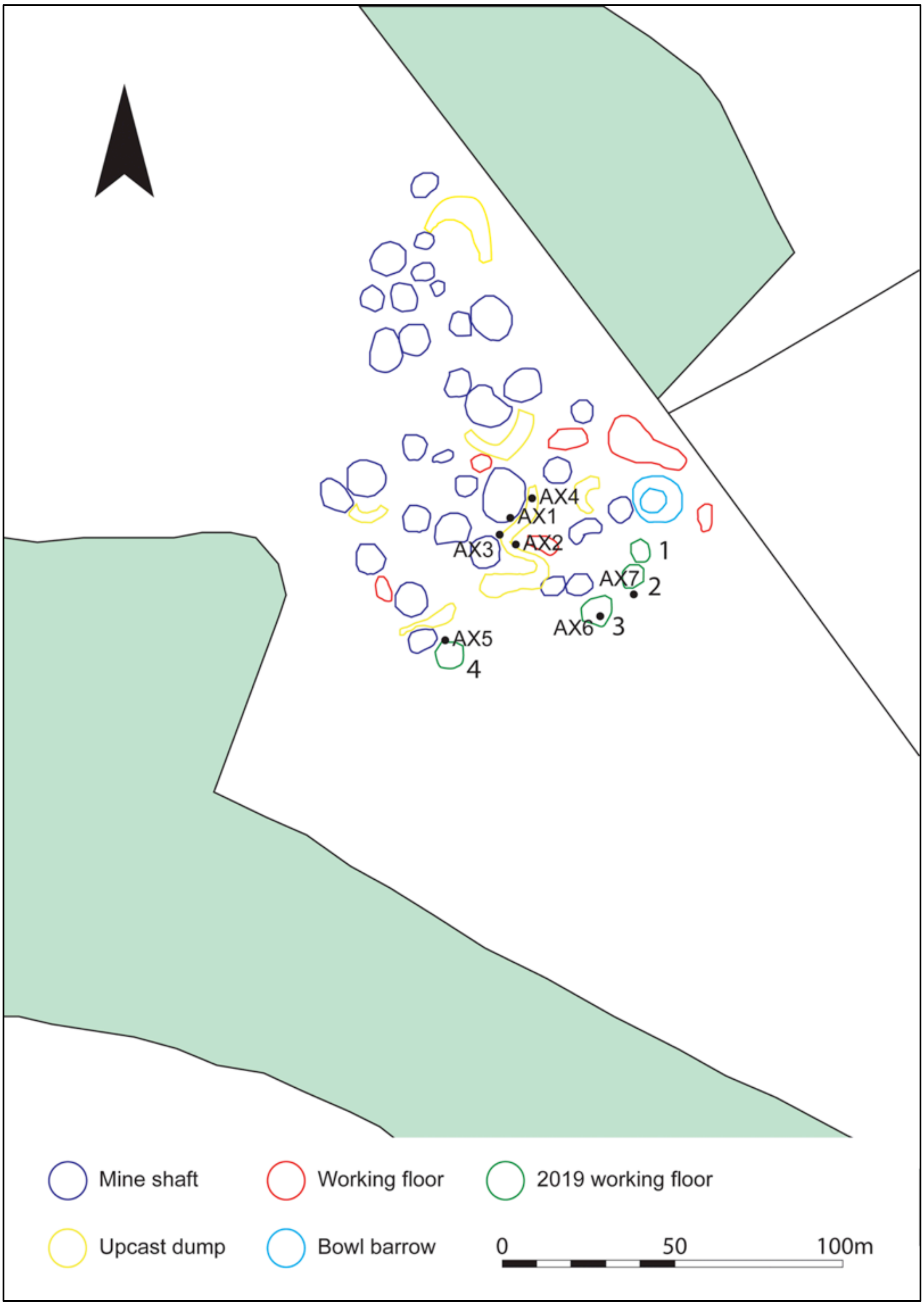


Fig. 5.11: Location of axes and working floors (Author).

It is concluded that the working floors are stratigraphically low in the sequence of mining activity on Church Hill, as during the 1984 survey the working floors were more prominent. Although this does not necessarily make them chronological early as the spoil heaps remain undated. Few notable spoil heaps were observed in the 2018 survey and the depressions of the mineshafts, clearly visible at many Sussex mines, were barely perceivable. It was recognised that the mine complex has been greatly reduced by ploughing and that the new working floors are probably very close to a former mining surface. The reason why they have survived *in situ* is because they were protected by a later covering of mine waste and debitage, which has now been truncated. Therefore, these small, discrete scatters are possibly amongst the earliest activity associated with mining in this area of the complex on Church Hill and are of significance.

Fig. 5.12: Area of working floors survey (Author 2019).

Aside from the working floors, a number of lithics were plotted and recorded (Figs.5.13 - 5.14). These were collected both from within and between the working floors. Whether they resulted from earlier or later working floors is unknown, although they are clearly mine products. Much material has been removed from the surface of Church Hill by collectors, so it is likely that they were only exposed by recent ploughing. Stratigraphically they are close to the same horizon as the new working floors. They appear to be reasonably fresh and not weathered, like some of the axes on Harrow Hill that had gained an off-white, buff patination. The pieces are presented in Table 4 with a full report in Appendix 5.2.

Fig. 5.13: Working Floor 1 (Author 2019).

Fig. 5.14: Detail of *in situ* debitage, Working Floor 1 (Author 2019).

5.3.4 The implements (Figs.5.15 - 5.17)

The five pick/chisel type implements (AX1, AX2, AX3, AX4, AX7) defy easy categorization. They are more finely worked than what are generally classified as Early Neolithic picks (Gardiner 1988. 85) and their cutting ends, where present, are more chisel like. They are clearly mine products, being produced from large flakes rather than being core tools. Comparable examples include one from the Long Down mines (Chapter Three, No. 1, Fig. 38), and another from the assemblage in Pit X, New Barn Down, (Baczkowski 2019a, See Chapter Six, Paragraph 6.5). That they appear to have been produced and used within the working floors and broken during use, strongly infers that they may have been an implement specially manufactured for use within the mining methodology, such as working of antler or wood.

The fine long backed knife is impressive for its length. There is no doubt that it was produced from a large core that more than likely was worked from mine-sourced flint. Backed knifes appear to have an association with pits, notably Pit X on New Barn Down, and Pit 9050 at Claypit Lane, Westhampnett, both analysed in Chapter Six. The manufacture, use and disposal of such an implement within a mining environment could be characteristic of either non-mining activity, or the manufacture of equipment needed for mining, such as antler or wooden props. A number of long blades with re-touch were also recorded in the Salisbury archive from Long Down excavation, supporting their production and use at mines.

5.2.5 Axe roughouts (Figs.5.17 - 5.18)

The axe roughouts are typical of Early Neolithic mine products. The large WF6, weighing 614g, is at the upper end of the size of axe roughouts and close to being finished. The two smaller roughouts, AX5, AX8, are both fine examples and fall within the size range for miniature axes. AX5 shares similarities in form and size, being close to 120mm in length, with several examples from Harrow Hill detailed above. The smaller AX8 is an unusual form, being pear-shaped and is clearly a miniature close to completion. Further discussion of the miniature axes follows below.

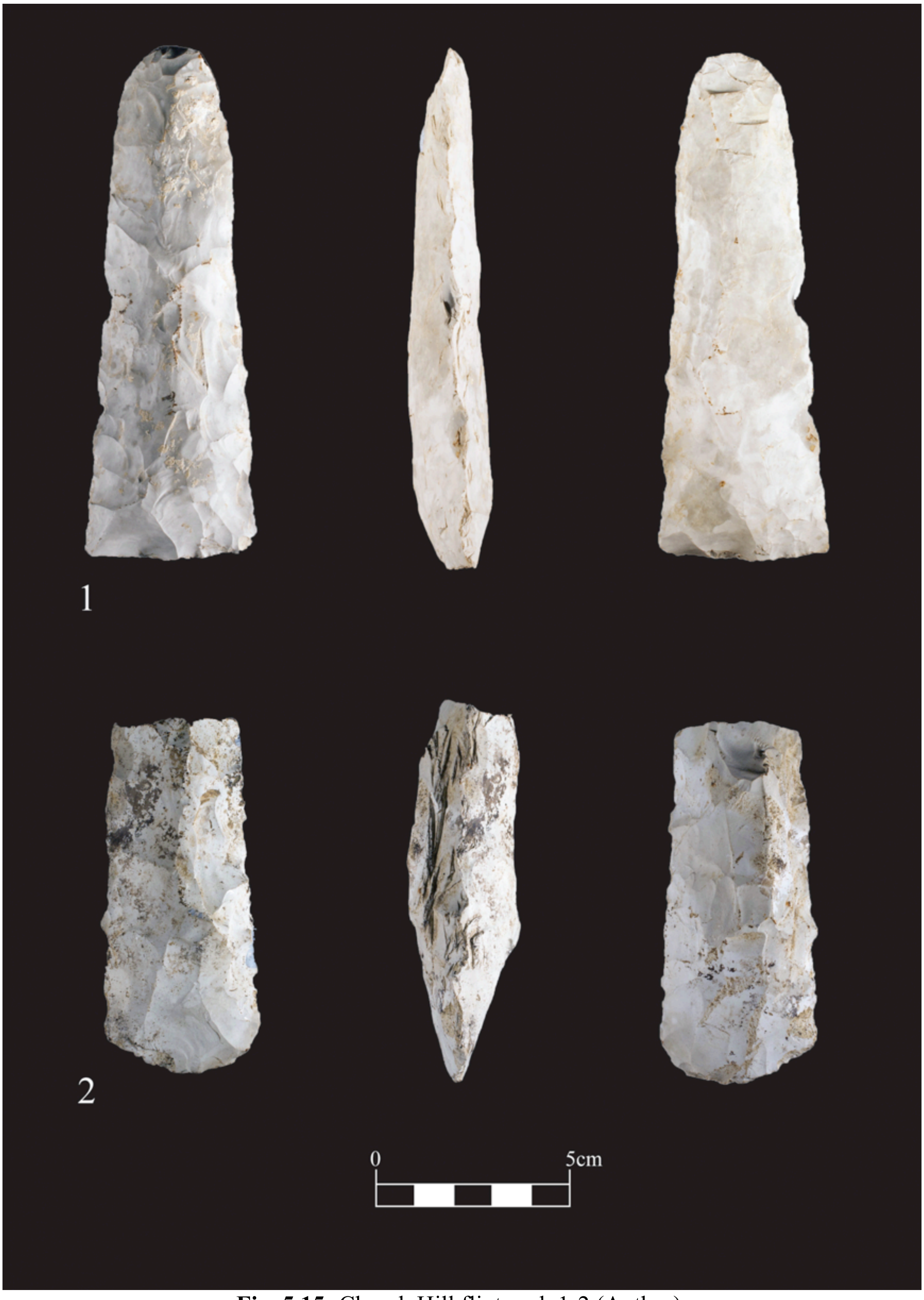


Fig. 5.15: Church Hill flintwork 1-2 (Author).

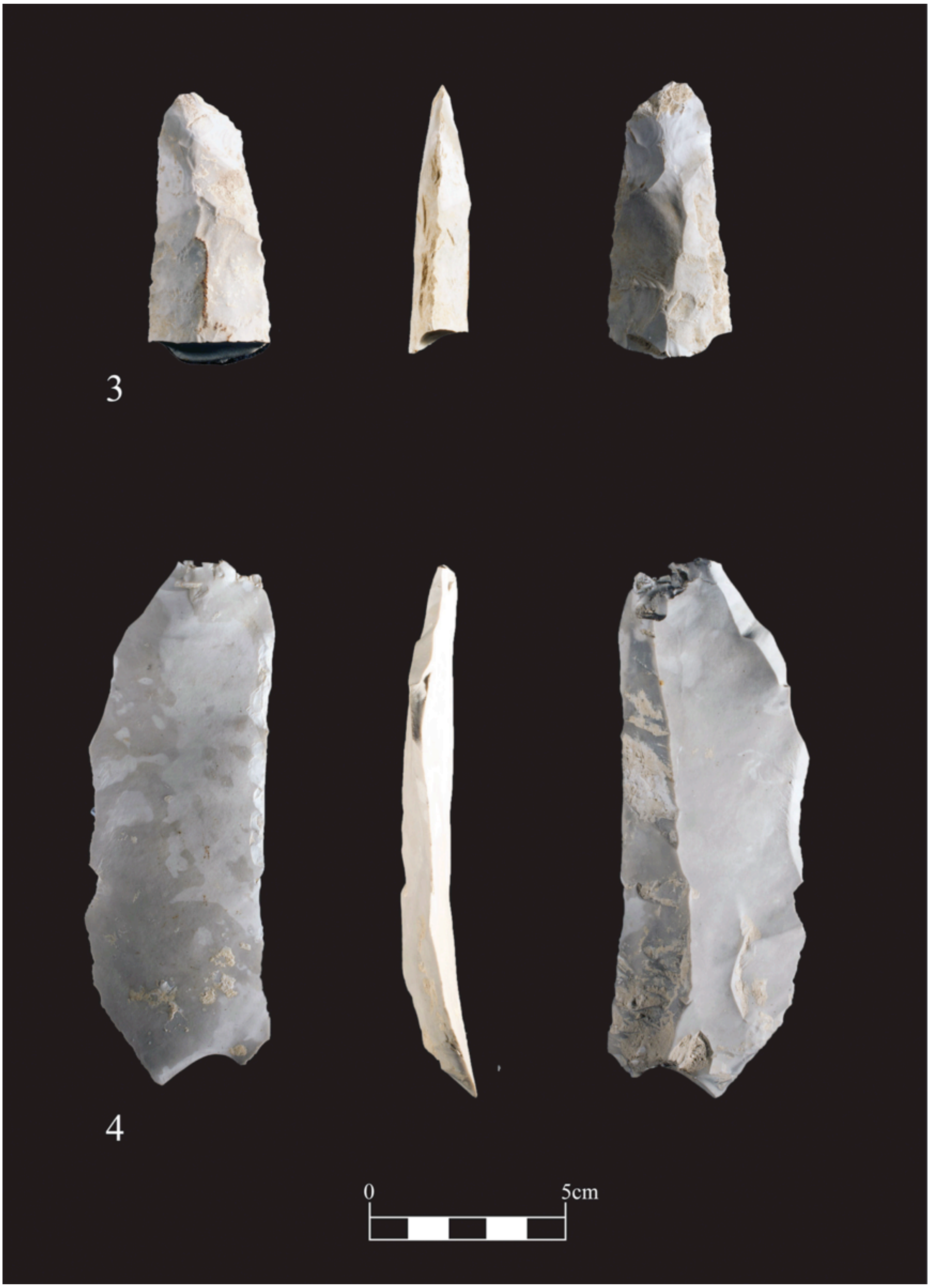


Fig. 5.16: Church Hill flintwork 3-4 (Author).

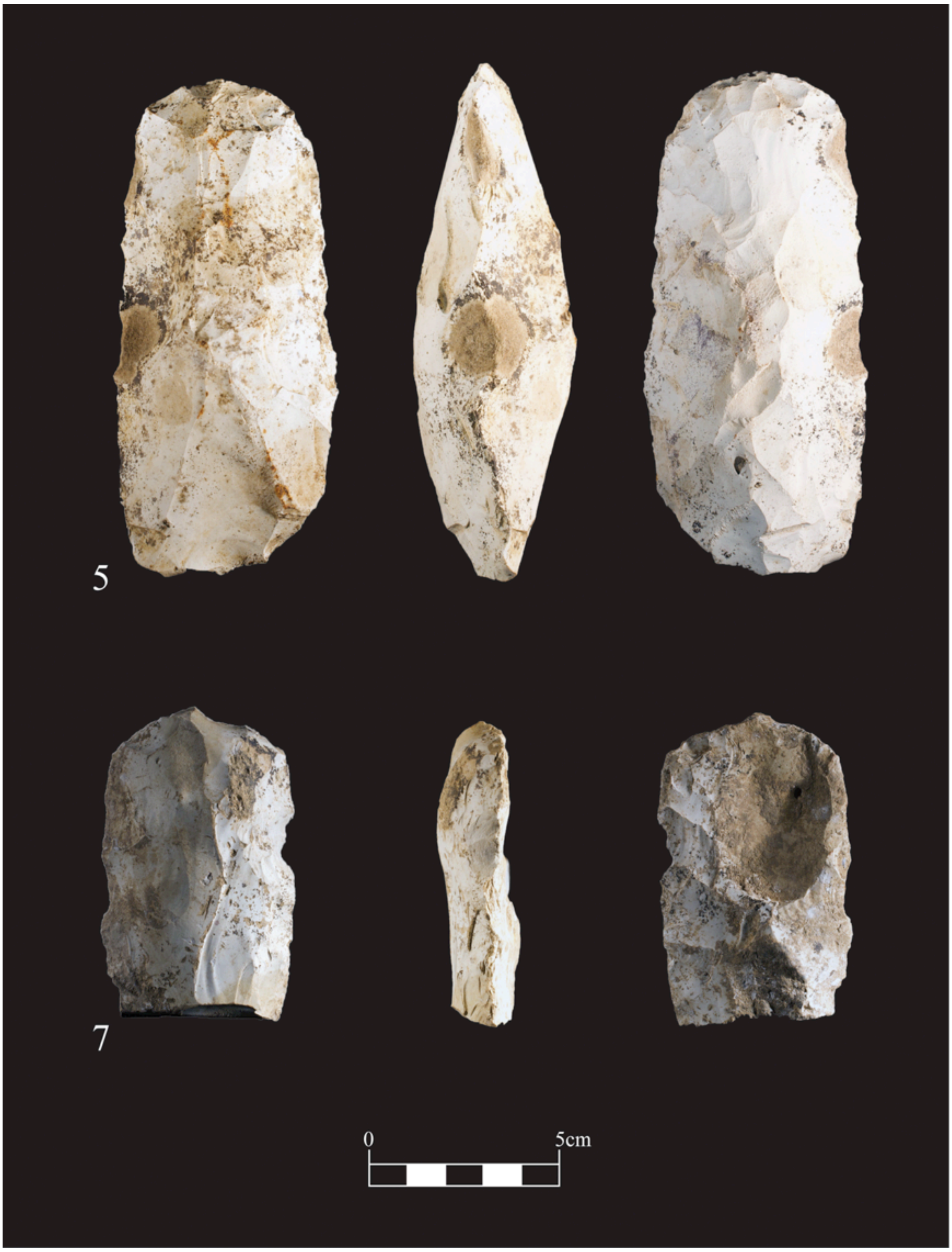


Fig. 5.17: Church Hill flintwork 5 and 7 (Author).

Fig. 5.18: Church Hill flintwork 6 (Author).

Fig. 5.19: Church Hill flintwork 8 (Author).

Table 4: Church Hill flintwork.

WF No.	Type	Length mm (L x W)	Weight	Comments
1	Tool	12 x 1	89g	Complete pick/chisel
2	Tool	87 x 26	92g	Butt ended half of a pick/chisel, nearly complete, but snapped in manufacture?
3	Tool	66 x 15	24g	Snapped tip of a pick/chisel, snapped in use?
4	Tool	129 x 14	74g	Long blade struck from core. Appears to have been utilised as a backed knife.
5	Roughout	121 x 38	222g	A complete small axe roughout, possible flaw. Almost finished.
6	Roughout	169x 53	614g	Large 'Cissbury type' roughout with step fracture
7	Tool	72 x 16	68g	Butt end of a pick/chisel. Well-rolled, broken in use?
8	Roughout	108 x 28	111g	Miniature axe roughout, pear-shaped and complete, no obvious flaws.

5.4 Case Study Three: Archival lithics

Aside from the lithics recorded in the Harrow Hill and Church Hill surveys, other small flint work assemblages were encountered in the course of the research. Extensive private collections are known to exist, especially of complete and roughout axes from the Cissbury mines. One such collection was recorded by Holgate, which comprised of large axes from Long Down (Fig.5.20). Although it is beyond the remit of this project to re-evaluate these collections, some of which were previously documented by Gardiner (Gardiner 1988, 1990), it is worth briefly outlining observations on some of the material reviewed for this project. This exercise supports some of the findings of this project, and also demonstrates the potential of such analysis for future research. Finally, it proves how little is actually known about aspects of flint mine assemblages, beyond bifacial axe production, and so could inform knowledge of activities associated with mining.

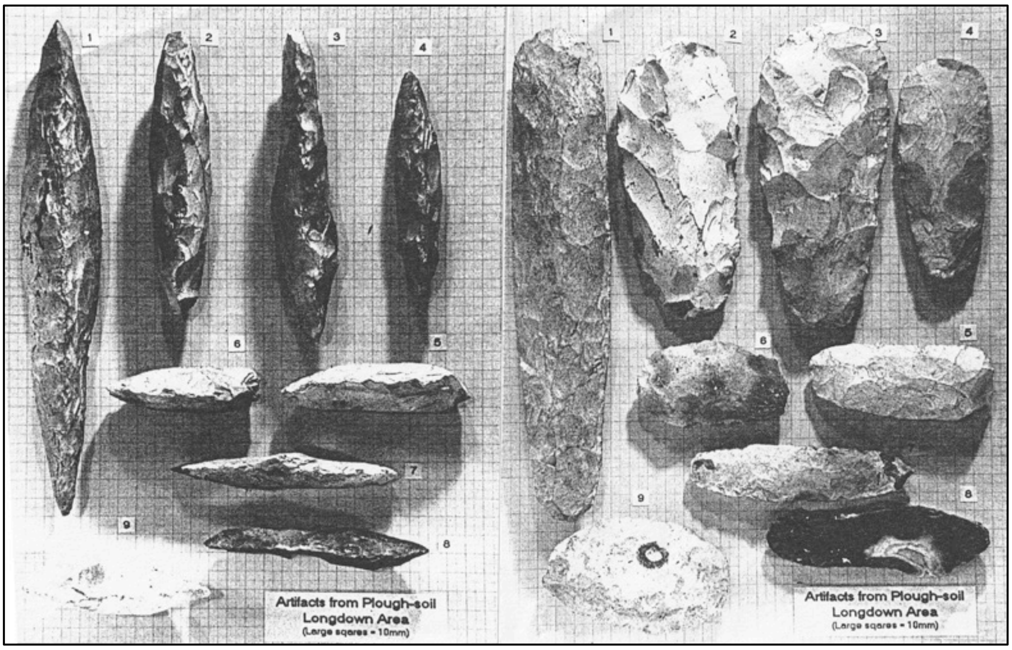


Fig. 5.20: Long Down axe collection (Holgate 1986).

5.4.1 Sickles

Apart from the sickle roughout recorded during the Harrow Hill survey, one other complete single piece sickle was recorded during this project Fig.5.21), contained within the Salisbury archive held in the Novium Chichester. Salisbury recorded that the sickle was recovered during his 1956 excavation of Long Down from the backfill of Shaft 1 (Salisbury 1961. 69), the same mineshaft excavated by Holgate (See Chapter Three). This is a notably long and finely made example, measuring 173m long x 43mm wide x 18mm thick and weighing 86g. It is produced from a long blade that has been delicately struck from what must have been large carefully prepared core, presumably manufactured from mine flint. It is bi-facially worked with fine semi-abrupt re-touch. There is no obvious reason for its discard.

Single piece sickles are rare implements and produced exclusively in the Early Neolithic (Butler 2005). Other examples, mostly fragments, are recorded from the Cissbury and Long Down mines, along with two surface finds from the Eastbourne area (Clark 1932; Gardiner 1988. 94). Their association with agriculture practices is clear and they have a long history of use on the Continent in Early Neolithic farming communities (Van Gijn 2010). That they were produced on flint mines is noteworthy and demonstrates that smaller amounts of specialist implements were produced alongside axes.

Fig. 5.21: Long Down sickle (Author).

5.4.2 Miniature axes, a mine phenomenon?

There is a clear relationship between miniature axes and flint mines, which has been previously observed (Gardiner 1988). Miniature axes remain an oddity, whose purpose has not clearly been defined. Curwen novelly considered miniature axes to be children's toys (Curwen 1937), although it is almost certain they represent specialist tools, particular to the Early Neolithic, for use in wood working, or similar craft activity (Gardiner 1988. 103). There is little to be gained from discussing the purpose of miniature axes here, instead a brief study of their relationship with flint mines is undertaken.

As proposed by Gardiner, miniature axes are classified by pieces measuring under 100mm in length (Gardiner 1988. 103-04). This is a somewhat arbitrary measurement and for this project any pieces below, or close to 120mm in length, are classified as miniature, because they are clearly smaller than the large ‘Cissbury type’ axes that consistently measure over 140-150mm+ in length. A fine example found at Cissbury, close to the mines, measured 80mm long, was of the same form as the larger ‘Cissbury type’ axes and may have been hafted (Field 1982. 205-207).

Several examples recorded from Harrow Hill measured between 100mm to 120mm in length (Table 3), which could be considered above the defined size for a miniature axe until it is recognised that these are unfinished roughouts whose final form would be have been closer to 100mm in length. Of the two examples from Church Hill, the small complete FW 8 measures 108mm in length and is certainly a miniature axe. Over fifty have also been recorded as originating from Cissbury (Gardiner 1988. 103).

During archival research on the Long Down a number of miniature axes were recorded from Salisbury’s excavation (See Appendix 5.3). These were of various stages of production and are detailed in Table 5 and presented in Figures 5.22-5.23. Some examples, No’s 2, 4, 6, 7, 8 are crude and are produced from thick flakes, probably from the debitage of axe production. These are more pick-like in profile and may have been used in mining. Strikingly similar picks are recorded from Rijkholt (Felder *et al.* 1998) and Spiennes (Collet *et al.* 2008). The other examples, No’s 1, 3, 5, 8, represent miniature bi-facially worked axes and are similar in size, up to 128 in length, and up to 229g in weight, to the other examples recorded during this project. Like the Harrow Hill examples, they appear unfinished and are the same in form as larger roughout axes. They have no obvious flaws and it is unknown why they have been discarded in the mining horizon. No 3 is particularly finely made example. There is no doubt they were produced during mining on Long Down and are similar to the examples from Harrow Hill, clearly proving their links to the flint mines.

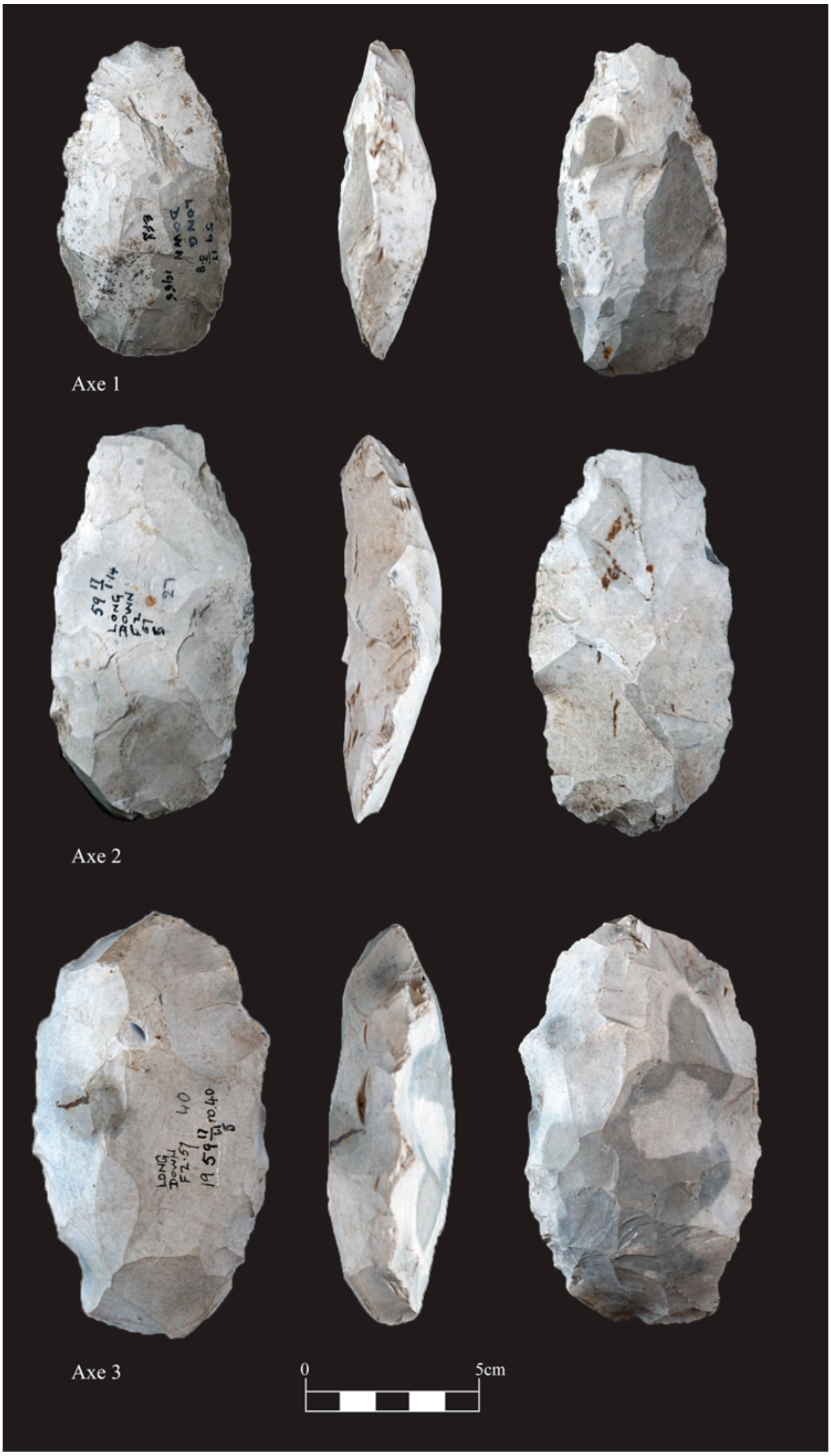


Fig. 5.22: Long Down, Miniature axes 1-3 (Author).

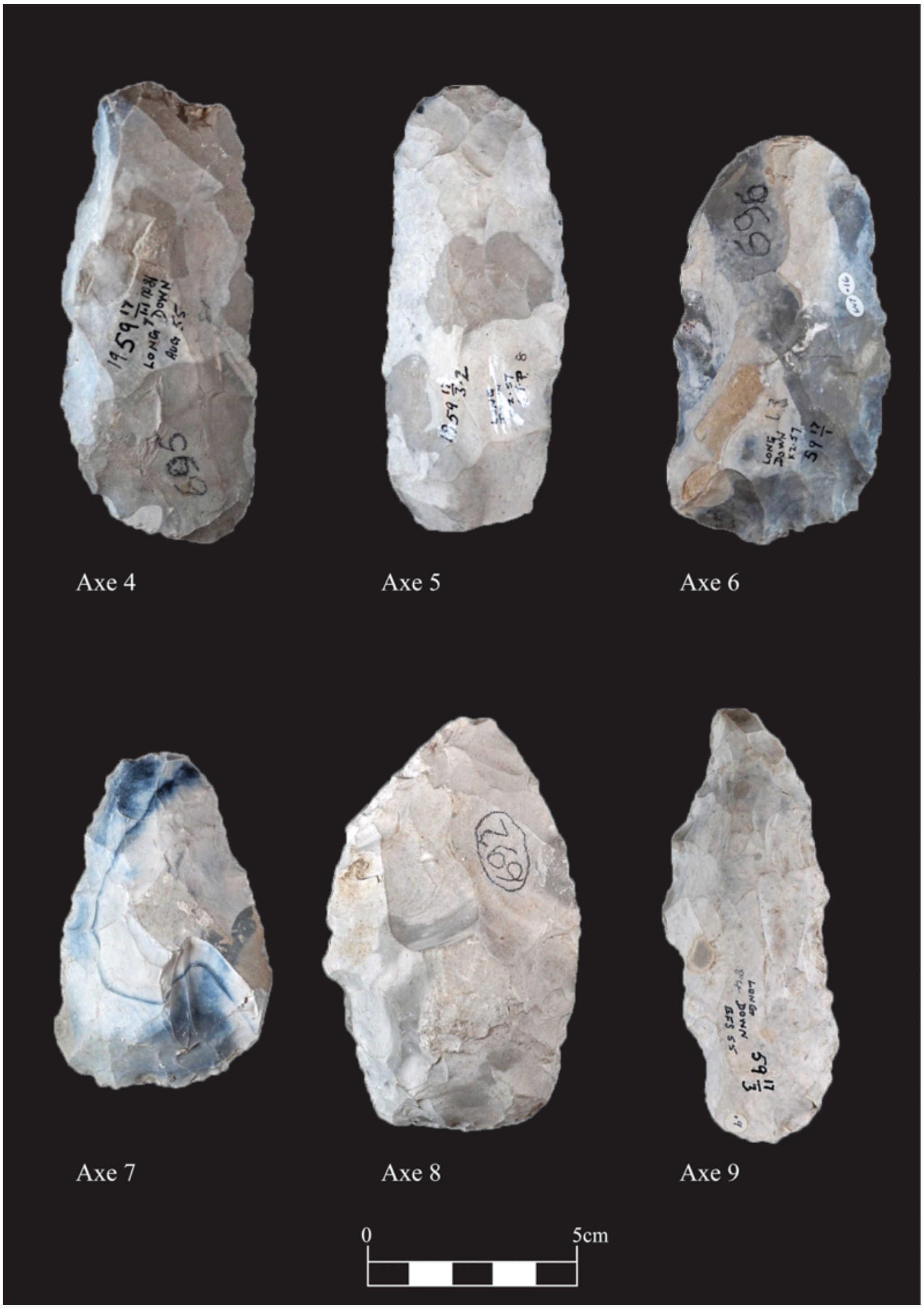


Fig. 5.23: Long Down, Miniature axes 4-9 (Author).

There are also c. 30 examples recorded from non-mining sites across Sussex, mostly from open scatters (Gardiner 1988). Miniature axes were therefore not only made at mines, but also used at occupation sites. One example was recorded during the course of this project from an Early Neolithic context, a gully, at North Bersted, Bognor Regis (See Chapter Six, Paragraph 6.4.2). The North Bersted example was 60mm long and 29mm wide and damaged either in use or manufacture and was associated with a small assemblage of Plain Bowl pottery. Its form is very similar to examples from the Long Down mines, which located c. 8km north of North Bersted, possibly indicates a link between the two Early Neolithic sites.

An interesting miniature axe was recovered from an Early Neolithic pit at Rookery Hill, Bishopstone (Bell 1977). Notably, this was provenanced to chalk bedrock in the area of the Cissbury mines (Craddock *et al.* 1983). Further analysis of this axe is untaken in Chapter Six.

Two other non-mining examples were recovered during field collection survey at Lower Hoddern Farm, Peacehaven (Angel 2007. 39). These examples measured 115mm and 89mm in length and were manufactured from good quality locally sourced flint (Fig.5.24), The area of Peacehaven is rich in Early Neolithic occupation activity (See Chapter Six). The presence of miniature axes at Peacehaven, Bishopstone, North Bersted demonstrates that they were a widely distributed, but reasonably rare form of axe.

Table 5: Long Down miniature axes and picks.

Axe No.	**Type**	**Length** mm (L x W)	**Weight**	**Comments**
1	Axe	98 x 52	130g	Small complete, finely bi-facially worked axe
2	Pick	126 x 69	229g	Pick, produced on a thick flake
3	Axe	128 x 78	342g	Complete bi-facially worked axe, no obvious flaws
4	Pick	129 x 42	101g	Narrow pick produced on a flake
5	Axe	105 x 62	105g	Fine bi-facially worked axe no obvious flaws
6	Pick	118 x 54	149g	Crude thick pick
7	Pick	97 x 51	110g	Short pointed pick produced on a flake
8	Axe	112 x 73	166	Short robust bi-facially worked axe, narrow to almost pick like profile
9	Pick	124 x 42	130	Pick like implement produced on a flake, possible use-wear on tip?

Without further, extensive assessment of the flint mine and other archives, little more can be added on miniature axes. However, it can be concluded that miniature axes are enigmatic tools and are firmly dated to the Early Neolithic. They were clearly being predominately produced at flint mines, along with smaller amount on settlement sites. They may been used in a craft activity, such as wood working, which was undertaken in a wide variety of settings, including flint mines and sites associated with occupation, such as Peacehaven. As some examples are finely made, and unused, and mirror the larger axe roughouts, they may have also been produced for non-functional reasons. They are important because they link the flint mines to non-mining sites located elsewhere in Sussex, as explored in Chapter Six.

Fig. 5.24: Lower Hoddern Farm miniature axes (Author).

5.4.3 Cissbury flintwork
(Appendix 5.4).

Whilst researching this chapter, a small assemblage of flintwork was discovered in the archives of the Barbican Museum, Lewes. The assemblage was being discarded, as ongoing reduction of the Sussex Archaeological Society and East Sussex County Council archives. The pieces in the assemblage are marked *Cissbury* or *Nr Cissbury* and dated to 1905, or 1906 and were possibly collected by a local landowner or one of the many antiquarians visiting Cissbury. A total of nine pieces are recorded and numbered from Cissbury Flint 1 (CF1). They are detailed in Table 6 and Figures 5.25 – 5.27.

All the pieces, including two axe roughout fragments and seven scrapers, are associated with bifacial axe production and are almost certainly produced from mined sourced raw flint, presumably from the Cissbury mines. Cortex, where present, is thick, pitted and white, in keeping with mined flint. The majority of the pieces are patinated white, consistent with prolonged deposition within calcareous soils. A notable number of the pieces are unpatinated, being a dark to light milky grey in colour, with a slight bluish hue. Significantly, this is the unpatinated colour of Cissbury flint that is rarely seen in mine pieces which are mostly patinated white from contact with calcareous soils. .

Table 6: Cissbury flintwork.

CF No.	**Type**	**Length** mm (L x W)	**Weight**	**Comments**
1	Tool	62 x 26	74g	Side and end scraper, unpatinated, on axe-thinning flake
2	Tool	63 x 17	48g	End scraper, white in colour, on axe-thinning flake
3	Tool	68 x 17	73g	Nicely worked end/side scraper, milky mid to light grey in colour, part of bulb missing
4	Tool	98 x 19	87g	A long end scraper on axe thinning flake
5	Tool	52 x 20	41	A short robust scraper, slightly burnt
6	Tool	67 x 17	43g	Small long-ended scraper, unpatinated and used
7	Tool	84 x 14	49g	A long fine end scraper on a plunging blade, probably an axe thinning flake
8	Roughout	114 x 33	285g	Fragment of axe roughout, with edge possibly re-worked for large scraper
9	Roughout	119 x 48	313g	Fragment of roughout, step fractured.

5.4.3 Significance

Although the assemblage is of limited value due to a lack of provenance, it is nonetheless of interest and was almost certainly produced on flint sourced from the

Cissbury mines. The axe roughouts are characteristic of others from flint mines examined in the course of this project and require no further discussion. However, the scrapers, all produced from axe production debitage, warrant some attention.

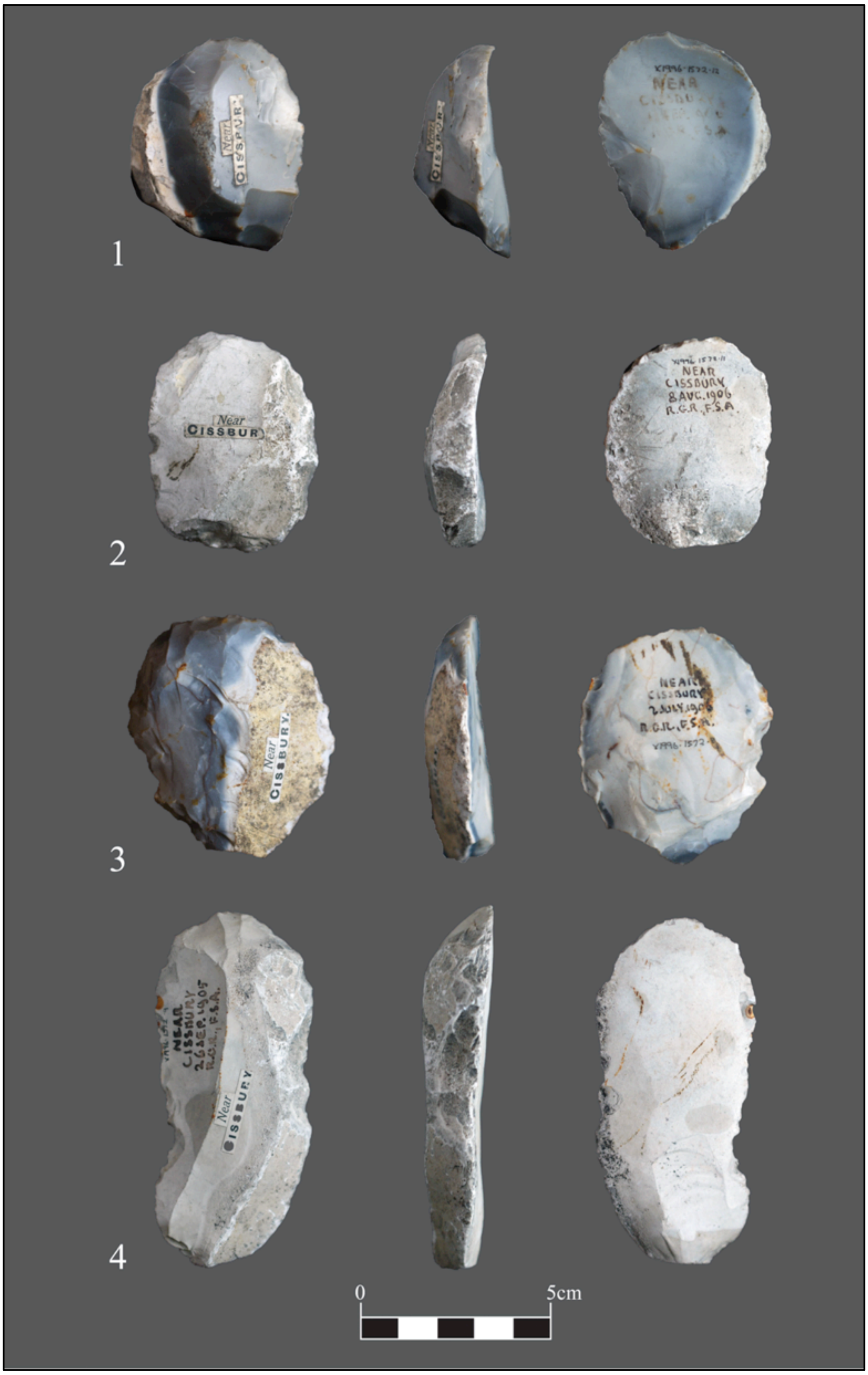


Fig. 5.25: Cissbury flintwork 1 – 4 (Author).

Fig. 5.26: Cissbury flintwork 5 – 7 (Author).

Fig. 5.27: Cissbury flintwork 8 – 9 (Author).

The form of the scrapers, large, robust and with plunging profiles, is typical for Early Neolithic examples (Gardiner 1988; Butler 2005). A similar set of scrapers, in form and size, were examined from Pit X, New Barn Down, as discussed in Chapter Six (See Paragraph 6.5), a feature clearly connected to the Harrow Hill mines. Both assemblages are also produced from fresh, not recycled flakes, as they show no prior weathering, of either short, thick pieces of debitage or long axe thinning flakes, or blades. Another common feature is the removal of the bulb of percussion and the knapping/blunting of one edge on the long-ended scrapers to possibly allow the other edge to be used for cutting.

The importance of the scrapers is that they demonstrate that somewhere, within the Cissbury environ, groups or individuals were not solely producing axes. This is notable, as scrapers are clearly associated with activities more domestic in character, rather than industrial. They indicate that not all aspects of lithic production at the mines were based on axe production and that other activities were carried out alongside mining. Whether this activity was connected to mining, such as processing of food or production of material needed by the miners, such as wooden props, or if it was on the periphery of mining and more domestic in nature is unknown. However, the presence of the scrapers clearly demonstrate the variety of lithics being produced and the need to re-examine archive material to understand the wider 'social' aspect of mining. Further discussion is reserved for below.

5.5 Discussion

The results of this chapter have informed on activities within areas peripheral to the main mine complex, but which are considered part of the wider mining landscape. These zones are of interest because they have been less explored and their investigation has revealed other facets of the mining narrative. The chapter established that flint working at the mines is complicated and requires comprehensive analysis to reveal different aspects of mining, which can either support or question current interpretations, as outlined in Chapter Two. Such distinctions are important in developing the narrative of flint mining and the communities who were active at the sites. Although this chapter only focused on two sites, and a tiny sample of the vast lithics archive from the mines, it is hoped that it demonstrates that such research can, and should, be used to re-analyse mining material to improve knowledge of mining and associated activities.

The working floors recorded at both Harrow Hill and Church Hill are undeniably based on the production of axes and are clearly associated with deep mining. Both sites seemed more focused on the secondary production of axes, rather than the robust primary knapping that occurred adjacent to the shafts. This shows that material was moved to the edge of the mines for secondary knapping, which could have been carried out by groups of individuals not directly engaged with extraction. This hints at some degree of organisation to the both the mining communities, and the mine landscape. It further infers that not all mining was focused on large-scale production, but perhaps small groups also undertook working in camp areas adjacent to the main mines.

The assemblages also have aspects that are less obviously related to axe production, such as scrapers, production of long blades, cores and other implements, such as a borer. The one exception could be the chisels from Church Hill that may be associated with the mining methodology, although their purpose is unclear. These lithics show that activities undertaken on the periphery of the mines, in a liminal zone, may have not always been based on axe production. Their production may have supplemented axe working, whilst extraction was ceased, or had slowed, and no axes were being produced.

With regards to the Cissbury scrapers, these also demonstrate, along with components of the Church Hill flintwork, further non-mining related activities carried out in the wider mining environ. This could indicate a more settled approach to mining, with pauses and breaks filled by other activities, such as the stock-piling of blocks of flint or large cores or big flake blanks to take away and work elsewhere. Other non-mining activities may have also taken place, such as the processing of food, or hides etc. The chronology of this activity, and its relationship to deep mining is unknown, although it must be noted that the non-mining lithics recorded on Harrow Hill appeared to be entirely contemporary with axe production. This further demonstrates how mining is compatible to, but also embedded in, other routines and productive practices. It is not a not a stand-alone practice separated from 'everyday' activities.

A further finding of this chapter was on the formation, and subsequent erosion of the mining environment. On Harrow Hill the survey area has now been taken out of cultivation and is preserved. Although it appears to have been ploughed flat, there is clear potential in this area for the survival of *in situ* flint work, because virtually none of the mines have remained 'static' since extraction stopped and earlier horizons have sometimes afforded protection, such as the working floors on Long Down. Some working floors were quickly covered as new deep mines were sunk and working floors developed. They were then truncated, re-worked or even covered further by extraction in later periods in the Late Neolithic or Early Bronze Age, as documented on Long Down and Church Hill. In other areas of the mine complexes working floors were truncated by centuries of ploughing, some of which may have been begun in the Late Bronze Age, as on Long Down. Finally, on the margins of mine complexes, working floors may have survived well, without being buried or truncated until relatively recently.

An informative narrative originating from the Harrow Hill and Church Hill surveys is one of constant change, of a landscape that has been heavily reworked over many millennia. This is telling, and means that any archaeological investigation and interpretation has to account for this change, due to the complexity of the mining landscape. The only certain and untouched components of the flint mines are *in situ* working floors, which are rare, and the deep shafts, although as with the recent dating of a Church Hill shaft to the Late Neolithic (Teather 2019), even these are not clear cut.

It is hoped that this chapter has demonstrated the potential of investigating under researched areas of the mining landscape and also re-analysis of archival material. The fieldwork component was quick, cheap and achievable without causing a disturbance to the flint mines. Such an approach proved useful where access is problematic, such as on Church Hill, and it is hoped that the small amount of survey carried out for this chapter has helped document the working floor before their unfortunate destruction. Further discussion of the results from this chapter is reserved for Chapter Seven, after consideration of the evidence presented in Chapter Six.

Chapter 6 Sussex in the age of flint mining

6.1 Introduction

This chapter will shape the re-appraisal of the chronology of the Early Neolithic in Sussex, c. 4050-3700 cal BC, in conjunction with the reconsideration of flint mining undertaken for this thesis, by examining how evidence, such as pits, material culture and possible settlements, can be connected to the mines and vice versa. During the research undertaken, new radiocarbon dates were obtained from a pit connected to the mining communities, New Barn Down, close to the Harrow Hill flint mines. Funding for a further three further radiocarbon dates from a pit at Rookery Hill, Bishopstone was obtained, but unfortunately delayed due to COVID-19.

At the end of the chapter it will be discussed how we can reconsider flint mining as part of broader activities in the Early Neolithic. It will be hypothesised that there are three phases to the Early Neolithic in Sussex, an early period dominated by flint mining (4100-3900 cal BC), a second phase represented by an increase in other forms of activity, such as pit digging (3900-3650 cal BC) and a third phase, associated with the construction of causewayed enclosures (3650-3500 cal BC). This chronology aligns with those previously proposed by Cleal (2004) and Whittle *et al.* (2011). It is hoped that the analysis undertaken to produce this chapter will change perceptions of mining and also of wider Early Neolithic communities in the age of the flint mines.

6.2 The beginning of the Neolithic

As outlined at the beginning of this thesis in Chapters One and Two, there is still much debate on the arrival of the Neolithic in Sussex (Thomas 1991, 2003, 2013; Rowley Conwy 2004; Sheridan 2004, 2011; Whittle *et al.* 2011). There is little point repeating these well-trodden debates here, as this chapter focuses specifically on evidence that is clearly Neolithic. Several of the sites examined did contain Late Mesolithic alongside Neolithic material, and these will be discussed where relevant.

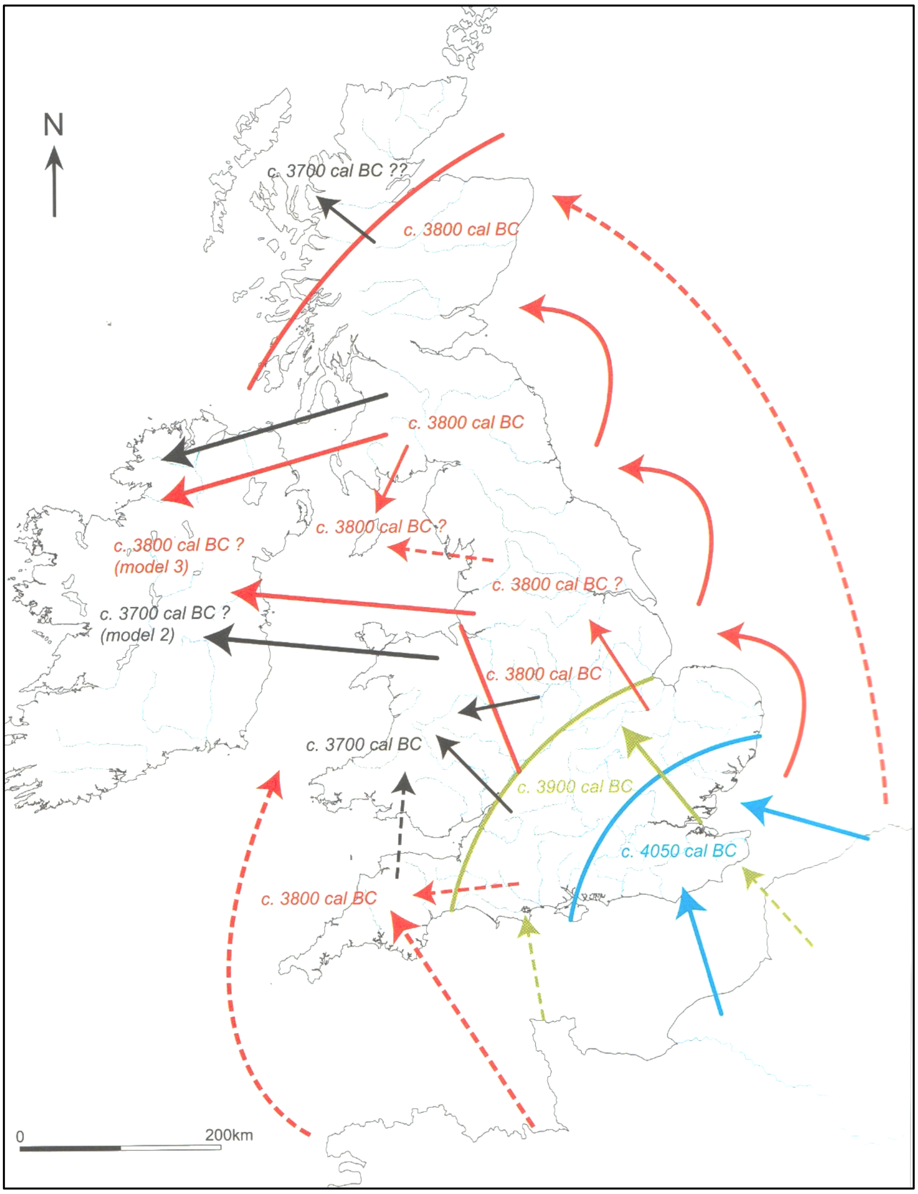


Fig. 6.1: Proposed chronological estimates for the spread of the Neolithicin southern England (From Whittle *et al.* 2011 Fig.15.8).

6.2.1 A model for Sussex?

The polarizing debate over indigenous adoption and colonisation has maybe run its course and models, as outlined here, which combine aspects of both narratives can now be developed (Whittle et al. 2011; Garrow and Sturt 2011).

This chapter aligns with the position that neither of the two main Mesolithic-Neolithic transition models, 'cultural acculturation' and 'colonisation' are adequate. Instead, it is hypothesised that the transition was a combination of both models, with various migrations occurring at different places and at varying times, similar to the transition model proposed in *Gathering Time* (Fig. 6.1; Whittle *et al.* 2011; Whittle 2007a,b).

6.2.2 The chronology

The radiocarbon dates obtained for this thesis, and the Neomine project, prove that mining was established in Sussex by the end of the 40th century BC at the very latest (Baczkowski and Holgate 2018; Edinborough et al. 2019; Teather 2019). Earlier dates, some of which are now discredited (Edinborough *et al.* 2019), suggest that mining was underway prior to the start of the 40th century BC (Barber *et al.* 1999; Whittle *et al*. 2011). Overall, the dates obtained for mining indicate and that it began ~4000–3700 cal BC (Fig.6.2) and that most were in use in the early 4th millennium (Edinborough *et al*. 2019. 27), proving that flint mines pre-date the majority of other monument construction, such as enclosures and long barrows (Fig.6.3).

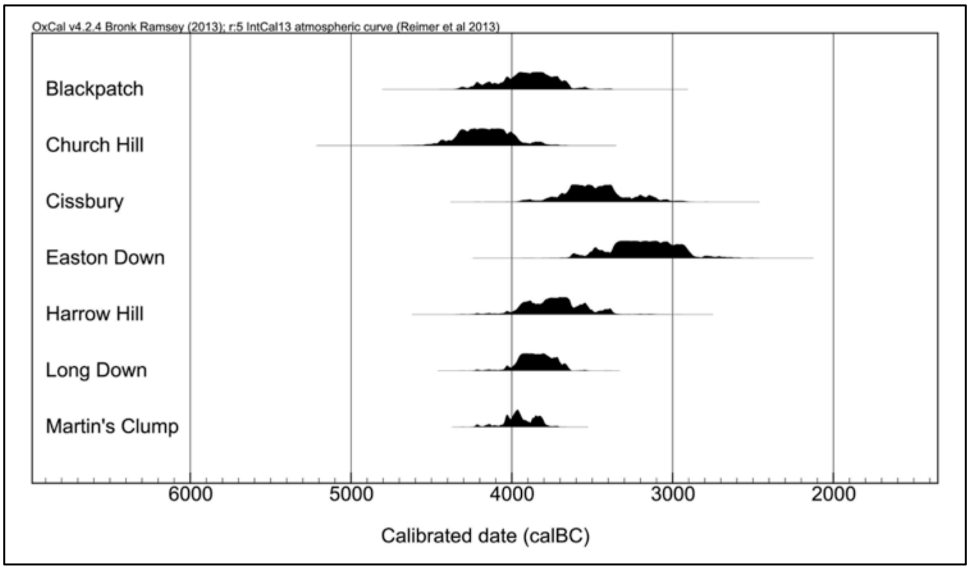


Fig. 6.2: Date ranges of British mines.

There is a paucity of radiocarbon dates for the earliest centuries of the Neolithic in Sussex, beyond those obtained from the flint mines. Radiocarbon dates obtained from enclosures show that their construction began between 3775-3655 cal BC (95% probability), with Bury Hill possibly the earliest and the others following in the succeeding 100 years or so (Whittle *et al.* 2011. 251). The few available secure radiocarbon dates from long and oval barrows, including Bevis Thumb, North Marden and Alfriston (Fig.6.3), indicate construction dates beginning in the late 38th century BC, with a similar chronology as causewayed enclosures (Whittle *et al.* 2011. 252-53). Mining is therefore one of the earliest indicators of Neolithic in the region and the radiocarbon dates for the mines can be used as a proxy for estimating the dating of activities at other sites that share characteristics, or material culture, with the mines as outlined in this chapter.

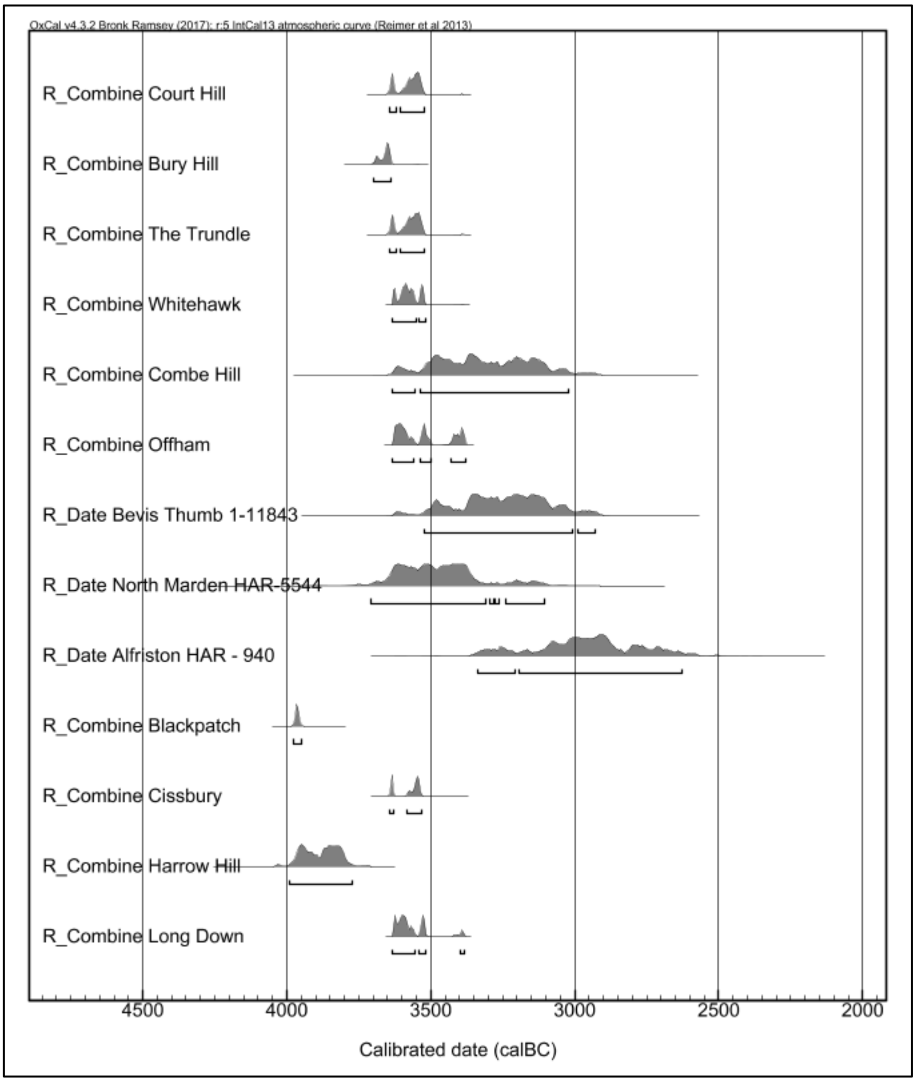


Fig. 6.3: Date ranges of Early Neolithic monuments in Sussex.

For production of this chapter it was decided to only focus on the formative centuries of the Neolithic in Sussex, that are clearly contemporary with flint mining between 4050 – 3700 cal BC. By the end of the 38th century BC causewayed enclosure construction had began, and extraction at the Sussex mines had ceased at some sites and began to wane at others. Therefore, enclosures and the majority of sites contemporary with their construction and use are not discussed. Exceptions are made to several sites that were deemed to have been important to the study of flint mines.

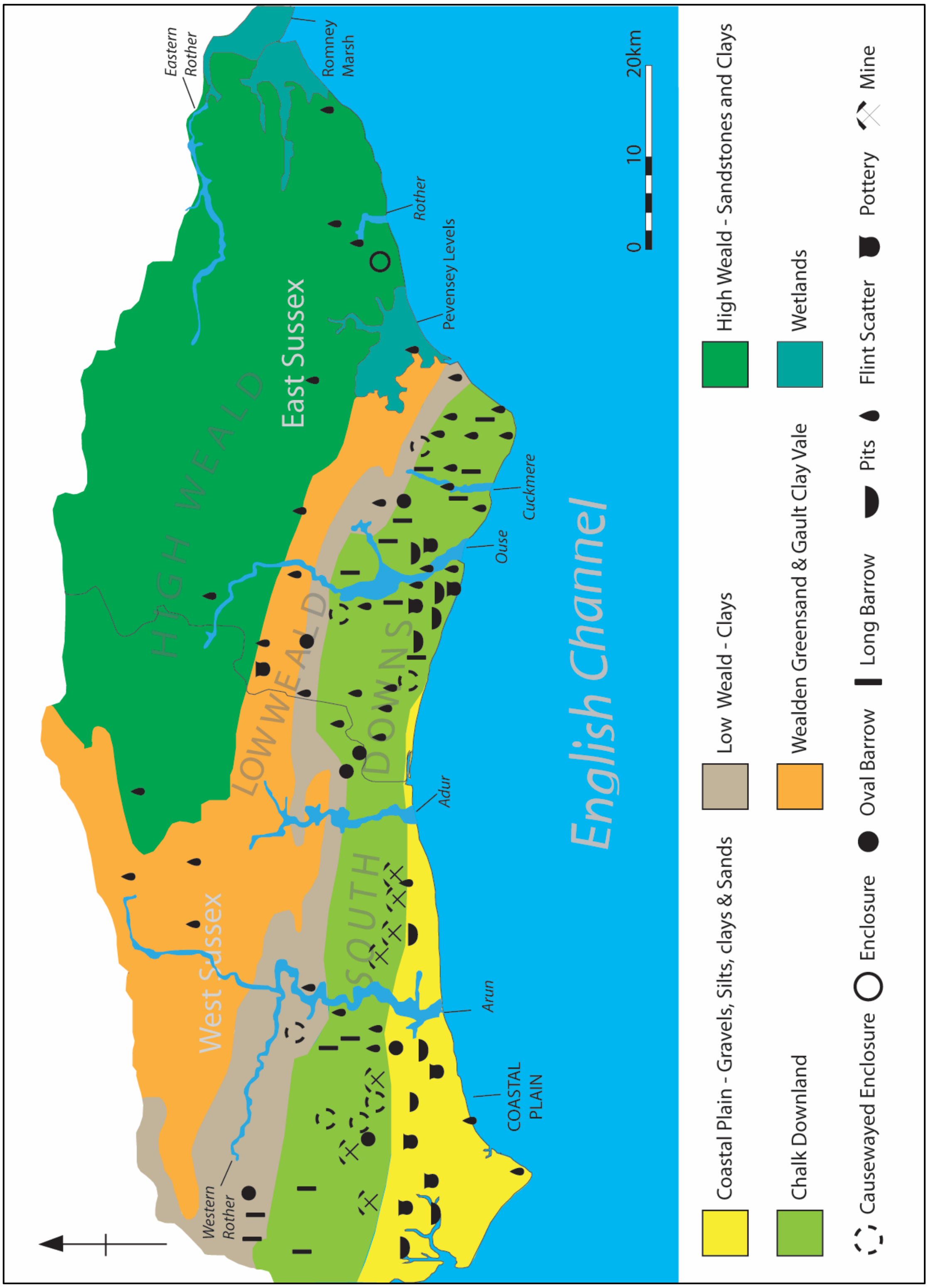


Fig. 6.4: Distribution of Early Neolithic monuments in Sussex (Author).

6.3 4000-3700BC, beyond flint mines

Outlined next is the Early Neolithic evidence recorded in Sussex (Fig.6.4), focusing on pits and the material culture they contain, such as pottery and flintwork. Although there is a vast amount of material from flint scatters, there is much less data on archaeological features and pottery from the Early Neolithic in Sussex. New evidence has been collected in the last twenty years from developer funded archaeological projects, much of it unpublished, which has been compiled alongside historic excavations.

The majority of the information outlined below is gathered from the Historic Environment Records (H.E.R) database. Over 800 entries on the H.E.R were examined, supported by numerous grey literature reports from developer funded excavations, reports from research excavations, academic dissertations and other various reports and articles. Many of these reports were held on the Archaeological Data Service (ADS) and other more obscure archives. Numerous museum visits were also made, including Worthing Museum, Brighton Museum, the Novium, Chichester, Littlehampton Museum, Eastbourne Museum and the Barbican House, Lewes. Research trips were also made to the Pitt Rivers archive, Oxford, and some material was obtained directly from the archives of archeological units. To keep in line with the H.E.R areas of Sussex, the data will be presented according to the following regions, Chichester District, East Sussex and West Sussex.

Before presenting the evidence from each study area, it is worth briefly discussing the different forms of archaeological features and material culture that are encountered, especially with regard to their chronologies and themes of their research.

6.3.1 Flint Scatters

In Sussex there is a rich history of flint working scatters recovered from a variety of landscape settings (Gardiner 1988; Holgate 1988a; Drewett 2003). Antiquarians and amateur archaeologists collected material from the late 19th century to the mid 20th century, much of which is poorly archived and removed from its archaeological context. Recently, the Portable Antiquities Scheme (PAS) and local archives have documented lithics, although many museums no longer accept such material and are even disposing of un-provenanced material. A vast amount of lithics collected in Sussex languish in private hands, including a collection from the Cissbury mines held by Cissbury House. Unfortunately, the majority of these collections remain poorly catalogued beyond the examination of researchers.

Despite the size and dispersed nature of the lithic assemblages in Sussex, there have been several attempts to catalogue them, most notably by Julie Gardiner (1988) and Verna Care (1982). There has also been an increase in lithics from closed contexts, such as pits, ditches and deposits, including buried soils, excavated during developer funded archaeological projects and published in grey literature reports (outlined below). Due to the sheer amount of flint scatters recorded in Sussex - between 10,000-20,000 scatters and thousands of individual find spots - it was decided to focus on flintwork from closed archaeological contexts.

Flint scatters across Sussex are concentrated on Downland locations, along with a lower density in the Weald, the former focused on hilltops and the latter often in river valleys or at spring-heads (Gardiner 1988; Drewett 2003). These scatters range in size from the small, such as Red Hill (Butler and Holgate 2002), to the large and extensive, such as on Bullock Down (Drewett 1982a). Apart from fieldwalking collection, targeted archaeological excavation of these scatters is limited. Where large-scale scatters have been investigated, such as Bullock Down (Drewett 1982a), they have been characterised by the presence of a wide range of implements, from scrapers and axes to arrowheads, produced from locally sourced flint and often found dispersed with potsherds. Such a variety of tools indicates a wide range of activities typical of settlement which contrasts with Wealden and river valley sites that often produce fewer implements and possibly represent hunting camps (Holgate 1998a, 2004; Drewett *et al.* 1988).

6.3.2 Pits, gullies and the occasional ditch

One of the best indicators of Early Neolithic activity are pits and gullies, especially those containing assemblages of pottery. Notable examples have been excavated at

New Barn Down (Curwen 1934; Baczkowski 2019), Bishopstone (Bell 1977) and Drayton Quarry (Seager Thomas 2010), as discussed below.

Nationally, patterns of pit deposition vary regionally (Garrow *et al.* 2005; Anderson-Whymark and Thomas 2012; Carver 2011). In Sussex, early pits tend be isolated features, up to 2m$^{\varnothing}$ and often contain selected assemblages of flint implements and other objects, such as polishing stones and quern stones. From around 3750BC onwards, pits become smaller, more grouped and contain a range of objects more indicative of 'domestic activities', such as quern and rubbing stones, with notable sites in Peacehaven (Hart 2015) and Goring-by-Sea (Clare 2012) found close to deposits of sandy brickearths, a favoured soil for early cereal cultivation. In other regions large pit groups have been excavated in East Anglia (Garrow *et al.* 2005; Garrow 2007, 2010; Tabor *et al.* 2016), Yorkshire (Harding 2006; Carver 2011) and the Thames Valley (Anderson-Whymark and Thomas 2012; Chaffey *et al.* 2012. 200-15).

Recent research on Early Neolithic pit assemblages has contributed much to narratives of the Neolithic period (Pollard 1999; Anderson-Whymark and Thomas 2012). Two core themes have long dominated debates on pits, firstly, their possible association with occupation activity (Garrow *et al.* 2005; Carver 2011) and secondly, the concept of structured deposition (Thomas 1991, 1999). The placement of objects in pits has been associated with the temporality of settlement and connectivity with a place (Harris 2009, Pollard 2001, Anderson-Whymark and Thomas 2012). More recently it is argued that pits are neither exclusively ceremonial nor mundane, and probably had diverse meanings for disparate communities at different times and places (Garrow 2012. 222-23). Despite the reasons for their digging, pits are intractably linked with settlement activity.

6.2.3 Pottery

In Sussex, research on Early Neolithic ceramics has been dominated by assemblages from those recovered from causewayed enclosures (Drewett 1980, 1982a, 2003), most notably Whitehawk, which became a type-site for early decorated forms (Oswald *et al.* 2001). This means there is reasonable chronological understanding of the later early forms, predominantly Plain and Decorated Bowl wares, but less so for the earlier Carinated Bowl wares. Research into the early forms, including Herne (1988) and more recently Cleal (1992, 2004) has advanced knowledge of Carinated Bowl assemblages by chronologically separating them from the later types. Despite this research, there still exists misunderstanding in identifying early Carinated Bowl assemblages, arising from its rarity and also the recent reclassification of the early forms, especially Plain Bowl and Decorated Bowl.

As this chapter stops at the construction of causewayed enclosures, its focus is on assemblages of Carinated Bowl. However, it was decided to include any non-enclosure Plain Bowl assemblages that also contained carinated forms, especially as there is recognised chronological overlap between the traditions (Whittle *et al.* 2011. 761-763). The importance of Carinated Bowl is discussed below, in Paragraph XXX.

6.3.4 Mortuary practices

At present, there are no burials in Sussex from the Early Neolithic, prior to the construction of large, communal mortuary monuments. This is largely echoed across southern England, although a single Early Neolithic inhumation, dated to between 4220-3970 cal BC, was excavated on the Thames foreshore at Yabsley Street London (Coles *et al.* 2008). The Yabsley inhumation and the early human burials from the Coldrum monument (Wysocki *et al.* 2013) can be considered as contemporary with the Sussex mines, although outside of the study area. Interestingly, a Carinated Bowl was found in association with the Yabsley Street burial, along with a fragment of polished axe recovered from a probable contemporary land surface (Coles *et al.* 2008).

The burial record in Sussex is represented by mortuary monuments in the form of long and oval barrows, around twenty of which are found mostly located to the east and west ends of the South Downs (Drewett 1982b, 2003). The only examples excavated include a long barrow at Bevis Thumb (Drewett 2003), an oval barrow at North Marden (Drewett 1986), both north of Chichester, and an oval barrow at Alfriston, east of Lewes (Drewett 1974, 1975).

Radiocarbon dates obtained from these sites provided little in the way of a clear chronology (Whittle *et al.* 2011. 253-54), and it is generally agreed that their construction in Sussex began at the very earliest in the mid 38th century BC (Drewett 2003; Whittle *et al.* 253-54). This date is in line with other burial monuments across southern England (Schulting 2000; Healy 2008; Whittle *et al.* 2007, 2011), and clearly shows that there is some crossover between their construction and the late phases of flint mining in Sussex. It is of note that a human burial discovered in the Cissbury mines is dated to 3644-3384 cal BC (Teather 2019) and is therefore later than the peak of extraction at other Sussex mines.

Burial practices and the treatment of the dead became more communal and monumental as the Early Neolithic progressed (Whittle *et al.* 2007; Fowler 2010; Thomas 2013. 316-29). However, as is the case with causewayed enclosures, the internment of the dead in large monuments increased as mining waned. Therefore, the study of monumental burial practices in Sussex is only useful to demonstrate the chronological development of the Early Neolithic practices in comparison with the timeline of flint mining. It may be of note that no long and oval barrows are found close to flint mines in Sussex (Drewett 2003).

6.4 Chichester District

(Appendix 6.1)

The Chichester District encompasses an area of c. 900km, from the coast to the south of Chichester, north to the Surrey border and west to the Hampshire border (Fig.6.5). Geologically the area is diverse, with coastal plain composed of gravels and sands, chalk downland to the north followed by sandstones of the greensand ridge. The majority of Early Neolithic monuments are located along the chalk South Downs, including three confirmed flint mines, Long Down, Nore Down and Stoke Down, and causewayed enclosures, including the Trundle, Court Hill and Halnaker Hill (Whittle *et al.* 2011) and numerous mortuary monuments, including the Bevis Thumb long barrow (Drewett 1981) and an oval barrow, North Marden (Drewett 1982b, 1986).

Along the coastal plain probable settlement sites have been recorded during developer funded excavations, including large lithic scatters and possible cursus monuments at Drayton Quarry, Chichester. At present, areas north of the South Downs, including the Weald are considered less populated in prehistory (Drewett 2003). However, as finds spots of flintwork and stray finds of polished axes are well documented the area was undoubtedly visited during the Early Neolithic.

Fig. 6.5: Distribution of Early Neolithic sites in the Chichester HER district (Author).

6.4.1 Chichester pit groups

A number of Early Neolithic pits are recorded surrounding Chichester city, located on a low-lying area of coastal plain composed of a complex arrangement of superficial Head deposits of fan gravels and raised beaches, which overly Lambeth Groups, clays, silts and sands (Fitzpatrick *et al.* 2008).

6.4.2 Baxondale Road

The site, discovered during an archaeological evaluation, consisted of a tightly spaced group of four shallow sub-circular pits, ranging between 0.8m^{ø} to 0.5m^{ø} and 0.1m to 0.3m in depth (King and King 2010). All the pits contained Early Neolithic flintwork (107 pieces), including a leaf-shaped arrowhead and four end scrapers, and a pottery assemblage (206 pieces), mostly consisting of plain hemispherical neutral or closed bowls, or cups, typical of the Plain Bowl tradition and probably manufactured within the vicinity of the site (Barclay, in King and King 2010. Fig.6.6).

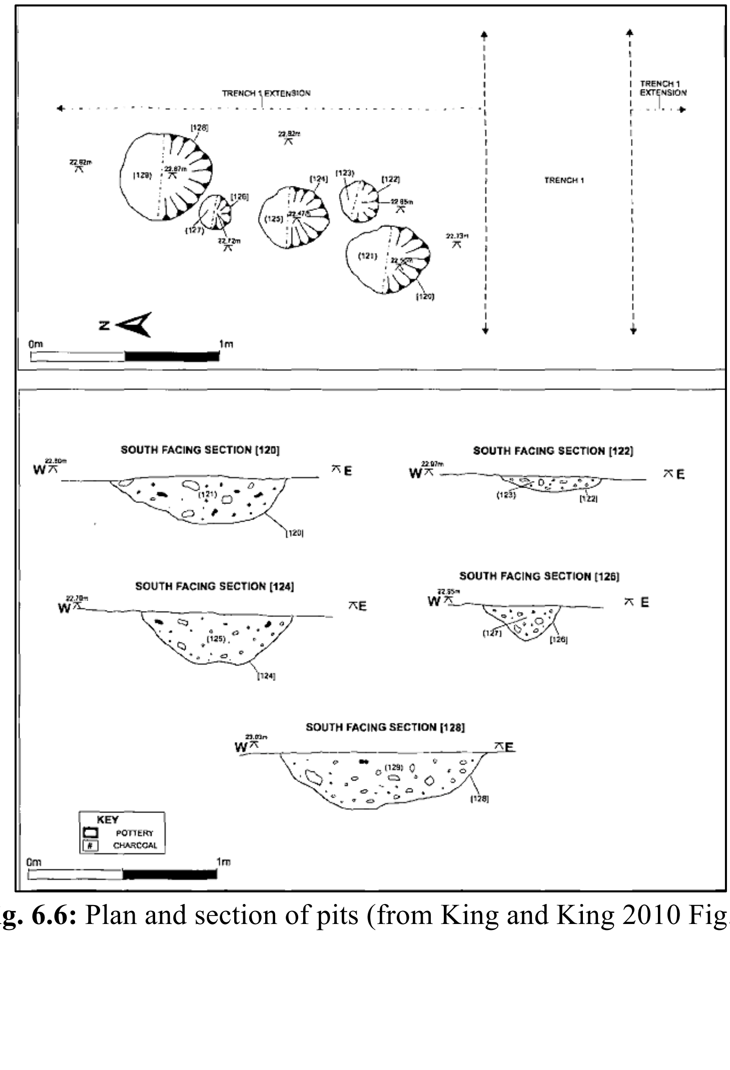


Fig. 6.6: Plan and section of pits (from King and King 2010 Fig.5).

The pits likely date to between 3750 – 3600 cal BC on consideration of the flint work and undecorated form of the pottery assemblage. Environmental data recovered indicates that they were dug in a lightly wooded setting that may have been recently cleared. Larger species, such as oak and ash still existed close by. The pits are located close to the foot of downland, along the banks of a winterbourne stream where it enters the coastal plain. It is suggested that the site represents temporary occupation within a woodland clearance, close to the rich hunting grounds of the coastal plain (King and King 2010).

6.4.3 Drayton Quarry

Between 1997 and 2005, excavation of a gravel quarry at Drayton recorded several Early Neolithic features (Brown 2010). Unfortunately, the archive became fragmented, with the flintwork assemblage lost and notable quantities of pottery missing. Some of the Early Neolithic pottery (Fig.6.7) was eventually located and analysed during this project, but it was decided not to undertake further work on the assemblage due to bureaucracy over ownership of its archive.

The site is located on the coastal plain, c. 2km southeast of Baxondale. Environmental analysis indicated much of the site was a marginal wetland until the Late Neolithic and was crossed by two small streams, one possibly being the same stream recorded at Baxondale Road. The site was rich in Middle and Late Neolithic activity, including a possible cursus, a ditched enclosure and several pit alignments (Brown 2010). Two isolated pits dated to the Early Neolithic were recorded, Pits 6 and Pit 690. Records of the form or size of Pit 6 and its flint assemblage have been lost. In total 39 sherds of Early Neolithic pottery, mostly Carinated Bowl w recovered from Pit 6. A further four undated pits were located close to the pit.

The large Pit 690 was located c. 160m to the east of Pit 6 and there is vagueness over the interpretation of this feature, and it is unclear if it represented a gully or ditch terminal. It was also truncated by a Bronze Age ditch, making interpretation difficult. Pit 640 is notable due to its producing the largest assemblage of Carinated Bowl pottery recovered from a single feature in Sussex, at almost 200 potsherds representing c. 12 vessels (Seager-Thomas 2010). Both pits produced notable quantities of Carinated Bowl pottery, over 300 potsherds originating from a minimum of 15 vessels (See Appendix 6.1).

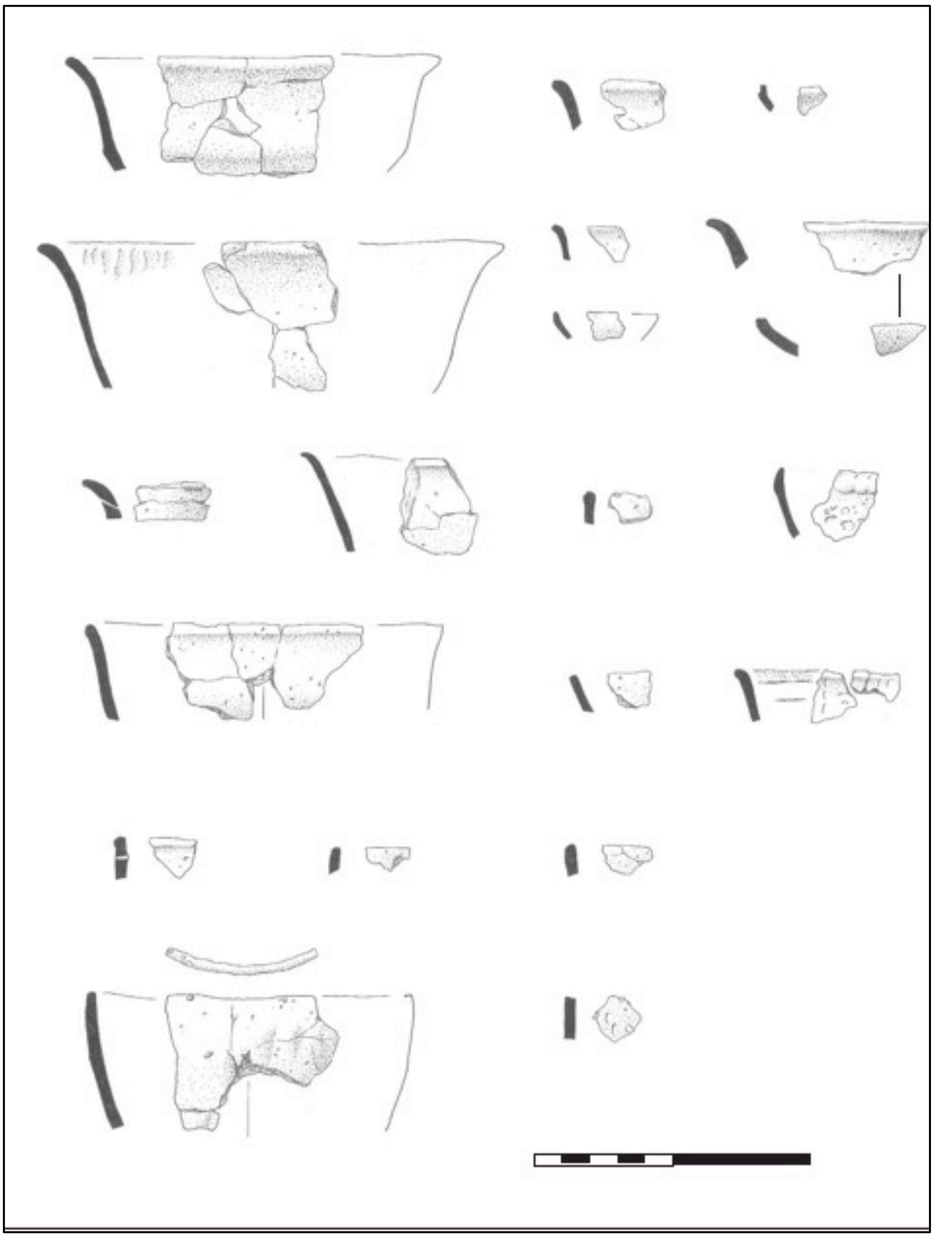


Fig. 6.7: Early Neolithic pottery, Drayton Quarry (from Seager-Thomas 2010 Fig.1).

6.4.4 Claypit Lane

A final Early Neolithic pit is worthy of mention, located at Claypit Lane, c. 1.5km east of Baxondale Road on the northern edge of the coastal plain close to margins of the South Downs. Here, one pit was recorded in a large open area excavation

(Chadwick 2006). Pit 9050 was oval in plan, 1mø and contained an assemblage of flintwork (34 pieces), pottery (50+ pieces) and macrofossils, including spelt (*Triticum spelta*) and emmer (*Triticum dicoccum*).

The flintwork assemblage, aside from debitage, included retouched implements, comprising six end-scrapers, a naturally backed knife and an edge-flaked knife (Chadwick 2006. 31). Analysis of the assemblage was undertaken for this project and the edge flaked knife (No 2, Fig.6.8) and one large scraper (No 2, Fig.6.8) were of interest as they were produced from a distinctive high quality milky grey flint. This was not in keeping with the other flint pieces produced from black Downland flint. There is a possibility that the source of the milky grey flint is Long Down, located c. 5.5km to the northeast of Claypit Lane, as it is of very similar colour and quality to the flint extracted there. The edge flaked knife is also of similar form to others recorded in flint mines assemblages (See Chapter Five) and also an example from Pit X, New Barn Down (See below). The butt-end of a finely polished axe, reused as packing in a Bronze Age posthole, was also produced from grey Downland flint (Chadwick 2006. 32), which again could have been from Long Down.

Fig. 6.8: Flintwork from Pit 9050 (Author 2019).
1) Edge-flaked knife 2) Naturally backed knife 3-6) Scrapers (Author 2019).

A minimum of two vessels were recorded in the pottery assemblage, both being plain rimmed and open, typical of the Plain Bowl tradition. Radiocarbon dates obtained from charred macrofossils gave a date range of 3800 to 3635 cal BC (94.4% probability), possibly making the assemblage amongst the earliest Plain Bowl for the region and certainly contemporary with activity at the Long Down mines.

Pit 9050 was interpreted as evidence of 'short term-occupation' by a community practicing both 'herding' and 'shifting' cultivation (Chadwick 2006. 42). Environmental evidence suggests, like the other Chichester features, that the pit was placed in an open setting of mixed scrub, but also that larger species, such as oak, were close by and were utilized for firewood. It was also suggested that the inclusion of finely finished implements, showing no signs of use, infer an element of ritual to the backfilling of the pit (Chadwick 2006. 33).

6.5 West Sussex

(Appendix 6.2)

Moving eastwards to West Sussex, coastal plain and downland are still present, along with the sandstone ridges, rolling low hills and heavy clays of the Weald (Fig.6.9). The Weald has long been considered a backwater that remained unoccupied and heavily wooded until the Saxon period (Curwen and Curwen 1926). This model is now changing, as more evidence of prehistoric activity in the Weald is emerging due to the growth of developer funded excavations, with notable evidence of Bronze Age and Iron Age settlement now recorded (Harris 2003; Butler 2009; Mullin *et al.* 2010; Pope *et al.* 2012; Pine 2012).

The West Sussex HER record and PAS databases contain over 500 individual find spots of Early Neolithic artefacts in the Weald, mostly polished axes and arrowheads. However, there are few definite Early Neolithic features recorded in the Weald, indicating that early communities visiting the area may have been undertaking different activities than on the South Downs and coastal plain.

The South Downs in central West Sussex is surprisingly absent of Early Neolithic monuments, apart from the mines, with only a single causewayed enclosure recorded at Bury Hill (Bedwin *et al.* 1981) and an absence of long barrows. Reasons for this are unclear. It has previously been proposed that the block of downland bordered by the River Arun to the west, and the Adur to the east, was not considered suitable for monument building due to the presence of the Worthing Group mines (Drewett 1978). Whether the mines were respected or avoided is unknown, although it is certainly true that greater densities of enclosures are found to the west and east of the Worthing Group mines, although it must be noted that Long Down and Stoke Down are close to other Early Neolithic monuments.

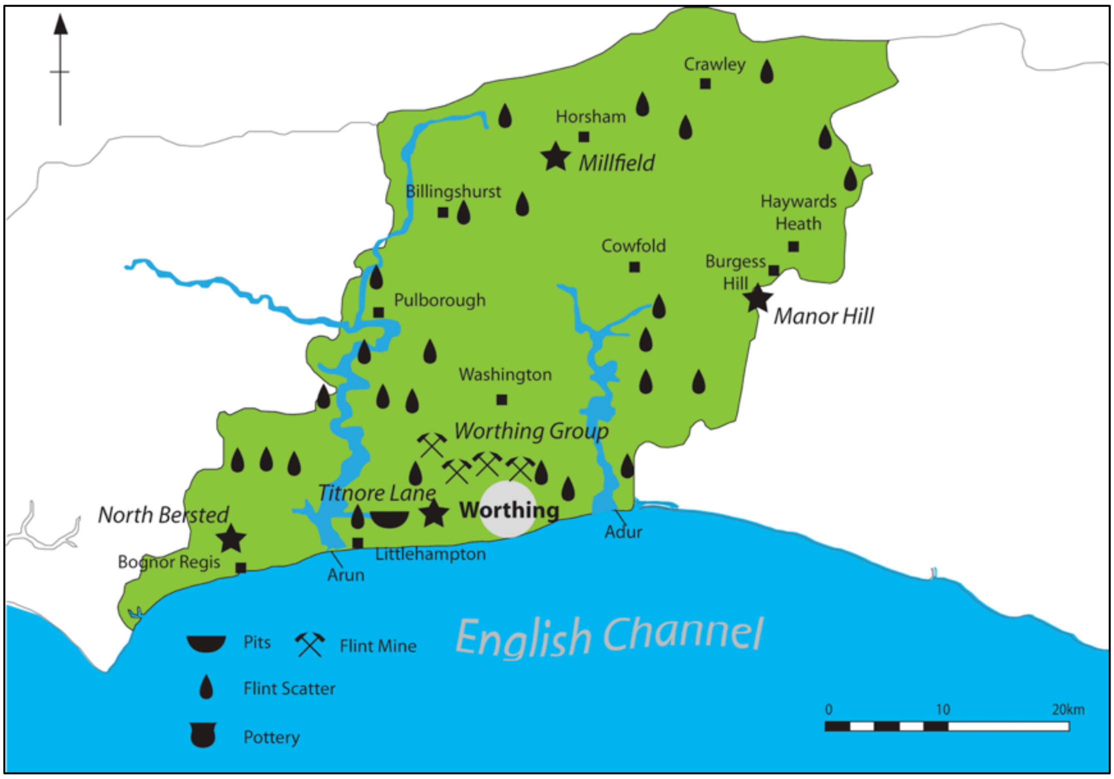


Fig. 6.9: Distribution of Early Neolithic sites in the West Sussex HER district (Author).

6.5.1 Two speculative Wealden sites

Two Wealden sites are worthy of mention, as both recorded probable Early Neolithic activity. The first, Manor Hill, is located close to East Grinstead, approximately 7km north of the South Downs on a south-facing hill with Head deposits of gravels and sands. During an archaeological evaluation a group of three pits was recorded, each measuring 0.5m$^{\varnothing}$ to 1.5m$^{\varnothing}$ (Fig.6.10). One of the pits may have been a gully due to its profile; unfortunately it was not investigated beyond the limit of excavation.

A small assemblage of probable Early Neolithic Plain Bowl pottery (25 pieces) and flintwork (30+ pieces), including a core and scraper, was recovered from the pits (Wallis 2011). The flintwork is locally sourced, probably from river gravels, however the pottery is consistent with flint-tempered fabrics from the South Downs, and a tentative comparison was made with the Early Neolithic pottery from Bishopstone (Bell 1977, See below).

Fig. 6.10: Southwest-facing section of Manor Hill Pit 13 (Wallis 2011 Plate 3).

The second site was located close to the centre of Sussex, at Millfield, c. 5km south of Horsham, discovered during another archaeological evaluation. Here a group of three shallow pits were recorded, all measuring c. 1m$^{\varnothing}$. A small amount of flintwork was recovered, including soft-hammer struck blades with platform preparation, typical of the Late Mesolithic to Early Neolithic, alongside a small pottery assemblage (Doherty 2013). The pottery was poorly fired and flint tempered and, although it was described as probable Plain Bowl, there was reluctance to formally identify it because it is extremely rare for the area (Doherty 2013). Interestingly, there is a speculative evidence of depositional curation, as each pit contained a single rimsherd, a practice not unknown in the Early Neolithic (See below).

Both sites are tentative in their dating, but they do share common attributes with those described elsewhere in this chapter, being focused on small groups of oval, shallow pits. They are also located on south facing slopes with sandy Head deposit geology and close to streams. In the case of Manor Hill, a connection to the South Downs is evidenced.

6.5.2 Coastal plain sites

Two sites are located on the brickearths and gravels of the Sussex Coastal Plain, both discovered during developer funded excavations. The first site, North Bersted, is close to Bognor Regis, less than 5km from the current coastline. Here, two linear gullies were discovered both measuring over 2m in length and 0.65m to 0.38m in width and up to 0.11m of depth (Taylor 2012). Only two artefacts were recovered from the features, a single Plain Bowl potsherd similar to Early Neolithic Fabric 1, as assigned by Drewett (1980), and a miniature bi-facially flaked axe. The miniature axe is a distinct implement (See Chapter Five) that has links to flint mines. Significantly, North Bersted is less than 8km south of Long Down and less than 5km southeast of Claypit Lane.

At Titnore Lane, Worthing, a group of four pits and a shallow curving gully were recorded (Clarke 2012). Titnore Lane is located on a south-facing slope, less than 3km north of the current coastline, and 3km south of Harrow Hill. Only one of the pits produced any artefacts, the butt end of a polished axe possibly produced from mine sourced flint. A small assemblage of Plain Bowl pottery was recovered from the gully. The pits, which formed an irregular circle, and the gully, curving in profile, were c. 100m apart from each other. Early Neolithic flintwork was also recovered from subsoil deposits, including a second fragment of polished axe. Overall, it was concluded that the Early Neolithic features were evidence of ‘sporadic exploration’ during the Early Neolithic, indicative of groups ‘moving through’ the landscape (Clarke 2012. 33).

Both coastal sites represent utilisation of the same geographical area as the Chichester pits, which all appear in a landscape between the South Downs and the coastline. Also of importance is the presence of gullies, which appear at several sites, often close to, or within a grouping of pits. These may be interpreted as relating to temporary structures, although little other evidence is found to support this conclusion, presumably because the structures are of minimal impact and leave no archaeological footprint.

6.6 Case Study One: New Barn Down, Pit X and Xa
(Appendix 6.3)

In 1933 the Curwens excavated a Late-Bronze Age settlement on New Barn Down, during which two Early Neolithic pits were discovered (Curwen and Curwen 1926; Curwen 1934). Radiocarbon dates obtained during this project determined that the pits belong to the earliest centuries of the Neolithic and are contemporary with activity at neighbouring flint mines, most notably Harrow Hill. This connection is also reflected in the artefact assemblage, specifically the flintwork that is produced on mined flint.

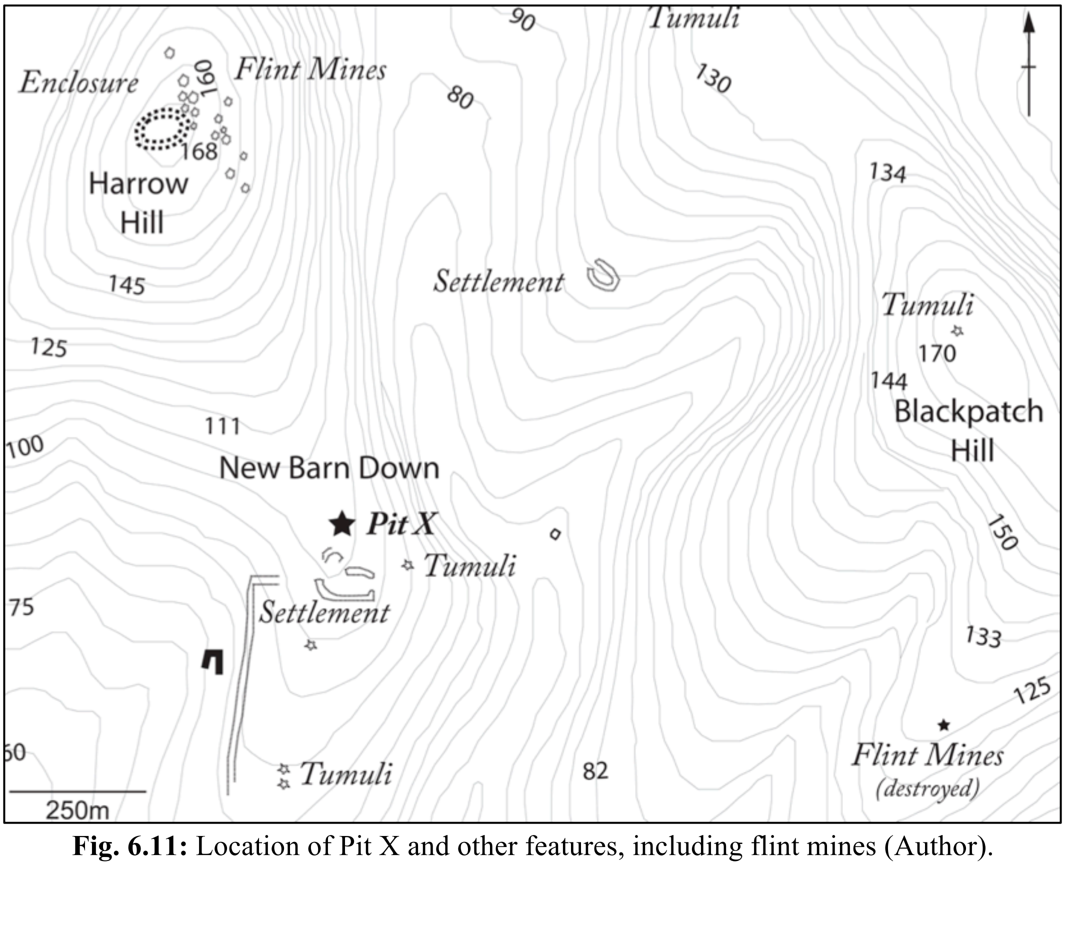


Fig. 6.11: Location of Pit X and other features, including flint mines (Author).

New Barn Down is a south-facing spur of chalk downland on the southern flank of Harrow Hill (Fig.6.11). The current coastline is located approximately 8km to the south, but may have been a further 5-10km in the Early Neolithic (Woodcock 2003).

The two intercut pits, Pit X and Pit Xa, are in close proximity to two flint mines, Harrow Hill, c. 650m to the north, and Blackpatch, c. 900m to the southeast, although the latter is across a dry valley. Both flint mines can be seen from the location of the pits, along with extensive views of the Sussex Coastal Plain extending to the Isle of Wight (Fig.6.12).

6.6.1 Pit X and Pit Xa

The larger of the two features, Pit X, was oval in plan, and measured c. 2.6m long by 1.8m wide and 0.9m deep. The smaller, Pit Xa, was cut into the western end of Pit X circular in plan and measured 1.2m^{ø} and 0.6m in depth (Fig.6.13). The sides of Pit X were near vertical and it had a flat base. Pit Xa was concave in profile. Both pits appear to have been backfilled soon after opening as they showed no signs of weathering. A hearth deposit was placed against the middle of the northern wall of Pit X and the floor was covered with 'black soil and ashes' (Curwen 1934. 155). The hearth contained charcoal and soot, possibly fallen from some soot-collecting surface, such as provided by a 'flue made of wood or leather' (Curwen 1934. 55).

Fig. 6.12: View from Harrow Hill flint mines to New Barn Down, location of Pit X marked by arrow (Author 2019).

All the objects in Pit X had been exposed to heat and were found on its base in a soot deposit. Artefacts included potsherds, flint implements, a small quantity of animal bone, a fine grained 'rubbing stone', a small part of a sandstone quern, two pieces of ferruginous sandstone, four lumps of fired clay and a mollusc shell (*Calliostoma zizyphinus*).

The artefacts in Pit Xa were also exposed to heat and found on its base covered in black soil and ash. The artefacts comprised fourteen potsherds, part of a polished axe found in the ashes, other flint implements, a small quantity of animal bone and four small pieces of ferruginous sandstone.

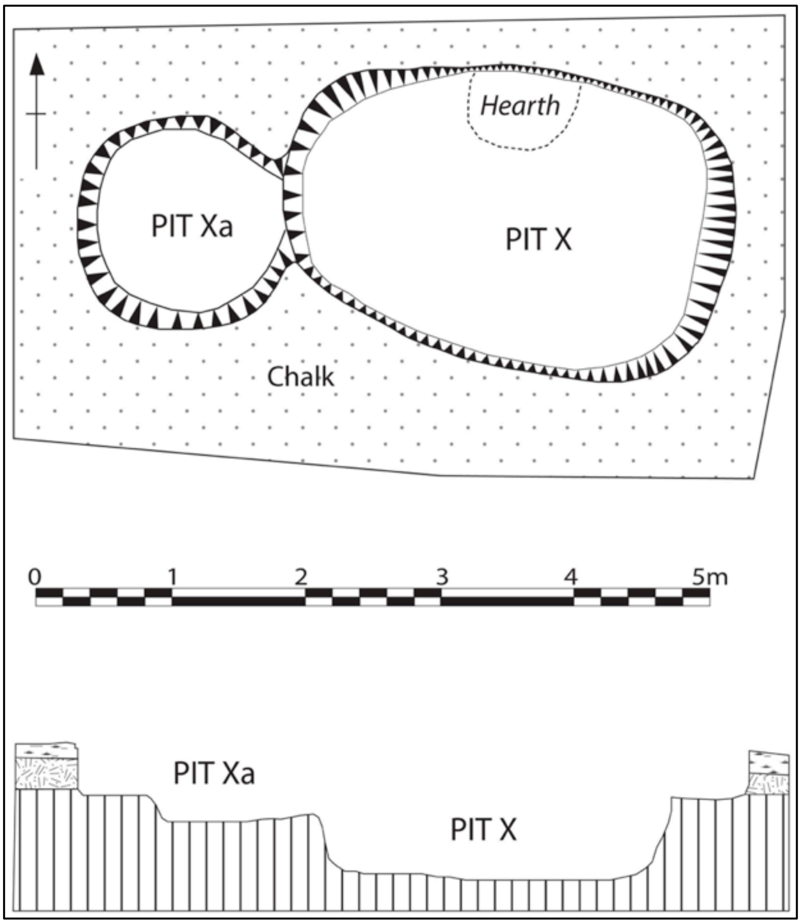


Fig. 6.13: Plan and section of Pit x and Pit Xa (Author adapted from Curwen 1934 Fig. 6).

No other features were found in association with the two adjoining pits. Shallow depressions were excavated close by, but were devoid of artefacts and probably represented tree-throws. It was concluded that Pit X and Pit Xa (hereafter collectively known as Pit X, unless discussed separately) was a 'Neolithic Pit-dwelling' occupied by a flint miner from Harrow Hill (Curwen 1934).

6.6.2 *The pottery*
(Appendix 6.4)

A small, but significant assemblage of Carinated Bowl pottery was recovered from both pits (Fig.6.14 and Figs.6.34-6.35). Four different vessels are present in the assemblage, identifiable from seven potsherds and a complete small bowl, or cup from Pit X, and a further five fragments from Pit Xa. Several potsherds from each pit re-fitted and are therefore from the same vessels. Two of the vessels are exceptional, being unusually fine-walled and of high quality. The fabrics present in the assemblage are all flint tempered and likely to be produced from local soils. One exception is Pot 1, which is tempered with veined quartz and non-local to Sussex. At present, the most likely source for this vessel is Devon (Elaine Morris pers. comm. 2017). There is a small possibility it may also originate from northwest France, specifically Brittany, where quartz geology is present (Gumiaux *et al.* 2004). Unfortunately, the potsherds are too fine to carry this possibility forward by thin sectioning to allow cross comparison of fabrics. Notably, one sherd (Fig.6.34) in the same fabric appears to be the rim of a platter, or plate (Ross Cleal pers comm. 2018). This could support a Continental origin as no known examples have been found in British assemblages.

It was not possible to analyse the largely complete plain cup from Pit X, reconstructed by the Curwen's (Fig.6.15). The bowl, or cup, was open, plain rimmed with a rounded base, fine walls and measured c. 150mm^{ø}. Similar small bowls were recovered from the Coneybury Anomaly (Cleal 2004) and South Coast Road, Peacehaven (See below).

All the pots in the assemblage, with the exception of the bowl, show evidence of carination. Pot 1 records the point of inflection. The other rimsherds have fairly pronounced s-shaped shoulders ending in simple, marginally outturned rims. All the bowls are either neutral, or open, classic Carinated Bowls, as proposed by Cleal (2004). By Cleal's definition (2004. 181), the pottery is dated to the *Early or Developing Neolithic (3850-3650BC)*.

Two of the vessels in the assemblage, Pot 1 and Pot 2, are unique for Sussex and southern England in general (Ross Cleal pers. comm. 2018), being exceptionally fine and high quality. A similar assemblage of finely made Carinated Bowls was found in pits at Cannon Hill, Maidenhead (Bradley *et al.* 1976). The assemblage is also comparable with those from southwest England, especially Rowden (Woodward 1991), the Sweet Track (Coles and Orme 1976; Bond 2003) and possibly Maiden Castle (Sharples 1991).

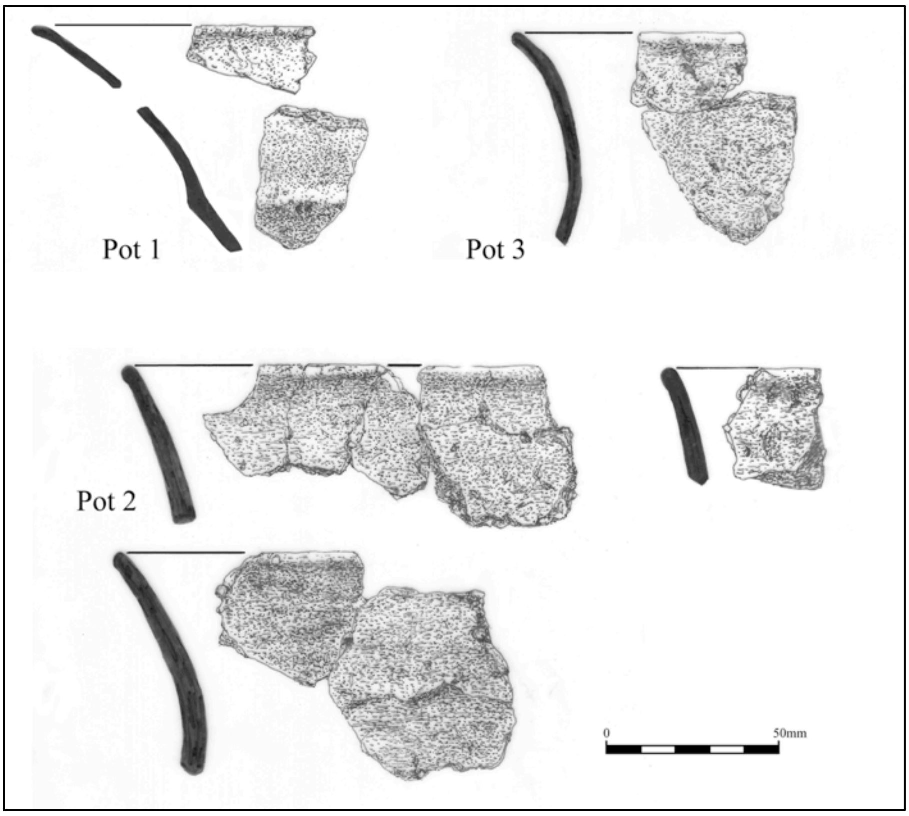


Fig. 6.14: Carinated Bowl, Pit X and Pit Xa (L. Drewett 2018).

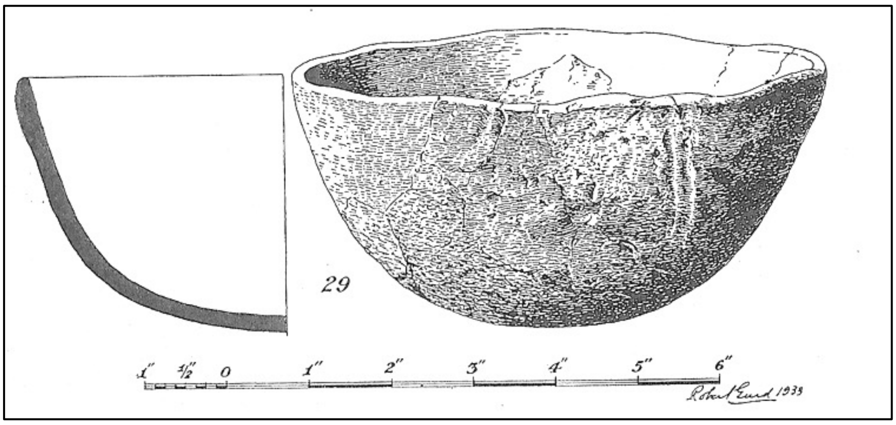


Fig. 6.15: Hemispherical cup from Pit X (Curwen 1934 Fig. 7).

6.6.3 Radiocarbon Dates
(Appendix 6.5)

In collaboration with the Neomine project (Edinborough *et al.* 2019) two radiocarbon dates were obtained from samples of Ash charcoal (Fig.6.16). Sample 1 was dated to 3958-3796 cal BC (95.4% probability) and Sample 2 to 3961-3797 cal BC (95.4% probability). Both dates are within the accepted timeframe for the production of Carinated Bowl pottery in southern England, between 3950-3650 cal BC (Herne 1998; Cleal 2004. 181; Whittle *et al.* 2011. 759). The Pit X pottery can be proposed as amongst the earliest assemblage in Southern England, and almost certainly for Sussex. Significantly, the assemblage falls well within the radiocarbon dates obtained for mining activity on Harrow Hill, between 4000-3600 cal BC (Barber *et al.* 1999. 81; Edinborough *et al.* 2019), proving a chronological connection between Pit X and the flint mines.

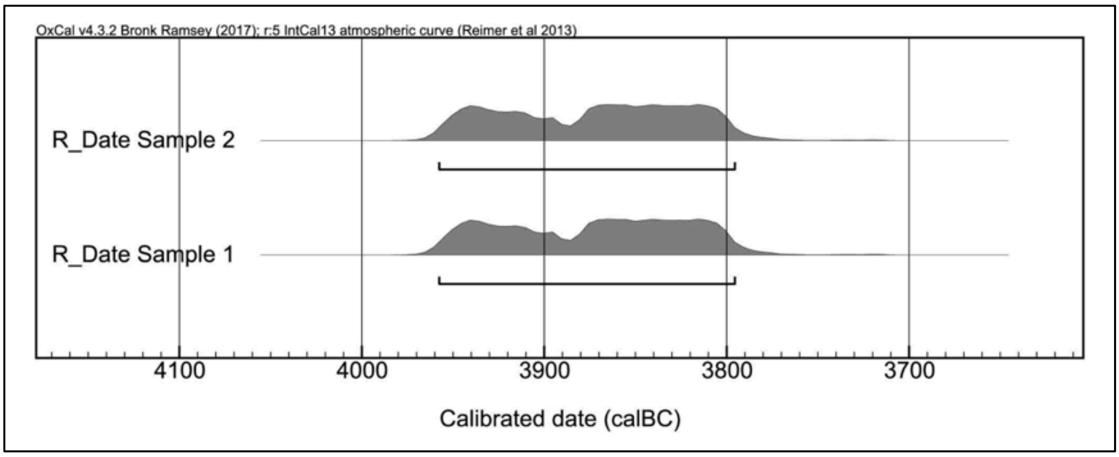


Fig. 6.16: New Barn Down radiocarbon dates.

6.6.4 The flintwork
(Appendix 6.6)

Ten struck flints were recovered, all finished implements with no debitage present (Fig.6.17). All the pieces are fashioned on mine waste, being mostly fresh axe-thinning flakes. Cortex, where present, is thick, white and unweathered, suggesting that they were produced on freshly mined flint rather than recycled debitage from spoil heaps. The source of the flint is more than likely the mines on Harrow Hill, which are closer to Pit X than Blackpatch. All the pieces have been subjected to fluctuating degrees of heat, perhaps indicating proximity to a hearth.

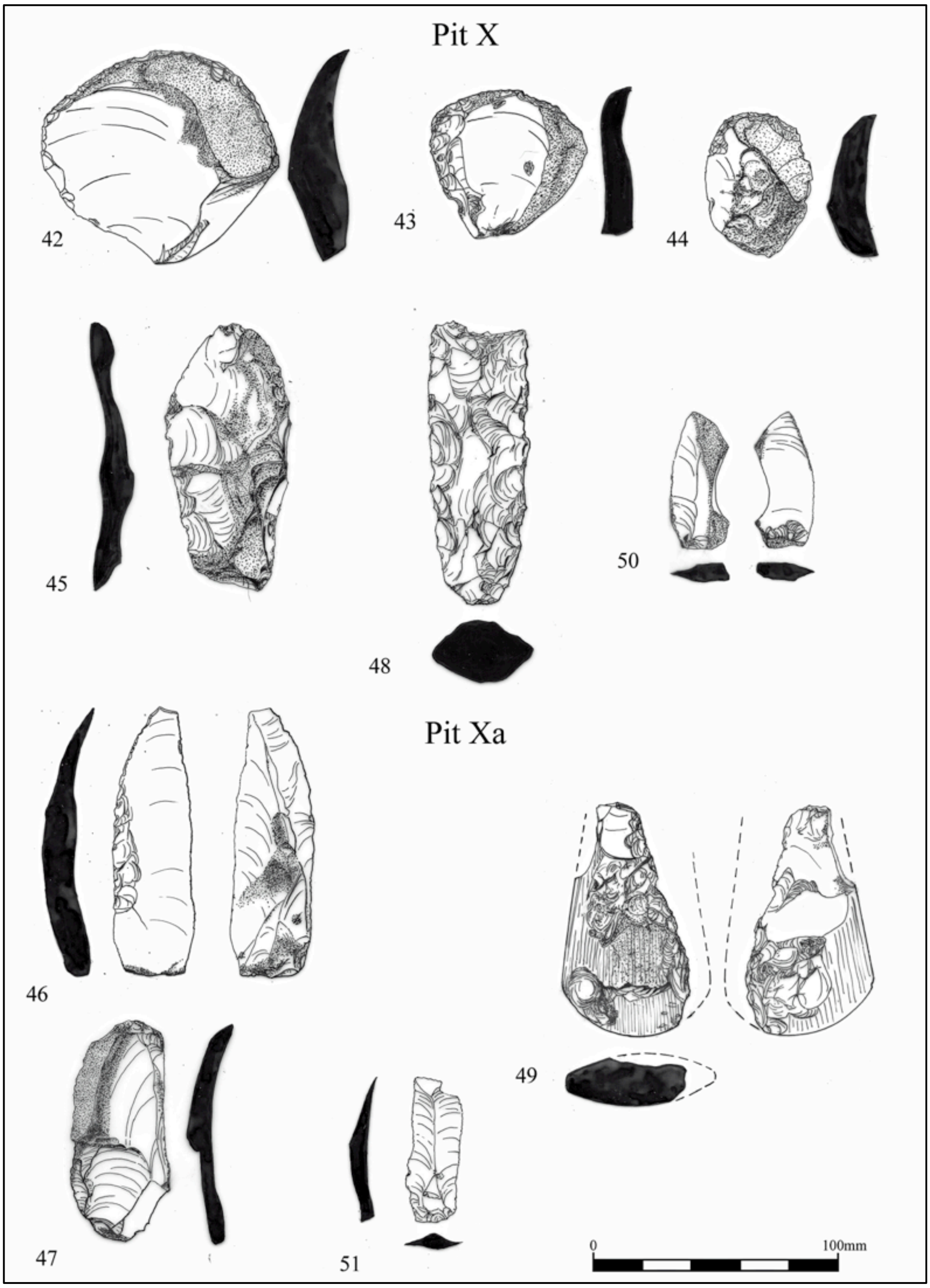


Fig. 6.17: Pit X and Pit Xa flintwork (L. Drewett 2018).

In total six flint implements were recovered from Pit X, including a large end-scraper (No. 42), two end scrapers (No. 43 and 44), a large flaked knife (No. 45), a damaged pick (No. 48) and a scalene serrated blade (No. 50).

Pit Xa contained four implements, including a large knife (No. 46), an long-end scraper produced on a thick blade (No. 47), a broken polished axe refashioned into a side scraper (No. 49) and serrated, or denticulated blade (No. 51).

Pieces produced on recycled axe-thinning waste include scrapers (No. 45, No. 47) and the knife (No. 46). Scraper (No 49) and the pick (No. 48) are re-worked fragments of polished axes. Finally, the small blade (No. 50) is fashioned from an unidentified implement or core.

Several of the pieces from Pit X are unique for a Sussex pit assemblage due to their oversizing, including the scraper (No. 42) and the long knife (No. 46). The long knife (No. 46) is comparable to the backed knife found in Pit 9050 at Westhampnett in form, but not in scale, being considerably larger. Scraper (No. 49) has an interesting history, starting life as an exceptionally fine and highly polished axe with side facets and bevelled cutting edge, before being snapped in half and re-worked into a scraping implement and given a final sharpen before deposition.

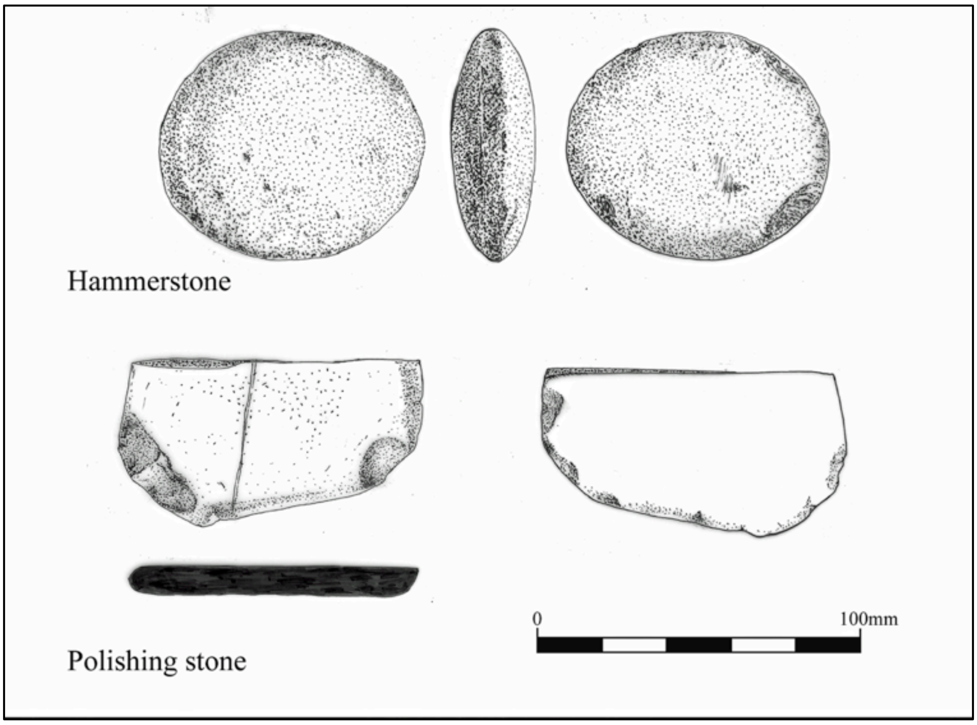


Fig. 6.18: Pit X and Pit Xa stones (L. Drewett 2018).

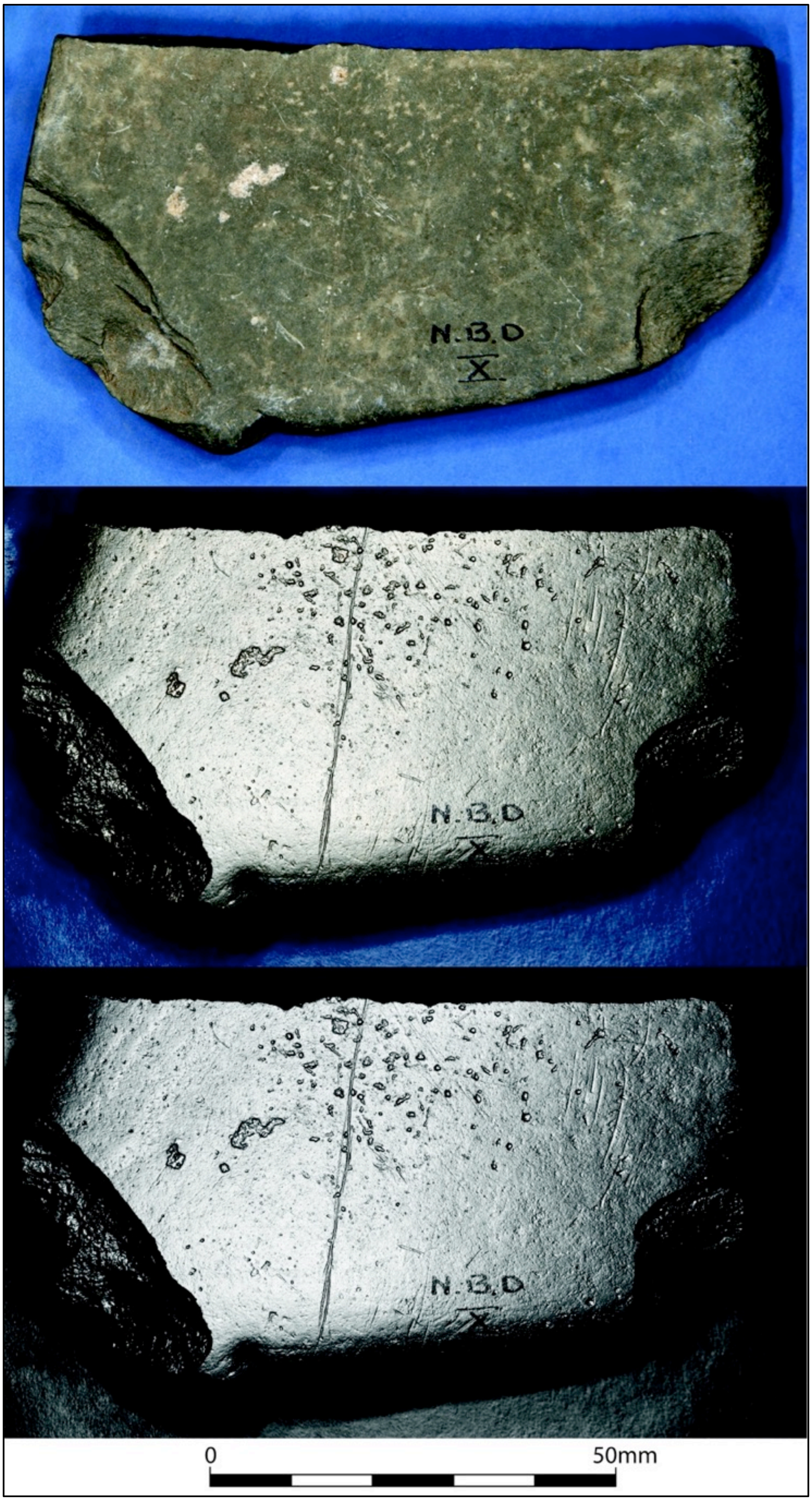


Fig. 6.19: RTI Photograph of 'decorated rubbing stone'(M. Díaz-Guardamino Uribe 2017).

6.6.5 The stone
(Appendix 16.7)

Of the eight stone artefacts originally found, only two (Fig.6.18) were located in the archives, a polishing stone (Stone 1) and the hammer-stone (Stone 2). The missing pieces are described as ferruginous sandstone and probably represent fragments of querns, although without analysis this is difficult to clarify.

Stone 1 was produced on a fine-grained indurated sandstone beach cobble and is remarkable for its possible decoration. Originally interpreted as a grain rubber (Curwen 1934), its use-wear and thin worn surface, unlike a rubbing stone, suggest it was used for another function. The deep and uniform nature of the striae along its used edge is a sign of repeated action from contact with the edge of a sharp object. One of its flat faces has been decorated with an arrangement of linear and dotted incisions (Fig.6.19). It is concluded that it may have been used for the fine sharpening or polishing of an object, such as an axe. It also seems purposefully broken prior to inclusion in Pit X, as a small striking scar is preserved along its fractured side.

Stone 2 is a hammerstone produced from an ovate beach pebble. It is finely made and has also possibly been used as a rubbing stone, prior to its use as a hammerstone. It is notable that both stones have been sourced from beach locations, presumably from the then contemporary coastline, located less than 10km to the south (Woodcock 2003).

6.6.6 Environmental evidence
(Appendix 6.8)

Three bags of assorted charcoal and soot were examined. The majority of the charcoal was identified as European ash (*Fraxinus excelsior*). The Curwen's originally reported that a small amount of hazel and hawthorn were present.

Only European ash (*Fraxinus excelsior*) was present in the samples, rather than oak (*Quercus robur*), the latter being more typical of Early Neolithic pits across Sussex (Bell 1977; Holgate 2004; Chadwick 2006; Hart 2015). The charcoal assemblage is suggestive of a brushy, semi-open environment and comparable with other pits in

Sussex (Bell 1977; Chadwick 2006; Hart 2015).

6.6.7 Other artefacts

It was not possible to locate all the artefacts in the archives, including a quantity of charred animal bone, two fragments of ferruginous sandstone and the complete and beach-worn top-shell (Curwen 1934. 156). Unfortunately, it is not reported what animal species were represented.

The Curwens identified the ferruginous sandstone as Carstone. This is intriguing as its nearest source is Midhurst, c. 25km to the northwest. It is possible that the sandstone are broken fragments of quern-stone, as Midhurst is the source for Lodsworth stone, quarried for quern-stones from the Late Bronze Age onwards (Peacock 1987). Without analysing them their source remains unknown, although they are certainly imported to the site.

The inclusion of the European painted top shell is enigmatic, being a sea snail with a highly coloured and decorative conical shaped shell. The shell was collected from a beach and probably has wider symbolic meaning, as it is doubtful it was foodstuff. It infers another link between the coast and Pit X.

It was possible to examine the fired clay fragments, which contained inclusions of abundant small, to occasional medium sized pieces of chalk and very occasional flints, including a few pieces of probable micro-debitage. Grass impressions and voids are present throughout, and several pieces have smoothed surfaces. The material may represent burnt daub or lining for a clamp kiln, or oven.

6.6.8 Discussion

Traditionally, pits of this size and form were considered as a large storage features (Field *et al.* 1964) or ‘dwelling’ pits (Curwen 1943). Both interpretations can be dismissed for Pit X, as it was backfilled rapidly, unlike a storage pit, and showed no signs of being occupied, such as trampled surfaces and an abundance of debitage.

Both pits contained exceptional artefacts, each with their own histories that together form an assemblage rich in meaning. Deposited by communities from one of the neighbouring mines, most likely Harrow Hill as this is short easy walk from Pit X. The dates for Carinated Bowl in southern England, 3850 – 3650BC (Cleal 2004. 181), and those obtained for Pit X clearly overlap with the radiocarbon dates obtained from Harrow Hill and Blackpatch (Fig.6.20), indicating a peak in mining activity between 4100 – 3700BC (Barber *et al.* 1999; Edinborough *et al.* 2019). There is little doubt that Pit X is contemporary with the neighbouring Harrow Hill mines, making it the first non-mining feature recorded to show a clear link with flint mining communities.

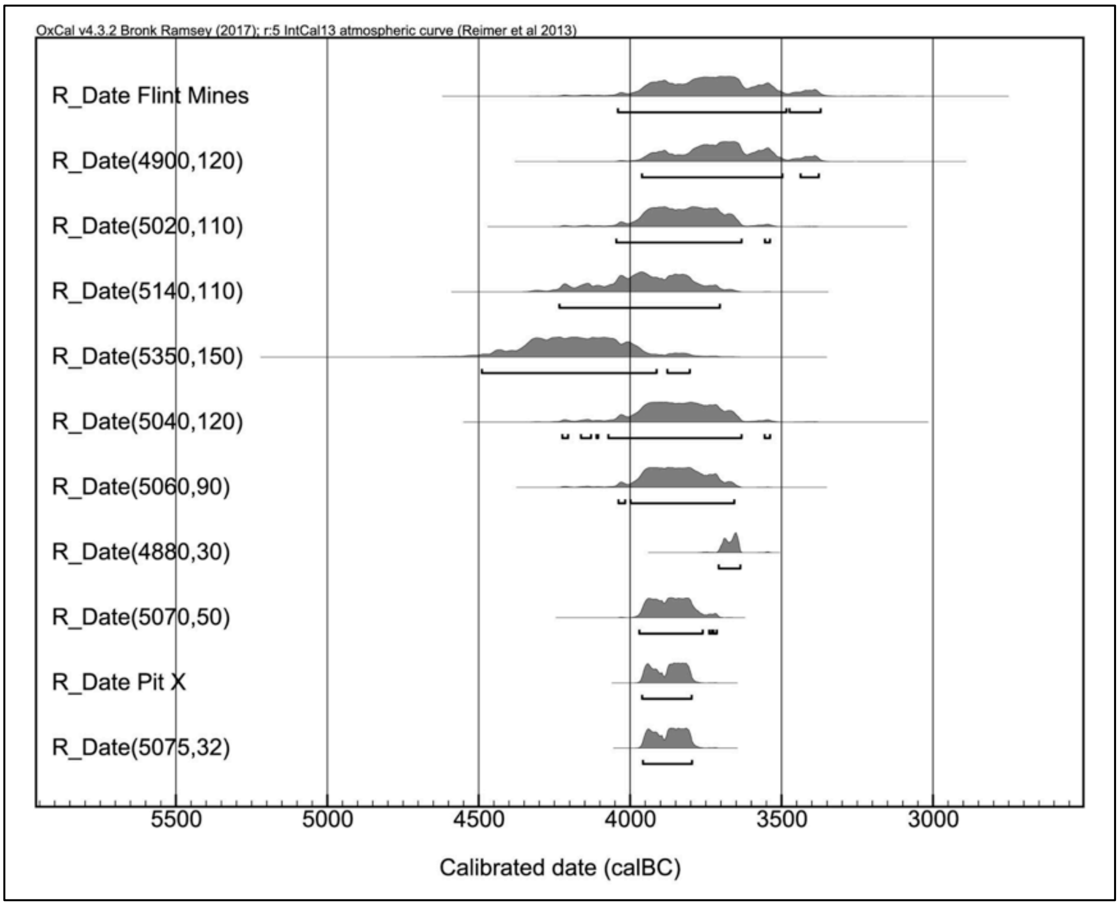


Fig. 6.20: Harrow Hill flint mine and New Barn Down Pit.

The relationship between Pit X and Pit Xa indicates connected sequences of deposition: the opening of Pit X, followed by the curation of objects for deposition, a probable hearth and feast, then its closing. A while later the same events seem to have been enacted with Pit Xa, including the possible collection and re-deposition of material from Pit X. That fresh fragments of Bowl 1, a particularly fine example and non-local, are divided between the two pits is evidence that the timescale between the opening and closing of both pits was short, maybe less than a year.

Prior to their deposition many of the objects had histories and were transformed before being placed in the pits. The flint implements were manufactured from mine debitage, a material that has already been extracted and worked. The polished axe (No. 49) had been reworked into an entirely new implement, further removing it from its original form. Its final re-sharpening may have been an effort to return it to its original form prior to its deposition. The rubbing stone (Stone 2) has been decorated, broken in half in what appears to be an act of decommissioning.

The flint implements were also exposed to heat, which seems to have been carefully managed as some of the implements are lightly heated, such as the blade (No. 51) and the scraper (No. 43), whilst others were exposed for a longer duration, such as the two axes. At least one implement, a scraper (No. 44) was heated to the brink of shattering. This could be explained by their location within the hearth deposit, but the pottery and the stone artefacts do not show signs of being heated, but could have been introduced after the fire cooled.

The curation of the objects prior to their deposition infers formalised acts, requiring a set of procedures to be carried out. Two processes may be evidenced, either the pieces have become 'cosmologically charged' by transformation of their appearance, or they have been 'decommissioned' before being deposited, with a final exposure to fire an essential act. It is likely the over-sized scraper (No. 42) and the knife (No. 46) had not been used prior to their deposition and may represent pieces made especially for deposition.

Ash dominated the charcoal sample, and is a fast burning wood that can be ignited immediately after felling due to its low water content. It is also a naturally springy wood, known for use as axe handles (Harding and Young 1979). It is tempting to imagine a 'ceremonial' fire, complete with an axe handle being offered, although such a scenario is impossible to prove.

The presence of Carinated Bowl pottery further provides a link between flint mines and sites located wider in the Sussex landscape. A coastal connection is observed in Pit X, with a single seashell and beach pebbles sourced from the Sussex coast. Coastal connections are an increasing theme of the Early Neolithic across the British Isles, as will be discussed below (Anderson-Whymark *et al.* 2015; Garrow and Sturt 2011; Bradley *et al.* 2016). A coastal link is further suggested by the presence of a fine Carinated Bowl possibly originating from Devon or Continental Europe.

Pit X is an exceptional feature. It has small evidence of occupation in the form of pottery, animal bone and scrapers, but it also appears associated with a formulised act, such as the closing of a settlement (Pollard 1999, 2001), due to the curation and careful management of the artefacts. It is highly probable that a community connected to one of the neighbouring flint mines opened Pit X, as it contained freshly mined flint, a mining implement in the form of a pick and is contemporary with extraction on Harrow Hill. The presence of Carinated Bowl, also found in association with mining material on Long Down and Cissbury, further supports a link between communities, mines and non-mining contexts.

6.7 East Sussex

(Appendix 6.9)

The landscape of East Sussex has key differences to the other areas, most notably the lack of coastal plain, with the South Downs forming sea cliffs west of the river Adur (Fig.6.21). The chalk downland also narrows, compressing into a thin strip until the end of the South Downs at Eastbourne. Many dry valleys run north to south from the downs to the English Channel, a number of which, such as in Peacehaven, hold deposits, including loess soils, suitable for early agriculture (Hart 2015).

The South Downs east of the River Adur are rich in Early Neolithic monuments, including causewayed enclosures at Whitehawk, Coombe Hill, and Offham (See Whittle *et al.* 2011), several long barrows, including the Camels Hump in Lewes and the Long Burgh in Alfriston (See Carpenter *et al.* 2013), and finally several extensive flint scatters, including those found on Malling Down, Alfriston and Bullock Down

(Drewett 1982a; Holgate 1988b). No flint mines are found in the area, with perhaps the exception of a single shaft at Slonk Hill (Hartridge 1978).

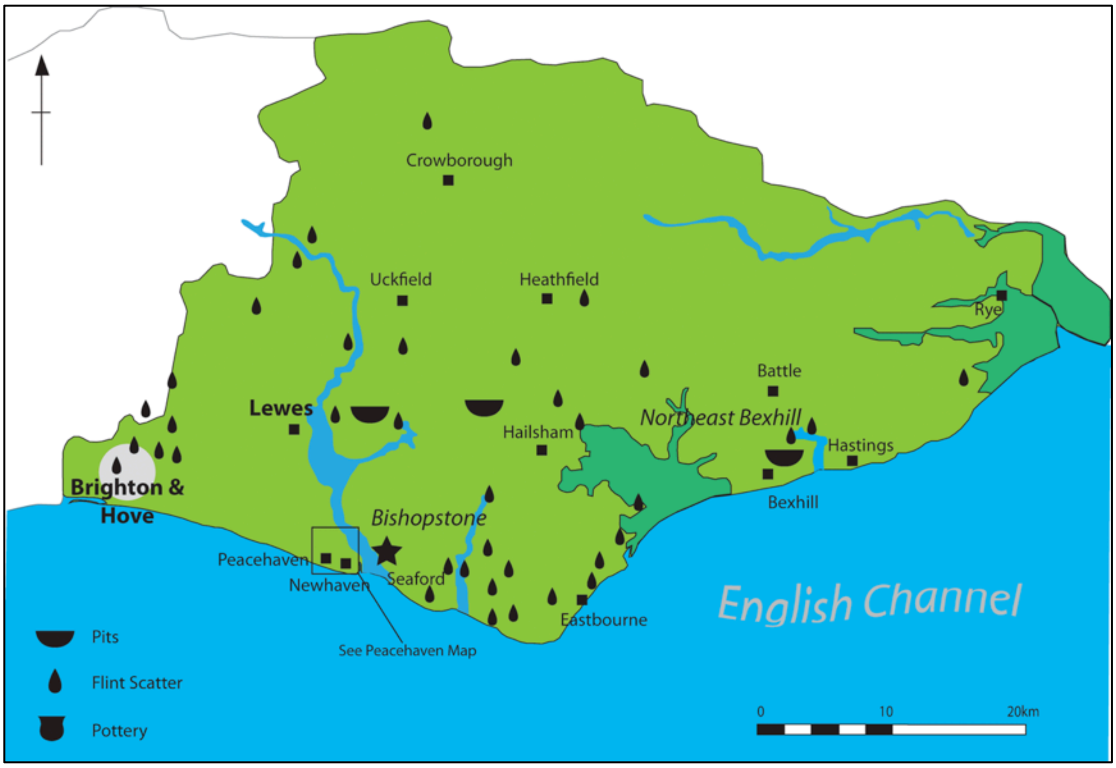


Fig. 6.21: Distribution of Early Neolithic sites in the East Sussex HER district (Author).

6.7.1 Peacehaven, an Early Neolithic super site?

Developer funded excavations have recorded a particularly high density of Early Neolithic sites in the Peacehaven area. These sites have been found in a roughly 10km^2 tract of land that is bordered by the River Ouse valley to the east, and high chalk sea cliffs to the south (Fig.6.22). The coastline in the Early Neolithic was probably c. 3-5km to the south (Woodcock 2003). All the sites are located on deposits belonging to the Woolwich and Reading Beds, composed of subordinate silts, sands and pebble beds (Young and Lake 1998). These deposits may have been advantageous for early agriculture as they are easily worked and have loess like qualities. In certain areas groundwater is held seasonally, due to their clay content, unlike in the chalk landscape surrounding the area (Hart 2015).

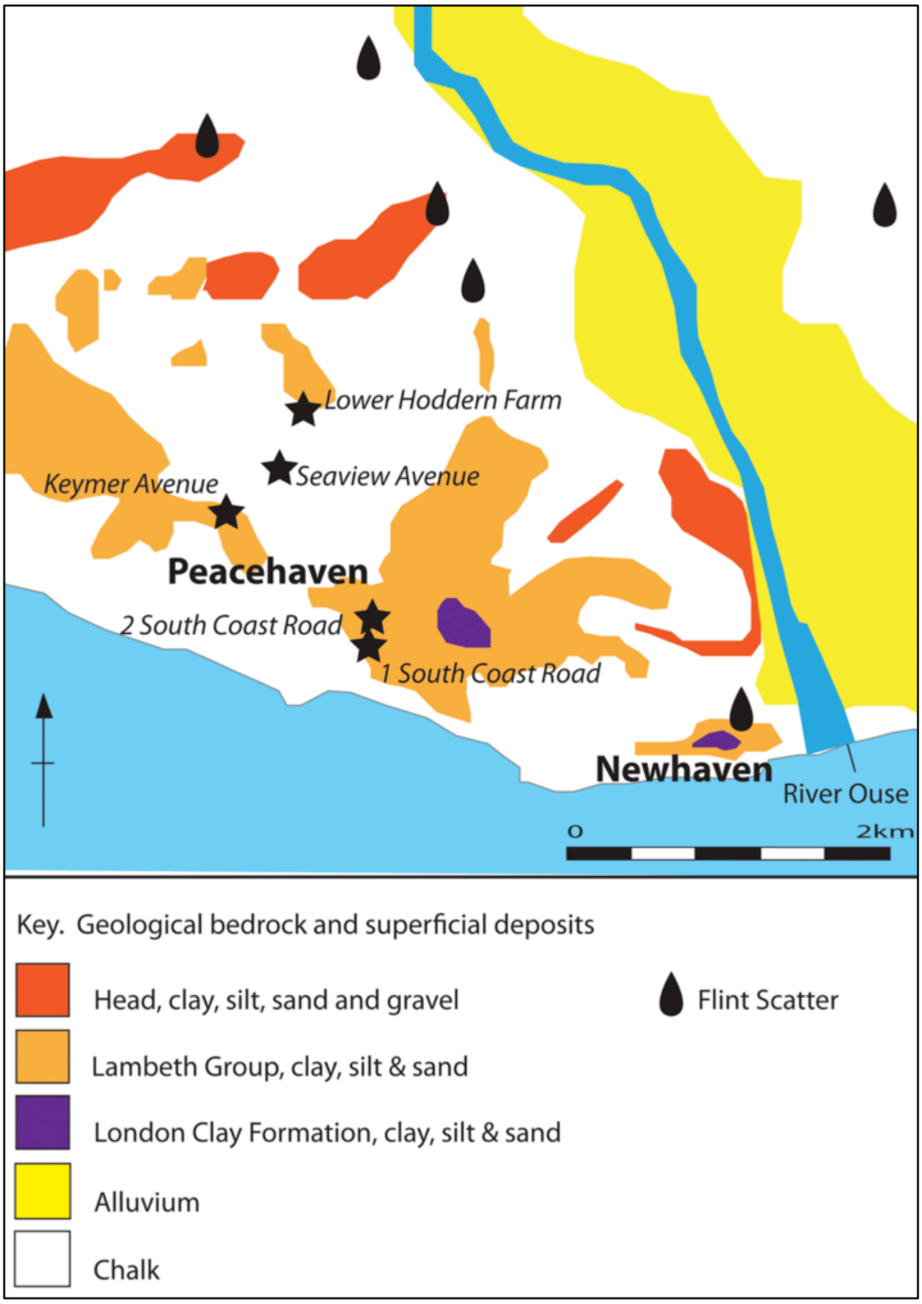


Fig. 6.22: Distribution of Early Neolithic sites in the Peacehaven area (Author).

6.7.2 Lower Hoddern Farm

The largest group of pits in the Peacehaven area was discovered at Lower Hoddern Farm, during a large open-area excavation (Hart 2010, 2015). In total 26 pits and other features were recorded, broken spatially into six groups. The larger of the groups comprised of three sub-oval pits, up 2.5m^{ø} and 0.9m of depth, and were rapidly backfilled. A further three groups comprised of smaller, sub-circular pits, up to 1.5m^{ø}

and possible postholes. The distribution of the pit groups was interpreted as possibly relating to at least four different episodes of activity (Hart 2015).

Artefacts recovered from the pits included a moderate assemblage of flintwork (458 pieces) mostly comprised of debitage. Surprisingly few implements were recorded, limited to serrated blades (10 pieces), utilised blades (57 pieces), scrapers (5 pieces) a leaf-shaped arrowhead and a knife. Only five axe-thinning blades were recovered, alongside four flakes recycled from polished axes.

A large assemblage of Plain Bowl pottery was recovered (949 pieces). Most vessels were thick walled and crudely made with laminar and ill-sorted flint inclusions, some of which were flaked, rather than crushed. Vessels were mostly plain rimmed with open, or closed profiles. Rare open profiled carinated forms were present.

A notable assemblage of stone artefacts was recovered from across the pit groups, including fragments of saddle-querns, rubbing stones and rubbing and grinding stones. The majority of the stone was imported sandstones, probably from Wealden locations (Barber 2015).

The environmental samples included charred macrofossils, dominated by barley (*Hordeum vulgare*), a small amount of either emmer or spelt varieties and even fewer flaxes and pulses. One pit, No. 777, was notable for its large assemblage of spelt (c. 14,500 pieces), as well as pulses and legumes. Analysis of wild flower and tree varieties revealed that the pits were excavated in a mixed environ of open cultivated areas and dry and damp woodland, dominated by Alder.

6.7.3 Dating

A series of radiocarbon dates were obtained from several of the pits, these ranged from between 3770-3470 cal BC and indicated that not all the features were contemporary (Hart 2015. 39). This certainly fits with the date range for Plain Bowl pottery, as proposed by Whittle *et al.* (2011. 762), beginning 3970-3715 cal BC (95% probability) and continuing for another 200 to 300 years.

The chronology between the pits was reasoned to indicate that the site was settled on multiple occasions for unspecified durations, and broken by unknown intervals over a period lasting up to 300 years (Hart 2015. 39). The site dates to the very earliest part of the causewayed enclosure period and could be considered contemporary with activity at causewayed enclosures, especially Whitehawk, less than 10km to the west. However, the pottery lacked Decorated Bowl, more typical of the enclosure period, and was dominated by Plain Bowl vessels with small amount of carinated forms. Although, it should be noted that Decorated Bowl is not always found on contemporary non-causewayed enclosures sites (Barclay 2002, 2007).

There is no doubt that the pits at Lower Hoddern Farm are evidence of seasonal occupation, based on a mixed economy of both wild and domestic plant cultivation. Other activities, such as the processing of plant for food or fabrics, also took place. It is unclear if a single group visited the site over a succession of visits, or if several groups visited over a shorter duration. Inclusion of the site in this chapter is helpful to develop the chronology of the Early Neolithic of Sussex in the period of mining. As discussed below, sharp distinctions can be drawn between earlier sites, such as New Barn Down, and later more aggregated sites, such as Lower Hoddern Farm.

6.7.4 Other Peacehaven sites

A number of other sites are found in the Peacehaven area, including almost 20 Early Neolithic pits excavated at 1 South Coast Road, c. 1km south of Lower Hoddern Farm, during a developer funded excavation whilst this project was underway (Baczkowski 2017). Two pits are of particular interest for this chapter as they contained Carinated Bowl vessels. The first pit (Pit 1) was c.1m^{ø} and concave in profile (Fig.6.23). The second pit (Pit 2) was 0.6m^{ø}, vertically sided and 1.1m in depth, giving it the appearance of a large posthole.

A large natural hollow was also excavated that contained a quantity of Early Neolithic material, including pottery, fire fractured-flint and struck flint. Such a feature may have been utilised to place midden deposits after an episode of woodland clearance, as documented elsewhere in southern England (Evans *et al.* 1999). This hypothesis may be supported by the recovery of c. 1500 pieces of Early Neolithic struck flint from the subsoil deposits.

Fig. 6.23: Post-excavation shot of Pit 1 (Author 2017).

Pottery recovered from Pit 1 included a body sherd from a classically Carinated Bowl. A larger pottery assemblage was recovered from Pit 2, including a small hemispherical bowl, or cup, and a rim sherd and body sherds from a fine Carinated Bowl that may been the same vessel as recovered from Pit 1(Fig.6.36). The fine Carinated Bowl is notable, belonging to a large open-mouthed vessel, with a thick rim, fine walled, and evenly fired in a reduced oxygen atmosphere, giving a uniform black finish. Further discussion of the pottery is carried out below. It is notable that like Pit X, a small cup was found alongside fine carinated vessels. All the fabrics present are consistent with local geology, and there is nothing to suggest imported wares.

Of the two features, Pit 2 contained a significant assemblage of flintwork, including 18 serrated pieces, axe-thinning flakes and over 100 fragments of micro-debitage. Use-wear analysis of the serrated pieces show that they were freshly deposited in the pits and were probably used for the butchery of animals or the processing of fibrous plants, presumably for the manufacture of products such as rope, nets or textiles, although in the case of the latter no loom weights were recovered. (Fig.6.24). A small amount of charred cereals, possibly emmer wheat, was recovered from Pit 2.

Fig. 6.24: Serrated blade from Pit 2 (P. Bye-Jenson 2017).

Radiocarbon dating of the features is yet to be undertaken. The form of the Carinated Bowl, lack of Plain Bowl and Decorated Bowl along with the flintwork infer a pre-3800 BC date. Although earlier than Lower Hoddern Farm the site shares many similarities, being focused on small pits groups, temporary occupation and the processing of plants. The presence of serrated blades, similar to those recovered from Bishopstone and Lower Hoddern Farm support the undertaking of craft activities.

A second site, 2 South Coast Road, located c. 20m to the north of the site was excavated prior to 1 South Coast Road. Only one feature was recorded, a curving linear ditch that appears to date to the Early Neolithic (Cipin and Douglas 2017). Unfortunately, it was only partially excavated due to being close to the limit of excavation. The site produced almost 500 pieces of struck flint, the majority of which dated to the Early Neolithic and was produced during primary core reduction indicating localised processing of raw materials, the subsequent preparation of cores and extraction of raw material on, or close to the site (Bishop, in Cipin and Douglas 2017. 65). It is likely that both South Coast Road sites are contemporary and may be part of a larger Early Neolithic landscape with defined areas of activity, including lithic production, agriculture and the undertaking of craft activities, such as rope making.

Other sites have also been recorded between South Coast Road and Lower Hoddern Farm (Fig.6.22), including a further fifteen pits containing a small amount of Early Neolithic flintwork and pottery at Keymer Avenue (Riccoboni 2008), and another three pits containing Plain Bowl pottery and Early Neolithic flintwork at Seaview Road, 600m southeast of Lower Hoddern Farm (Hart 2010). Numerous finds of Early Neolithic flintwork are also found in the Peacehaven area, including a significant number of axes, some of which may be sourced from flint mines (Angel 2007).

The area of Newhaven is therefore rich in Early Neolithic activity ranging over an area of landscape that was a subject to a long period of probable seasonal occupation. Communities may have been drawn by the rich sandy soils of the Lambeth Beds the only place such geology is found in Sussex, and seasonal water pools. Settlement of the area continued into the Middle Neolithic, with upwards of fifty Peterborough Ware pits excavated close to Keymer Avenue at Arundel Road (Stevens 2014).

6.8 Case Study Two: Bishopstone

(Appendix 6.10)

A multi-period site was excavated on Bishopstone from 1967 to 1975, mostly directed by Martin Bell (1977). Early Neolithic features recorded included eight pits and six gullies (Figs.6.31 - 6.32). One of the pits is detailed here, Pit 357, due to its containing an axe, provenanced to the Cissbury flint mines, and an assemblage of early pottery.

Bishopstone is located on a south-facing spur of land, less than 1km north of the current coastline and overlooking the valley formed by the River Ouse estuary, whose present course is c. 1.5km to the west (Fig.6.25). Further to the west by c. 6km are the Peacehaven pit groups. Unlike Peacehaven, Bishopstone can be considered a true downland site, with Upper Chalk bedrock and a patchwork of thin calcareous soils, deposits of Clay-with-Flints and pockets of sands (Bell 1977).

Fig. 6.25: Location of Bishopstone (Author).

6.8.1 Early Neolithic occupation

Evidence of Early Neolithic settlement was recorded in the form of eight pits and six gullies (Fig.6.26). Aside from Pit 357, detailed below, the largest pit was Pit 711, oval shaped in plan, with straight vertical sides, a flat bottom and measuring 3.5m long x 2m wide and 1.54m deep. The top of Pit 711 hade been truncated by an Iron Age pit. No weathering had occurred to the pit and it seemed to be immediately backfilled with chalk rubble and soil. The few artefacts recovered from Pit 711 included four pieces of worked flint, a rubber stone and three potsherds. Comparisons were made between Pit 711 and Pit X on New Barn Down, due to their similar size and form (Bell 1977. 9).

Other pits recorded included Pit 570, an oval shaped feature 4m^{ø} containing flints from a single episode of knapping, probably with material extracted from the pit, and a small hearth. The irregularly shaped Pit 710, measuring roughly 3mø and 1.5m in depth, with a series of scoops dug along its northern edge. A further six small pits were all circular or oval in plan, bowl shaped in section, shallow and between 2mø to 0.84mø. All contained flint work and potsherds. One pit contained a flake of foreign stone, possibly a polished axe, and one a sarsen rubber. These features were interpreted as grain storage pits, with one assumed to be for holding water as it appeared to be lined with clay.

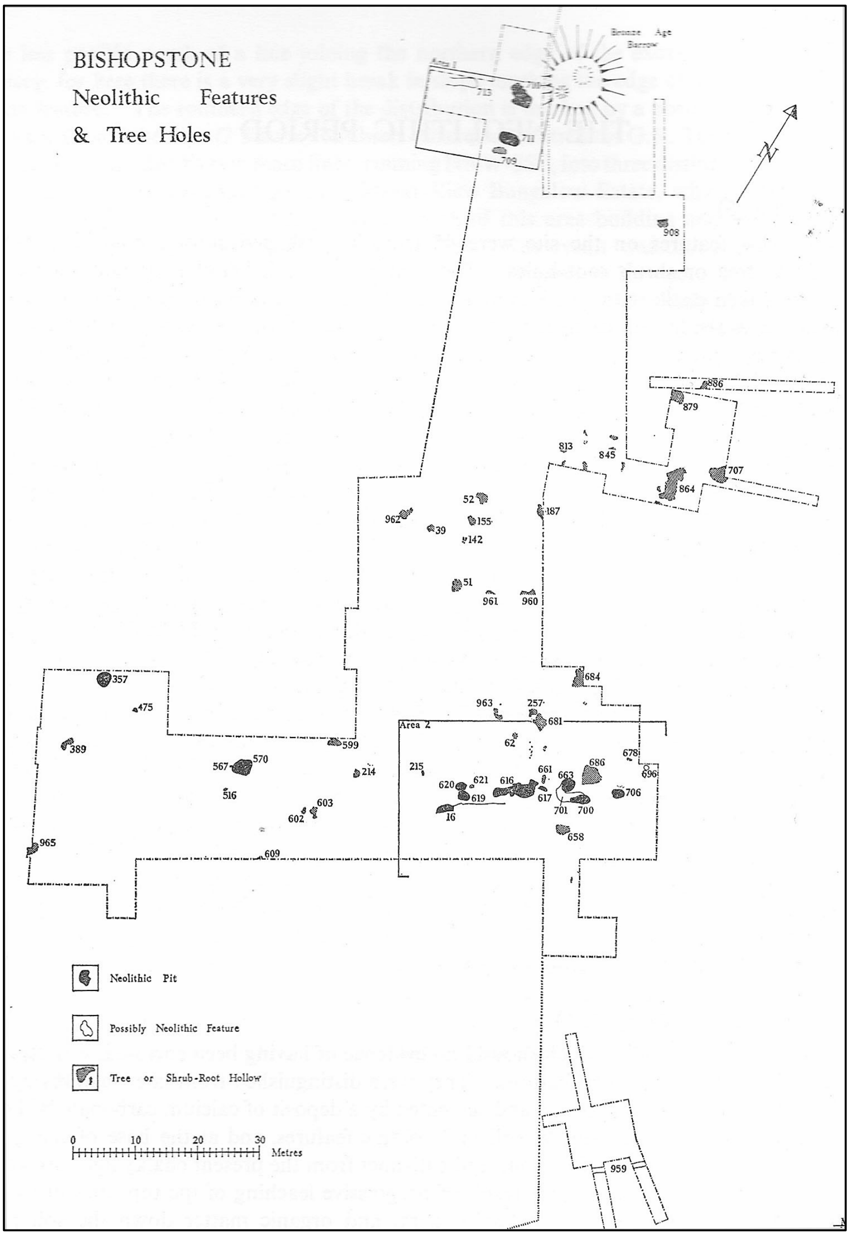


Fig. 6.26: Plan of Early Neolithic features, Bishopstone (From Bell 1977 Fig.3).

In total four gullies were recorded, ranging depth from between 0.06m and 0.3m, most were filled with chalk rubble. Two of the gullies, No. 16 and No. 616 had flint work in their fills, No. 16 contained a single potsherd. It was concluded that the features were either associated with chalk quarrying or were drainage gullies for structures.

6.8.2 Artefacts assemblage

Over 1000 pieces of struck flint dated to the Early Neolithic were recovered during the excavations. Flint was used from at least five different sources, local chalk geology in the majority but also smaller amounts from river gravels and Clay-with-Flint deposits (Fig.6.27). The flintwork recovered mostly consisted of debitage, in the form of blades and flakes. Sixty-two flakes were recovered from Pit 570, a re-touched piece and eight cores, all seemingly relating to a single knapping event. A small assemblage collected from Pit 710 included a probable bi-facial worked axe roughout, two hollow scrapers and a large bi-facially flaked knife. The six smaller pits all contained flint work, mostly consisting debitage and a side scraper from Pit 706.

Only two of the gullies contained struck flint, including a side scraper, a re-touched awl and a retouched scraper from No. 16. Gully No. 616 contained 112 pieces of debitage and 14 implements, including a side scraper, a hollow scraper and a backed knife.

The assemblage from Pit 711 is of interest, consisting solely of four finished implements, an end scraper, a side scraper on a thick flake, a hollow scraper with a wide concave scraping edge, and a thin serrated or denticulated flake, with its bulb of percussion removed. Certain similarities, as discussed below, can be drawn between this assemblage and Pit X on New Barn Down.

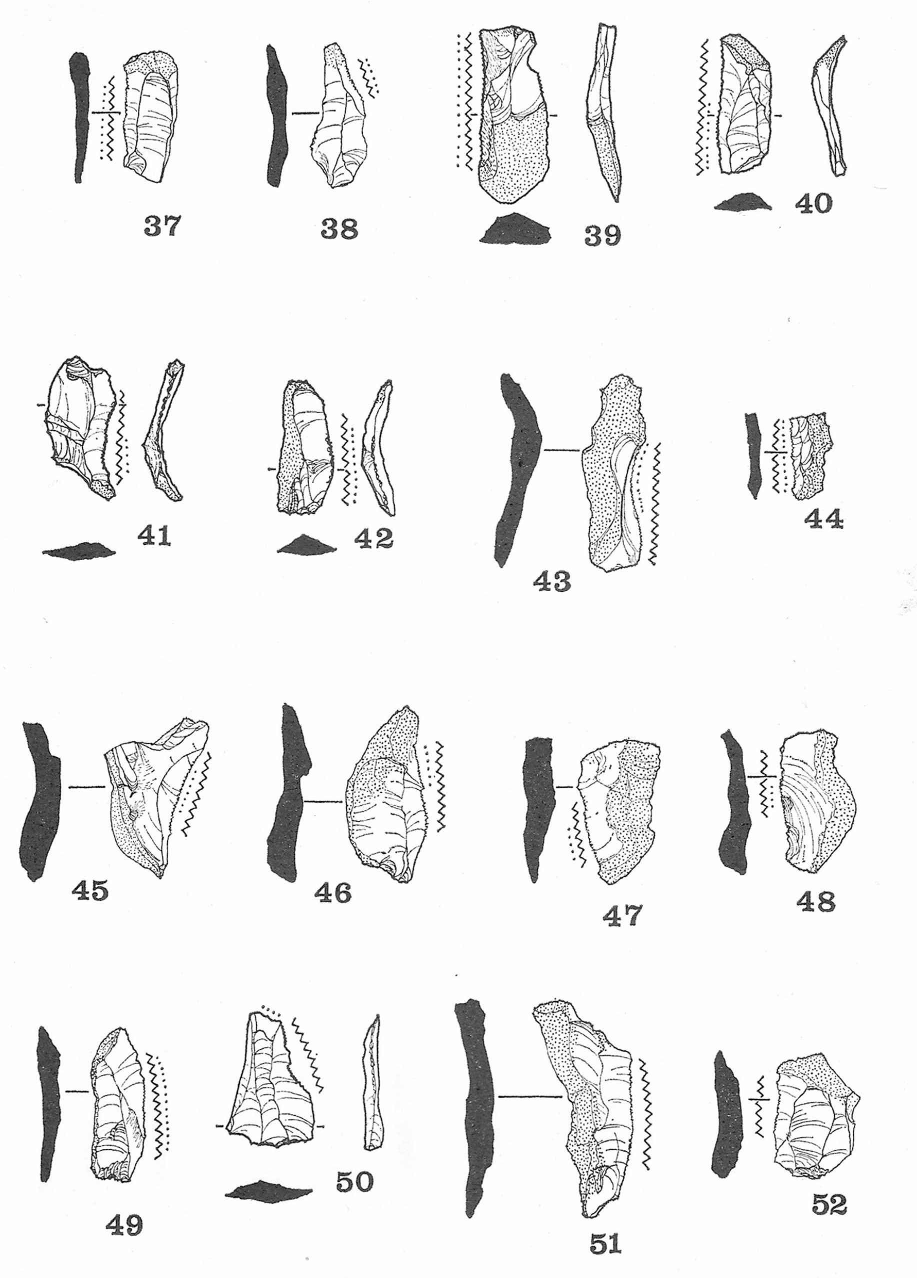


FIG. 12. The Neolithic flint industry from pit 357, nos. 37-52. Scale ½

Fig. 6.27: Serrated pieces, from Pit 357, Bishopstone (From Bell 1977 Fig.12).

A small stone assemblage was recovered from the pits, mostly comprising of implements associated with processing plants and made from beach sourced flint pebbles, or erratic sandstones collected on the South Downs or imported from primary sources wider afield. The most significant artefacts were a polished axe or pebble from Pit 700, a rubbing stone from Pit 710, identified as fine-grained sandstone and a rubbing stone from Pit 711, part of a large broken beach pebble which, after breaking, appears to have been used as a rubber.

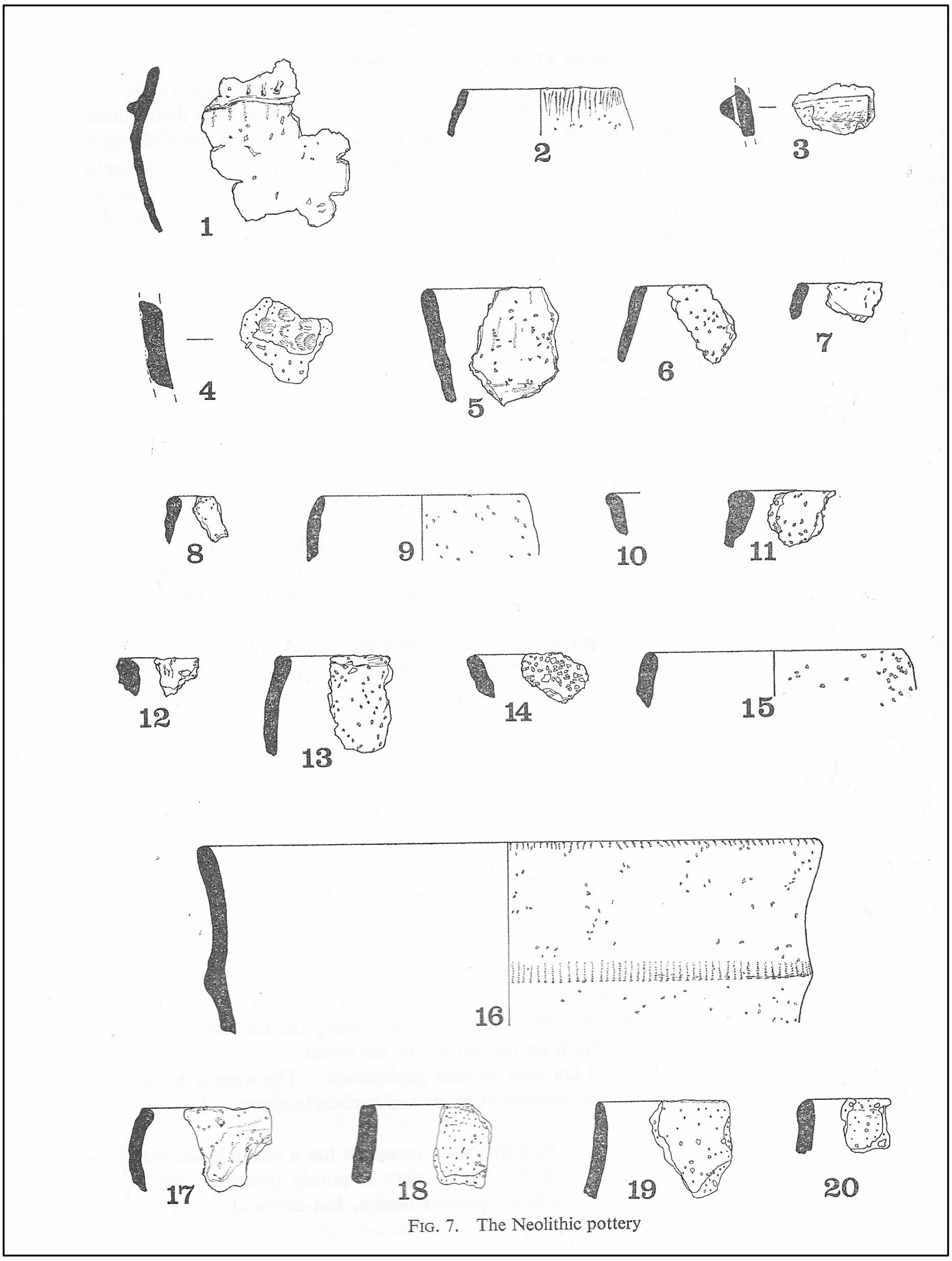


Fig. 6.28: Pottery from Neolithic features, Bishopstone (From Bell 1977 Fig.7).

In total, 90% of the pottery assemblage from the excavations originated from Pit 357 (Fig.6.28). The remaining 10% was scattered amongst the other pits and comprised of small non-diagnostic sherds of probable round-based open-mouthed bowls, typical of the Plain Bowl tradition (Bell 1977. 18). A few decorated sherds were noted. Coarse calcined flint fabrics dominated, although there was some shell backed fabrics. All fabrics can be considered local in origin, possibly from the Woolwich and Reading

Beds in the Newhaven Area. Two potsherds from Pit 357 contained inclusions of metamorphosed limestone and are maybe non-local in origin (Bell 1977. 17).

Three potsherds were recovered from Pit 711, including one from a Carinated Bowl (See below and Fig.6.32). This is of note and is comparable to the finer vessels from Pit X, being well-made and fine-walled it probably represents a classic Carinated Bowl (Cleal 2004).

Environmental samples acquired from the pits included samples of mollusca, plant remains and charcoal. Charcoals from hearths in Pit 570 and 357 included oak, hazel and hawthorn, in keeping with a wooded environment. The mollusca samples showed that the immediate area was closed. However, there was a background of grass loving species indicating that woodland clearance had started in the area followed by scrub formation, although the scale of the clearance and regeneration was difficult to determine (Bell 1977. 270). Overall, the environmental setting was a 'mosaic of grassland and scrub (Bell 1977. 270).

6.8.3 Pit 357
(Appendix 6.11)

Pit 357 was roughly circular in plan with vertical sides and a flat floor. The pit measured 2.5m^{ø} and 0.85m in depth (Fig.6.29). Distinct episodes of backfilling had occurred in the pit, starting with a primary fill of silty grey chalk with charcoal inclusions compressed by trampling. Little weathering of the pit had occurred before a 0.5m thick layer of chalk rubble was backfilled over the silty chalk to 0.3m of the pits top.

A short period of weathering occurred before three shallow scoops were dug, the largest of which contained a hearth. The last episode of backfilling was undertaken a short while after the digging of the small pits, with more chalk rubble and brown earth. Finds were reported throughout the fill with the majority in the middle deposits, including struck flints (c. 1000 pieces), 153 potsherds from 32 different vessels and a fragment of a saddle quern.

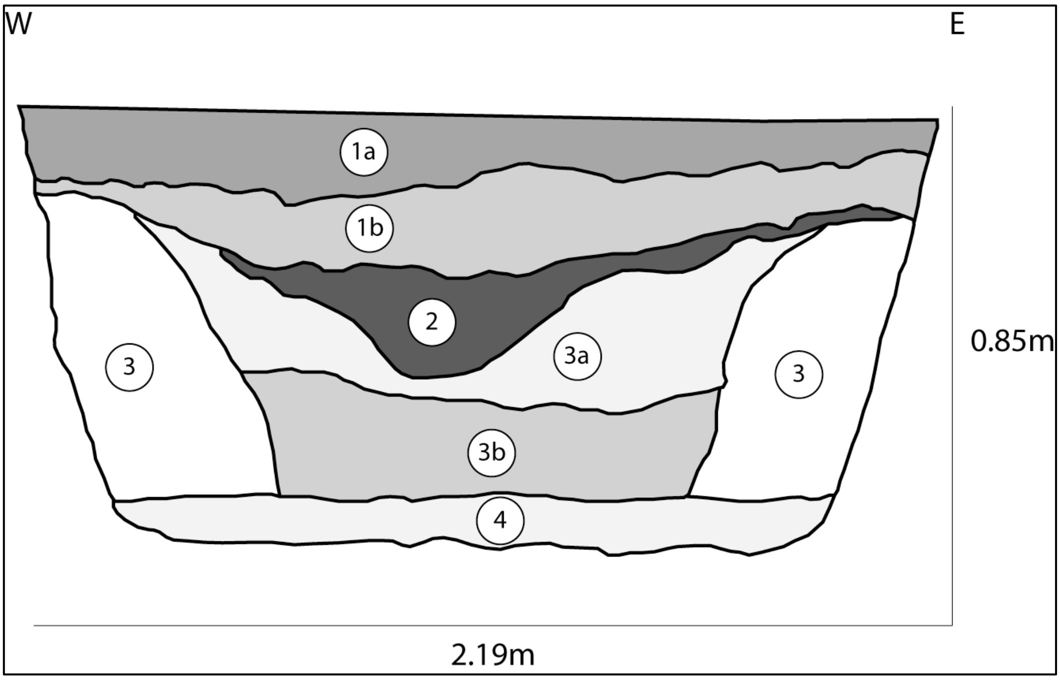


Fig. 6.29: South facing section of Pit 357 (Adapted from original Bell 1972).

Fills **(1a)** Hard compacted chalk 'lumps' in calcium carbonate and dark brown earth **(1b)** Same as above, but cemented and hard. **(2)** Hearth layer, fine ash with 'Charcoal of grasses, twigs and wood, and pieces of chalk and serrated blade also showed the effects of heat. The hearth was contained within a scoop. **(3)** Chalk rubble in light clay. Similar deposit to **(4)** **(3a)** Chalk rubble soil cemented with calcium carbonate. Weathered for while before the hearth scoop was cut into it. **(3b)** Hard chalk rubble containing large numbers of mussel shells. **(4)** Compacted dark grey chalk silt with tiny charcoal fragments. A trampled deposit on the base of the pit. Similar to **(3),** but with more charcoal. Containing flint, shells and pottery (From Bell 1977).

6.8.4 Dating

(Appendix 6.12)

In late 2019 funding for three radiocarbon dates was obtained during the course of this project, via an award from the Natural Environment Research Council (NERC). As previously stated, these dates were delayed due to the COVID-19 pandemic forcing the University of Oxford laboratory to close.

In consideration of the pottery (detailed below), belonging to the Plain Bowl or very Decorated Bowl phase, it is considered that Pit 357 dates to 3740 – 3580 cal BC (Cleal 2005). This makes it contemporary with the later phases of mining at Cissbury (Edinborough *et al.* 2019, Teather 2019). The bi-facial axe, provenanced to Cissbury

(See next), also supports this date and clearly indicates a possible link with the flint mines.

6.8.5 Flintwork

The assemblage of flintwork from Pit 357 contained a large amount of waste flakes (754 pieces), the majority of which had been struck from cores in a systematic reduction method. Surprisingly only three cores were recovered. The majority of the raw flint was locally sourced from chalk deposits (97.39%), with a smaller amount from beaches and even less from Clay-with-Flints (Bell 1997. 19).

Of the implements, serrated flakes dominated (43 pieces), mostly fashioned on parallel-sided blades with small platforms and re-touched with multiple v-shaped or u-shaped notches to create distinctive serrated edges. Use-wear analysis revealed that many had been hafted and probably used to process fibrous plant material (Bell 1977. 26). Other implements included two leaf-shaped arrowheads, both very fine examples, nine end scrapers of varying sizes, some showing heavy use and glossed surfaces indicative of woodworking, a broken blade segment from a knife or sickle and four re-touched flakes.

A complete bi-facial axe was recovered (Fig.6.30) that was noted to be of a different source to the rest of the assemblage. A flint mine source was hypothesised, which was confirmed when analysis carried out by the British Museum indicated a geological source in the Worthing area, most likely Cissbury (Craddock *et al.* 1983).

The axe is typical in profile for a mine product, specifically a 'Cissbury type'. Its size, measuring 124mm long by 60mm wide and 32mm thick, and weight, 60g, is in the upper size range of miniature axes, as discussed above, rather than a large 'Cissbury type' axe. No polish or use-wear is observed on the axe and it appears fresh and unused prior to deposition. It may have left Cissbury in its current state for possible polishing at a later date. It is a particularly fine piece, unlikely to have been an accidental inclusion into the pit. Its form is entirely in keeping with other flint mine axes analysed during this research (See Chapter Four).

Fig. 6.30: Bi-facial axe from Pit 357 (Author).

6.8.6 The pottery

The majority of the assemblage from Pit 357 is closed or straight-sided bowls, with simple rims, a lugged vessel and at least three decorated vessels, including the carinated bowl. In consideration of the dominance of Plain Bowls and decorated forms, albeit minimal, the assemblage cannot be regarded as belonging to the Carinated Bowl tradition.

One bowl, Vessel 16, is a carinated form, moderately fine and well made in comparison with other vessels in the assemblage. This appears in style to be a large classically Carinated Bowl, except it has simple decoration along its rim and carination in the form of lightly incised lines (See below). The decoration has similarities with the assemblage from Coombe Hill causewayed enclosure (Drewett 1980, 1994), although it is much better made. It appears to be a finely made copy of a Carinated Bowl, but lightly decorated and of considerable size.

6.8.7 Other artefacts

Unusually, a substantial amount of marine molluscs were recovered (c. 2500 pieces), predominately mussel (*Mytilus edulis L.*), but also smaller quantities of oyster (*Ostera edulis L.*), pullet carpet shell (*Venerupis pullastra*) and common limpet (*Patella vulgate*). The majority of the marine molluscs were from Pit 357, although smaller amounts were recovered from the other pits. Interestingly, one shell in Pit 357 had been perforated, possibly as an ornament.

Fourteen animal bones were recovered from Pit 357, with four different species present, including eight sheep bones (*Ovis.* sp.), three pig bones (*Sus.* sp.), two cattle bones (*Bos*. sp.), and a single fragment of Roe Deer antler. It was not clear if the antler represented a fragment of a tool.

Numerous carbonised cereals were also found in Pit 357, with three species present, six-row barley (*Hordeum vulgare*), emmer wheat and another wheat (*Triticum* sp.). Common weeds were also found mixed with these cereals, including Common Knotgrass (*Polygonum aviculare*), Fat Hen (*Chenopodium album*) and Chickweed (*Stellaria media*), all edible species that populate both arable and wasteland settings.

6.8.8 Comments

There is little doubt that Bishopstone is evidence of Early Neolithic occupation. The pits appear to document chronologically separated visits over an unknown duration of time, with scrub growth forming between episodes of occupation. A mixed economy was adopted, based on cultivation of domestic plant and collection of wild plants, craft activities based on the processing of fibrous pants, and use of local deposits for producing specialised lithics, most notably serrated-blades. There was evidence of chronological separation between the pits, as environmental evidence indicated that some of the pits were excavated in a wooded environment and others in an open, then shrubby one (Bell 1977. 44). This infers repeated visits to the same locale, possibly after a primary period of woodland clearance. Whether this was by the same community is unknown.

Bishopstone is contemporary with the Peacehaven sites and part of a much larger landscape of Early Neolithic activity, focused around the River Ouse estuary and a shifting economy based on cultivation and processing of domestic and wild plants. Developing connections between the two areas is difficult, although it is noted that many of the pottery fabrics at Bishopstone are probably from deposits only found in the Newhaven area, such as the Woolwich Beds. Whether the same or many different communities occupied these sites is unknown.

The connection between Bishopstone and the Sussex flint mines is significant. Pit 357 is likely contemporary with later mining and the axe is probably manufactured at Cissbury, proving a level of connectedness. The axe is unused and in fresh condition, indicating that it had not circulated long before it was deposited. It is impossible to know if the axe was bought directly from Cissbury, or passed through communities.

Further comparisons can be developed between Bishopstone and Pit X on New Barn Down. A comparison between Pit 711 and Pit X was originally made due to their similar size and form (Bell 1977. 9). This can be extended to the artefacts deposited within them, as both contained small assemblages of finished flintwork, mostly scrapers, and potsherds from a fine Carinated Bowl. Unfortunately, a later feature truncated the upper layers of Pit 711, making further analogy difficult. Nonetheless, artefacts at both pits appear to be placed on its floor making it likely that those in Pit 711 represented a considerable part of the total assemblage. Therefore, both Pit 711 and Pit X were of similar size, form and contained small assemblages of carefully chosen objects. This is in contrast to Pit 357 that contained a larger assemblage of diverse artefacts from a variety of activities, more akin to the deposition of a midden deposit (Pollard 2001), alongside selected objects, such as the axe.

Comparisons extend between Pit 357 and Pit X with the inclusions of non-local objects, including fragments of sandstone quern stones. More noteworthy is the selection of objects from coastal locations, including beach sourced flint and seashells. These, as discussed below, show links between the South Downs, coastal areas and possibly in the case of the sandstone, the Weald.

The large quantity of seashells in Pit 357 is of interest, and questions the notion that Neolithic communities rejected marine resources (Richards 2003; Thomas 2003; Schulting 2004; Richards and Schulting 2004; Milner *et al.* 2015). Alternatively, it may be the case that Pit 357, where the majority of the marine shell originated, represents the remains of a 'special' feast, possibly with totemic significance (Reynolds 2012). A comparison with another large pit, the Coneybury Anomaly, could be drawn, which contained roe deer, a previously favoured Mesolithic food staple. The inclusion of roe deer has been interpreted as evidence of the meeting of Mesolithic and Neolithic communities (Gron *et al.* 2018), although the date of Pit 357 appears way too late to support this interpretation.

Finally, a chronology for Bishopstone was originally proposed based on consideration of the environmental evidence, as earlier pits, including the large Pit 570 were excavated in a woodland setting, and later ones, such Pit 357 in open grassland (Bell 1977. 271-272). The radiocarbon dates obtained in this study could support this hypothesis, when available, especially as Pit 711 contained a fragment of earlier 'true' Carinated Bowl and Pit 357 dated to the later Plain Bowl period. If this chronology is correct then it may be possible to perceive a trend developing between Pit 711, Pit X and Pit 357, beginning with larger singular pits with few artefacts towards pits with larger midden-like deposits. It also is possible that the dating of Pit 357 demonstrates that it is the last in the Bishopstone chronology. This, combined with its abnormally rich assemblage, may hint that it is part of a closing, or abandonment act (Pollard 2001).

6.9 Early Enclosure?

A possible enclosure is worthy of brief mention in this chapter, which was excavated at Gateway Road, Northeast Bexhill and tentatively dated to the Early Neolithic. Located to the northeast of Bexhill on low hills overlooking an area of wetland, the Combe Haven, the enclosure is located below a south-facing hill, between 35 – 51m, on mixed bedrock geology comprising of sandstone, siltstone and mudstone of the Ashdown Formation, overlain by superficial deposits of Wadhurst Clay.

The site is composed of an extensive Late Mesolithic flint scatter and pit, which was dated to 4100 cal BC. One Early Neolithic flint scatter with associated early pottery types was also recorded (Mike Donnelly pers. comm 2014). The enclosure was comprised of a discontinuous 'semi-circular or possibly circular ditch' with steeply sloping sides, a flat base and measuring between 0.36m-1.0m wide and less than 0.1m in depth (Poole *et al.* 2015. 62). Dating was problematic, as no artefacts or organic material was recovered. Instead, the ditch was dated by a buried soil horizon that contained Late Mesolithic and Early Neolithic flintwork that had survived within its circuit, and included a high proportion of blades, a Mesolithic core and an Early Neolithic flake from a polished implement (Poole *et al.* 2015. 10).

The enclosure has been interpreted as 'proto-causewayed enclosure', due to the segmented ditch, its oval form, a possible outer ditch and its position, slightly off-summit from the hilltop. If this interpretation is correct, then this almost certainly represents one of the earliest Neolithic features in the region, and southern England. However, this interpretation is problematic, not least because it is poorly dated and its location is unlike any causewayed enclosure in Sussex, not being located on high chalk downland.

6.10 Carinated Bowl Pottery: A Brief Assessment

6.10.1 Sussex Carinated Bowl assemblages

In the process of researching this chapter it became evident that there was an association with flint mining and Carinated Bowl pottery, which has been largely overlooked. As discussed previously, it is proposed that one reason for its paucity in flint mines contexts was because it may have been considered taboo to carry it onto mining complexes, because pottery was associated with domestic activity and mines were ritualised, sacred landscapes (Topping and Lynott 2005; Teather 2016).

The best known example of a Carinated Bowl from a mine complex was a rimsherd found in a shaft at Cissbury and interpreted as either being residual from a truncated pre-mining context, or intrusive into an earlier mine (Barber *et al.* 1999. 69). This research has revealed that probable Carinated Bowl pottery was also found on Long Down, both within a mineshaft and working floor, and that Pit X on New Barn Down is almost certainly contemporary with mining on the neighbouring Harrow Hill. In view of these findings it was deemed a justifiable exercise to examine Carinated Bowl in more detail.

The research undertaken for this chapter has analysed three Carinated Bowl assemblages from non-mining contexts, and two from mining contexts (Table 7). Of the non-mining assemblages, New Barn Down can now be firmly connected to a flint mine, meaning that out of a total of six Carinated Bowl assemblages from Sussex, three are non-mining, one is connected to mining and a further two are from flint mines. This strongly connects flint mines and their communities to the Carinated Bowl tradition, a cultural phenomenon that warrants further, albeit brief, investigation.

Table 7: Sussex CB Assemblages

Non-mining Contests	**Mining Contexts**
Bishopstone (Pit 711)	Cissbury
Drayton Quarry	Long Down
New Barn Down	
South Coast Road	
4	2

6.10.2 New ceramics

Before proceeding, it is worth drawing a clear definition here between true Carinated Bowl assemblages (Herne 1988; Cleal 2004), containing finely produced pottery with clear body inflections and no decoration, to the later ‘pseudo’ carinated forms, such as Bishopstone, which tend to be more robust vessels often associated with Plain Bowl pottery and occasionally decorated.

The definition of Carinated Bowl has varied since first being classified by Piggott (1954), but can now be characterised as a bipartite open or natural bowl and includes vessels with a marked carination, or inflection on the body, such as S-profiled bowls and shouldered bowls, as proposed by Herne (1988) and Cleal (2004. 165). Carinated Bowl vessels tend to be, although not exclusively, of high quality, finely made and with simple rims. Regional styles previously included Hanging Grimston/Lyles Hill in Yorkshire, Carn Brea in the southwest and Windmill Hill in southern England (Whittle *et al.* 2011. 757). The use of these regional styles has now largely elapsed and Carinated Bowl is now understood as the earliest ceramic tradition in the British Isles. Assemblages are more common in northern England, Scotland and the southwest (Whittle *et al.* 2011. 757).

6.10.3 Chronologies

The chronology of Carinated Bowl is nuanced and regional. It is now accepted that Carinated Bowl was introduced in the 40th century BC, with Yabsley Street currently the earliest dated assemblage to 4028-3990 cal BC at 45% confidence (Thomas 2013. 358). It becomes more established in the archeological record through the 39th century BC, with notable assemblages in south and southwestern England including the Sweet Track, Rowden, White Horse Stone, Ascott-under-Wychwood, Hazleton, and Cannon Hill, all dated to pre-3800 BC (Whittle *et al.* 2011. 763. Thomas 2013. 369-371). In Sussex, Carinated Bowl is rare and there has been no attempt to refine its chronology, with Pit X the only firmly dated assemblage (this Chapter – Baczkowski 2019a).

The most important aspect of Carinated Bowl is that it arrives as a fully formed practice, in much the same way that has been proposed for mining (Baczkowski 2014, 2019b). In fact, early fineware vessels are of such exceptional quality, which only decreases though the Neolithic (Seager Thomas 2010. 2) that even modern potters struggle to recreate the vessels (Roz Cleal pers. comm 2017). Therefore, Carinated Bowl is undoubtedly, like mining, an import that travelled with communities arriving from the Continent and arrives as a fully formed practice, c. 4000 cal BC.

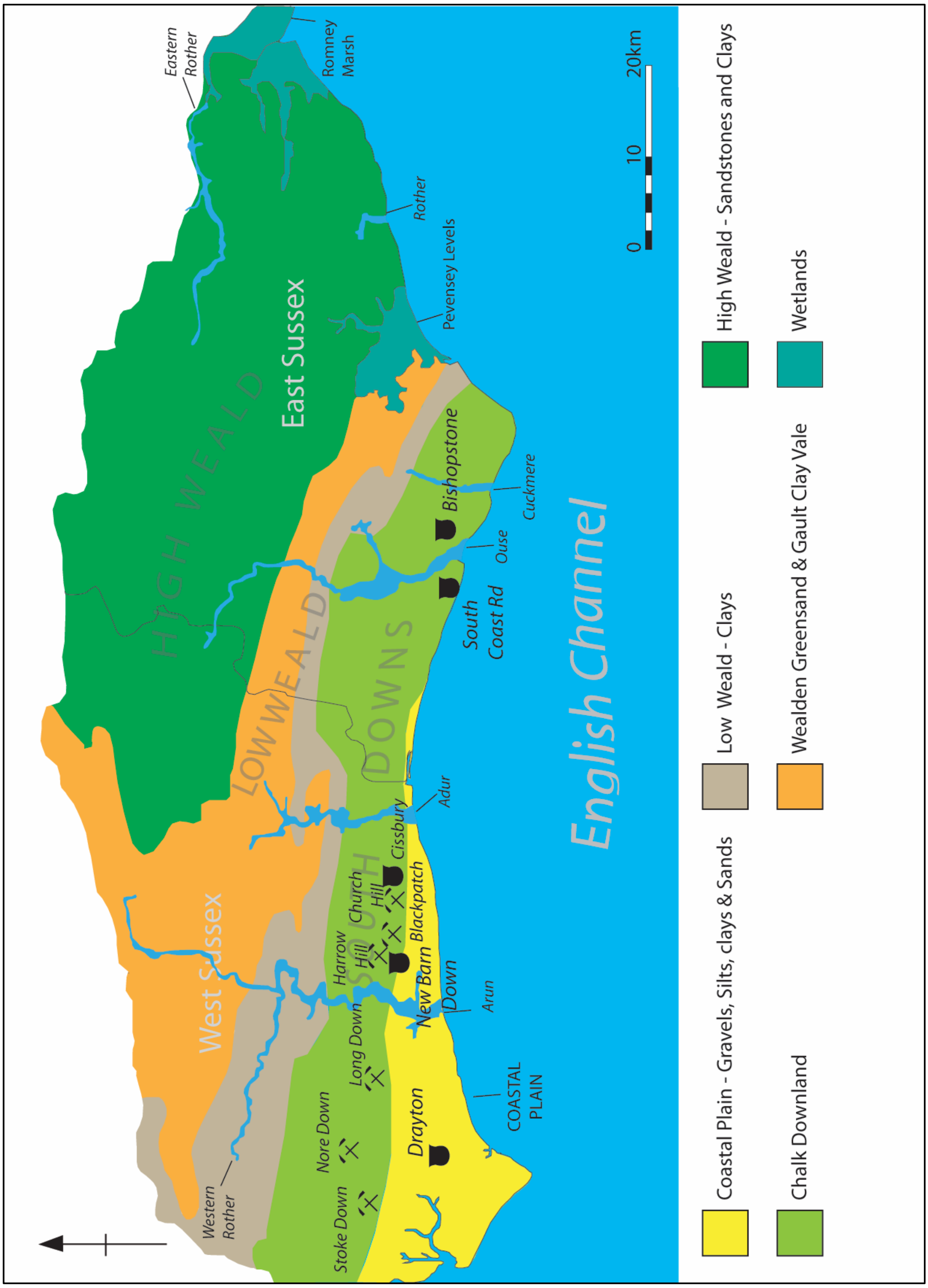


Fig. 6.31: Distribution of Carinated Bowl in Sussex (Author).

The use and significant of Carinated Bowl to Early Neolithic communities is largely unknown, although two aspects may indicate its role was not purely based on domesticity. Firstly, ongoing lipid analysis indicates a strong association with enzymes from ungulates, probably originating from its use to store milk or butter (I. Wiltshire, pers. comm 2019). Secondly, it often appears to be selected for careful deposition in pits and natural places, such on New Barn Down, the Sweet Track (Bond 2003), Yabsley Street (Coles *et al.* 2008) and Fitz Park, Cumbria (Williams and Holgate 2015). Such deposition practices suggest that Carinated Bowl had a specific role and use that was not solely domestic. Its association with milk is noteworthy, especially as ceremonies involving milk and the vessels that contain them are well documented in ethnographic studies of contemporary pastoralists (Green and Perlman 1985) and the British Neolithic (Copley *et al.* 2003), notably at Durrington Walls in the late Neolithic (Craig *et al.* 2015).

6.11 Sussex assemblages

The assemblages analysed in this chapter all belong to the Carinated Bowl tradition, pre-date the 37th century BC and are therefore contemporary with the mining period (Fig.6.31). All the assemblages contain a mix of fine walled carinated bowls of exceptional quality and larger coarseware vessels, which are more robust, but of similar form to the finer vessels. Detailed photographs and basic fabric analysis are presented in Appendix 7. In the case of South Coast Road and Long Down the assemblages are yet to be published, New Barn Down and Cissbury had not been analysed for over 70 years.

6.11.1 Bishopstone Pit 711

Only a single sherd of true, fineware Carinated Bowl was present in the Bishopstone assemblage, which was recovered from Pit 711 (See Appendix 7.1). As discussed above, Pit 711 was interpreted as possibly earlier than many of the other pits at Bishopstone and was also compared, due to is size and form, to Pit X on New Barn Down (Bell 1977. 9).

The single rimsherd is from a fine, less than 0.5mm in thickness, good quality probable open-mouthed Carinated Bowl with a delicate rim (Fig.6.32). It is produced with a fabric with a fine sandy matrix and tempered with sparsely calcined flint. The quality and fineness of the vessel compares well with other Carinated Bowls from Sussex, in particular from Pit X. Notably, its fabric is similar to a vessel from South Coast Road.

6.11.2 Drayton Quarry

The largest assemblage from Sussex is West Drayton, possibly containing more than 20 vessels (for contextual detail See above). The majority of the vessels can be described as classic Carinated Bowl, with open forms and simple rims. Cursory analysis of the pottery for this project (See Appendix 7.2) did not add anything to the original report by Seager Thomas (2005), although several observations were made.

Virtually all the vessels were coarseware, with an average thickness of just over 10mm, and most could not be considered as exceptional in quality. Fabrics varied between sparsely to abundant flint tempered and there is nothing to suggest a non-local geological source. One vessel stands out, NEO Pot 4, which was fine walled, well made and was carefully burnished (Fig.6.33).

A comparison between this NEO Pot 4 and Pot 1 from South Coast Road (See below) can be made. Both vessels are large, well made classic open-mouthed Carinated Bowls with distinctive rolled rims and carefully applied black burnish to their inner surfaces. Notably, both vessels are also produced from similar sandy fabrics with small inclusions (1mm<) of white calcined flint. Further work, such as thin-sectioning could prove these are from the same geological source, possibly sandy deposits in the Peacehaven area.

6.11.3 New Barn Down: Pit X and Pit Xa

Full description of the Carinated Bowl assemblage has already been discussed above, however several observations are worth expanding on. Most notable is the difference in quality between individual vessels in the assemblage, either fineware or coarseware. For example, two of the vessels, Pot 1 and Pot 2 are unusually fine, less than 0.2mm in thickness and are not produced with fabrics tempered with abundant calcined flints (Figs: 6.34 – 6.35). Pot 1 is also quartz tempered and is clearly non-local in origin. The other vessels are indeed Carinated Bowl, but are mostly c. 10mm in thickness, coarse and robustly made with abundant calcined flint tempered fabrics. A tentative comparison can be made in both form and fabrics to the coarseware vessels from Drayton Quarry.

The source of the coarseware vessels from Pit X is noteworthy as they are clay that, although common in Sussex, is not overly local to New Barn Down (See Appendix 7.3). There is a capping of Clay-with-Flints on Harrow Hill, but it is considered more likely that the origin is probably the brickearths and clays found on the Coastal Plain, c. 3km south of New Barn Down. Therefore, this aspect of the assemblage shares affinities with Drayton Quarry, being robust vessels, produced on clayey flint tempered fabrics and probably originating from the same area of the Sussex Coastal Plain within a 10km radius of both sites).

6.11.3 1 South Coast Road

A single Carinated Bowl vessel, Pot 1, was present in the small assemblage from the pits at 1 South Coast Road, along with a small cup (Fig.6.36). Only a single bodysherd from Pit 1 recorded an inflection, although other sherds probably originated from the same vessel, including rimsherd from Pit 2. The vessel is unusually well finished and thin bodied which, combined with its large rolled rim, must have made it an impressive bowl. In form, it represents a large classic open-mouthed Carinated Bowl (Cleal 2005). It is burnished black and has been finished with horizontal rippling across its inner wall, to give a similar effect as observed on NEO Pot 4 from Drayton (See above). It is probably manufactured from local sandy deposits and its fabric is tempered with moderate amounts of small (1mm<) calcined flint (See Appendix 7.3). Similar fabrics were recorded from the pits at Bishopstone (Bell 1977), indicating that Lambeth Group deposits in the Newhaven/Peacehaven area, not found elsewhere in Sussex, were utilised throughout the earlier Neolithic (Bell 1977. 15-19).

6.12 Flint mine assemblages

6.12.1 Cissbury

The Carinated Bowl from Cissbury was found in a mineshaft known as the 'Large Pit' Cissbury, excavated by Lane Fox in the 1870's (Lane Fox 1876. 379-383). Ambiguity exists over the context that the vessel was recovered from, which has limited its interpretation and led to an assumption that it is residual in a later mineshaft (Barber et al. 1999. 69)

However, Lane Fox reports that the pottery was discovered in the Large Pit at a depth of c. 4.2m in the chalky backfill of the mineshaft, along with animal remains, 'rude' flint implements and charcoal (Lane Fox 1876. 381). Two distinct layers of compacted large chalk blocks were recorded in the 12m section of the Large Pit, these separated by deposits of finer chalk fragments interpreted as spoil from neighbouring shafts (Lane Fox 1876. 381). The base of the Large Pit was not reached and excavation ceased at a depth of c. 12m. This means that no galleries, if present, were opened and therefore datable artefacts were not recovered.

The lower chalk deposit was recorded as the top of the original backfilling of the shaft. Resting on this backfill were hundreds of waste flakes, charcoal and animal bones, including ox, goat and red deer. The shaft appears to have been left open prior to further backfilling and followed by another layer of compacted chalk blocks, presumably fresh spoil from a neighbouring shaft. Lane Fox interpreted the artefacts as evidence of flint working and feasting carried out on the top of the freshly backfilled mineshaft, prior to secondary backfilling from neighbouring shafts. The pottery was found above the primary backfill deposit, sealed by the secondary backfilling.

It is difficult to be certain on the exact context of the pottery, but three scenarios are most likely. Firstly, Lane Fox was correct in his interpretation that flintworking and feasting occurred directly on the surface of the backfilled mine, presumably immediately after it has been sealed, as there was no indicate of silting. Or, the artefacts were backfilled into the shaft from the ground surface surrounding the mineshaft, along with the spoil from other the Large Pit and other shafts. Lastly, the artefacts may have been middened close to the Large Pit and then backfilled into it.

It is difficult to know which is correct, but what it is clear is that the pottery appears contemporary with mining because it was sealed by backfilling from neighbouring shafts, an event that occurred not long after the backfilling of the Large Pit, because no weathering or silting was recorded. It is also obvious that the pottery was not introduced later into the shaft as no mention of a cut was recorded and the upper deposit of blocky chalk sealed the lower deposits. There is no reason to suspect that the Carinated Bowl is not contemporary with the earlier phases of mining on Cissbury. It probably relates to activity occurring within the vicinity of the open mineshafts, which appears to have included secondary knapping and consumption of animals.

Analysis of the vessel undertaken for this project recorded that the rimsherd is from a large open-mouthed vessel, c. 200-300m$^{\o}$, less than 8mm thick with a clear inflection and plain, slightly outturned rim (Fig.6.37). By Cleal's definition, the vessel can be described as a straight-necked Carinated Bowl. Its fabric is clay based and tempered mostly with moderate fine calcined flint, with lesser amounts of un-burnt flint, some of which could be knapping waste. Its outer surface is light brown and has wipe marks from its burnishing, the inner surface is charred black with residue. Of note, is an impression within its inner surface at the point of inflection that could relate to a twisted cord. This does not appear to be decoration and may relate to its manufacture. It is a well-made vessel and in fresh unrolled condition, indicating it was probably in its primary context.

A bodysherd from the same context is not from the same Carinated Bowl, being more of a coarseware and produced from a sandy quartz fabric tempered with moderately sorted fine burnt flint temper and occasional calcined flint.

6.12.2 Long Down

The other assemblage from a Sussex flint mine is from Long Down, as discussed in Chapter Three and detailed in (See Appendix 7.5). This assemblage is notable for potsherds, possibly from the same vessel, being divided between a mineshaft and working floor. It was not possible to establish with certainty if any Carinated Bowls were present in the assemblage, although the general quality, fineness and angle of some of the bodysherds are suggestive of Carinated Bowl. The potsherds are also moderately tempered with calcined flint and at least one of the vessels is burnished on the outside to give a smooth brown finish, similar to other Carinated Bowls investigated here, most notably Cissbury and several bowls from Drayton Quarry.

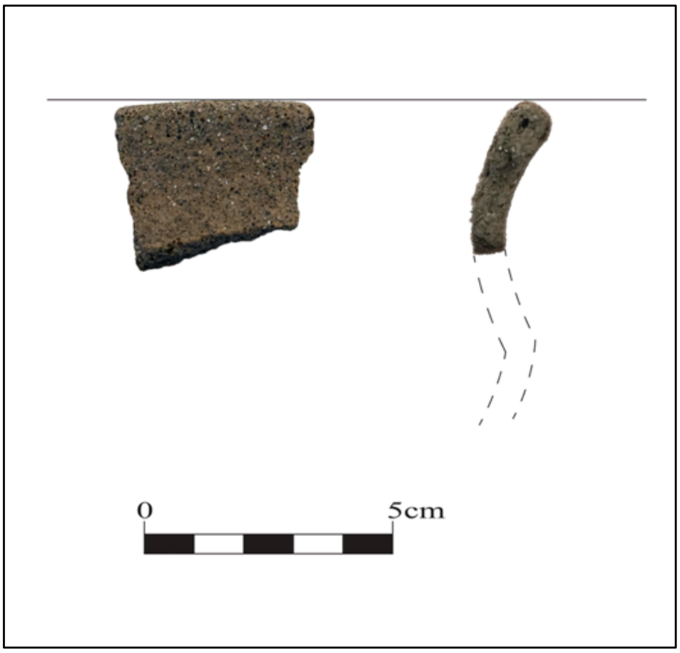


Fig. 6.32: Carinated Bowl from Pit 711 (Author).

Fig. 6.33: West Drayton Pot 4, inner wall showing burnish strips (Author).

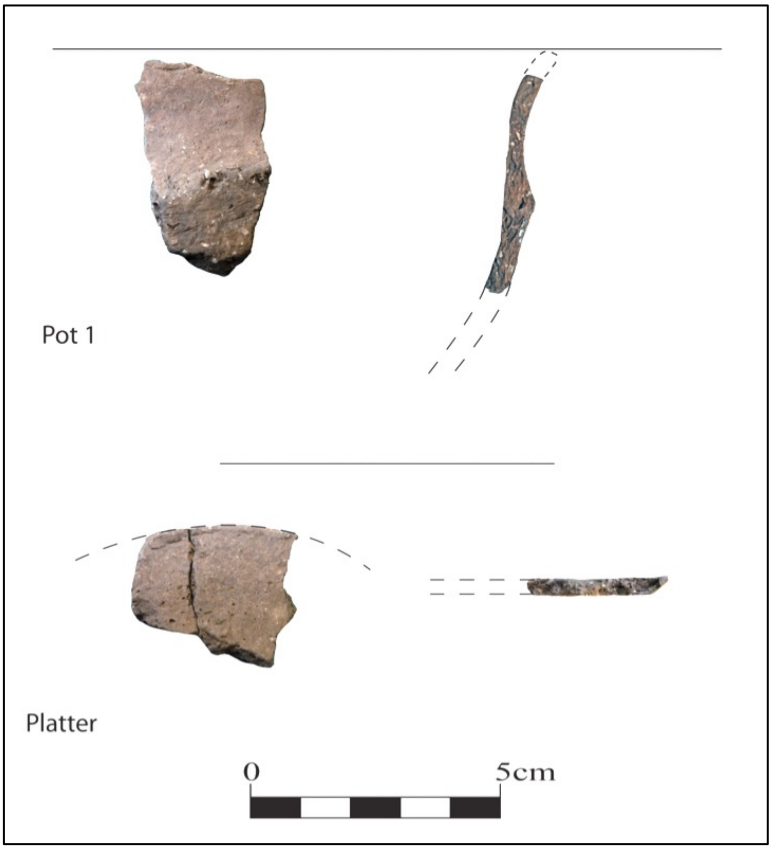


Fig. 6.34: New Barn Down, Pot 1 and platter (Author).

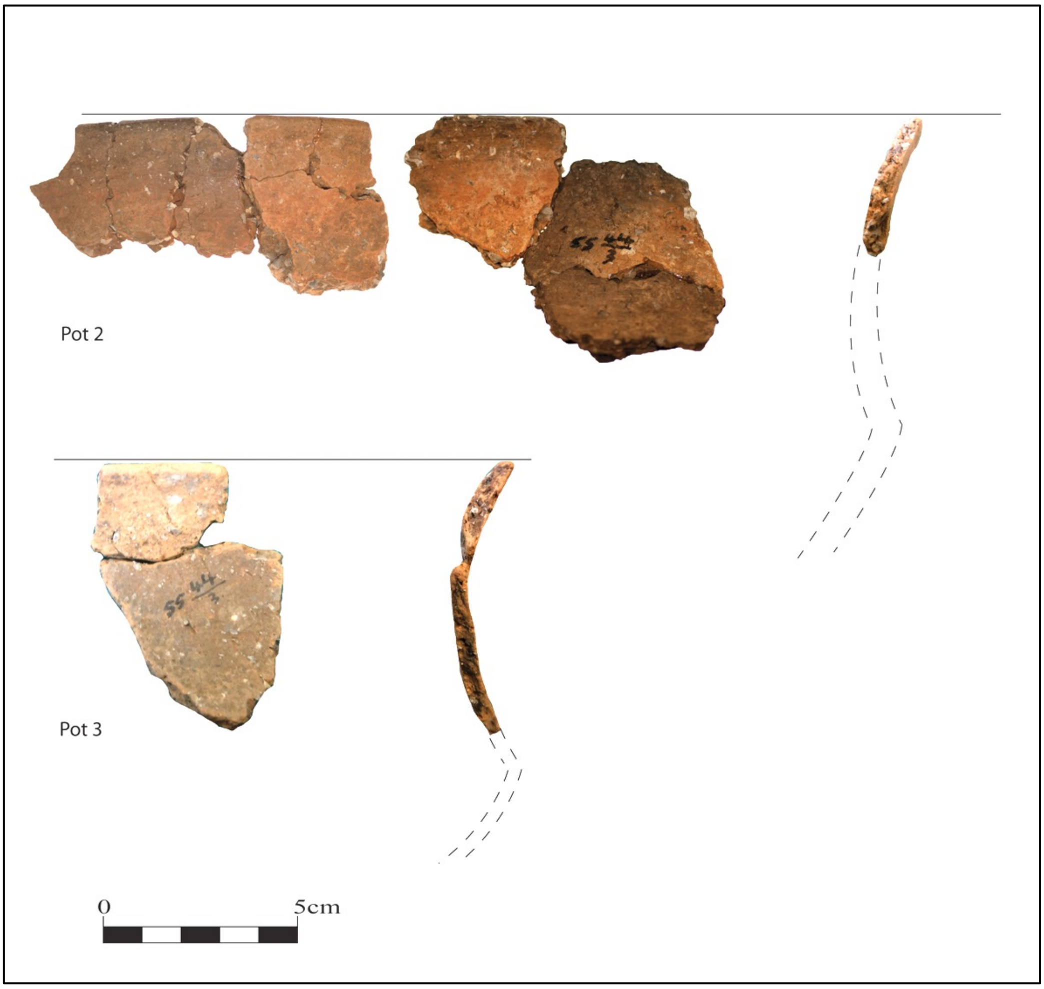


Fig. 6.35: New Barn Down, Pot 2 and 3 (Author).

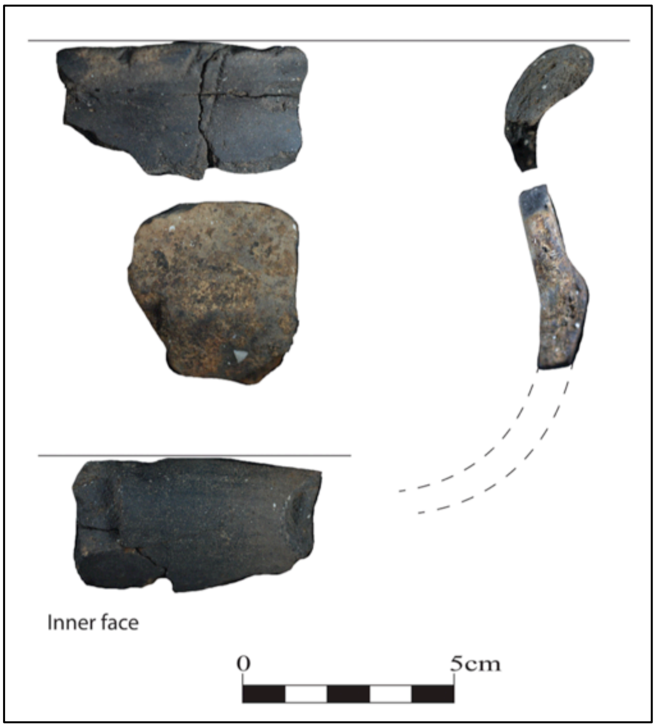


Fig. 6.36: South Coast Road Carinated Bowl, inner wall showing burnish strips (Author).

Fig. 6.37: Cissbury, Carinated Bowl (Author).

6.12.1 Discussion

The limited analysis of Carinated Bowl assemblage from Sussex carried out for this chapter was a rewarding, albeit partial, exercise. More detailed analysis could in theory be carried out on the assemblages, such as extracting lipids, thin sectioning, and composing a detailed county fabric series. But research of this nature is somewhat limited by both the scarcity of the pottery and the character of the source material, as many potsherds, such those from Pit X are too delicate. The only assemblages large enough in Sussex to carry out destructive sampling on are Drayton Quarry and South Coast Road, and in the case of the former the lack of contextual information compromises the integrity of further analysis.

Also relevant is the size of the assemblages, mostly composing of fewer than five vessels and in contrast with the much larger assemblages more common with Plain Bowl, such as recovered from Lower Hoddern Farm (Hart 2015). This makes constructing a fabric series difficult as comparable material, both upon an individual site and in the wider region, is lacking. In a sense, this informs us on Carinated Bowl as it indicates that it was not common in the Early Neolithic as, apart from the large assemblage from Drayton Quarry, all the other assemblages are small, composed of c. 15 sherds, or less.

It is further apparent that, on the whole, fabrics are locally sourced from clays or sands, with the exception of one vessel from Pit X. There is no overriding trend for Carinated Bowl, or centralized location of production in Sussex, with the possible exception of Peacehaven. This decreases the usefulness of fabric analysis as no county level fabric series could be produced, such as has been created for later Bronze Age wares (Seager-Thomas 2010). Such analysis could be useful for a chalk site, such as New Barn Down, where some vessels are possibly manufactured from coastal deposits, but the assemblage is too small to thin section.

The analysis undertaken for this chapter was most successful in proving a connection between mining and Carinated Bowl. It can be further proposed that this connection is because the mining communities were versed in the use and manufacture of Carinated Bowl vessels. The evidence presented here indicates that Carinated Bowl was present in the mining environment, but its survival, aside from within mineshaft backfills, is unlikely in open deposits, such as working floors. The only mine context that it has not been found in is the galleries. If there is a taboo on its use at mines, it may well have been applied within the galleries. However, its absence could be solely due to practical reasons, as fragile pottery probably had no use in robust mining activates.

Another observation is that Carinated Bowl vessels appear to have been treated in the same way at mines as ‘occupation’ sites, mostly being deposited in pits. At both Cissbury and Long Down, individual sherds appear to be have been selected for deposition in shafts, or possible pits in shafts. This is a trend that is also present with the pits explored in this chapter, as only a few sherds of fine-ware vessels are found, often alongside marginally greater quantities of coarseware vessels. It could be argued that the sherds are accidental additions within the mineshafts whilst backfilling, but the fact that all the mine potsherds examined are in fresh, unrolled conditions would favour against this interpretation. It is also considered that they would be highly fragmented if they were carried in mine spoil for any duration of time.

If they did originate from deposits close to a mineshaft then this implies that middens must have existed within the mine area or, at minimum, activities were carried out that required the use of Carinated Bowl. Both hypotheses rather disprove the perception that Carinated Bowl was not present within the mines. Overall, it is proposed that the connecting factor between mines and Carinated Bowl is the communities who produced axes and early forms of ceramic vessels.

6.13 Discussion

6.13.1 A Sussex chronology?

Despite the paucity of dates a cautious chronology for the development of Early Neolithic practices in Sussex can be formulated as a model against the backdrop of the flint mining (Fig. 6.38. Tables 7 - 8). The model begins c. 3950 cal BC with larger singular pits that often contained small amounts of selected and curated artefacts alongside high quality Carinated Bowl vessels. This is followed from c. 3800/3750 cal BC by smaller pits, either singular or in small groups containing larger assemblages of artefacts, including ecofacts, and pottery with ‘transitional’ characteristics between Plain Bowl and Carinated. These sites often appear as singular occupations events focused on the coastal plain.

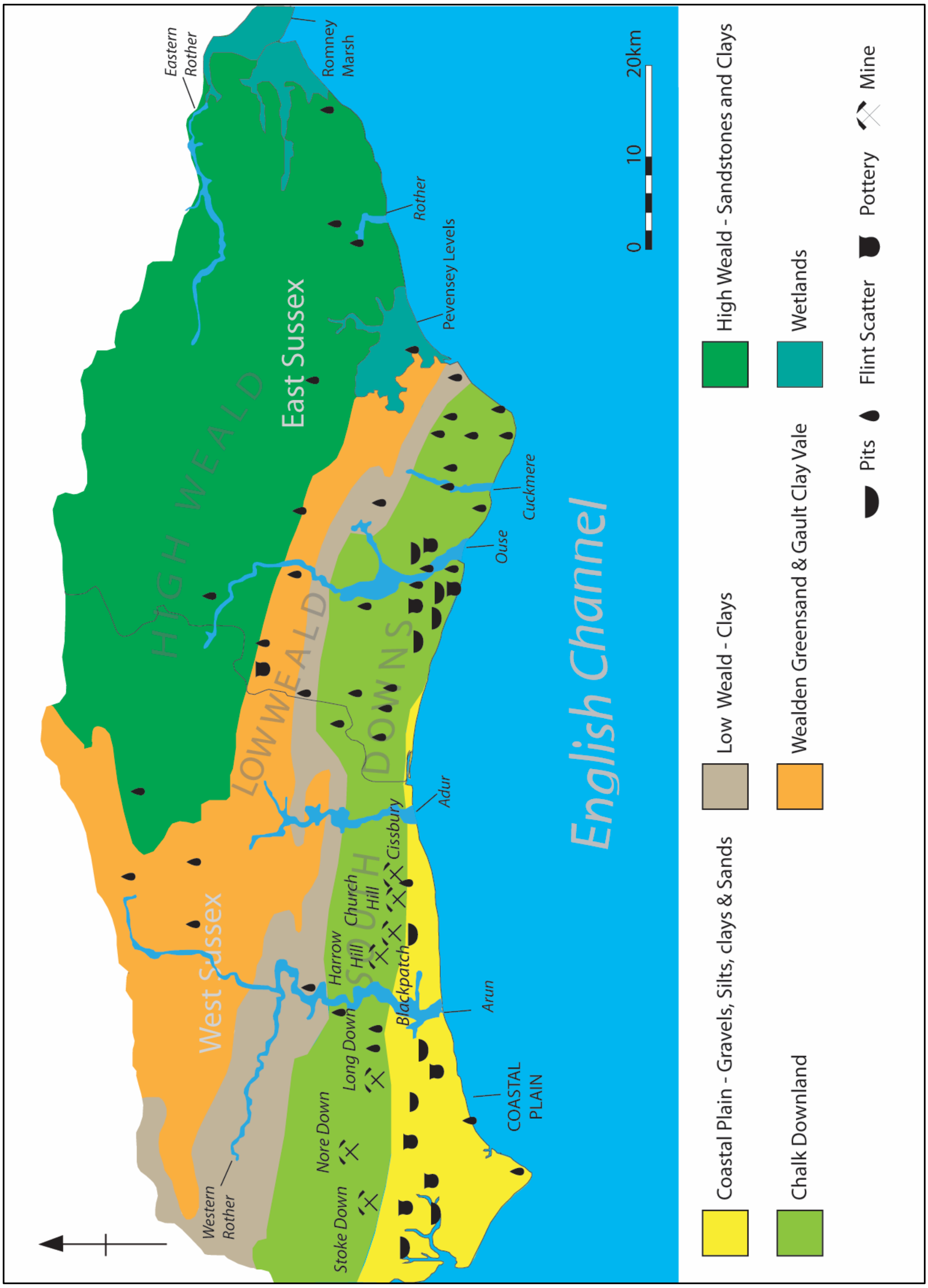


Fig. 6.38: Early Neolithic Sussex pre-enclosure (Author).

Table 8: Sussex Early Neolithic sites included in this chapter.

Site Name	*Number of pits*	*Other Features*	*Pottery*	*Flintwork*	*Other finds*	*Environmental data*	*Tree Species*	*Geology*	*Radiocarbon Dates*
Baxondale Road, Chichester	4		PB	115		CG, CH	O,H,HT,P,A,E,I,BT	C, G	
Drayton Quarry, Chichester	2	1 Gully	CB	Yes	?	CH	0,P,AL	BE	
Claypit Lane, Chichester	1		PB	34		CP, CG, CH,HS	O,H,HT,	BE, G	3800-3635 cal. BC
Manor Hill, West Sussex	3		PB	20+				C, S, G	
Millfield, West Sussex	3		PB	9				C	
New Barn Down, West Sussex	2		CB	10	S0, RS, B, S	CH	A, H, HT	CH	3961-3797 cal BC 3958-3796 cal BC
North Bersted, West Sussex		2 Gullies	PB	1				BE, G	
Titnore Lane, West Sussex	4	1 Gully	PB	1				BE, C, G	
Bishopstone, East Sussx	8	6	CB/PB	700+	SO, QS, S, RS	CP,CH,LM	O, A, H, HT, Y	CH, S	
Lower Hoddern Farm, East Sussex	26	5 Post-holes	PB	458	QS, RS	C, CP , CC, C.		BE, S	3640-3370 cal BC 3710-3620 cal BC 3660-3520 cal BC
South Coast Road, East Sussex	6		CB/PB	400+	RS	C, CC	In progress	BE, S	
Bexhill Enclosure	n/a	Possible pits		500+					4000-3700 cal BC?

Pottery CB, Carinated Bowl. PB, Plain Bowl. *Other* Finds B, Bone. RS, Rubber Stone. S, Shell. QS, Quernstone. *Environmental Data* CG, Charred Grain. CH, Charcoal. CP, Charred Pollen, HS, Hazel Shell. LM, Land Mollusc. *Tree Species* A, Ash. AL, Alder. BT, Buckthorn, E, Elm, H, Hazel. HT, Hornthorn, I, Ivy. O, Oak. P, Prunus, Y, Yew. *Geology* C, Clay.CH, Chalik BE, Brickearth. G, Gravel. S, Sand.

Table 9: Proposed chronology.

Phase 1 **4100-3900 cal BC**	**Phase 2** **3900-3650 cal BC**	**Phase 3** **3650-3500 cal BC**
Characteristics		
Mainly large single pits and flint mines, along with dispersed flint scatters. Difficult to define aside from securely date flint mines and occasional pits.	Continuation of earlier phases but more pits are evident, often in groups. Mining begins at some sites, but may begin to wane at others.	Rapid construction of causewayed enclosures. Pit focused sites becoming larger and more aggregated. Mining ending at most sites. Possibly re-appearing towards the end of the period?
Locations		
Mostly downland and Sussex Coastal Plain, but finds of axes within the Weald hint at activity north of the South Downs. Flint scatters mostly on hilltops and river valleys.	Same as earlier periods, mostly hint that more coastal plain sites are visited and perhaps more Wealden sites.	Concentration of enclosures upon downland locations. Continuation of coastal plain sites and perhaps increased activity in the Weald.
Monuments		
Flint mines: Blackpatch, Cissbury, Church Hill? Harrow Hill Long Down?	Flint mines: Long Down, Stoke Down Enclosures: Possible early phase at Bury Hill? Early Long Barrows? Bevis Thumb?	Causewayed enclosures" Bury Hill, Court Hill, The Trundle, Halnaker, Barkhale, Whitehawk, Offham, Combe Hill. Flint mines: Church Hill? Long Down; Stoke Down? Long Barrows: North Marden, Alfriston etc.
Pits		
New Barn Down Drayton? Cissbury? 1 South Coast Road? Bishopstone Pit 711?	Lower Hoddern Farm 1 South Coast Road Baxondale Road Claypit Lane	Lower Hoddern Farm /Peacehaven, Bishopstone Pit 357, Titnore Lane, North Bersted etc.
Material Culture		
Absence of pottery initially, but Carinated Bowl begins c. 3950 cal BC. Lithics already clearly Early Neolithic, - bi-facial axes, large robust scrapers, leaf-shaped arrowheads, serrated blades.	Carinated Bowl begins to replaced by Plain Bowl. Lithics remain the same; serrated blades are found in larger numbers in pits. Perhaps an increase in quern stones?	Carinated Bowl absent, but some carinated forms still manufactured. Decorated Bowl closely associated with enclosures. Plain Bowl on non-enclosure sites. Leaf-shaped and other forms of arrowheads also associated with enclosures. As are serrated blades.
Environment		
Wooded, but with preliminary clearance occurring.	Woodland clearances utilised for several years prior to abandonment? Areas of the South Downs becoming more open	Areas of enclosures open, mines may have become scrub. Open areas, such as Peacehaven still favoured.

The final period begins c. 3650/3600 and is dominated by pit groups rich in large assorted assemblages of artefacts and ecofacts. These sites appear mostly on the Peacehaven/Bishopstone area and, at present, are rare in Sussex, unlike elsewhere in England, such as Norfolk (Garrow 2007, 2010). Presumably this final phase, largely contemporary with the beginning of causewayed enclosures, is evidence of much larger concentrations of groups on locations that are visited repeatedly, such as Lower Hoddern Farm, rather than singular occurrences.

This elementary model does reflect other examples developed for Early Neolithic pottery traditions in southern England. Both Cleal (2004) and Whittle *et al.* (2011. 757-79) have proposed similar chronologies, starting with a *Earliest/Contact Neolithic* (c. 4100-3850 cal BC) evidenced by Carinated Bowl, progressing into the *Early/Developing Neolithic* (c. 3850-3650 cal BC), mostly associated with Plain Bowl, but overlapping with Carinated Bowl at its start and Decorated Bowl at its end, and finishing with the *High/Developed Neolithic* (c. 3650-3350BC), mostly associated with the numerous styles of Decorated Bowls.

Significantly, the ceramic chronology is also mirrored on flint mines, with Carinated Bowl at Cissbury and Pit X, close to Harrow Hill where early dates have been obtained, and either later Carinated Bowl, or Plain Bowl on Long Down, possibly one of the later Sussex mines (Edinborough *et al.* 2019). A chronological model based on ceramic traditions also mirrors wider transformations in Early Neolithic activities, as investigated in this chapter, changes that broadly align to the start and end of the period of mining, a point returned to below.

6.13.2 Connections to flint mines

Without doubt Pit X on New Barn Down offered the best evidence of a feature connected to the flint mines by location and date. Located only c. 700m from the Harrow Hill mines it contained material, including a pick and polished axe, produced on fresh mining debitage. It could be argued that the flintwork was collected and deposited in the pit by a non-mining community, but overall this is considered unlikely as the material was freshly mined and showed no signs of weathering. A more likely scenario is that Pit X was opened by a community who were settled within its vicinity whilst mining at Harrow Hill, possibly at the end of extraction.

The inclusion of mining implements, including a pick, along with a fine polished axe is telling, alongside implements more associated with domestic activities, such as the serrated blade, scrapers and knife. It is also apparent that some artefacts in Pit X were unique, non-utilitarian and selected, or curated, such as the seashell, the polishing stone and pottery, comprising only of rim sherds.

The most significant artefact recovered from Pit X is the fine Carinated Bowl which, along with the radiocarbon dates, prove that the mining community was familiar with the newly introduced pottery tradition, possibly even with direct Continental connections. The chronology between the introduction of Carinated Bowl and flint mining are compatible and provided a standard to compare with other contemporary non-mining features that contained similar artefacts and evidenced similar practices.

Beyond New Barn Down, the most notable pit was Pit 357 at Bishopstone, where a Cissbury sourced axe was discovered. Although somewhat later than Pit X, towards the final centuries or decades of mining, the radiocarbon dating of Pit 357 nonetheless ties with the later, final phases of mining c. 3600 cal BC, especially at Cissbury (Teather 2019). Its fresh condition indicates that it had not circulated long before deposition and it was probably made within months of being deposited. It is notable that the Peacehaven and Bishopstone area of the River Ouse estuary has produced many stray finds of Early Neolithic axes (Angel 2007).

6.13.3 Wider connections

Beyond Pit X and Pit 357 other features demonstrated links between each other and the flint mines. On Bishopstone, Pit 711 was similar in form to Pit X and also contained a small assemblage of flintwork dominated by scrapers and single fragment of fine walled Carinated Bowl. Unfortunately it was not possible to accurately date Pit 711, although an earlier date is supported by the identification during this project of the Carinated Bowl potsherd. If this is the case, then it appears that a connection between Bishopstone and the flint mines may have been present from the beginning of occupation on the site, maintained until Pit 357 closed the settlement.

Other links with pits are more tentative and can be mostly made by comparing artefacts and location. The Chichester and Worthing sites for example, like Peacehaven, are part of wider landscape of Early Neolithic occupation. Occasional finds of axes, particularly the miniature axe from North Bersted and fragments of polished axes, such as from Titnore Lane, provide speculative links to the mines. Pit 9050 at Clay Pit Lane provides the best link, as several implements may have been produced from mine sourced flint, presumably from Long Down.

Further links can be made to the Weald, with Pit X and other sites containing fragments of sandstone quern stones. The presence of sandstone, alongside the two possible Wealden sites, indicates a certain amount of activity north of the South Downs in the Early Neolithic.

With regard to locations, much of the coastal plain is visible from the flint mines and vice-versa (Fig.6.39). Further, some of the sites, such as Claypit Lane, Baxondale Road and North Bersted, are less than 10km from a flint mine, an easy distance to cover in a few hours. The large expanse of the Sussex Coastal Plain in the Early Neolithic would have been rich in natural resources and soils favourable to early agriculture and were likely to have been favoured locations for early farming communities. It maybe no coincidence that both the Worthing mines (Fig.6.40) and the Chichester flint mines are focused on the South Downs to the north of the coastal plain and that pits, such as Clay Pit Lane, occupy a liminal setting between the high chalk Downland and the Sussex Coastal Plain Pit X also contained finds from the coast, and it is possible that these pits were placed in these liminal areas to combine aspects of the two contrasting environments.

Fig. 6.39: The Sussex Coastal Plain viewed from Long Down, the Isle of Wight is visible on the horizon at centre of frame (Author 2019).

A further connection to coastal areas can be observed, beyond the location of many of the pits, in their artefact assemblages. In Pit X a single seashell and beach sourced pebbles were recovered, alongside a non-local Carinated Bowl that was imported to the area. Its West Country, or Continental origin is intriguing and could provide a link to much wider locations, such as the Sweet Track in Somerset where a Cissbury axe and Jadeite axe from the Alps, France, were discovered (Bond 2004). Even larger artefacts, such as quern stones from an Early Neolithic pit on Maiden Castle, Dorset, which had travelled from the French Normandy coast, also reveal the movement and exchange of objects across the sea (Peacock and Cutler 2010). The movement of such artefacts may well be further evidence of coastal links by seafaring communities (Garrow and Sturt 2011; Bradley *et al.* 2016).

At Bishopstone the large assemblage of seashells, presumably for consumption, also provided a link to the coastline. It seems likely that the coastal areas in Sussex can be considered as focal points for distribution and exchange activities focused on seafaring routes (Garrow and Sturt 2011; Anderson-Whymark *et al*. 2015). Both Peacehaven and Bishopstone, close to the River Ouse estuary would have also provided an ideal natural maritime haven, with offshore sand and gravels bars providing calm water and sand dune beaches (Woodcock 2003; Moore *et al.* 2016). Similar coastal settings along the south coast, such as Hengistbury Head, Dorset, were probable maritime havens in the Neolithic period (Bradley *et al.* 2016), and there seems little reason to doubt that the Ouse estuary did not offer the same level of sanctuary.

6.13.4 Pits and Settlement

Although nothing new was presented, the evidence collected in this chapter adds to the growing narrative of the Early Neolithic, with pits and gullies now accepted as evidence of short-lived occupation (Pollard 1999; Whittle 1997; Edmonds 1999; Anderson Whymark and Thomas 2012). It appears that in Sussex, Early Neolithic occupation was temporary, possibly seasonal and based on a mixed economy of animal husbandry and cultivation of both wild and domestic crops. Such broken periods of short- medium term occupation on locations that were settled only once, occasionally or seasonally is highly suggestive of settlement that was not fixed on single locales and for which movement after a period of occupation may have been then the norm.

Some support for this occupation model can be drawn from analysis of plant remains, which indicate that early agriculture was based on 'transient plots' that were only cultivated for several years (Bogaard and Jones 2007). Such activity appears to have occurred at Bishopstone and Peacehaven, where pits, reasonably rich in artefacts, were grouped in specific landscape locations that may only have been settled seasonally before abandonment. This model could further suggest a complex settlement model based on both a mix of residency and mobility, with certain members of a community more fixed than others who may have been focused on tasks that required greater degrees of movement, such as animal herding or woodland clearance.

This 'residential mobility' model (Whittle 1997, 1999) can also be observed in the evidence from the flint mines, with short-medium term mining events held annually, an interpretation that also has support from the Continental mines, especially from

Spiennes where the evidence strongly indicates that mining was communal, seasonal and undertaken by agricultural groups at part of a yearly calendar (Collet *et al.* 2008).

Regarding the other sites investigated, in the majority they were individual pits, or small groups of features, i.e. pits and gullies. Caution should be expressed here as, by nature, the results from archaeological excavation are dictated by the limits of any given area. Therefore, certain open excavations with either one or two pit groups, like Titnore Lane and Baxondale Road, may actually only represent a small sample of a much larger landscape of activity. Depending on where trenches are located, and this is specifically the case with archaeological evaluations, many other pit groups could be completely missed, or only partially revealed. Peacehaven offers an exception here, because it is composed of multiple small to large-scale archaeological interventions across an extensive area, thus allowing for links to be developed between sites located some distance from each other, such as Lower Hoddern Farm and South Coast Road. The Sussex Coastal Plain, especially between Chichester and Worthing, can also be thought of in the same parameters, as it is obvious that many Early Neolithic sites exist in this area.

The limits of archaeological practice should also be noted here, as developer funded post-excavation publications often only focus on individual sites and rarely on large landscape studies. For example, with Peacehaven, no publication or research has been produced that considers the numerous Early Neolithic sites as a whole. Such an approach rather limits interpretation of the evidence left by semi-mobile groups who ranged widely across the landscape.

Caution expressed, several of the larger open excavations, such as Drayton Quarry, Claypit Lane and the early phase at Bishopstone, isolated, or singular pits do seem to be the norm, especially during the earlier formative centuries of the Early Neolithic.

A limited chronology of settlement is present in the evidence gathered in this chapter. For example, the earlier large individual pits, such as Pit X, Drayton Quarry, South coast Road and Pit 711 are associated with Carinated Bowl and single occupation, possibly short-lived events in recently cleared wooded landscapes. It is perhaps notable that both Pit X and Pit 357 were both re-opened not long after they were closed, used for hearths and also the secondary deposition of objects. This implies that they were re-visited, in the same way that some of the sites were. As proposed above, the later Plain Bowl sites, such as Lower Hoddern Farm and the final phases at Bishopstone, grew in scale, both in the number of pits and deposition assemblages. Conspicuous consumption may also be documented, especially in the mussel rich Pit 357 and packed cereal pit at Lower Hoddern Farm.

Overall then, as the Early Neolithic progressed in Sussex, occupation appears to have become more aggregated and connected, eventually resulting in the construction of causewayed enclosures (Thomas 1999; Oswald *et al.* 2001. 123–6; Whittle *et al.* 2011. 891–5; Thomas 2016). Processing of plants, as evidenced by serrated blades (Bye-Jensen 2019), was important, along with the production of pottery and axes, the latter often sourced from the Sussex mines. Reasons for the subtle changes are unclear, maybe that as populations increased disparate communities became more coalesced.

Understanding the movement of communities away from mining to causewayed enclosures in Sussex is of upmost importance in developing this narrative, but is beyond the remit of this thesis. Instead, what can be asked is how the pattern of occupation laid out in this chapter expands our understanding of the Sussex flint mines during their peak. It is this question that will form the basis of the next chapter, with the evidence collected from this and previous chapters.

Fig. 6.40: The Worthing Group mines with the English Channel in the background, viewing south (Author 2015).

Chapter 7 Discussion

7.1 Introduction

This thesis evolved from a simple objective, to improve knowledge of Early Neolithic flint mining in Sussex. It was hoped that knowledge of the flint mines would be improved, along with the practices of the mining communities and their engagement with the wider landscape of Early Neolithic Sussex. It was proposed that mining should be understood as a reflection of the settlement practices of communities who were seasonally mobile. This was in contrast to previous flint mining narratives, which proposed that it was a practice separate from settled areas and removed from 'everyday' life (See Chapter One).

Chapter Seven will be broken into several parts: firstly the aims and objectives will be addressed, followed by discussion on the results from the project. The chapter will end with a brief conclusion and then a set of questions for future research.

7.2 Aims and Objectives

The project was successful in meeting its aims and objectives, as laid out in Chapter 1. These are addressed individually, as follows.

7.2.1 Aims

1. **Re-interpret flint mining as core to the Early Neolithic in southern England,**

The project gathered new data, radiocarbon dates and evidence of flint mining, both from the immediate mining horizon and the wider landscape of Sussex. This data, as discussed below, helped redefine both activities at the mines, and also the wider landscape. By the comparative study of material culture and archaeological sites this research has demonstrated how mines can be interpreted as social spaces where communities gathered at specific times of the year, whilst also engaging with sites across the Early Neolithic landscape of Sussex.

2. **Define the wider environs of the Sussex mines.**

The project successfully completed the geophysical surveys of two flint mines, Harrow Hill and Long Down, combined with walk over surveys, including on Church Hill. Although it was not possible to carry out further fieldwork, due to COVID-19 restrictions, the results obtained in the surveys carried out were enough to add knowledge on the wider mining landscape. The documentation of further mines and working floors on the periphery of the mine complexes was key in developing the mining narrative beyond the mineshafts into the wider landscape. This allowed a basis for the project, which was expanded into Aim 3.

3. **Define the Early Neolithic of Sussex in the age of mining, enhancing its chronology and the implications that has for understanding the 'spread of the Neolithic'**

A comprehensive search of relevant resources, including the HER, grey literature and museum archives revealed several sites that could be linked to the flint mines, including New Barn Down and Bishopstone. The subsequent research on these sites has shown how they could be connected to the flint mines. Therefore, the research successfully met its aim to consider the mines within a wider pattern of Early Neolithic activity.

4. **Endeavour to resolve the question of mining and settlement**

Aim 4 was more difficult to meet, as the archeological evidence of settlement within the mining landscape is slight. The presence of pottery and of domestic lithics was the best evidence discovered for settlement, along with the Early Neolithic pit on New Barn Down, close to the Harrow Hill mines and the possible pits recorded in the geophysical survey. Key also is the re-consideration of mines as lived sites, rather than isolated monuments. Although there was no conclusive evidence of settlement, the project's discoveries have successfully demonstrated both the complexity of flint mines (still woefully under-researched) and the importance of reviewing archival material to develop new narratives.

7.2.2 Objectives

1. **Re-analysis of archive material to question traditional interpretations of flint mining by gathering new and/or reanalysis of historic excavation data**

A multitude of historic archives were analysed, which resulted in new evidence, such as the pottery from Long Down and flintwork from Cissbury. These helped develop the mining narrative into avenues previously overlooked, as discussed below.

2. **Identification of individual archaeological features that could be connected and compared to flint mines, therefore improving knowledge on the Early Neolithic narrative of Sussex**

Following on from Aim 3, the archaeological record of Early Neolithic Sussex was examined, resulting in the expanded case studies of two pits that displayed connections to the flint mines and their communities. This research helped develop knowledge of both flint mining, and the Early Neolithic of Sussex.

3. **Obtain new radiocarbon dates from mining and non-mining contexts**

Obtaining new radiocarbon dates for the flint mines was a difficult task due to the nature of the archives and uncertainty over the integrity and context of material, as discussed in Chapter Two. However, five new dates were obtained from a mining context and a further two from non-mining contexts. Three radiocarbon dates from Pit 357 are pending at time of submission due to laboratory delays associated with COVID-9. Therefore, the project successfully met Objective 3.

4. **Bring together Early Neolithic sites across Sussex, using HER/Grey Literature**

An extensive search of the HER and Grey Literature archive was undertaken, to develop Aim 3. This demonstrated the effectiveness of a combined examination of material from historical and developer funded excavations, such as Bishopstone and Westhampnett. Overall, this objective helped frame the flint mines against a backdrop of wider activity across Sussex and develop a chronological narrative for the Early Neolithic of Sussex.

5. **Geophysical survey of mines/search for none mining features close to mines**

Two flint mines were surveyed by geophysics during the project, Long Down and Harrow Hill. The results informed on the extent of the flint mines, the wider use of the mining area and on possible non-mining activity. The surveys were therefore justifiable and profitable in the production of new data.

6. **Surface survey: can more material be gathered/how are the mines being damaged/evidence of settlement?**

Two walkover-surveys were undertaken on Church Hill and Harrow Hill. Both were successful in documenting how the mining landscape has been damaged and altered by agriculture. The results of these survey developed knowledge of contemporary activities in the wider mining landscape, which met Aims 2 and 4. A separate report on plough damage assessment will also be produced and submitted to Historic England, in the hope of gaining protection for sites still being damaged, such as Church Hill.

7.3 Discussion

From its inception this project focused on re-imagining flint mines as important locales for Early Neolithic communities in Sussex and the wider region. It was proposed that the narrative of mining should be shaped by themes of aggregation, transformation and dissemination, rather than otherness, removal and separation. Instead of understanding mines as located at the fringe of settled areas, removed from everyday activities, it is hypothesised that mines were nodal points for the creation, reproduction and propagation of the Early Neolithic world view during its formative centuries. Therefore, mines were not only focused on ‘industrial activity’, such as the production of axes, but were also places where everyday acts associated with occupation were undertaken. The constant replication of these acts shaped the Early Neolithic worldview and, although mining represented an event beyond the norm, the background hubbub of everyday activity would have served as a backdrop to the theatre of mining.

Mining creates communities and impacts on others via the flow of products and transformation of landscape (McNeil 2011). Communities support miners and mining communities influence wider culture via the movement of products and people (Burton 2014). For over half a century anthropological and ethnographic research on indigenous and contemporary mining communities has highlighted the societal, cultural, political, and economic processes of mining (Ballard and Banks 2003; Burton 2014; Jacka 2018). Contemporary research has focused on the impact of large-scale mining operations on indigenous communities (Burton 2014), often resulting in conflict (Pijpers and Eriksen 2018). Although, much of this research is unhelpful in considering the Early Neolithic of southern England, it nonetheless recognises that when mining is introduced it creates new networks, transforms landscapes, and social interactions for both frontier and wider communities (Grätz 2013). It also contributes to the formation, or reinterpretation of previous social alliances, both personal and community-based, and shapes new identities and entities, commonly known as the 'social relations of mining' (Ernst 1999).

Attempts to apply these ethnographic themes to prehistoric mining are few. Recently, Topping has been most active with regard to applying ethnographic studies of indigenous mining and extraction, as discussed in Chapter Two, to interpret Early Neolithic mining (Topping 2019). By detailing 168 ethnographic studies of indigenous mining communities Topping proposes five correlations that can be universally applied to the archaeological flint mine record, *distinctive locations*, *ritualised extraction*, *pre- and post-excavation ceremonialism/burials*, *rock/art graffiti* and finally *supra-regional product distribution* (Topping 2019). These, Topping argues, are the most archaeological visible indicators of ritual mining that lead to a '*more nuanced interpretation of prehistoric extraction*' (Topping 2019. 182)

Whilst this thesis did not engage with the ethnographic material, it does recognise that aspects of the mines could be evidence of 'ritualistic' activity, such as 'rock art' and single human burials, as proposed by Topping (2011a, 2019) and others (Edmonds 1995; Field 1997; Barber *et al.* 1999; Teather 2008, 2011, 2016). There is, however, a problem in the use of ritual to describe activities that occurred in the galleries, as they are predominantly a functional space focused on extraction. Beliefs may have been expressed within the galleries, both cultural and personal, but to separate the act of mining from other activities, such as art, and to argue that one is functional and one is ritual is problematic, because this is based our own perceptions of how they may be presented in the archaeological record (Brück 1999). The planning, organisation and act of mining would have combined both functional and non-functional needs, which were part of the everyday world view of the communities, rather than separate, or abnormal to it. In short, Early Neolithic mining is neither purely functional nor non-functional. It is a cultural tradition that connected many cultures across Northwest Europe who gained meaning and symbolism from it. Its cultural meaning, and the way it was enacted, may have varied between areas, and even between mineshafts in the same complex.

This thesis endeavoured to view the Sussex flint mines with a different prospective that recognised the social and community aspects of mining and meant that they were far more integrated into the 'everyday world' of the Early Neolithic, rather than being detached monuments. Alongside mining a broad spectrum of community-based happenings were carried out, from general settlement, cooking, children playing, to craft activities, such as production of pottery and 'everyday' lithics, such as scrapers and blades, and so forth. Such mundane activities are rarely discussed with regard to Neolithic mining, partly because they are difficult to perceive in the archeological record, but also because the focus of much research on mining is preoccupied with removing it as an activity from the everyday (See Chapter Two). Partly, this is because archaeological attention has often been on the act of mining within the confines of the spatially restricted galleries and mineshafts, or the wider distribution of mine products. Much less attention is paid to the wider landscape, both at the margin of the mines and across Sussex. Even less attention is on the communities who undertook mining and how they organised the mining landscape.

This thesis attempted to connect the subterranean to the terrestrial and beyond into the wider landscape. Mining connects both the personal experience of an individual, or a small team of miners, toiling in the confines of a mine gallery, with a much larger community effort to support, or work alongside the miners. The next part of this discussion will focus on how the results of this thesis can develop a new mining narrative for the Sussex mines, which recognises the social complexity and engagement of communities that also inhabited the wider landscape. This discussion is broken up into the themes of time/change, place/contact and finally people/objects, as these emerged as the key topics engaged with throughout this thesis.

7.4 Time/change

7.4.1 The Continental influence

This thesis began by stating that flint mining was introduced into southern England c. 4000 cal BC with the movement of communities from Continental Europe (Fig.7.1). Nothing recorded during this research has changed this hypothesis and it remains the case that deep mining is part of wider pan-European extraction tradition that cut across numerous disparate Early Neolithic ethnic groups (Cunliffe 2008; Wheeler 2011). This tradition appears to have begun in the centuries proceeding c. 4000 cal BC, possibly in the Paris Basin and with a strong association with the Michelsberg Culture (Collet *et al.* 2008). The link between the southern English and Continental mines is the application of the same methodology based on deep shaft and galleried mines to exploit deep flint seams (Baczkowski 2014), but probably also extends to extraction of stone from remote quarries, such as in Langdale, Cumbria (Bradley and Edmonds 1993; Bradley *et al.* 2019).

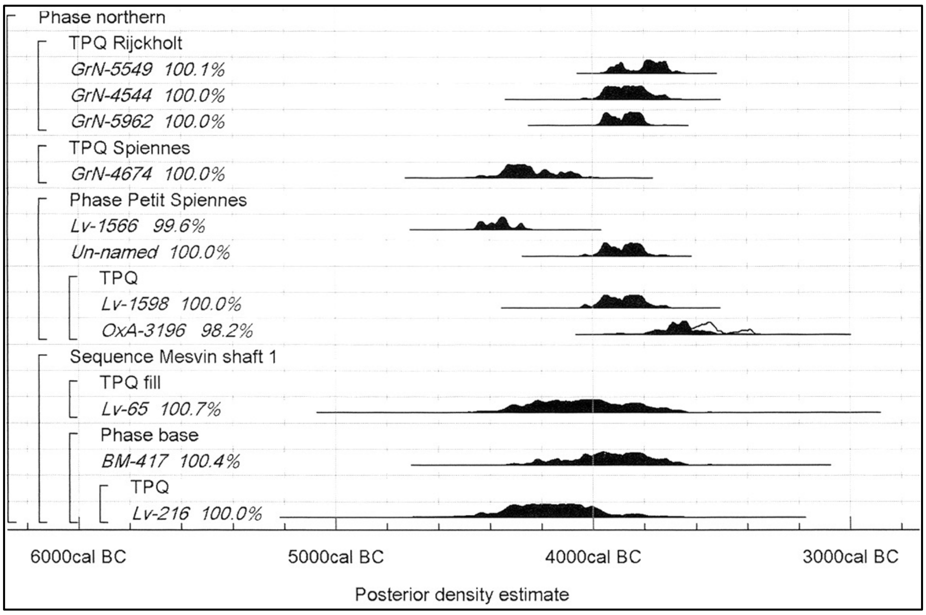


Fig. 0.1: Dating of Northwest European mines, Rijckholt and Spiennes(From Whittle *et al.* 2011 Fig.5.40).

Bi-facial axes were the main products of these numerous extraction sites, which are of similar form across Northwest Europe. The tradition lasted for nearly 2500 years at some mine complexes, most notably Spiennes and Krzemionki, and continued to be practiced by many Neolithic to Early Bronze Age cultures, from the Michelsberg (Collet *et al.* 2008; Manolakakis and Giligny 2011) to the Bell Beaker (Sarauw 2007; Lech 2008;). This extraction tradition therefore becomes one of the defining aspects of European prehistory after 4000 BC for almost 2500 years.

7.4.2 A mining Chronology

The five radiocarbon dates obtained from the Long Down mines during this research, alongside other dates presented in the Neomine project (Shennan *et al.* 2017; Edinborough *et al.* 2019), now amount for the largest dating program of the southern English mines. These new radiocarbon dates have shifted the start date for mining forward from a pre-4000 cal BC date, as previously proposed by Barber *et al.* (1999).

The new dating indicates that deep mining started suddenly and collectively at the Sussex mines in the early 40th century BC (Edinborough *et al.* 2019). This removes the debate over the Mesolithic origins of the Sussex mines (Teather 2008, 2019; Thomas and Ray 2018), as deep mining in a Continental method appears to have started from the outset of the Early Neolithic in Sussex. There is no evidence of a progression from earlier, 'basic' quarrying, with the drift mines on Harrow Hill likely to be contemporary with deep mining, as discussed in Chapter Three. There is also a lack of Mesolithic flintwork in mining assemblages, as proven by the analysis carried out for this research that only documented Neolithic and later Neolithic/Bronze Age flintwork in archival material and the field surveys. Naturally, such material could be buried by later mining horizons, but it seems unlikely that it would be completely absent.

The same chronology is largely repeated at the Wessex Group mines, with the exception of a pre-4000 cal BC date from Easton Down (Edinborough *et al.* 2019. 18). As with all radiocarbon dates obtained from historic excavations, some caution should be expressed with this single early date from Easton Down, and on the whole the other dates indicate that mining began uniformly c. 4000 cal BC (Edinborough *et al.* 2019).

The reason for the sudden uptake of extraction across Northwest Europe will be debated, and is somewhat beyond the remit of this limited thesis. Harking back to mid 20th century interpretations (Clark and Piggott 1933), Edinborough *et al.* opt for a supply and demand model driven by the need for a good supply of axes required for tree felling by a society that was in a population boom phase (Shennan *et al.* 2013; Bevan *et al.* 2017; Edinborough *et al.* 2019).

Some issue is expressed here with regard to the supply and demand model. Firstly, it assumes that axes were needed for tree felling, an assumption that is not fully supported by the archaeological record as many axes appear to be have been prestige items exchanged in complex trade networks (Phillips 1979; Bradley 1990; Edmonds 1995; Brumm 2004, 2010; Schauer *et al.* 2019). This is also supported by ethnographic accounts of axe use, which show both the nuanced role of axes in cultural customs, and also their preferred practical use for woodworking and gardening tasks, rather than large-scale tree-felling, (Brumm 2011; Topping 2019). Many of the Continental mines, such as Rijckholt, are located in areas already deforested in the proceeding LBK period (De Grooth 1998), and in the case of Krzemionki, an area not suitable for agriculture (Lech 2008). Supply and demand does also not fit with the long working life of certain Continental mines, such as Spiennes and Krzemionki, whose products were almost certainly prestige objects for exchange (Lech 2008; Collet and Hauzer 2019).

The overall mining chronology is also telling and possibly regional, with an apparent uptake of extraction activity towards the end of the Neolithic and into the Early Bronze Age after a pause in the Middle Neolithic. This second phase of mining is best documented at Grimes Graves, where no Early Neolithic extraction occurred, and is also apparent at the Cumbrian quarries and at the Continental mines, most notably Spiennes, Jutland, and Krzemionki (Babel 2008). At present, the only mines in Sussex that have Late Neolithic or Bronze Age radiocarbon dates are Cissbury, Blackpatch, Long Down and Church Hill, and it is unclear what form this extraction took, or if it is even comparable to Grimes Graves. The later extraction was also not concerned with axe production, with ovate forms produced at the Sussex mines, most notably Long Down, fine Danish daggers manufactured at the Jutland mines (Sarauw 2007), archers' bracers from the Cumbrian quarries (Woodward and Hunter 2011) and a variety of products from Grimes Graves (Bishop 2014).

The radiocarbon dates obtained for this chapter also indicates later activity at Long Down in the late 19th century BC, which may have been focused on the quarrying of earlier mine spoil by open quarries. There is also evidence from Cissbury and Church Hill of late shaft mining, although it is unclear if old mines were re-worked or new ones opened, both intriguing possibilities. Further research is required to understand the end of mining in Sussex, particularly to establish if activity carried on through the Middle Neolithic. This can only be resolved by large-scale excavation and sampling, which is unlikely. This problem is drawn into sharp relief when the numbers are considered, as of the 2000 or more shafts known in southern England, less than 10 have been dated and these are not without problems due to contextual difficulties, as discussed in Chapter Two.

To summarize, it is clear that mining was introduced abruptly into southern England close to the start of the 40th century BC. The Worthing and Wessex Group mines are maybe the earliest, but extraction at the Chichester Group soon followed, as supported by the radiocarbon dates obtained during this project from Long Down. Mining then stopped or waned towards the mid 35th century BC, but appears to have started again at specific mines, including Church Hill, Long Down and Grimes Graves in the mid 3rd millennium BC. This chronology is reflected at Continental mines (Shennan *et al.* 2017), demonstrating not only long-range connections in a period when Britain was supposedly 'culturally isolated' (Stevens and Fuller 2012), but that extraction was one of the principal expressions of the Neolithic.

Overall, if mining reflects the changes and trends of wider Neolithic society, no one mines if there is no social or economic demand for a product, then the ebbs and flows of mining perhaps inform on cultural change more often than acknowledged. The final period of mining is particularly significant, as axes were less favoured whilst the probable stone economy shifted to a bronze one. That fine Danish daggers, produced from mine flint in Jutland, often mimicked bronze knives reflects the end of one technology, and the transition to another (Sarauw 2007).

7.5 Place/contact

A core objective of this project was to question how mines can inform on Neolithic Sussex if we accept, as previously proposed, that mines reflect wider cultural trends. To answer this, extensive surveying and research was carried out in the immediate mining landscape, at areas marginal to mining and finally across wider Sussex. By undertaking this process it was hoped links and connections would be noted and developed.

7.5.1 The deep mines

The geophysical surveys conducted during this project added to knowledge of the main mine complexes on Harrow Hill and Long Down. In both surveys, anomalies were recorded, mostly over 4m$^{\varnothing}$, which are interpreted as mineshafts. These results were not surprising, as visible mine remains were targeted to help characterise their geophysical footprint, most notably on Long Down. Other areas were also targeted where suspected mines were previously recorded that had been levelled by ploughing in recent decades, as on Harrow Hill.

The results from Harrow Hill were expected and indicated the limits of the mine complex on its southern side, close to New Barn Down. In contrast, Long Down was unexpected, as many more probable mining features were recorded to the south of the Scheduled mine complex. This is notable, indicating that Long Down is a larger complex than previously recorded and has important consequences for how all mine complexes are currently understood as many, if not all, maybe considerably larger than previously thought.

Not knowing the true extent of the mines has implications for their interpretation, as it is difficult to gauge their output, their lifespan and their chronology. Although many of the mines were adequately recorded in the late 19th and early 20th centuries prior to being truncated by emergency ploughing in World War II, such as areas of Cissbury and Harrow Hill, the case study of Long Down has shown that cultivation dating to the later prehistoric period has removed traces of mining. Therefore, without extensive landscape investigation based on a methodology that includes map regression, test pitting and core sampling, it has to be concluded that the true size of the Sussex mines is far from clear. Without this research, previous studies of their size, output and plan (Clark and Piggott 1993; Gardiner 1900; Barber *et al.* 1999; Shennan *et al.* 2017) should be considered of restricted value.

Perhaps the most important consequence of not knowing the true size of the mines is on the industrial vs. symbolic debate, as recently resurrected by the Neomine project (Edinborough *et al.* 2019). Put simply, the larger the mine complex, the more intensive the working and the more industrial in character it is, especially if mining only continued for c. 200-400 years. This model makes more sense if the probable size of Long Down is considered, for example, as this project indicates that it is perhaps more than 30-40% larger than previously recorded. If this simple equation is applied to all known mine complexes, a considerable number of shafts, upwards of 2000-3000 across the Sussex mines could be added.

Naturally, there are many problems with this consideration. Firstly, at present there is no firm chronological model for the progression of workings within an individual mine complex. All the current radiocarbon dates (Barber *et al.* 1999; Edinborough *et al.* 2019; Teather 2019) have been obtained from shafts at the heart of the complexes, the areas most worked and also possibly the earliest mines. No radiocarbon dates come from peripheral workings, which are possibly later in date and located in areas less intensively mined. Without knowing this chronology, it is difficult to gauge how intensive extraction activity was: there could either be many mines opened over a relatively short period, or the same amount of mines over a long period, with only one or two worked per year. This picture is further confused by a probable second uptake of mining towards the end of the Neolithic period, based on the opening of new workings and even the re-opening of previous shafts (Teather 2019). In short, we now know when mining began, but have very little knowledge of how long it lasted and even less on when it ended.

Little more can be added without extensive fieldwork supported by a new programme of radiocarbon dating. However, the geophysical surveys undertaken for this project have shown the complexity of the mining landscape and the problem of extrapolating interpretative models from such an incomplete and archaeological biased record. The case of Spiennes makes for sobering comparison, as when the complex was discovered in the late 19th century it was thought to consist of c. 2000 mines which grew to 10,000 shafts by the mid 20th century, but is now considered to compose of well over 20,000 shafts (Collet *et al.* 2008, 2016). Recent geophysics at Grimes Graves also indicates that the complex could be much larger than previously thought (Bishop 2014).

7.5.2 The margins of the mines

The geophysical and field surveys undertaken have increased knowledge on the marginal areas of the mine complexes on Church Hill, Harrow Hill and Long Down, which has important implications for developing the mining narrative, a major aim of this project.

On Long Down and Harrow Hill the geophysical data recorded numerous smaller anomalies, often appearing grouped at the outer edges of the mine complexes. Although the opportunity was unfortunately not afforded to substantiate the character and date of these smaller features by archaeological sampling, their presence nonetheless is intriguing and significant. It is suspected that they either represent pits, or small extraction features. The only known examples of similar features discovered within a mine complex were several large pits excavated by Pull on Church Hill (Pull 1954; Russell 2001). Dating of these was problematic, as their upper deposits contained later Neolithic and also Early Bronze Age pottery and several also contained axe manufacture debitage and hearths. It is probable these features were associated with later extraction, or were earlier 'test shafts' that were not backfilled and naturally silted.

It is difficult to date the pit like anomalies on both Long Down and Harrow Hill without archaeological sampling. They are almost certainly human in origin, appearing too regular in form and size to be tree-bowls. Their date is unknown, although they are likely to be prehistoric, in keeping with the general date of activity at both mines. Some of the pits on Long Down could be related to a possible Late Bronze Age or Iron Age structure, although this is far from clear. On balance, it is considered that the features are likely to date to any of the prehistoric periods on both Long Down and Harrow Hill. On probability it is likely that some date to the Early Neolithic, especially those located towards the periphery of the mine complexes, or areas devoid of mineshafts.

Limited evidence was gathered to support the dating of the pit features to the Neolithic. The recording of clearly domestic lithics on Harrow Hill, including a core, scraper and piercer, along with Pit X on New Barn Down, located less than 450m south of the survey area, both indicate the possibility of Early Neolithic pits close to the mines. Also considered is material that is typical of objects deposited in Early Neolithic pits (See Chapter Six), including the scrapers from Cissbury, the pottery from both Cissbury and Long Down and lastly the diverse range of lithics from Church Hill. These also hint at the possibility that non-mining activity may have been focused on the edge of the mine complexes.

A relationship between Early Neolithic pits and occupation has already been covered in the previous chapter, and it is clear that Pit X connects flint mining and domestic material. If further pits are located along the edge of the mine complex then this is likely to be associated with occupation activity whilst extraction was underway. It does not stretch interpretation too far to imagine the liminal zones of the mining horizon were dynamic areas alive with activity associated with both extraction, and more mundane habitation practices. Such areas could be where communities settled during extraction events and partook in activities that supported mining, such as preparation of antler picks and other equipment, along with general domestic activity.

Overtime, the mine complexes may have become active locales and been far more productive in terms of community interactions and cultural exchanges than the cramped spaces of the mines, where only small teams of miners operated (Fig.7.2). Social relationships and cultural identities may have been forged in these areas, along with the knowledge and teaching of mining and axe production. Non-mining communities, who may not have been permitted access to the mines for practical, or cultural reasons, may have also frequented these areas to exchange knowledge of the wider landscape, and for the exchange of axes and other material, such as pottery and antler. The ebbs and flows of daily life may have therefore been carried out in these marginal areas, whilst deep extraction was underway. Furthermore, at the end of a mining season these areas may have also been the places where closing ceremonies and rituals were carried out, with objects either deposited within recently sealed mineshafts, or at pits close by, such as Pit X.

Support for activities of this nature in the wider mining environs, aside from that presented here, is limited, partially due to the limits of only excavating mineshafts. Evidence from mines in the Mons and Paris basins, which have a long history of excavation continuing until the present day (Collin 2016), is telling, with contemporary occupation recorded at Douvrain and Flénu (Collin 2016).

Perhaps the best evidence of contemporary occupation with a mine is from Spiennes, which included a Michelsberg enclosure (Collet *et al.* 2008; Collin 2016) located on the Petit-Spiennes plateau overlooking the mine complex, c. 400m to its east (Collet *et al.* 2008, 2016). Limited excavation of the enclosure, composed of two concentric ditches and enclosing an area of c. 14ha, recorded that the ditches were filled with occupation deposits, which included pottery, flint tools including scrapers, retouched knifes, blades, borers and burins, grinding stones, polissoir fragments and faunal remains (Hubert 1980; Collet *et al.* 2011). Further evidence of occupation was also found within the main complex in the form of midden deposits from the shafts, containing animal bone, pottery and human burials (Collet *et al.* 2008). Evidence of cattle grazing within the mining area during extraction events was also discovered, indicating that mining and livestock farming was carried out side by side (Collet *et al.* 2014). Although Spiennes is of a scale not known in southern England, its extensive excavation and similarity to the Sussex mines, which includes deep shafts and galleries, human burials, chalk art and production of axes (Teather 2016), demonstrate that such activity is likely to exist in the Sussex mines.

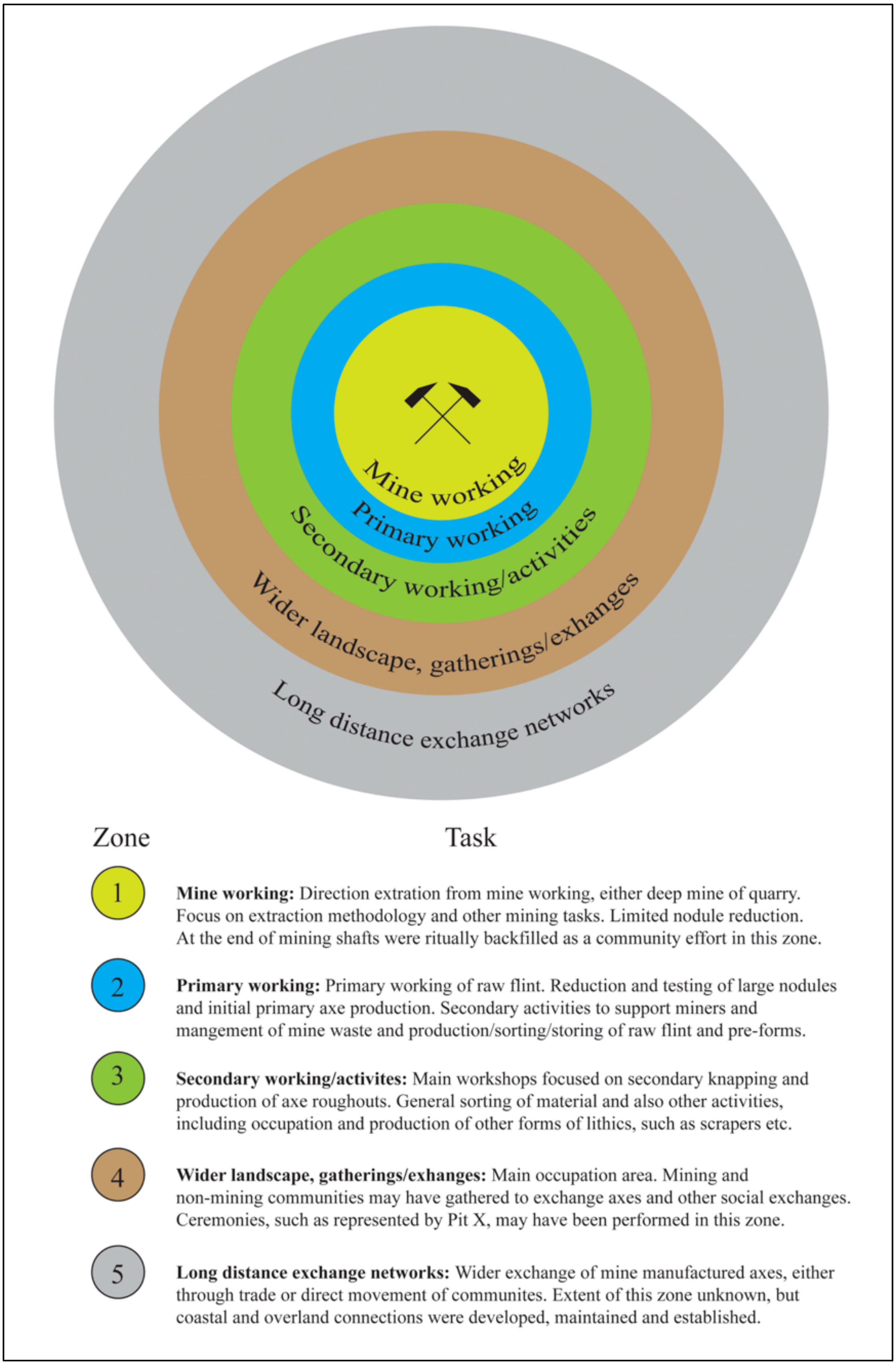


Fig. 0.2: Tasks scape of a flint mine (Author).

What can be underlined at this point of the discussion is that thus far, the archaeological investigations of the Sussex mines are incomplete and have collected little data on wider parts of the mining landscape. There are still aspects of the mines that are under researched; this project did not look at the vast assemblages of animal bone recovered from in and around mineshafts, for example. The surveys carried out for this project, albeit limited, have successfully demonstrated that marginal, or intermediate areas of the wider mining landscape, are likely to contain evidence of mining and non-mining activities, the latter of which can, and should be, easily classified as occupation.

7.5.3 Organisation of knapping?

Much more extensive fieldwork, beyond what was possible to undertake for this thesis is required to increase knowledge of the marginal mining areas. Such work will increase knowledge of the working floors and help established how these were organised and if specialists produced the axes in organised areas, as found at Spiennes (Collet *et al.* 2008, 2011; Holgate 2019), or the general mining community undertook knapping in apparently communal workshops, as found at Rijckholt (Felder *et al.* 1998; Holgate 2019).

At present, the results from this project show a mixed narrative. Some flintwork was highly skilled, such as the chisels from Church Hill, others were crude and quickly produced, including the roughouts from Harrow Hill. Working floors appear to have been placed both within areas of mines, as on Harrow Hill, but also towards the periphery of the mines, as on Church Hill and Long Down. Chronology is the key to understanding these working floors, as it is likely that the location of working floors fluctuated over time.

There is no doubt that mining itself was undertaken by specialist members of the community, as it was skilled, dangerous and required knowledge of the working methodology (Baczkowski 2014). But the primary and secondary knapping could have been undertaken by less skilled individuals working as mining was underway. This supports the hypothesis that mining was a community effect requiring all individuals to play their part, from direct extraction, to axe production and supplying equipment needed for mining. The one time that the community worked together may have been when shafts were opened and backfilled, and it may be no coincidence that the latter is when 'closing deposits', including pottery and midden material was placed in the shafts, as on Cissbury and Long Down.

It is also apparent that, although axes were the main products of the flint mines, they were not the only lithics produced. This research also found evidence of other flintwork, such as knives, scrapers and sickles. It is suspected that these are under represented in the mine assemblages, as they were easy for antiquarians and collectors to identify and remove from the mines. Evidence of their production is also difficult to identify, as they were often produced from axe debitage. It is also unknown if this activity was contemporary with mining, and it could be the case that mined flint was stored and returned to when the need arose.

Some of these lithics are more associated with everyday activity, such as the scrapers, although others, such as the sickles and miniature axes are more enigmatic and may have been both domestic and symbolic objects. The sickles are rare and required large nodules to produce them, which the mines would have provided. Other items, such as the knives produced from long blades or axe thinning flakes, appear at other mines and often as unused objects deposited in pits, most notably at Clay Pit Lane and New Barn Down. It is possible their manufacture from distinctive mine sourced flint may have imbued them with cultural significance.

Overall, the lithics examined in this research, albeit a minuscule percentage of the mine assemblages, prove that other forms were produced alongside axes and these may have also been carried, exchanged or traded across Sussex and the wider region.

7.5.4 Seasonal mining?

At present, the data gathered during the project confirms the findings of 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 most of the previously excavated Sussex mineshafts were quickly backfilled (Barber *et al.* 1999, 62). This practice was also encountered in this project, especially at Long Down, where fresh blocks of chalk had been deposited into un-weathered shafts, demonstrating that the mines were not open for long before being filled with freshly mined chalk spoil.

It must be acknowledged here that this project has serious concerns over assumptions on the backing filling process (Teather 2008, 2019). It is unknown if the waste recorded on Long Down originated from the same shaft, or from a neighbouring shaft. It is possible that when spoil from new shafts is deposited in recently exhausted neighbouring shafts, it may have been undertaken in an effort to minimise 'double handling' the spoil. In a sense, this mirrors the backfilling of galleries, and even the Harrow Hill drift mines, as spoil was moved with minimal effort before older workings were utilised for its deposal. If such a method of shaft backfilling did take place then it has implications for the integrity of radiocarbon dates obtained from backfill, as many residual objects would have become mixed during backing from previous workings and activity. Attempts to date shafts from top to the bottom of fills have so far provided confused chronology, with later dates stratigraphically below earlier, possibly because much of it is poorly archived or was not clearly contexted in historic excavations (Teather 2019).

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 polished or traded in their unfinished forms.

The evidence of axes being finished on the working floors of Long Down, combined with the presence of pottery, could be tentative evidence for more sustained occupation of the mines. This, in small part, questions the assumption that all mining may have been exclusively transient in character (Barber *et al.* 2019; Topping 2019). Little is known about the wider landscape of Long Down, where activities peripheral to mining may have occurred and where the miners may have settled during periods of extraction.

7.5.5 Wider Sussex

Moving on from the immediate landscape of mining, this project also sought to develop connections with non-mining sites across Sussex, because it was reasoned that the flint mines document the cultural and social practices of Early Neolithic communities. Therefore, it was justifiable to compare and contrast any findings from the mines with other, non-mining sites and features, such as pits. Much of this was achieved through research of the HER and other grey literature sources produced by developer funded archaeological excavations. Also undertaken was the detailed examination of two Early Neolithic pits, Pit X, New Barn Down and Pit 357, Bishopstone. This exercise was successfully in revealing links between flint mines and the wider landscape of Sussex.

The most definitive feature associated with a mining community is Pit X, located less than 450m south of the survey area on Harrow Hill. Pit X undoubtedly contained material sourced from the mines and its radiocarbon dating proved it was contemporary with mining on Harrow Hill. Due to elements of the artefact assemblage deposited in Pit X, including curated objects possibly altered by fire, it was interpreted as evidence of a possible closing ceremony, possibly to mark the end of a mining season.

The artefacts contained within the pit, and its general form, provided for the first time a hint of the cultural context of a mining community. It is clear that the community associated with Pit X, and the Harrow Hill mines, were Neolithic, they were familiar with the newly introduced Carinated Bowl pottery, new forms of lithics, including bi-facial axes and serrated blades. They were also expressing their Neolithic worldview by the deposition of objects into a large pit in a clear break from Mesolithic practices. This break is also reflected in the practice of mining, which is clearly tied to a Continental tradition. Finally, the community was connected, with pottery from the West Country, or even the Continent, stone from the Weald and material from coastal areas. The outward flow of mine-produced axes would have also connected the Harrow Hill community to others across southern England.

Moving outwards from Pit X it was possible to recognise similarities, and therefore connections, with other sites across Sussex. The most notable was the occupation site excavated at Bishopstone, where a mine-sourced axe was recovered, along with Carinated Bowl pottery and one feature, Pit 711, which was comparable to Pit X (Bell 1977). Beyond these two sites other links were developed with Early Neolithic sites and the flint mines and Pit X, including the deposition of fine Carinated Bowl pottery and specialist lithics, such as, South Coast Road, Drayton Quarry and Westhampnett. Several sites also contained miniature axes, a probable mine product with examples from Long Down and Cissbury. The pit located at Clay Pit Lane may have also contained lithics produced on flint sourced from the mines at Long Down.

Although it is impossible to ascertain if the mining communities were associated with these sites, it seems improbable that they did not engage with other sites and communities across Sussex. The results obtained in this thesis have shown that tentative links between mines and settlement sites can be demonstrated, albeit via material culture. It is important to recognise that mining does not exist as an isolated activity, as it is not inwardly focused and, after the point of an individual extracting flint nodules from a working face in a gallery, it becomes an outward facing industry.

That axes were manufactured for trade in extensive and complex networks is much better researched on the Continent (De Groth 1999, 2015; Allard and Denis 2015; Bostyn 2015; Collin 2016; Schauer 2019). Such networks would have required communities to be well connected (Fig.7.3). It is constrictive to not consider that mining communities were as important in developing and maintaining these networks and relationships, as much as the products that flowed through them.

The trade networks were complex, nuanced and rich with cultural meaning, as indicated by numerous ethnographic accounts (See Chapter Two). Therefore, mines are not bounded sites and they connect to the wider landscape, via both the exchange of axes and the movement of communities. This is particularly apparent if the duration of an individual mining season is considered, with estimates from a few weeks to a couple of months, as the mining community, or more likely communities, cannot have vanished from the archaeological record between these extraction events. These communities were likely to have moved to other locales across Sussex, and probably the wider area of southern England. Fresh axes would have travelled with them, along with the knowledge of mining and their fine pottery. Through these movements the Early Neolithic worldview would have been reproduced, transformed and maintained.

Fig. 0.3: Links between flint mines and other Sussex sites (Author).

This research has shown how the mines can be connected to other sites. These connections were begun at the margins of the mines, in a sphere that was peripheral to deep mining and focused on occupation and other activities, as outlined above. Once an extraction season had finished, the mining communities moved beyond the mines and settled at other sites. Whether any of the sites outlined in this thesis can be firmly tied to a mining community is doubtful, as an axe, such as the example from Pit 357, can travel through communities as easily as with them. But what this research has shown is that mines were not as peripheral to settled areas as often proposed (See Chapter Two), not only were they occupied whilst mining was underway, but they were also linked to other sites because the mining communities were not confined and bounded entities who only occupied the mines.

7.6 People/objects

Much of this thesis was focused on an attempt to answer long-standing questions on the Sussex mines: Who were the miners? Was mining undertaken by a specialist workforce? How was mining managed? These are perhaps the most simple, but difficult questions to ask with regard to Early Neolithic mining, partially due the lack of settlement evidence and material culture, both within the mines and wider Sussex. This thesis also attempted to question how the mines could influence conceptions of Early Neolithic, and vice versa.

As already discussed, the surveys presented limited, but significant, evidence of occupation activity, along with connections to settlements sites. At the end of Chapter Six a provisional chronology was presented for the Early Neolithic of Sussex, based on the archaeological record presented, and the new radiocarbon dates obtained for this project. This chronology began with the commencement of extraction at the Sussex mines, almost certainly at Worthing initially, and possibly the Wessex Group as well, close to 4000 cal BC. Aside from flint mines, the earliest feature dated to the late 40th century BC in Sussex was Pit X, connected to the Harrow Hill mines but otherwise an isolated feature. Few comparable large single pits were present, with the possible exceptions of South Coast Road, Drayton and Pit 711 from Bishopstone. Aside from the pits, and numerous undated flint scatters, the formative centuries of the Neolithic, apart from the mines, are elusive in the archaeological record of Sussex, mirroring a problem encountered across the British Isles.

It is perhaps significant that Carinated Bowl vessels from mining contexts documented in this project possibly reflect its use on non-mining sites. At both Cissbury and Long Down small amounts of Carinated Bowl vessels, all rimsherds, were discovered deposited in shafts, along with other material including a cache of axe roughouts and debitage. Further sherds of Carinated Bowl were found with the *in situ* working floor on Long Down. This somewhat mirrors its deposition in pits, including on Pit X and Pit 711, where small assemblages of potsherds, nearly all rimsherds, appear to have been selected for deposition. This comparative evidence therefore seems to indicate that mines document wider Early Neolithic practices, and the careful selection and deposition of a rare and 'special' object, such as sherds of Carinated Bowl pottery, along with small quantities of more general flintwork and other material.

The research carried out for Chapter Seven indicates an increase in Early Neolithic features from the early 38th century BC onwards, with a series of sites focused on small groups of pits and gullies rich in domestic material culture, such as flintwork, quern stones and pottery. Occupation sites, such of those on the coastal plain and the Peacehaven area, including Bishopstone, appear to have been focused on cultivation of both domestic and wild crops, indicated by numerous charred plant seeds and cereals. Sites of this character appear to have increased along with the start of enclosure construction in the 37th century BC in Sussex (Whittle *et al.* 2011), when mining appears to have waned, or stopped at some complexes. The start of the enclosure building was a natural cut-off point for this project, although the overlap between the two monuments is of interest and can inform on the cultural meaning of mining, both its beginning and eventual decline.

7.6.1 Mining and enclosures

The relationship between the Sussex Early Neolithic enclosures and flint mines is an ambiguous one. Previous interpretations have often highlighted the spatial distribution of both monuments, which appeared to infer that enclosures and mines occupied defined locations within territorial areas of Downland (Drewett 1978). The initial radiocarbon dating of the Sussex flint mines (Barber *et al.* 1999), followed by enclosures (Whittle *et al.* 2011) largely dismissed this model, although more recent mine dates, as presented here, suggest overlap between the two monuments, most notably at Cissbury and Long Down (Baczkowski and Holgate 2018; Edinborough *et* *al.* 2019; Teather 2019). The new radiocarbon dates from Long Down (See Chapter Three) clearly indicate that mining was underway when the causewayed enclosure on Halnaker Hill was constructed, c. 900m to the west of the mines (Whittle *et al.* 2011. 249-50). The two sites are located on opposing sides of a dry-valley that runs to the Coastal Plain, c. 1km to the south (Fig.7.4).

There is no clear archaeological evidence of any relationship between the two monuments, except for the find of a single sherd of Peterborough Ware pottery on Long Down, which could be contemporary with the Halnaker enclosure (Drewett 1983). None of the other Sussex mines can be easily associated with the enclosures, with the exception of Cissbury, as recent radiocarbon dates obtained from the mines showed deep mining in the 37th century (Edinborough et al. 2019; Teather 2019). This is intriguing, as the Cissbury mines have been previously compared to causewayed enclosures, in particularly Whitehawk, due to the presence of carved chalk objects and a fully articulated human burial surrounded by chalk blocks, an example of which has also been found at the enclosure on the Trundle, Chichester (Teather 2008. 151-53; 2011).

Fig. 0.4: Map showing the Long Down mines and Halnaker Hill enclosure (Crown copyright and database rights 2020 Ordnance Survey 100025252).

The dating of the Cissbury burial to 3644-3384 cal BC (Teather 2019. 43) may show further connections between the two forms of monuments, which appear linked by non-functional cultural practices possibly based on the symbolic associations of chalk, community monument construction, gatherings, ceremonies, and finally individual burial rites, the latter of which contrast against the large communal mortuary monuments, such as long barrows. It is suspected that similar evidence would be found in the deeper workings on Long Down, perhaps mirroring those on Halnaker Hill.

This project has demonstrated how flint mines can be shown to reflect the wider chronology of cultural practices associated with Early Neolithic communities in Sussex. Objects were deposited within their shafts and in the wider landscape in the early centuries, and in their final period they were used in a similar fashion to enclosures. This use goes beyond their primary function as mines and clearly demonstrates their importance to communities, which treated them in the same manner as later monuments, as places to gather, exchange and finally perform ceremonies involving the careful placement of objects.

Finally, as mining and the demand for axe flint waned in Sussex, it is tempting to think that the need for community projects, along with the cultural and social aspects of mining were replaced by causewayed enclosures. The now revised chronology between the two monuments certainly indicates an overlap at Cissbury and Long Down, followed by the probable abandonment of deep mining for almost a millennia. Less formal and more sporadic episodes of extraction were carried out at certain mines, such as the quarries on Long Down and also at other Neolithic monuments, such as Durrington Walls. The renewal of mining at Church Hill and the start of extraction at Grimes Graves at the end of the Neolithic is significant and is also mirrored at Continental mines. This is perhaps indicative of a last effort to express and hold onto a tradition that had its origins at the start of the Early Neolithic in southern England.

7.6.2 Coastal Connections and community

Although the establishment of links to the flint mines beyond Sussex is beyond the limited remit of this project, its findings nonetheless hint that such connections exist. Evidence of the distribution of flint mine axes beyond Sussex is limited to one major study, conducted by the British Museum (Sieveking *et al.* 1972; Craddock *et al.* 1983). This used neutron activation to analyse the chemical composition of over 400 Neolithic axes from southern and eastern England, against flint from all the major mining sites. The results were mixed and only indicated that 67% of the axes were *likely* to have originated from chalk downland within the general vicinity of individual mines, and were therefore non-local to the area in which they were found. This is particularly striking in the East Anglian and Wessex study areas, the location of Grimes Graves and Easton Down respectively, which showed that the majority of axes did not come from these local mines and were imports (Craddock *et al.* 2019). This is less surprising for the Late Neolithic mines at Grimes Graves mines, as the extracted flint did not travel far and was not used solely for axe production (Bishop 2014; Healy *et al.* 2014).

More extensive and thorough studies of axe distribution have been conducted on the Continental mines, including Spiennes, Rijckholt, Jutland and Krzemionki, which have shown wide distribution of mine flint, up to 400km from the source (See Collet and Hauzer 2019 for a summary of the most recent research). These studies, and the limited success of the British Museum analysis, clearly demonstrate that axes travelled far from their mine source presumably through the direct movement of people and/or trade networks, as has been successfully proven for the Cumbrian stone axes (Clough and Cummins 1979, 1988; Schauer *et al.* 2019).

This research added little to the limited knowledge of the distribution of mine flint. Certain findings did however show the movement of objects associated with the mines. The presence of miniature axes, almost certainly produced at Long Down, Church Hill and Cissbury, in pit and open assemblages from sites along the Coastal Plain is notable, as is the presence of the axe from Pit 357, Bishopstone, previously provenanced to Cissbury (Craddock *et al.* 1983). These show the localised movement of material from the mines to occupation sites.

Further afield, the fine Carinated Bowl (Pot 1) from Pit X, New Barn Down, has travelled from the West Country, probably Devon, or even Continental Europe, indicating a long-distance link with this area. This is an especially compelling connection, in consideration of the probable Cissbury type axe deposited next to the Sweet Track, along with fine Carinated Bowls and Jadeite axe from The Alps (Bond 2003, 2004, 2007).

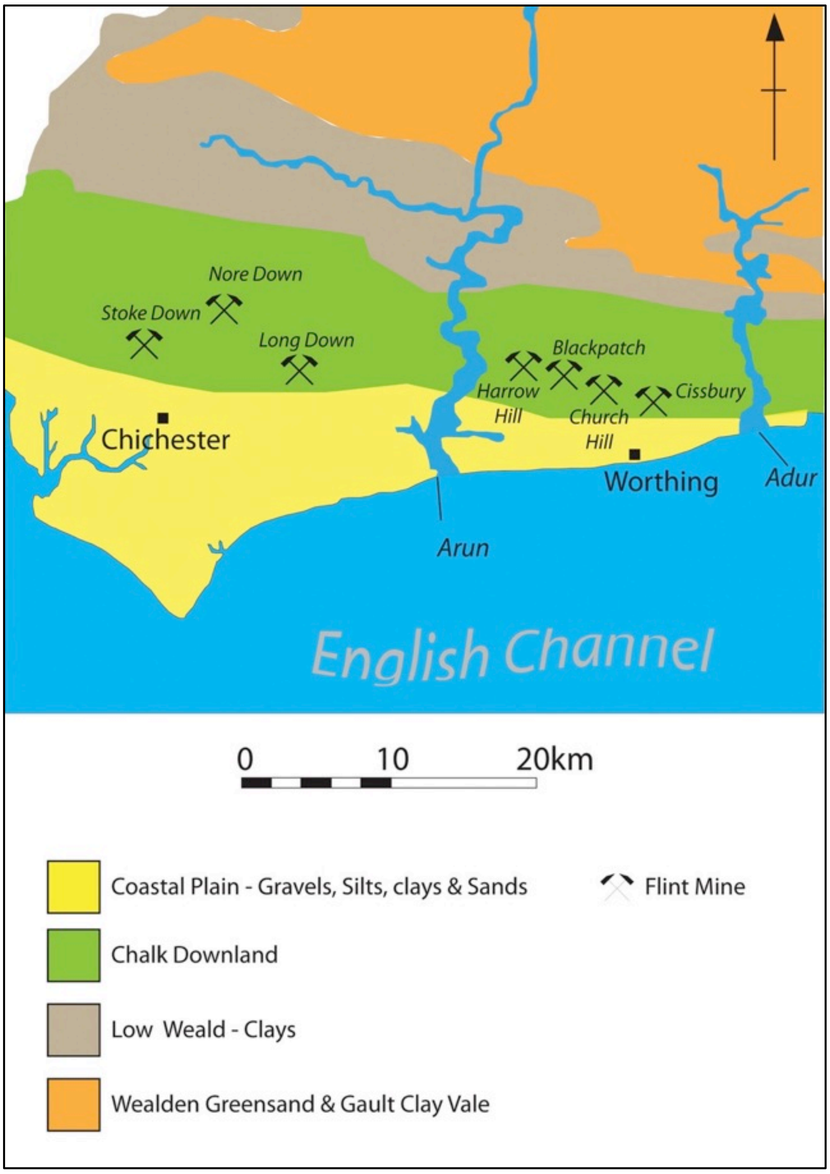


Fig. 0.5: Sussex mines and their coastal connections (Author).

As proposed in Chapter Six, these materials probably indicate coastal movement, a theme reflected in the assemblages from Pit X and Pit 357. The mines themselves also retain a strong coastal link, all less than 10km from the contemporary Neolithic coastline and all with panoramic views of the sea (Fig.7.5). It is perhaps not surprising that many Continental mines are close to major European waterways, including the river Meuse at Rijckholt, and the river Marne, a major tributary of the Seine, at the Paris Basin mines, including Jablines (Fig.7.6). This may be due to geological factors, as flint seams are exposed in river valleys, but the wide distribution of mine flint would have been undoubtedly partially undertaken along river routes and networks.

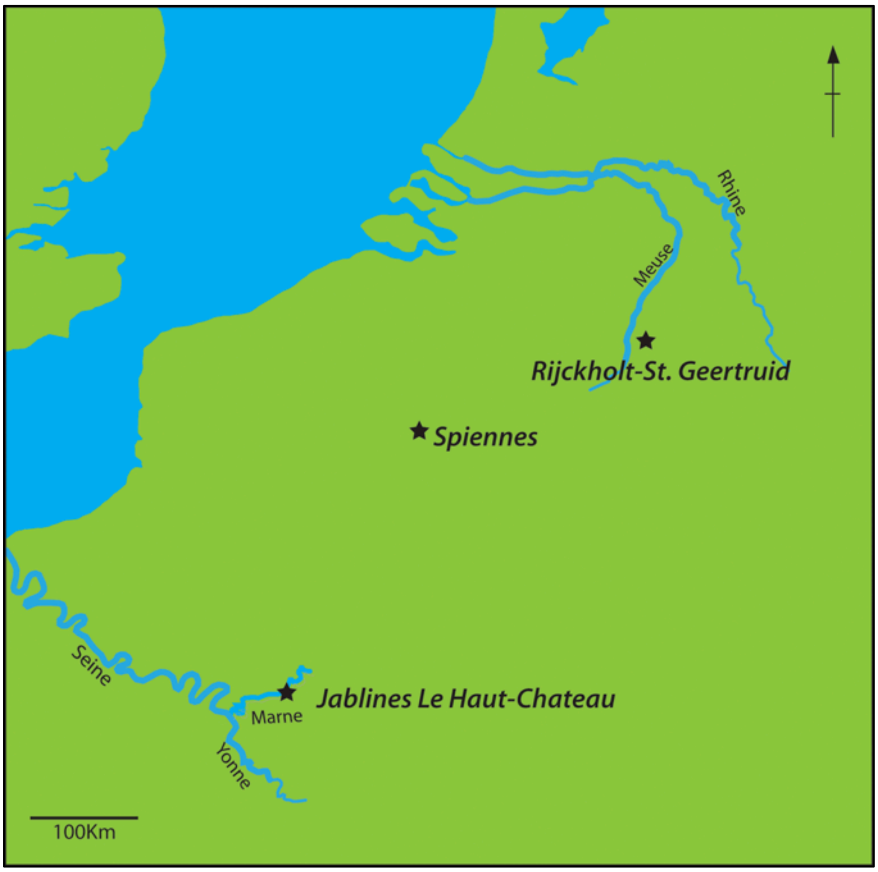


Fig. 0.6: European mines and major rivers (Author).

Overall, links beyond Sussex are tentative, but present. Whether individuals from the mining communities moved with this material, or if it was exchanged through networks of trade is unknown. Its presence, nonetheless, shows that mines were connected to areas far beyond Sussex via networks that included coastal routes, an increasingly defining component of the Early Neolithic along southern England (Garrow and Sturt 2011; Anderson-Whymark *et al*. 2015; Bradley *et al.* 2016). Flint mines therefore not only looked inwards to the chalk bedrock, but outwards to the wider landscape, they are both isolated and connected.

7.7 Concluding remarks

It is hoped that this research has demonstrated the ability of archaeological narratives to be re-imagined through low cost field surveys, archival research and engagement with developer funded archaeological projects. It is also hoped that it has successfully shown the limits of previous research and narratives on flint mining.

Aside from this project, no new fieldwork has been carried out at the Sussex flint mines for nearly 30 years. This means that this project has relied heavily on re-assessment of archival research from records that are not always complete, however work of this nature is now reaching its limits. In contrast, research driven by new fieldwork and excavation is very much ongoing in mainland Europe, the results of which continue to develop the narrative of mining, a defining aspect of the Neolithic.

Overall, it is hoped that this project renews interest in the Sussex mines, and perhaps fieldwork that supports, or even contradicts, the findings of this and previous work. The Sussex mines remain a grossly under researched class of Early Neolithic Monument. This is surprising in consideration of their impressive contribution to the development of archaeology as a discipline through its formative decades in the 19th century, most notably by Pitt-Rivers, and the wealth of new data still being produced by researchers across Northwest Europe. It is perhaps time to recognise that flint mines were instrumental in the establishment, development and spread of the Neolithic in southern England and should not be considered as isolated monuments on the margins of society.

Chapter 8 Bibliography

ADLER T., and THOMPSON, S. D. 1992. Mining Methods Classification System, in H. L. Hartman (ed.) *SME MINING ENGINERRING HANDBOOK VOL 1*, Society for Mining, Metallurgy, and exploration, Inc. 531-7.

ALDSWORTH, F. G. 1983. Prehistoric flint mines on Nore Down, West Marden, *Sussex Archaeological Collections,* 117, 251.

ALIYU, M., MURPHY, W., LAWRENCE, J., and COLLIER, R. 2017. Engineering Geological Characterisation of Flints, *Quarterly Journal of Engineering Geology and Hydrogeology*, 50: 2. 1-32.

ALLARD, P., and DENIS, S. 2015. The circulation of flint raw materials in northern France and Belgium during the Early Neolithic, in T. Kerig and S. Shennan, *Connecting Networks: Characterising Contact by Measuring Lithic Exchange in the European Neolithic,* Oxford; Archaeopress Publishing Ltd. 64-74.

ALLEN, M. J. and GARDINER, S. 2009. If you go down to the woods today; a re-evaluation of the chalkland postglacial woodland, in M. J. Allen., N. Sharples and T. O'Connor (eds.), *Land and People: papers in memory of John G. Evans*, Prehistoric Society Research Paper 2. Oxbow Books. 49–66.

- 2012. Not Out Of The Woods Yet; Some Reflections On Neolithic Ecological Relationships With Woodland, in A. M. Jones., J. Pollard., J. Gardiner., and M. J. Allen (eds.), *Image, Memory and Monumentality, archaeological engagements with the material world*: *A celebration of the academic achievements of Professor Richard Bradley*, Prehistoric Society Research Papers 5. Oxbow Books. 93-108

ALLEN, M. J., and SCAIFE, R. G. 2007. A New Downland Prehistory: Long-Term Environmental Change on the Southern English Chalklands, in A. Fleming., and R. Hingley (eds.), *Prehistoric and Roman Landscapes,* Macclesfield, England, Windgather Press. 16-32.

ANDERSON-WHYMARK, H., and THOMAS, J. (eds.). 2012. *Regional Perspectives on Neolithic Pit Deposition: Beyond the Mundane,* Neolithic Studies Group Seminar Papers 12. Oxford: Oxbow Books.

ANDERSON-WHYMARK, H., GARROW, D., and STURT, F. 2015. *Continental Connections; Exploring cross-Channel relationships from the Mesolithic to the Iron Age*, Oxford: Oxbow Books.

ANELAY, G. 2019. *The Selhurst Park Project; Middle Barn, Selhurstpark Farm, Eartham, West Sussex 2005-2008,* Oxford and Philadelphia, Oxbow Books.

ANGEL, D. 2007. Neolithic Implements In The Landscape Of Peacehaven And Their Wider Context. Unpublished Ma Dissertation, University Of Sussex.

APPADURAI, A. (ed.). 1986. *The Social Life of Things: Commodities in Cultural Perspective,* Cambridge and New York: Cambridge University Press.

ARIAS, P. 1999. The Origins of the Neolithic Along the Atlantic Coast of Continental Europe: A Survey, *Journal of World Prehistory,* 13: 4. 403-464.

ARMSTRONG, A. L. 1934. Grime's Graves, Norfolk: report on the excavation of Pit 12, *Proceedings of the Prehistoric Society East Anglia,* 7: 1932-4. 382-94.

ASHBEE, P. 1993. The Medway Megaliths in Perspective, *Archaeologia Cantiana*, Kent Archaeological Society, 111. 57–112.

- 1998. Coldrum Revisited and Reviewed, *Archaeologia Cantiana*, Kent Archaeological Society 118. 1–44.

BABEL, J. 2006. The Krzemionki Flint Mines Latest Underground Research 2001-2004, in P. Allard., F, Bostyn., F. Giligny and J. Lech (eds.) *Flint Mining in Prehistoric Europe: Interpreting the Archaeological Records: European Association of Archaeologists, 12th Annual Meeting Cracow, Poland 19th-24th September 2006* (British Archaeological Reports International Series 1891), 97-111. Oxford: Archaeopress. 97-109.

BACZKOWSKI, J., and HOLGATE, R. 2017. Breaking Chalk; The archaeological Investigations of Early Neolithic Flint Mines at Long Down and Harrow Hill, West Sussex, 1984-86, *Sussex Archaeological Collections,* 155. 1-30.

- 2018. Neolithic flint mining in Southern England: new radiocarbon dates for Long Down, West Sussex, and their implications, *PAST The Newsletter of the Prehistoric Society* 88, 3-5.

BACZKOWSKI, J. 2014. Learning by Experience: The Flint Mines of Southern England and Their Continental Origins, *Oxford Journal of Archaeology,* 33: 2. 135–153.

- 2017. Post Excavation Assessment Report For A Strip, Map And Sample Archaeological Excavation At 1 South Coast Road, Peacehaven, East Sussex, BN10 7AE. CBAS0754. Unpublished Report

- 2019a. Making connections: a fresh analysis of an Early Neolithic pit and its contents, *Oxford Journal of Archaeology*, 38: 4. 378–397.

- 2019b. Comings and goings: The wider landscape of Early Neolithic flint mining in Sussex, in A. Teather., P. Topping and J. Baczkowski (eds.), *Mining and Quarrying in Europe: A social perspective*, Neolithic Studies Group Seminar Papers, 16. Oxford and Philadelphia: Oxbow Books. 21-37.

- 2019c. Methodologies of extraction: The mining techniques in the Early Neolithic flint mines of southern England and their Continental origins, in A. Collet and A. Hauzer. *Mining and Quarrying. Geological Characterisation, Knapping Processes and Distribution Networks during Pre- and Protohistoric Times, Proceedings of the*

7th International Conference of the USIPP Commission on flint mining in Pre- and Protohistoric Times. Mons and Spiennes, 28th Sept – 1st Oct 2016, Anthropologica et Praehistorica 128/2017, Royal Belgian Institute of Natural Sciences.

BALLARD, C., and BANKS, G. 2003. Resource wars: the anthropology of mining. *Annual Review of Anthropology*, 32. 287-313.

BARBER, M., FIELD. D., and TOPPING, P. 1999. *The Neolithic Flint Mines of England,* London: English Heritage.
,
BARBER, M. 2014. Stoke Down, West Sussex; A survey of the Neolithic flint mines and associated features. *Research Report Series* 71-2014. English Heritage.

BARCLAY, A., FITZPATRICK, A., HAYDEN, C., and STAFFORD, E. 2006. The Prehistoric Landscape at White Horse Stone, Aylesford, Kent, Oxford: Oxford Wessex Archaeology Joint Venture (London and Continental Railways).

BARCLEY, A., and CHAFFEY, G. 2014. Horton's Neolithic house. *Current Archaeology*, 292. 24-30.

BARCLAY, A. 2002. Ceramic lives, in, A. Woodward and J. D. Hill (eds.), *Prehistoric Britain: the ceramic basis*, PCRG Occasional Publications, Oxford. 85-95.

- 2007. *Ceramics of the south-east: new directions,* South East Research Framework resource assessment seminar.

BEDWIN, O., DREWETT, P., THOMAS, K., and CARTWRIGHT, C. 1981. Excavations at the Neolithic Enclosure on Bury Hill, Houghton, West Sussex 1979, *Proceedings of the Prehistoric Society,* 47. 69-86.

BECKER, C. J. 1959. Flint Mining in Neolithic Demark. *Antiquity,* 33: 130. 87-92.

BELL, M., and NOBLE, G. 2012. Prehistoric Woodland Ecology, in A. M. Jones., J. Pollard., M. J. Allen and J. Gardiner (eds.), *Image, Memory and Monumentality: Archaeological Engagements with the Material World*, Prehistoric Society Research Paper 5: The Prehistoric Society and Oxbow Books. 80-92.

BELL, M. 1977. Excavations at Bishopstone, East Sussex, *Sussex Archaeological Collections*, 114.

- 1993. Valley sediments as evidence of prehistoric land-use on the South Downs. *Proceedings of the Prehistoric Society*, 49. 119-50.

BENDER, B. 2001. Landscapes on the move, *Journal of Social Archaeology,* 1. 75–89.

BISHOP, B., J. 2014. *The Grimes Graves Environs Survey; Exploring the Social Landscapes of a Flint Source*. Unpublished PhD thesis. University of York.

BLINKHORN, E., and LITTLE, A. 2018. Being Ritual in Mesolithic Britain and Ireland: Identifying Ritual Behaviour Within an Ephemeral Material Record, *Journal of World Prehistory*, 31. 403–420.

BOGAARD, A., and JONES, G. 2007. Neolithic farming in Britain and central Europe: Contrast or continuity? in, Whittle, A and Cummings, V. (eds.), *Going Over: The Mesolithic-Neolithic Transition in North-West Europe*, Proceedings of the British Academy 144. Oxford and New York, Oxford University Press. 357-399.

BORKOWSKI W., and BUDZISZEWSKI, J. 1995. The Use of Stripped Flint in Prehistory. *Archaeologia Polona,* 33, 71-87.

BOND, C, J. 2003. The coming of the earlier Neolithic, pottery and people in the Somerset Levels, in *Prehistoric Pottery: People, Pattern and Purpose*, British Archaeological Reports International Series 1156, Prehistoric Ceramic Research Group Occasional Publication 4. Oxford: Archaeopress. 1-27.

- 2004. The Sweet Track, Somerset: a place mediating culture and spirituality?, in T. Insoll, (ed.) *Belief in the Past, The Proceedings of the 2002 Manchester Conference on Archaeology and Religion*, British Archaeological Reports International Series 1212, Oxford: Archaeopress. 37-50.

- 2007. Walking the track and believing: the Sweet Track as a means of accessing earlier Neolithic spirituality, in D. A. Barrowclough and C. Malone (eds.), *Cult in Context. Reconsidering Ritual in Archaeology,* Oxford: Oxbow Books. 158–166.

BOOTH, A. St S., and STONE, J.F.S. 1952 'A trial flint mine at Durrington', *Wiltshire Archaeological and Natural History Magazine,* 54, 381.

BOSTYN F., and LANCHON Y. 1992. *Jablines Le Haut-Château (Seine-et-Marne): Une Minière de silex au Néolithique*, Documents d'Archéologie Francaise 35. Paris, Sciences de l'Homme.

- 1995. The Neolithic Flint Mine at Jablines, 'Le Haut-Château' (Seine-et-Marne). *Archaeologia Polona,* 33. 297-310.

BOSTYN, F., GILIGNY, G., and CARMINE, A, LO. 2008. A new flint mine at Flins-sur-Seine/Aubergenville (Yvelines, France), in P. Allard., F, Bostyn., F. Giligny and J. Lech (ed.), *Flint Mining in Prehistoric Europe: Interpreting the Archaeological Records: European Association of Archaeologists, 12th Annual Meeting Cracow, Poland 19th-24th September 2006,* Oxford: Archaeopress: British Archaeological Reports International Series 1891. 41-77. 79-97.

BOSTYN, F. 2015. Flint productions and distribution networks at the end of the 5th and the beginning of the 4th millennia BC in north-western France and western Belgium, in T. Kerig and S. Shennan, *Connecting Networks: Characterising Contact by Measuring Lithic Exchange in the European Neolithic,* Oxford; Archaeopress Publishing Ltd. 74-83.

BOURDIEU, P. 1977. *Outline of a Theory of Practice*, Cambridge University Press.

BOWDEN, M. 1991. *Pitt Rivers: The Life and Archaeological Work of Lieutenant-General Augustus Henry Lane Fox Pitt Rivers,* Cambridge University Press.

BRACE, S,. DIEKMANN, Y,. BOOTH, T. J,. FALTYSKOVA, Z., ROHLAND, N., MALLICK, S., FERRY, M., MICHEL, M., OPPENHEIMER, J., BROOMANDKHOSHBACHT, N., STEWARDSON, K., WALSH, S., KAYSER, M. SCHULTING, R., CRAIG O. E., SHERIDAN, A., PEARSON, M. P., STRINGER, C., REICH, D., THOMAS, M. G., and BARNES, I. 2018. Population replacement in Early Neolithic Britain. bioRxiv. https://doi.org/10.1101/267443 (assessed October 2019).

BRACE, S., DIEKMANN, Y., BOOTH, T. J., VAN DORP, L., FALTYSKOVA, Z., ROHLAND, N., MALLICK, S., OLALDE, I., FERRY, M., MICHEL, M., and OPPENHEIMER, J. 2019. Ancient genomes indicate population replacement in Early Neolithic Britain. Nature Ecology and Evolution 3:m5. 765–771.

BRADLEY, R., OVER, L., STARTIN, W. A., and WENG, R. 1976. The Excavation of a Neolithic Site at Cannon Hill, Maiden Head, Berkshire, 1974-75. *Berkshire Archaeological Journal,* 68. 5-19.

BRADLEY, R., and EDMONDS, M. 1993. *Interpreting the Axe Trade: Production and Exchange in Neolithic Britain,* Cambridge University Press.

BRADLEY, R., ROGERS, A., STURT, F., and WATSON, A. 2016. Maritime Havens in Earlier Prehistoric Britain, *Proceedings of the Prehistoric Society,* 82. 125-59.

BRADLEY, R., WATSON, A., and STYLE, P. 2019. After the Axes? The Rock Art at Copt Howe, North-west England, and the Neolithic Sequence at Great Langdale, *Proceedings of the Prehistoric Society*, 85. 177–192.

BRADLEY, R. 1990. Perforated Stone Axe-Heads in the British Neolithic: Their Distribution and Significance. *Oxford Journal of Archaeology,* 9: 3. 299-304.

- 1998: *The Significance of Monuments: On the Shaping of Human Experience in Neolithic and Bronze Age Europe,* London and New York, Routledge.

- 2005. *Ritual and Domestic Life in Prehistoric Europe,* London and New York, Routledge.

- 2007. *The Prehistory of Britain and Ireland*, Cambridge, Oxford, World Archaeology.

BROWN. A. 2007. Dating the onset of cereal cultivation in Britain and Ireland: the evidence from charred cereal grains, *Antiquity,* 81. 1042-1052.

BROWN, J. 2010. *The Archaeological Landscape of Drayton Quarry, Chichester, West Sussex: Excavations 1997-2005*, Unpublished Report.

BRÜCK, J. 1999. Ritual and rationality: some problems of interpretation in European archaeology, *European Journal of Archaeology*, 2: 3. 313-344.

BRUMM, A. 2004. An Axe to Grind: Symbolic Considerations of Stone Use in Ancient Australia, in N. Boivin and M. A. Owoc (ed.), *Soils, Stone and Symbols: Cultural Perceptions of the Mineral Worlds*, London: UCL Press. 143-65.

- 2010. 'The Falling Sky': Symbolic and Cosmological Associations of the Mt William Greenstone Axe Quarry, Central Victoria, Australia, *Cambridge Archaeological Journal,* 20: 2. 179-96.

- 2011. Power Tools. Symbolic Considerations of Stone Axe Production and Exchange in 19th Century South-Eastern Australia, in V. Davis and M. Edmonds (eds.), *Stone Axe Studies Volume,* 3. Oxford, Oxbow Books. 86-97.

BURTON, J. 1984. Quarrying in a Tribal Society, *World Archaeology*, 16: 2. 234-47.

- 2014. Agency and the "Avatar" narrative at the Porgera Gold Mine, Papua New Guinea *Journal de la Societé des Océanistes,* 138-139, 37-51.

BUSH, P. R., and SIEVEKING, G. DE G. 1986. Geochemistry and provenance of flint axes, in G. de G. Sieveking and M. B. Hart (eds.), *The scientific study of flint and chert: proceedings of the fourth international flint symposium held at Brighton Polytechnic 10-15 April 1983*, Cambridge, Cambridge University Press. 133-40.

BUSH, M. A. 1989. On the Antiquity of British Chalk Grasslands: A Response to Thomas, in *Journal of Archaeological Science*, 16. 555-60.

BUTLER, C., and HOLGATE, R. 2002. The flintwork at Red Hill, in, D. Rudling (ed.), *Downland Settlement and Land-Use,* London: Archetype.

BUTLER, C. 2001. A Mesolithic and later prehistoric flintworking site at East and West Hills, Pyecombe, West Sussex, *Sussex Archaeological Collections,* 139. 7-26.

-2005. *Prehistoric Flintwork*, The History Press, Tempus Publishing.

- 2008. A collection of Mesolithic flintwork from the Horsham area, *Sussex Archaeological Collections,* 14. 7-18.

- 2009. Prehistoric burnt flint mounds and later activity at Hammonds Mill Farm, Burgess Hill, West Sussex, *Sussex Archaeological Collections,* 147. 7-19.

BURTON, J. 2014. Agency and the "Avatar" narrative at the Porgera Gold Mine, Papua New Guinea. *Journal de la Societé des Océanistes* 138-139. 37-51.

BYE-JENSEN, P. 2019. *Causewayed enclosure under the microscope*, Unpublished PhD thesis, University of Southampton, Faculty of Humanities, The Department of Archaeology.

CAMPRUBÍ, A., MELGAREJO, J. C., PROENZA, J. A., COSTA, F., BOSCH, J,. ESTRADA, A., BORELL, F., YUSHKIN, N. P., and ANDREICHE, V. L. 2003. Mining and geological knowledge during the Neolithic: a geological study on the variscite mines at Gavà, Catalonia, in *Episodes*, 26. 295-301.

CARE, V. 1979. The Production and Distribution of Mesolithic Axes in Southern England, *Proceedings of the Prehistoric Society,* 45. 93-103.

- 1982. The Collection and Distribution of Lithic Raw Materials During the Mesolithic and Neolithic Periods in southern England, *Oxford Journal of Archaeology* 1: 3. 269-85.

CARPENTER, E., BARBER, M., and SMALL, F. 2013. South Downs: Beachy Head to the River Ouse. Aerial Investigation and Mapping Archaeological Report, *Research Report Series,* 22-2013. English Heritage.

CARVER, G. 2011. Pits and Place-making: Neolithic Habitation and Deposition Practices in East Yorkshire *c.* 4000-2500 BC, *Proceedings of the Prehistoric Society,* 78. 111-134.

CLARK, G. 1932. The Curved Flint Sickle Blades of Britain, *Proceedings of the Prehistoric Society of East Anglia,* 7: 1. 67-81.

CONSUEGRA, S., CASTAÑEDA, N., CAPDEVILA, E., CAPOTE, M., CRIADO, C., CASAS, C., NIETO, A., and DIAZ-DEL-RÍO, P. 2018. The Early Neolithic flint mine of Casa Montero (Madrid, Spain), 5350-5220 cal BC, Trabajos de Prehistoria, Vol. 75: 1. 52-66.

CHADWICK, A, M. 2006. Bronze Age burials and settlement and an Anglo-Saxon settlement at Claypit Lane, Westhampnett, West Sussex, *Sussex Archaeological Collections*, 144. 7-50.

CHAFFEY, G., BARCLEY, A., and PELLING, R. 2016. *Horton Kingsmead Quarry*: *Volume 1,* Oxbow Books: Oxford.

CHAFFEY, G., and BROOK, E. 2012. Domesticity in the Neolithic: excavations at Kingsmead Quarry, Horton Berkshire, in H., Anderson-Whymark and J. Thomas (eds.), *Regional Perspectives on Neolithic Pit Deposition: Beyond the Mundane,* Neolithic Studies Group Seminar Papers 12. Oxford: Oxbow Books. 200-15.

CHARRAUD, F. 2019. Flint mining and blade management in the Blicquy/ Villeneuve-Saint-Germain culture through the earliest mines of Normandy and Northwest France settlements, in Collet, A and A. Hauzer (eds.), *Mining and Quarrying. Geological Characterisation, Knapping Processes and Distribution Networks during Pre- and Protohistoric Times, Proceedings of the 7th International Conference of the USIPP Commission on flint mining in Pre- and Protohistoric Times. Mons and Spiennes, 28th Sept – 1st Oct 2016,* Anthropologica et Praehistorica 128/2017, Royal Belgian Institute of Natural Sciences. 119-123.

CHILDE, G. 1958. *The Prehistory of European Society,* London: Penguin Books.

CIPIN, I., and DOUGLAS, A. 2017. 2 South Coast Road, Peacehaven, East Sussex, BN10 8SI: An Archaeological Assessment, *Pre-Construction Archaeology Report No. R13048.* PCA Ltd.

CLARK, S. and S. PIGGOTT. 1933. The Age of the British Flint Mines, *Antiquity,* 7. 166-83.

CLARK, J. G. D. 1934. A Late Mesolithic Site at Selmeston, Sussex, *The Antiquaries Journal*, 14: 2. 134-158.

CLARKE, C. 2012. Exploration of the Sussex coastal plain through time: Excavations at Titnore Lane, Goring-By-Sea, West Sussex, *Sussex Archaeological Collections*, 150. 5-46.

CLAYTON, C. J. 1986. The chemical environment of flint formation in Upper Cretaceous 499 chalks, in G. de, Sieveking and M. B. Hart, (eds.), *The scientific study of flint and 500 chert*, Cambridge University Press, Cambridge, 43-53.

CLEAL, R. 1992. Significant form: ceramic styles in the earlier Neolithic of southern England, in, N. Sharples and A. Sheridan (ed.), *Vessels for the Ancestors*, Edinburgh University Press. 286-306.

- 2004. The Dating and Diversity of the Earliest Ceramics of Wessex and South-west England, in R. Cleal and J. Pollard (eds.), *Monuments and Material Culture: papers in honour of an Avebury archaeologist: Isobel Smith,* Hobnob Press. 164-192.

CLOONEY, G. 1997. Images of settlement and the landscape in the Neolithic, in Topping, P (ed), *Neolithic Landscapes*, Neolithic Studies Group Seminar Papers, 2. Oxbow Monograph 86. Oxford: Oxbow Book. 23-33.

CLOUGH, T. H. McK., and CUMMINS, W. A. 1979. *Stone Axe Studies*. London, Council for British Archaeology.

- 1988. *Stone Axe Studies, Volume 2,* London, Council for British Archaeology.

CLUTTON-BROCK, J. 1984. Neolithic antler picks from Grimes Graves, Norfolk and Durrington Walls, Wiltshire: a biometric analysis, *Excavations at Grimes Graves, Norfolk, 1972-1976; Facsimile 1*. British Museum.

COLES, J.M., and ORME, B. J. 1976. The Sweet Track, railway site, *Somerset Levels Papers*, 2. 34-65.

COLES, S., FORD, S., and TAYLOR, A. 2008. An Early Neolithic Grave and Occupation, and an Early Bronze Age Hearth on the Thames Foreshore at Yabsley Street, Blackwell, London, *Proceedings of the Prehistoric Society,* 74. 215-233.

COLLIN, J. P. 2016. Mining for a week or for centuries: Variable aims of flint extraction sites in the Mons Basin (Province of Hainaut, Belgium) within the lithic economy of the Neolithic, *Journal of Lithic Studies,* 3: 2. 1-17.

COLLARD. M., EDINBOROUGH K., SHENNAN. S., and THOMAS, M. G. 2009. Radiocarbon evidence indicates that migrants introduced farming to Britain, *Journal of Archaeological Science,* 37. 866-870.

COLLET, C., A. HAUZEUR., and LECH, J. 2008. The Prehistoric Flint Mining Complex at Spiennes (Belgium) on the Occasion of its Discovery 140 Years Ago, in, P. Allard., F, Bostyn., F. Giligny and J. Lech (eds.), *Flint Mining in Prehistoric Europe: Interpreting the Archaeological Records: European Association of Archaeologists, 12th Annual Meeting Cracow, Poland 19th-24th September 2006,* Oxford: Archaeopress: British Archaeological Reports International Series 1891. 41-77.

COLLET, H., WOODBURY, M., and COLLIN, J. P. 2014, Investigation of new chipping floors at the flint mining site of Spiennes (Hainaut Province, Belgium) in 2011 and 2012, in *Lithic raw Material Resources and Procurement in Pre- and Protohistoric Times: Proceedings of the 5th International Conference of the UISPP Commission on Flint Mining in Pre- and Protohistoric Times, Paris 10-11 September 2012,* Bostyn, F. and Giligny, F (eds.), British Archaeological Reports International Series Vol. 2656, Archaeopress, Oxford. 47-58.

COLLET, A., and HAUZER, A. 2019. *Mining and Quarrying. Geological Characterisation, Knapping Processes and Distribution Networks during Pre- and Protohistoric Times, Proceedings of the 7th International Conference of the USIPP Commission on flint mining in Pre- and Protohistoric Times. Mons and Spiennes, 28th Sept – 1st Oct 2016,* Anthropologica et Praehistorica 128/2017, Royal Belgian Institute of Natural Sciences.

COLLET H., LAVACHERY P., and WOODBURY, M. 2016. Raw material exploitation strategies on the flint mining site of Spiennes (Hainault Belgium), *Journal of Lithic Studies,* Vol 3, 2.

CONNELLER, C., and WARREN, G. (eds). 2006. *Mesolithic Britain and Ireland: New Approaches*, Stroud: Tempus.

COPLEY, M. S., BERSTAN, R., DUDD, S. N., DOCHERTY, G., MUKHERJEE, A. J., STRAKER, V., PAYNE, S. and EVERSHED, R. P. 2003. Direct chemical evidence for widespread dairying in prehistoric Britain, *Proceedings of the National Academy of Sciences*, USA 100: 1524–29.

CRADDOCK, P.T., COWELL, M. R., LEESE, M. N., and HUGHES, M. J. 1983. The trace element composition of polished flint axes as an indicator of source, Archaeometry 25, 135–63.

CRAIG, O., SHILLITO, L., ALBARELLA, U., VINER-DANIELS, S., CHAN, B., CLEAL, R., and PEARSON, M. (2015). Feeding Stonehenge: Cuisine and consumption at the Late Neolithic site of Durrington Walls, *Antiquity*, 89: 347. 1096-1109.

CUMMINGS, V., and MORRIS, J. 2018. Neolithic Explanations Revisited: Modelling the Arrival and Spread of Domesticated Cattle into Neolithic Britain, Environmental Archaeology, DOI: 10.1080/14614103.2018.1536498 (accessed October 2019).

CUNLIFFE, B. 2008. *Europe Between the Oceans; 9000 BC-AD 1000,* Yale University Press, New Haven and London.

CURWEN, E., and CURWEN, E. C. 1926. Harrow Hill Flint Mine Excavation 1914-5, *Sussex Archaeology Collection,* 67. 103-38.

CURWEN, E, C. 1934. A Late Bronze Age farm and a Neolithic pit-dwelling on New Barn Down, *Sussex Archaeological Collections,* 75. 137-70.

- 1937. *The Archaeology of Sussex,* London: Methuen and Co. Ltd.

DARVILL, T., and THOMAS, J. 2000. *Neolithic Houses in Northwest Europe and Beyond*, Neolithic Studies Group Seminar Papers, 1. Oxbow Books.

DARVILL, T. 2010. *Prehistoric Britain*, London and New York: Routledge.

DAVIS, V., and M. EDMONDS. 2011. Studying Stone Axes, in V. Davis and M. Edmonds (eds.), *Stone Axe Studies Volume 3,* Oxford, Oxbow Books. 1-7.

DE LABRIFFE, P. A., REGGIO, A., and PIERRE, A. 2019. Neolithic flint mines and quarries from Vaucluse (France): Assessment and review, in Collet, A and A. Hauzer (eds.), *Mining and Quarrying. Geological Characterisation, Knapping Processes and Distribution Networks during Pre- and Protohistoric Times, Proceedings of the 7th International Conference of the USIPP Commission on flint mining in Pre- and Protohistoric Times. Mons and Spiennes, 28th Sept – 1st Oct 2016,* Anthropologica et Praehistorica 128/2017, Royal Belgian Institute of Natural Sciences. 271-290.

DE GROOTH, M. E. 1998. The Flint Mines at Rijckholt-Sint Geertruid and Their Social-economic Interpretation, in M. Edmonds and C. Richards (eds.), *Understanding the Neolithic of North-Western Europe*, Glasgow: Cruithne Press. 352-369.

- 2015. The 'Rijckholt' connection: Neolithic extraction and circulation of Lanaye flints, in T. Kerig and S. Shennan, *Connecting Networks: Characterising Contact by Measuring Lithic Exchange in the European Neolithic,* Oxford; Archaeopress Publishing Ltd. Oxford. 24-42.

DOHERTY, A. 2013. *Archaeological Excavations at Millfield, Southwater, Horsham, West Sussex: A Post Excavation Assessment and Updated Project Design Report*, Unpublished Report No. 5506, Archaeology South East.

DREWETT, P., GARDINER, M., and RUDLING, D. 1988 *The South-East to AD 1000*, London: Longman.

DREWETT, P. 1974. The excavation of an oval burial mound of the Third Millennium B.C. at Alfriston, East Sussex, *Rescue Archaeology in Sussex, 1974,* 12. 15-19.

- 1975. The Excavation of a Round Barrow and Cross-Ridge Dyke at Alfriston, East Sussex, *Rescue Archaeology in Sussex, 1975,* 13. 6-10.

-1978. Neolithic Sussex, in P. J. Drewett (ed.), *Archaeology in Sussex to A.D. 1500,* Council for British Archaeology Research Report, 29. 23-29.

- 1980. Neolithic Pottery in Sussex, *Sussex Archaeological Collections*, 118. 23-30.

-1981. Rescue archaeology in Sussex, 1980: a seventh progress report on the Sussex Archaeological Field Unit, *Bulletin of the Institute of Archaeology University of London*, 18. 21-47.

-1982a. The Archaeology of Bullock Down, Eastbourne, East Sussex: The Development of a Landscape, *Sussex Archaeological Society Monograph*, 1. Lewes: Sussex Archaeological Society.

- 1982b. The Excavation of a Neolithic Oval Barrow at North Marden, West Sussex, 1982, *Proceedings of the Prehistoric Society,* 52. 31-51.

- 1983. A Peterborough Ware sherd from the Long Down Flint Mines, West Sussex, *Sussex Archaeological Collections*, 95. 121.

-1986. The excavation of a Saxon sunken building at North Marden, West Sussex, 1982, *Sussex Archaeological Collections,*124. 109-119.

- 1994. Dr. V. Seton Williams excavations at Combe Hill, 1962, and the role of Neolithic causewayed enclosures in Sussex, *Sussex Archaeological Collections,* 132. 7-24.

- 2003. Taming the wild; the first farming communities in Sussex, in, D. Rudling (ed.), *The Archaeology of Sussex to AD2000,* Heritage Marketing and Publications Ltd. 39-47.

EDINBOROUGH, K., SHENNAN, S., TEATHER, A., BACZKOWSKI, J., BEVAN, A., BRADLEY, R., and SCHAUER, P. 2019. New Radiocarbon Dates Show Early Neolithic Date of Flint-Mining and Stone Quarrying in Britain, *Radiocarbon*, 62: 1. 75-105.

EDMONDS, M., and DAVIS, V. 2011. *Stone Axe Studies III*, Oxford, UK, Oxbow Books.

EDMONDS, M. 1995. *Stone Tools and Society: Working Stone in Neolithic and Bronze Age Britain*, London and New York: Routledge.

- 1999. *Ancestral geographies of the Neolithic: Landscape, monuments, and memory*, London and New York: Routledge.

EISENMANN, S., BÁNFFY, E., VAN DOMMELEN, P., HOFMANN, K. P., MARAN, J., LAZARIDIS, I., MITTNIK, A., MCCORMICK, M., KRAUSE, J., and REICH, D. 2018. Reconciling material cultures in archaeology with genetic data: The nomenclature of clusters emerging from archaeogenomic analysis. Scientific Reports 8, 13003. https://doi.org/10.1038/s41598-018-31123-z (accessed November 2018).

ELLIS, C. 1986. The postglacial molluscan succession of the South Downs dry valley, in G. de G. Sieveking, and M. B. Hart (eds.), *The Scientific Study of Flint and Chert*, 175-84. Cambridge University Press, Cambridge.

ERNST, T, M. 1999. Land, Stories and Resources: Discourse and Entification in Onabasulu Modernity, *American Anthropologist*, 101: 1.88-97.

EVANS, E., POLLARD., J. and KNIGHT, M. 1999. Life in woods: Tree-throws, 'settlement and Forest cognition, *Oxford Journal of Archaeology,* 18: 3. 241-54.

EVANS, J.G. 1972. *Land Snails in Archaeology*, London: Seminar Press.

FARRELL, M., BUNTING, M. J., STURT, F., GRANT, M. J., AABERSBERG, G., BATCHELOR, R., BROWN, A., DRUCE, D., HILL, T., HOLLINRAKE, A., JONES, J., TINSLEY, H., BAYLISS, A., MARSHALL, P., RICHER, S., and WHITTLE, A. 2019. Opening the Woods: Towards a Quantification of Neolithic Clearance Around the Somerset Levels and Moors. *Journal of Archaeological Method and Theory*. https://doi.org/10.1007/s10816-019-09427-9 Accessed March 2020.

FELDER P. J., 1981. Prehistoric mining at Rijkholt- St. Geertruid (Netherlands) and Grimes Graves (England), in F. H. G, Engelen (ed.), *Third International Symposium on Flint, 24-27 Mei 1979 – Maastricht,* Maastricht, Nederlandse Geologische Vereniging (*Staringia* 6). 57-62.

FELDER, P. J., RADEMAKERS, P. C., and GROOTH, DE. M. E. 1998. Excavations of Prehistoric Flint Mines at Rijckholt-St. Geertruid (Limburg, The Netherlands) by the 'Prehistoric Flint Mines Working Group' of the Dutch Geological Society, Limburg Section, *Archäologische Berichte 12*, Bonn.

FIELD, D. 1982. Miniature Axe from Cissbury, *The Sussex Archaeological Collections,* 120. 205-207.

- 1997. The Landscape of Extraction: Aspects of the Procurement of Raw Material in the Neolithic, in P. Topping (ed), *Neolithic Landscapes: Neolithic Studies Group Seminars Papers 2*, Oxford Monograph 86. Oxbow Books: Oxford.

FIELD, N., MATTHEWS, C., SMITH. I., and EWBANK, J. 1964. New Neolithic Sites in Dorset and Bedfordshire, with a Note on the Distribution of Neolithic Storage-Pits in Britain, *Proceedings of the Prehistoric Society,* 30. 352-381.

FINLAYSON, B., and WARREN, G. (eds.). 2010. *Landscapes in Transition*, Oxford and Oakville: Oxbow Books.

FITZPATRICK, A. P., POWELL, A. B., and ALLEN, M. J. 2008. *Archaeological excavations on the route of the A27 Westhampnett bypass, West Sussex, 1992. Volume 1, Late Upper Palaeolithic-Anglo-Saxon*, Wessex Archaeology Report 21. Salisbury, Wessex Archaeology.

FOWLER, C. 2010. Pattern and diversity in the Early Neolithic mortuary practices of Britain and Ireland: contextualising the treatment of the dead, *Documenta Praehistorica,* 1-22.

FOWLER, M. J. F. 1987. Over Wallop - Martin's Clump, *Hampshire County Council Archaeology in Hampshire, annual report,* 4.

FRENCH, C., LEWIS., H. ALLEN, M. J. GREEN, M. SCAIFE, R. G., and GARDINER, J. (eds.) 2007. *Prehistoric Landscape Development and Human Impact in the Upper Allen Valley, Cranborne Chase, Dorset,* Cambridge.

GARDINER, J. 1988. *The Composition and Distribution of Neolithic Surface Flint Assemblages in Central Southern England.* Unpublished PhD thesis, University of Reading. Wessex Archaeology Reports 32, Wessex Archaeology.

- 1990. Flint Procurement and Neolithic Axe Production on the South Downs: A Re-Assessment, *Oxford Journal of Archaeology,* 9: 2. 119-40.

GARLAND, N., and ANDERSON-WHYMARK, H. 2016, Mesolithic and Late Neolithic/ Bronze Age Activity on the Site of the American Express Community Stadium, Falmer, East Sussex, *Sussex Archaeological Collections*, 154. 1-44.

GARROW, D., BEADSMOORE, E., and M. KNIGHT. 2005. Pit clusters and the temporality of occupation: an Early Neolithic Site at Kilverstone, Thetford, Norfolk, *Proceedings of the Prehistoric Society,* 71. 139-57.

GARROW, D., and STURT, F. 2011. Grey waters bright with Neolithic Argonauts? Maritime connections and the Mesolithic-Neolithic transition with the 'western seaways' of Britain, c. 5000-3500 BC, *Antiquity* 85. 59-72.

- 2017. The Mesolithic-Neolithic Transition in the Channel Islands: Maritime and terrestrial perspectives, *Oxford Journal of Archaeology,* 36: 1. 3-23.

GARROW, D. 2007. Placing pits: Landscape Occupation and Depositional Practice During the Neolithic in East Anglia, *Proceedings of the Prehistoric Society,* 73. 1-24.

- 2010. The temporality of materials: occupation practices in eastern England during the 5th and 4th millennia BC, in B. Finlayson and G. Warren (eds.), *Landscapes in Transition,* Oxford: Oxbow Books, *Council for British Research in the Levant Supplementary Series* 8. 208-18.

GOODMAN, C., CURWEN, E., and CURWEN, E. C. 1924. Blackpatch Flint Mine Excavation 1922: Report Prepared on Behalf of the Worthing Archaeological Society, *Sussex Archaeological Collections,* 65. 69-111.

GRÄTZ, T. 2013. The "frontier" revisited: gold mining camps and mining communities in West Africa, ZMO Working Papers, 10.

GREEN, M. and ALLEN, M. 1997: An early prehistoric shaft on Cranborne Chase, *Oxford Journal of Archaeology,* 16, 121-32.

GREEN, S. W., and Perlman, S. M. (eds.), *The Archaeology of Frontiers and Boundaries*, Orlando: Academic Press.

GREENWALL, W. 1870. On the opening of Grimes Graves in Norfolk, *Journal of the Ethnological Society of London,* New Series 2. 419-39.

GRIFFITHS, S. 2014. Points in Time: the Mesolithic-Neolithic transition and the chronology of late rod microliths in Britain, *Oxford Journal of Archaeology,* 33: 3. 221–243.

GRON, K., ROWLEY CONWY, P., FERNANDEZ DOMINGUEZ, E., GRÖCKE, D., MONTGOMERY, J., NOWELL, G., and PATTERSON, W. 2018. A Meeting in the Forest: Hunters and Farmers at the Coneybury 'Anomaly', Wiltshire, *Proceedings of the Prehistoric Society*, 84. 111-144. 203-218.

GUMIAUX, G., GAPAIS, D., BRUN, J. P., CHANTRAINE, J., and RUFFET, G. 2004. Tectonic history of the Hercynian Armorican Shear belt (Brittany, France), Geodinamica Acta, 17: 4.

HARDING, J. 2006. Pit-digging, occupation and structured deposition on Rudston Wold, eastern Yorkshire, *Oxford Journal of Archaeology,* 25. 109–26.

HAMILTON, S., and J. MANLEY. 2001. Hill-forts, Monumentality and Place: A Chronological and Topographic Review of First Millennium BC Hill Forts of South East England, in, *European Journal of Archaeology,* 4: 1. 7-42.

HARDING, P., and YOUNG, R. 1979. Reconstruction of the hafting methods and function of stone implements. In, T.H. McK Clough and W.A. Cummins (eds.), *Stone axe studies. Archaeological, petrological, experimental and ethnographic*, Council for British Archaeology Research Report 23. 102–105.

HARDING, P. 2000. A Mesolithic site at Rock Common, Washington, West Sussex, *Sussex Archaeological Collections,* 138: 29-48.

HARRIS, O. 2009. Making places matter in Early Neolithic Dorset, *Oxford Journal of Archaeology,* 28:2. 111-123.

HARRIS, R. B. 2003. *The Making of the High Weald,* High Weald AONB Joint Advisory Committee.

HARRISON, J. P. 1877a. On marks found upon chalk at Cissbury, *Journal of the Royal Anthropological Institute,* 6. 263-71.

1877b. Report on Some Further Discoveries at Cissbury, *Journal of the Royal Anthropological Institute,* 6. 430-42.

- 1878. Additional Discoveries at Cissbury, *Journal of the Royal Anthropological Institute,* 7. 412-33.

HART, D. 2010. *A Post-Excavation Assessment and Updated Project Design for Excavations at Seaview Avenue, Peacehaven, East Sussex*, Unpublished Report No. 2010083. Archaeology South East.

- 2010a. *A Post-Excavation Assessment and Updated Project Design for Excavations at the Brighton and Hove Wastewater Treatment Works, Lower Hoddern Farm Peacehaven, East Sussex (Stage 3).* Unpublished Report No. 2010098. Archaeology South East.

- 2015. *Around the Ancient Track: Archaeological Excavations for the Brighton and Hove Water Treatment Works and Adjacent Housing at Peacehaven, East Sussex,* Spoil Heap Publications.

HARTRIDGE, R. 1978. Excavations at the prehistoric and Romano-British site on Slonk Hill, Shoreham, Sussex, *Sussex Archaeological Collections*, 116. 69-141.

HAYDEN, C. 2007. White Horse Stone and the Earliest Neolithic in the South East. *South East Research Framework Resource Assessment Seminar.* Available at: https://shareweb.kent.gov.uk/Documents/Leisure-and-culture/heritage/serf-seminar-papers-neolithic-and-early-bronze-age/chris-hayden.pdf (accessed March 2 2015).

HEALY, F., MARSHALL, P., BAYLISS, A., COOK, G., BRONK RAMSEY, C., VAN DER PLICHT, J., and DUNBAR, E. 2014. *Grime's Graves, Weeting-with-Broomhill, Norfolk: radiocarbon dating and chronological modelling*. English Heritage Research Report No 27-2014. London: English Heritage

HEALY, F. 2008. Causewayed Enclosures and the Early Neolithic: The Chronology and Character of Monument Building and Settlement in Kent, Surrey and Sussex in the Early to Mid-4th Millennium cal BC. *South East Research Framework Resource Assessment Seminar*. Available at: https://shareweb.kent.gov.uk/Documents/Leisure-and-culture/heritage/serf-seminar-papers-neolithic-and-early-bronze-age/frances-healy.pdf (accessed 16 November 2014).

HERNE, A. 1998. A time and a place for the Grimston Bowl, in J. C. Barrett and I. A. Kinnes (eds.), *The Archaeology of Context in the Neolithic and Bronze Age. Recent trends,* Sheffield: Department of Archaeology and Prehistory, University of Sheffield. 9-29.

HOFMANN, D. 2015 What Have Genetics Ever Done for Us? The Implications of aDNA Data for Interpreting Identity in Early Neolithic Central Europe, *European Journal of Archaeology*, 18: 3, 454-476.

HOLGATE, R. D. C., HOLDEN, E. W., and H. G. HOLDEN. 1986. An early Mesolithic site and prehistoric flintwork from Graffham Common and neighbouring areas on the Lower Greensand, West Sussex, *Sussex Archaeological Collections*, 124, 1–8.

HOLGATE, R. 1988a. A review of Neolithic domestic activity in southern Britain, in J. Barrett and I. Kinnes (eds.), *The Archaeology of Context in the Neolithic and Early Bronze Age: recent trends,* Sheffield: Department of Archaeology and Prehistory. 104-13.

- 1988b. Further investigations at the later Neolithic domestic site and Napoleonic 'Camp' at Bullock Down, Near Eastbourne, East Sussex, *Sussex Archaeological Collections,* 126. 21–30.

- 1989. *The Neolithic Flint Mine Mines in Sussex: A Plough Damage Assessment and Site Management Report*. An Unpublished Report.

- 1991. *Prehistoric Flint Mines,* Shire Publications Ltd.

- 1995a. Neolithic Flint Mining in Britain, *Archaeologia Polona,* 33, 133-61.

- 1995b. Long Down Near Chichester, West Sussex, *Archaeologia Polona,* 33. 350-52.

- 1995c: Harrow Hill near Findon, West Sussex, *Archaeologia Polona,* 33. 347-350.

- 2003. Late Glacial and Post-Glacial hunter-gatherers in Sussex, in D. Rudling (ed.), *The Archaeology of Sussex to AD2000,* Heritage Marketing and Publications Ltd. 29-38.

- 2004. Managing change: the Mesolithic-Neolithic transition in south-east England, in J. Cotton and A. Field (eds.), *Towards a New Stone Age: aspects of the Neolithic in south-east England.* CBA Research Report 137. 24-28.

-2019. Flint-working areas and bifacial implement production at the Neolithic flint-mining sites in southern and eastern England, in A. Teather., P. Topping and J. Baczkowski *Mining and Quarrying in Europe: A social perspective*, Neolithic Studies Group Seminar Papers, 16. Oxford and Philadelphia: Oxbow Books. 1-20.

HOLLEYMAN, G. 1937. Harrow Hill Excavations, 1936, *Sussex Archaeological Collections,* 78. 230-51.

HUBERT, F. 1978. Une néolithique à silex au Camp-à-Cayaux de Spiennes, *Archaeologica Belgica*, 167. 5-44.

- 1980. Le camp Michesberg de Spiennes. *Archaeologica Belgica*, 223. 35-38.

INGOLD, I. 1993. The Temporality of the Landscape, *World Archaeology: Conceptions of Time and Ancient Society*, 25: 2. 152-174.

- 2000. *The Perception of the Environment: essays in livelihood, dwelling and skill*, London and New York: Routledge.

- 2006. Rethinking the animate, re-animating thought. Ethnos 71. 9–20.

- 2007. Material against materiality. *Archaeological Dialogues*, 14. 1-16.

INSOLL, T. 2006. Shrine Franchising and the Neolithic in the British Isles: Some Observations based upon the Tallensi, Northern Ghana, *Cambridge Archaeological Journal*, 16: 2. 223-238.

JACOBI, R. M., and TEBBUTT, C. F. 1981. A Late Mesolithic rock shelter at High Hurstwood, Sussex, *Sussex Archaeological Collections,* 119. 1–36.

JACOBI, R. M. 1976. Britain inside and outside Mesolithic Europe, *Proceedings of the Prehistoric Society,* 42. 67-84.

- 1978. The Mesolithic of Sussex, in P. L. Drewett (ed.), *Archaeology in Sussex to AD1500,* CBA Research Report 29. 15-22.

JENSEN, J. 2007. *The Prehistory of Denmark,* Taylor and Francis.

JONES, D. 2016. Mesolithic, in Moore, D., Allen, M. J and D. Rudling, *Archaeology of the Ouse Valley, Sussex, to AD 1500: A tribute to Dudley Moore and Archaeology at Sussex University CCE,* Archaeopress Publishing Ltd, Banbury. 27-37.

JONES, P. 2013. *A Mesolithic 'Persistent Place' at North Park Farm, Bletchingley, Surrey,* SpoilHeap Monograph 8.

KERIG, T., and SHENNAN, S. 2015. *Connecting Networks: Characterising Contact by Measuring Lithic Exchange in the European Neolithic,* Archaeopress Publishing Ltd. Oxford.

KING, R., and D. KING. 2010. *St Richards Hospital, Chichester, West Sussex, Archaeological Evaluation and Watching Brief*, Unpublished Report No. 507.

LANE FOX, A. 1876. Excavations in Cissbury Camp, Sussex: Being a Report of the Exploration Committee of the Anthropological Institute for the Year 1875, *The Journal of the Anthropological Institute of Great Britain and Ireland,* 5. 357-90.

LARSSON, M., and DEBERT, J. (eds) 2013. *North West Europe in Transition: The Early Neolithic in Britain and South Sweden,* BAR International Series 2475, Oxford; Archaeopress.

LEARY, J., and KADOR, K. 2016. *Moving on in Neolithic Studies, understanding mobile lives*, Neolithic Studies Group Seminar Paper, 14. Oxford and Philadelphia, Oxbow Books.

LEARY, J. (ed,). 2014. *Past mobilities: Archaeological approaches to movement and mobility,* Farnham, Ashgate Publishing.

LECH, J. 2008. In the realm of the Devil, *Academia* 18: 2. 16-19.

MACPHIL, R. I., and GOLBER, P. 2018. *Applied soils and micromorphology in Archaeology,* Cambridge University Press, UK.

MANOLAKAKIS, L., and GILIGNY, F. 2011. Territories and lithic resources in the Paris basin during the Middle Neolithic (4200-3600 BC), in M. Capote, S. Consegrua, P. Diaz-del-Rio and Xavier Terradas (eds.), *Proceedings of the 2nd International Conference of the UISPP Commission on Flint Mining in Pre- and Protohistoric Times*, Archaeopress. 45-50.

MARTINEAU, R., IMBEAUX, M., AFFOLTER, J., CHARPY, J-J,. BOSTYN, F., and A, DUMONTET. 2019. The Neolithic Flint Mines of Les Marais de Saint-Gond and La Côte des Blancs (Marne, France), in A. Collet and A. Hauzer. *Mining and Quarrying. Geological Characterisation, Knapping Processes and Distribution Networks during Pre- and Protohistoric Times, Proceedings of the 7th International Conference of the USIPP Commission on flint mining in Pre- and Protohistoric Times. Mons and Spiennes, 28th Sept – 1st Oct 2016,* Anthropologica et Praehistorica 128/2017, Royal Belgian Institute of Natural Sciences. 101-118.

McBRYDE, I. 1984. Kulin Greenstone Quarries: The Social Contexts of Production and Distribution for the Mt William site, *World Archaeology* 16. 267-85.

McNABB, J., FELDER P. J., KINNES, I., and SIEVEKING, G. 1996. An Archive Report on Recent Excavations at Harrow Hill, Sussex, *Sussex Archaeological Collections,* 134. 21-37.

McNEIL, B. 2011. *Combating mountaintop removal: new directions in the fight against big coal*. Urbana: University of Illinois Press.

MERCER, R., and HEALY, F. 2008. *Hambledon Hill, Dorset, England: Excavation and survey of a Neolithic monument complex and its surrounding landscape, Vol 1*, English Heritage, Archaeological Reports.

MILLNER, N., CRAIG, O. E., BAILEY, G. N., PEDERSEN, K. and ANDERSEN, S. H. 2004. Something fishy in the Neolithic? A re-evaluation of stable isotope analysis of Mesolithic and Neolithic coastal populations, *Antiquity,* 78. 9-22.

MOORE, D., RUDLING, D., and ALLEN, M. A. 2016. *Archaeology of the Ouse Valley, Sussex, to AD 1500,* Archaeopress Archaeology.

MORTIMOE, R. N., and C.J. WOOD. 1986. The distribution of flint in the English Chalk, with particular reference to the ‘Brandon Flint Series’ and the high Turonian flint maximum, in G. de G. Sieveking. and M. B. Hart (eds.), *The Scientific Study of Flint and Chert*, Cambridge University Press, Cambridge. 7–20.

MORTIMORE, R. N. 1986. Stratigraphy of the Upper Cretaceous White Chalk of Sussex, *Proceedings of the Geologists' Association*, 97: 2. 97-139.

MULLIN, D., BIDDULPH, E., and BROWN, R. 2010. A Bronze Age settlement, Roman Structures and a field system at Hassocks, West Sussex, *Sussex Archaeological Collections,* 148. 7-17.

NOWELL, D. 2007. Chalk and landscape of the South Downs, England, *Geology Today*, 23. 147-152.

OSWALD. Q., DYER., C. and BARBER, M. 2001. *The Creation of Monuments: Neolithic causewayed enclosures in the British Isles,* Swindon, English Heritage.

OSWALD, A. 1994. Harrow Hill, West Sussex, *Industry and Enclosure in the Neolithic* Project, RCH01/113, Royal Commission on the Historical Monuments of England.

PATON, R. 1994. 1994. Speaking through stones: a study from northern Australia, *World Archaeology*, 26. 172-84.

PARKER PEARSON, M., and RICHARDS, C. (eds.) *Architecture and Order: Approaches to Social Space*, London and New York: Routledge.

PEACOCK, D., and CUTLER, L. 2010. A Neolithic voyage, *The International Journal of Nautical* Archaeology, 39:1. 116–24

PEACOCK, D. 1987. Iron Age and Roman Quern Production at Lodsworth, West Sussex, *Antiquaries Journal,* 67. 61-87.

PETREQUIN P., SHERIDAN, A., CASSEN, S., ERRERA, M., GAUTHIER, E., KLASSEN, L., LE MAUX, N., and Y, PAILLER. 2008. Neolithic Alpine axeheads, from the Continent to Great Britain, the Isle of Man and Ireland, in : H. Fokkens, B. J. Coles, A.L. Van Gijn, J. P. Klejne, H. H. Ponjee and C. G. Slappendel (ed.), *Between foraging and farming*, Analecta Praehistorica Leidensia, 40, Leiden, Leiden University: 262-279.

PETREQUIN, P., SHERIDAN, A., CASSEN, S., ERRERA, M., GAUTHIER, E., KLASSEN, L., LE MAUX, N., PAILLER, Y., PETREQUIN, A. M., and ROSSY, M. 2011. Eclogite or jadeitite : the two colours involved in the tranfer of alpine axeheads in western Europe, in : *Stone Axe Studies*, Oxford, III, Oxbow : 52-82.

PHILIPS, P. 1979. Stone Axes in Ethnographic Situations: Some Examples from New Guinea and the Solomon Islands, St*one Axe Studies,* 23. 108-12.

PIGGOTT, S. 1954. *The Neolithic Cultures of the British Isles: A Study of the Stone-using Agricultural Communities of Britain in the Second Millennium B.C.* Cambridge University Press.

-1965. *Ancient Europe from the beginnings of agriculture to classical antiquity,* Edinburgh University Press.

PINE, J. 2013. A re-investigation of Late Iron Age and Roman iron production, and Saxon activity, at Rathlin Road, Crawley, *Sussex Archaeological Collections,* 151. 13-25.

PIJPERS, R., and T.H. ERIKSEN (eds.) 2018. *Mining encounters: extractive industries in an overheated world*. London: Pluto Press.

PITTS, M. 1980. A gazetteer of Mesolithic finds on the West Sussex coastal plain, *Sussex Archaeological Collections,*118. 153-62.

PLUCIENNIK, M. 2008. Hunter-Gathers to Farmers, in A. Jones (ed.), *Prehistoric Europe: Theory and Practice*, Wiley-Blakewell. 16-34.

POLLARD, J. 1999. These places have the moments: thoughts of settlement practices in the British Neolithic, in *Making Place in the Prehistoric World: Themes in Settlement Archaeology,* London: University College Press. 76-93.

- 2001. The aesthetic of depositional practice, *World Archaeology,* 33. 315-33.

POOLE, C., BIDDULPH, E., and CHAMPNESS, C. 2015. North-east Bexhill Gateway Road and East Sussex Business centre. Post Excavation Assessment, Issue 3 Oxford Archaeology.

POPE, M., WELLS, C., RUDLNGS, D., DOHERTY, A., PRINGLE, S., RAYNOR, L., and TOMBAR, R., 2012. Commanding position: high-status Late Iron Age and Romano-British occupation of a Wealden ridge at Beedings Hill, West Sussex, *Sussex Archaeological Collections,* 150. 71-95.

PRESTON, P. R., and KABOR, T. 2018. Approaches to Interpreting Mesolithic Mobility and Settlement in Britain and Ireland, *Journal of World Prehistory*, 31: 321–345.

PULL, J. 1932. *The Flint Miners of Blackpatch,* London: Williams and Norgate Ltd.

1933a. Some Discoveries at Findon: 1: The Prehistoric Antiquities of Church Hill, *Sussex County Magazine,* 7. 470-2.

- 1933b. Some Discoveries at Findon: 4: The Flint Industries, *Sussex County Magazine,* 7. 653-55.

- 1933c. Some Discoveries at Findon: 5: The Flint Implements. *Sussex County Magazine,* 7, 727-30.

- 1933d. Some Discoveries at Findon: 6: The Flint Mines. *Sussex County Magazine,* 7. 810 - 4.

- 1953. Further Discoveries at Church Hill, Findon, *Sussex County Magazine,* 27. 15-21.

- 1956. *Notes on the Cissbury Excavations, The John Pull Collection*, Worthing Museum: Acc. No 1961/1586.

RADEMAKERS, P. C. M. 1998. Aanpassingen van de Meetmetoden, in P. C. M. Rademakers (ed.) *De Prehistorische Vuursteenmijnen: van Ryckholt – St. Geertruid*: 57-68. Limburg: Nederlandse Geologische Vereniging Afd.

REYNOLDS, F. 2012. Totemism and Food Taboos in the Early Neolithic: A Feast of Roe Deer at the Coneybury 'Anomaly', Wiltshire, Southern Britain, in, H. Anderson-Whymark and J. Thomas (eds.), *Regional Perspectives on Neolithic Pit Deposition: Beyond the Mundane,* Neolithic Studies Group Seminar Papers 12. Oxford: Oxbow Books. 171-86.

RICCOBONI, P. 2008. *Archaeological Investigations at Keymer and Seaview Avenues, Peacehaven, East Sussex: Post Excavation Assessment and Project Design for publication*. Unpublished Report No.2008029. Archaeology South East.

RICHARDS, M. P., and SCHULTING, R. 2006. Touch not the fish: the Mesolithic-Neolithic change of diet and its significance, *Antiquity*. 80: 308. 444-456.

RIDE, D. J., and JAMES, D. J. 1989. An account of an excavation of a prehistoric flint mine at Martin's Clump, Over Wallop, Hampshire, 1954-5, *Proceedings of the Hampshire Field Club and Archaeological Society*, 45. 213-5.

ROBINSON, M. 2014. The ecodynamics of clearance in the British Neolithic, *Environmental Archaeology*, 19: 3. 291-297.

ROWLEY-CONWY, P. 2004. How the West was Lost: A Reconstruction of Agricultural Origins Britain, Ireland, and Southern Scandinavia, *Current Anthropology,* 45. 83-113.

- 2011. Westward Ho! The Spread of Agriculturalism from Central Europe to the Atlantic, *Current Anthropology, The Origins of Agriculture: New Data, New Ideas*, 52, 4. 431-451.

RUSSELL, M. 2000. *Flint Mines in Neolithic Britain,* Tempus Publishing Ltd.

- 2001. Excavations at Church Hill, 1922-9. *Rough Quarries, Rocks and Hills: John Pull and the Neolithic Flint Mines of Sussex,* Bournemouth University Occasional Paper 6. Oxford: Oxbow Books.

SALISBURY, E. F. 1961. Prehistoric Flint Mines on Long Down, *Sussex Archaeology Collections,* 99. 66-73.

SAVILLE, A (ed.). 2011. *Flint and Stone in the Neolithic Period*, Neolithic Studies Group Seminar Papers, Oxbow Books, Oxford, UK.

SCHAUER, P,. BEVAN, A., SHENNAN, S., EDINBOROUGH, K., KERIG, T., and PEARSON, M. P. 2019. British Neolithic Axehead Distributions and Their Implications, *Journal of Archaeological Method and Theory*, 27. 836–859.

SARAUW, T. 2007. Danish Bell Beaker pottery and flint daggers – the display of social identities? *European Journal of Archaeology*, 11:1. 23-47.

- 1998. Slighting the sea: the transition to farming in northwest Europe. *Documenta Praehistorica* 25. 203-18.

- 2013. On the northwestern fringes: Earlier Neolithic subsistence in Britain and Ireland as seen through faunal remains and stable isotopes, in S. Colledge., J. Connolly., K. Dobney., K. Manning and S. Shennan (eds.), *The Origins and Spread of Stock-Keeping in the Near East and Europe*, Walnut Creek, California: Left Coast Press. 313-338.

SEAGER-THOMAS, M. 2010. *The Drayton Early Neolithic Pottery Assemblage. The West Sussex Coastal Plain's first pottery*, Artefact Services Technical Reports 23.

- 2010. The West Sussex Coastal Plain: the Bronze and Earlier Iron Age Pottery in Context. Unpublished.

SHARPLES, N. 1991. *Maiden Castle*. English Heritage, London.

SHERIDAN, A. 2004. Neolithic connections along and across the Irish Sea, in V. Cummings and C. Fowler (eds.) *The Neolithic of the Irish Sea*, 9–21. Oxford: Oxbow Books.

- 2010. The Neolithization of Britain and Ireland: The 'Big Picture', in B. Finlayson. and G, Warren (eds.), *Landscapes in Transition,* Oxbow Books. 89-106.

- 2011. The Early Neolithic of south-west England: new insights and new question, in S. M. Pearce (ed.), *Recent Archaeological Work in South-Western Britain: Papers in Honour of Henrietta Quinnell*, British Archaeological Reports British Series 584. 21-39.

SHENNAN, S., BEVAN, A., EDINBOROUGH, K., KERIG, T., PEARSON, M. P., and P. SCHAUER. 2017. Supply and Demand in Prehistory? Economics of Neolithic Mining in NW Europe (NEOMINE). *Archaeology International*, 20. 74–79.

SIEVEKING, G. de, G., BUSH, P., FEGUSON, J., CRADDOCK, P. T., HUGHES, M. J., and COWELL, M. R. 1972. Prehistoric Flint Mines and their Identification as Sources of Raw Material, *Archaeometry* 14: 2. 151-76.

SIEVEKING, G, de, G. LONGWORTH, I. H., HUGHES, M. J., CLARK, A. J., and MILLETT, M. 1973. A new survey of Grimes Graves, *Proceedings of the Prehistoric Society*, 39: 182–218.

SIEVEKING, G, de, G., HART, M. B. 1986. *The scientific study of flint and chert: proceedings of the Fourth International Flint Symposium held at Brighton Polytechnic, 10-15 April 1983*, Cambridge (Cambridgeshire); New York: Cambridge University Press.

SØRENSEN, L. 2014. From hunter to farmer in northern Europe – migration and adaption during the Neolithic and Bronze Age, *Acta Archaeologica* 85. 1-1794.

STEVENS, C. J., and FULLER, D. Q. 2012. Did Neolithic farming fail? The case for a Bronze Age agricultural revolution in the British Isles, *Antiquity,* 86. 707-722.

STEVENS, S. 2014. Land North of Arundel Road, Peacehaven, East Sussex. Post-Excavation Assessment and updated Project Design. Report No. 2014302. Archaeology South East.

STONE, J. F. S. 1930. Easton Down, Winterslow, S Wilts, Flint Mine Excavation 1930, *The Wiltshire Archaeological and Natural History Magazine,* 45. 350-65.

- 1933. Excavations at Easton Down, Winterslow, 1931-2, *The Wiltshire Archaeological and Natural History Magazine,* 46. 225-242.

- 1935. Excavations at Easton Down, Winterslow, 1933-4, *The Wiltshire Archaeological and Natural History Magazine,* 47. 68-80.

TABOR, J., BILLINGTON, L., HEALEY, F., and KNIGHT, M. 2016. Early Neolithic Pits and Artefact Scatters at North Fen, Sutton Gault, Cambridgeshire. *Proceedings of the Prehistoric Society* 82. 161-191.

TAYLOR, A. 2012. Land at North Bersted Phase 6, Bognor Regis, West Sussex: An Archaeological Evaluation for Berkeley Homes (Southern) Limited. Report 07/135c Thames Valley Archaeology Ltd.

TEATHER, A., TOPPING, P., and BACZKOWSKI, J. 2019. *Mining and Quarrying in Europe: A social perspective* Neolithic Studies Group Seminar Papers, 16. Oxbow Books, Oxford and Philadelphia.

TEATHER, A. 2008: *Mining and Materiality in the British Neolithic,* Unpublished PhD thesis, Department of Archaeology and Prehistory University of Sheffield.

- 2011. Interpreting Hidden Chalk Art in Southern British Neolithic Flint Mines. *World Archaeology* 43, 2: 230-51.

- 2016. Mining and Materiality: Neolithic Chalk Artefacts and Their Depositional Contexts in Southern Britain. Archaeopress Archaeology.

- 2019. Radiocarbon dating on flint mining deposits at Blackpatch, Cissbury and Church Hill, Sussex, in Teather, A., Topping, P. and Baczkowski, J. (eds.). 2019. *Mining and Quarrying in Europe: A social perspective* Neolithic Studies Group Seminar Papers, 16. Oxbow Books, Oxford and Philadelphia. 37-48.

THOMAS, K. D. 1982. Neolithic enclosures and woodland habitats on the South Downs in Sussex, England, in S. Limbrey. and M. Bell (eds.), *Archaeological Aspects of Woodland Ecology,* BAR International Series 146.147-70.

- 1989. Vegetation of the British Chalklands in the Flandrian Period: A Response to Bush, in *Journal of Archaeological Science,* 16. 549-53.

THOMAS, R., and RAY, K. 2018. *Britain: The transformation of social worlds*, Oxford: Oxford University Press.

THOMAS, J. 1991. *Rethinking the Neolithic.* Cambridge: Cambridge University Press.

- 1999. *Understanding the Neolithic.* London: Routledge.

- 2003. Thoughts on the 'Repacked' Neolithic Revolution. *Antiquity*, 77(295), 67-74.

- 2004. Current debates on the Mesolithic-Neolithic transition in Britain and Ireland. *Documenta Praehistorica,* Vol 31, 113-30.

- 2007. Mesolithic-Neolithic transitions in Britain: from essence to inhabitation, in A. Whittle. and V. Cummings (ed), *Going Over: The Mesolithic-Neolithic Transition in North-West Europe,* Oxford: British Academy and Oxford University Press. 423-39.

-2008. The Mesolithic-Neolithic Transition in Britain, in J. Pollard (ed), *Prehistoric Britain*, Oxford; Blackwell. 58-89.

-2013. *The Birth of Neolithic Britain: An Interpretive Account.* Oxford University Press.

- 2016. Cattle, consumption and causewayed enclosures (response to Parmenter, Johnson and Outram), *World Archaeology* 48:5. 728–44.

TOPPING, P., and M. LYNOTT. 2005. Miners and Mines, in P. Topping and M. Lynott (eds.), *The Cultural Landscape of Prehistoric Mines*, Oxford: Oxbow. 181-91.

TOPPING, P. 1997. Neolithic Landscapes, *Neolithic Studies Group Seminar Paper 2,* Oxbow Books.

- 2004. The South Downs Flint Mines: Towards an Ethnography of Prehistoric Flint Extraction, in J. Cottam and D. Field (eds.), *Towards a New Stone Age: Aspects of the Neolithic in south-east England,* York, Council for British Archaeology Research Report 137. 177-99.

- 2011a. Prehistoric Extraction: Further Suggestions from Ethnography, in A. Saville (ed.), *Flint and Stone in the Neolithic Period*, Oxbow: Oxford. 273-86.

- 2011b. The Evidence for the Seasonal use of the English Flint Mines, in M. Capote., M. S. Consuegra., P. Diaz-Del-Rio and X. Terrados. 2011. *Proceedings of the UISPP Commission on Flint Mining in Pre- and Protohistoric Times, Madrid, 14-17 October 2009,* Archaeopress, British Archaeological International Series 2260. 35-45.

- 2019. The social context of lithic extraction in Neolithic Britain and Ireland, in Teather, A., Topping, P. and J, Baczkowski (eds.). 2019. *Mining and Quarrying in Europe: A social perspective* Neolithic Studies Group Seminar Papers, 16. Oxbow Books, Oxford and Philadelphia. 179-192.

VALDE-NOWAK, P., and KERNEDER-GUBALA, K. 2019. Mapping the radiolarite outcrops as potential source of raw material in the Stone Age: Characterisation of Polish part of the Pieniny Klippen Belt, in in Collet, A and A. Hauzer. *Mining and Quarrying. Geological Characterisation, Knapping Processes and Distribution Networks during Pre- and Protohistoric Times, Proceedings of the 7th International Conference of the USIPP Commission on flint mining in Pre- and Protohistoric Times. Mons and Spiennes, 28th Sept – 1st Oct 2016,* Anthropologica et Praehistorica 128/2017, Royal Belgian Institute of Natural Sciences. 157-174.

VAN, GIJN. A. 2010. *Flint in Focus: Lithic Biographies in the Neolithic and Bronze Age, Sidestone Press, Leiden.*

VANDER LINDEN, M. 2016. Population history in third-millennium-BC Europe: assessing the contribution of genetics, *World Archaeology*, 48: 5, 714-728.

VINCENT, B. 2019. New data on the flint mines of Commercy and Saint-Mihiel (Meuse, France). *9th international Conference UISPP Commission on Flint Mining in Pre- and Protohistoric Times "The flint mining studies: archaeological excavations – extraction methods – chipping floors – distribution of raw materials and workshop products",* Krzemionki, Poland, 19-21th September 2019.

WADE. A. G. 1922. Ancient Flint Mines at Stoke Down, Sussex. *Proceedings of the Prehistoric Society of East Anglia,* 4, 1. 82-91.

WALLER, M. P., and S. D. HAMILTON. 1998. The vegetational history of the South Downs: Mount Caburn, in, M.P. WALLER (eds.), *The Quartnary of Kent and Sussex: Field Guide.* London: Quaternary Research Association. 115-20.

WALLIS, S. 2011. *Land off Manor Road, Burgess Hill, West Sussex: An Archaeological Evaluation for J S Bloor Homes Ltd,* Unpublished Report 10/92, Thames Valley Archaeological Services Ltd.

WATON, P. V. 1982. Man's impact on the chalklands: some new pollen evidence, in S. Limbrey and M. Bell (eds.), *Archaeological Aspects of Woodland Ecology,* BAR International Series 146. 75-91.

WESSEX ARCHAEOLOGY. 2006. *Blackpatch, Worthing, West Sussex: Archaeological Evaluation and Assessment of Results.* Wessex Archaeology, Report reference 59565.01.

WHEELER, P. 2008. Ideology and Influences Behind the Neolithic Flint Mines of the Southern Britain, in Allard, P. F, Bostyn, F. Giligny and J. Lech (eds.), *Flint Mining in Prehistoric Europe: Interpreting the Archaeological Records: European Association of Archaeologists, 12th Annual Meeting Cracow, Poland 19th-24th*

September 2006, Oxford: Archaeopress, British Archaeological Reports International Series 1891. 155-63.

- 2011. Ideology and context within the European flint-mining tradition, in A. Saville (ed.), *Flint and Stone in the Neolithic Period*, Neolithic Studies Groups Seminar Papers 11, Oxbow Books. 304-15.

WHITTLE, A., BARCLAY, A., BAYLISS, A., McFADYEN, L., SCHULTING, R., and WYSOCKI, M. 2007. Building for the Dead: Events, Processes and Changing Worldviews from the Thirty-eighth to the Thirty-fourth Centuries cal. BC in Southern Britain, *Cambridge Archaeological Journal,* 17: 1. 123-47.

WHITTLE, A., HEALEY, F., and BAYLISS, A: 2011. *Gathering Time: Dating the Early Neolithic Enclosures of Southern Britain and Ireland,* Volume 1 – 2, Oxford: Oxbow Books.

WHITTLE, A.1996. *Europe in the Neolithic: The Creation of New Worlds,* Cambridge University Press.

- 1997. Moving on and moving around: Neolithic settlement mobility, in P. Topping (ed.), *Neolithic Landscapes,* Oxford, 15-22.

1999. The Neolithic period, c. 4000–2500/2200 BC, in J. Hunter and I. Ralston (eds.), *The archaeology of Britain*, London and New York: Routledge. 58–76

- 2003. *The archaeology of people: dimensions of Neolithic life*, London and New York: Routledge.

- 2007a. Going Over: People and their Times, *Proceedings of the British Academy* 144. 617-628.

- 2007b. The temporality of transformation; dating the early development of the southern British Neolithic. *Proceedings of the British Academy,* 144. 377-398.

WILLETT, E. H. 1875. On Flint workings at Cissbury Sussex, *Archaeologia,* 14. 337-48.

WOODBRIDGE, J., FYFE, M., ROBERTS, N., DOWNEY, S., EDINBOROUGH, K., and SHENNAN, S. 2012. The impact of the Neolithic agricultural transition in Britain: a comparison of pollen-based land-cover and archaeological ^{14}C date-inferred population change, *Journal of Archaeological Science* 51. 216-224.

WILLIAMS, S., and HOLGATE, R. 2015. An early Neolithic vessel from Fitz Park, Cockermouth, Cumbria, *Transactions of the Cumberland and Westmorland Antiquarian and Archaeological Society,* 15. 211-254.

WOODCOCK, A. 2003. The archaeological implications of coastal change in Sussex, in, D. Rudling (ed.), *The Archaeology of Sussex to AD2000,* Heritage Marketing and Publications Ltd. 1-17.

WOODWARD, A., and HUNTER, J, 2011. *An Examination of Prehistoric Stone Bracers from Britain*, Oxford: Oxbow Books.

WOODWARD, P. 1991. *The South Dorset Ridgeway Survey and excavations 1977-84,* Dorset Natural History and Archaeological Society. Monograph Series No. 8.

WYSOCKI, M., GRIFFITHS, S., HEDGES, R., BAYLISS, A., HIGHAM, T., FERNANDEZ-JALVO, Y., and WHITTLE, A. 2013. Dates Diet and Dismemberment: Evidence from Coldrum Megalithic Monument, Kent, *Proceedings of the Prehistoric Society,* 79. 61-90.

YOUNG. B., and LAKE, R. D. 1988. *Geology of the country around Brighton and Worthing*, British Geological Survey: London.

Appendices

Appendix 1: Gazetteer of Sussex Flint Mines

Site 1: Blackpatch – Worthing Group.	**List Entry:** 1015880
Location: Patching, West Sussex.	**NGR:** TQ 09400 08786
Bedrock Geology: Tarrant Chalk Member – Chalk. 72-84MYA - Cretaceous Period.	
Size: 20-30 mineshafts.	

Details: A small complex of originally comprised of around 20 shafts located in an area of downland on the westerly side of Blackpatch Hill. Only one excavation of Blackpatch was undertaken, between 1922-30 by John Pull (Pull 1932, Russell 2001), during which some nine shafts were investigated, four flint-working floors and 12 round barrows. The shafts were wide, up to 5.1m in diameter, and connected to an intricate basal system with between four to seven galleries originating from a single shaft. A single large seam of nodular flint was mined, located between 2m to 3.2m of depth. It was noted that the mine workings on Blackpatch were similar in size and form to those on Harrow Hill (Goodman *et el*. 1924), located around 1.5km to the northwest.

In 2005 Wessex Archaeology on behalf of Time Team conduced an archaeological evaluation close to the flint mines in an area that Pull had identified as a containing a series of ‘dwellings’ and ‘huts’. A series of natural hollows and tree-bowls where recorded, and one barrow that Pull had excavated was re-investigated (Wessex 2016).

Dating: Prior to 2019 only a single radiocarbon date of 4490-3810 (95% probability) had been obtained for Blackpatch (Barber *et al*. 1999. 81), from an antler pick excavated from a gallery by Pull.

Teather obtained a further 11 in 2019 on material excavated from Shaft 1 by Pull (Teather 2019). These dates were modeled as part of the Neomine and indicated that mining in Shaft 1 was short-lived, between 3964–3797 cal BC at a 95.4% probability range (Edinborough *et al.* 2019). Two dates from the tops of the shaft were Roman, 1st century AD in date.

Current Condition: Nothing can be seen of the site today as it was bulldozed flat in the 1950’s. The site is out of cultivation.

Reports:
GOODMAN, C., CURWEN, E., and CURWEN, E. C. 1924. Blackpatch Flint Mine Excavation 1922: Report Prepared on Behalf of the Worthing Archaeological Society, *Sussex Archaeological Collections,* 65. 69-111.

PULL, J. 1932. *The Flint Miners of Blackpatch,* London: Williams and Norgate Ltd.

RUSSELL, M. 2001. Excavations at Blackpatch, 1922-32, *Rough Quarries, Rocks and Hills: John Pull and the Neolithic Flint Mines of Sussex,* Bournemouth University Occasional Paper 6. Oxford: Oxbow Books. 24-81.

WESSEX ARCHAEOLOGY. 2006. *Blackpatch, Worthing, West Sussex: Archaeological Evaluation and Assessment of Results,* Wessex Archaeology, Report reference 59565.01

Site 2: Church Hill - Worthing Group.	List Entry: 1015238
Location: Findon, West Sussex.	**NGR:** TQ 11422 08277
Bedrock Geology: Tarrant Chalk Member – Chalk. 72-84MYA - Cretaceous Period.	
Superficial Geology: Clay-with-Flint Formation – Clay, silt, sand and gravel. 23MYA, Quaternary – Neogene Periods.	
Size: 30-40 mineshafts.	

Details: A small mine complex of between thirty-forty mine shafts is located below the eastern summit of Church Hill, on the western side of Findon Valley between the 135 to 145m contours. The only excavation of Church Hill was carried out by Pull, intermittently between 1932-52 (Pull 1993a,b,c,d; 1953: Russell 2001). Pull opened seven mineshaft, a number of pits and a c. 12 round barrows, including a possible Bronze Age roundhouse. The mine features recorded including shafts without galleries and short, curving galleries. The deeper shafts passed through three flint seams, before extracting the fourth at a depth of c. 5.1m.

Dating: The dating of Church Hill has proved problematic. An initial radiocarbon date obtained by the British Museum (Barber *et al.* 1999. 81) from a deer antler gave an early date of 4490-3810 cal BC (95% probability).

A further three date were obtained by Teather (2019) for the Neomine project (Edinborough *et al.* 2019) on material from Shaft 4, excavated by Pull. These indicated that Shaft 4 was open between 2526-1751 cal BC, making it Late Neolithic to Early Bronze age and possibly contemporary with Grimes Graves. No dates for any of the other mines on Church Hill have been obtained.

Current Condition: Modern ploughing continues to destroy evidence of the shafts and associated features, such as working floors and spoil heaps, as such, the site remains on Historic England's, Heritage at Risk Register. The current landowner does not permit access to the mines.

Reports:

Pull, J. 1933a. Some Discoveries at Findon: 1: The Prehistoric Antiquities of Church Hill, *Sussex County Magazine,* 7. 470-2.

- 1933b. Some Discoveries at Findon: 4: The Flint Industries, *Sussex County Magazine,* 7. 653-55.

- 1933c. Some Discoveries at Findon: 5: The Flint Implements, *Sussex County Magazine,* 7, 727-30.

- 1933d. Some Discoveries at Findon: 6: The Flint Mines, *Sussex County Magazine,* 7. 810 - 4.

- 1953. Further Discoveries at Church Hill, Findon, *Sussex County Magazine,* 27. 15-21.

RUSSELL, M. 2001. Excavations at Church Hill, 1933-9, 1946-52, *Rough Quarries, Rocks and Hills: John Pull and the Neolithic Flint Mines of Sussex,* Bournemouth University Occasional Paper 6. Oxford: Oxbow Books. 85-149.

Site 3: Cissbury – Worthing Group.	**List Entry:** 1015817
Location: Findon, West Sussex.	**NGR:** 13953 07947
Bedrock Geology: Newhaven Chalk Formation – Chalk. 72-86MYA Cretaceous Period.	
Superficial Geology: Clay-with-Flint Formation – Clay, silt, sand and gravel. 23MYA, Quaternary – Neogene Periods.	
Size: 250-300 mineshafts across northwestern and southwestern complexes.	

Details: The mine complex on Cissbury is comprised of c. 300 mineshafts. The main area of mining extends westwards below the eastern summit of Cissbury Hill, between the 145 to 165m contours. A second 'southern' mine complex ranges slightly southwestwards along the 125m contours. Cissbury Hill is archaeological complex that is also the location of a large univallate hillfort dated to the Iron Age, probably used between c. 400-100 cal BC, an extensive field system associated with the hillfort and also an late Roman settlement.

Cissbury has been the subject of several major episodes of excavation dating back to the birth of modern archaeology in the 19th century. The most notably excavations were undertaken by Ernest Willet (1880) Augustus Lane Fox (1876) and John Park Harrison (1877a, 1877b, 1878), who investigated the shafts and galleries of c. 15 mines. These excavations did much to establish knowledge of Early Neolithic flint mining and noteworthy finds included human burials, chalk engraving, Carinated Bowl pottery, numerous axes in various stages of production and antler picks (Lane-1876).

A second major period of excavation began by Pull on the southern mine complex in 1952 and continued until 1955 (Pull 1953, 1956; Pull in Russell 2002. 170-90). Pull opened a total of fur shafts and their associated galleries. Significant finds from Shaft 27 included more graffito, the fully articulated burial of an adult female and a void left from a possible wooden mining implement, or ladder. These excavations demonstrated the Cissbury mines are extensive and complicated, with flint extracted from several flint seams, including the sixth located at a depth of 12.8m. The findings from Pull's excavation were never fully published.

A geophysical survey was conducted by Archaeological South East (ASE) in 2014 on the southern flank of Cissbury Hill recorded anomalies possibly relating to mineshafts (J. Cook pers. comm 2016). Although it is noted these were singular features and not part of a complex and could therefore represent pits, or Medieval chalk extraction.

Dating: Three dates were obtained by the British Museum on material excavated by Pull and Park Harrison, which indicated mining activity between 3910-2920 cal BC. Two further dates were obtained by Barber *et al.* 1999, ranging from between 4040-3360 cal BC (Barbet *et al.* 1999). Finally, the Neomine project obtained a further six radiocarbon dates from Shaft 27. Overall, modeling of the 2019 radiocarbon dates, and previous dates indicate a start date range of 4200–3650 cal BC at 95%, and end date 3500–2950 cal BC at 95% (Edinborough *et al.* 2019). In consideration of the large amount of mineshafts on Cissbury, it is probable that there is chronologically variation between areas of the mine complex, with earlier and later periods of mining.

Current Condition:
The site is well preserved and currently managed by the National Trust. The workings of around 250 mineshafts are still visible and the majority of the hill is open-access.

Reports:
HARRISON, J. P. 1877a. On marks found upon chalk at Cissbury. *Journal of the Royal Anthropological Institute,* 6. 263-71.

1877b. Report on Some Further Discoveries at Cissbury, *Journal of the Royal Anthropological Institute,* 6. 430-42.

- 1878. Additional Discoveries at Cissbury. *Journal of the Royal Anthropological Institute,* 7. 412-33.

LANE FOX, A. 1876. Excavations in Cissbury Camp, Sussex: Being a Report of the Exploration Committee of the Anthropological Institute for the Year 1875, *The Journal of the Anthropological Institute of Great Britain and Ireland,* 5. 357-90.

PULL, J. 1953. Further Discoveries at Church Hill, Findon, *Sussex County Magazine,* 27. 15-21.

- 1956. *Notes on the Cissbury Excavations, The John Pull Collection*, Worthing Museum: Acc. No 1961/1586.

RUSSELL, M 2001. Excavations at Cissbury, 1952-6. *Rough Quarries, Rocks and Hills: John Pull and the Neolithic Flint Mines of Sussex,* Bournemouth University Occasional Paper 6. Oxford: Oxbow Books. 170-190.

WILLETT, E. H. 1875. On Flint workings at Cissbury Sussex, *Archaeologia,* 14. 337-48.

Site 4: Harrow Hill – Worthing Group	**List Entry:** 1015239
Location: Angmering, West Sussex	**NGR:** TQ 08162 09986
Bedrock Geology: North flank of hill: Newhaven Chalk Formation – Chalk. 72-86MYA Cretaceous Period. South flank of hill: Tarrant Chalk Member – Chalk. 72-84MYA - Cretaceous Period.	
Superficial Geology: Clay-with-Flint Formation – Clay, silt, sand and gravel. 23MYA, Quaternary – Neogene Periods.	
Size: 100-130 mineshafts	

Details: Around 100 shafts are located below the summit (186m) of Harrow Hill, extending in a series of terraces down its eastern side. The mines are located between the 150 to 160m contours. A dry valley separates Harrow Hill from the Blackpatch mines, c. 1.4km to the southeast. The top of Harrow Hill the location of a Late Bronze Age Martin Down enclosure, c. 0.3ha in size.

The mines on Harrow Hill were excavated most notably by the Curwen's between 1924-25 (Curwen and Curwen 1926), in 1926 by George Holleyman (Holleyman 1937) and finally by Gale de Sieveking in 1982 and 1984 (McNabb *et al* 1996). In 1986 a small-scale sample excavation and field walk survey was undertaken by Robin Holgate, which revealed an area of opencast quarries to the southeast of the main deep mines (Holgate 1995; Baczkowski and Holgate 2017). In total five shafts have been opened on Harrow Hill, which revealed the workings to be complex with numerous galleries. The shafts on were large, up to 6.1m in diameter, and connected to complex basal system of linked galleries. Flint was extracted from multiple seams, with a focus on the deepest seam third seam, at 6.8m of depth.

The 1986 excavation uncovered an area of open-cast mining and associated working floors, probably contemporary with the main mine complex (Baczkowski and Holgate 2018). As part of this project in 2019 a geophysical and walkover survey established the presence of ploughed out mineshafts and more working floors to the south of the main complex.

Dating: A total of seven radiocarbon dates were obtained by the British Museum, along with another two by Barber et al. 1999 (1999. 82). These were not modeled during the Neomine Project, but indicate that mining ranged from between c. 4200-3370 cal BC.

Current Condition: The mine complex and enclosure is well preserved and there are noticeable amounts of mining spoil across Harrow Hill. It is not possible to access the mines without permission. Harrow Hill forms part of the Angmering Park Estate, owned by the current Duke of Norfolk.

Reports:
BACZKOWSKI, J., and HOLGATE, R. 2017. Breaking Chalk; The archaeological Investigations of Early Neolithic Flint Mines at Long Down and Harrow Hill, West Sussex, 1984-86. *Sussex Archaeological Collections,* 155. 1-30.

CURWEN, E., and CURWEN, E. C. 1926. Harrow Hill Flint Mine Excavation 1914-5, *Sussex Archaeology Collection,* 67. 103-38.

HOLLEYMAN, G. 1937. Harrow Hill Excavations, 1936, *Sussex Archaeological Collections,* 78. 230-51.

McNABB, J., FELDER, P. J., KINNES, I., and SIEVEKING, G. 1996. An Archive Report on Recent Excavations at Harrow Hill, Sussex, *Sussex Archaeological Collections,* 134. 21-37.

HOLGATE, R. 1995. Harrow Hill near Findon, West Sussex, Archaeologia Polona, 33. 347-350.

Site 5: Long Down – Chichester Group.	List Entry: 1017521
Location: Eartham, West Sussex.	**NGR:** SU 93138 09357
Bedrock Geology: North flank of hill: Newhaven Chalk Formation – Chalk. 72-86MYA Cretaceous Period. South flank of hill: Tarrant Chalk Member – Chalk. 72-84MYA - Cretaceous Period.	
Size: 30-40 mineshafts	

Details:
Long Down is located close to the village of Eartham, on a prominent spur of downland that overlooks a dry valley that runs north from the downs, and south to the Sussex coastal plain. The small mine complex exists of c. 30 mineshafts, with extraction focused on single seam of large tabular flint. Long Down was excavated between 1955-58 by E. F. Salisbury (1961). During these excavations the top of one mineshaft was opened and two 'workshop floors' were excavated. The findings from the excavation have never been fully been published and much of the archive, except the finds, is lost.

In 1986 Robin Holgate re-opened the top of a mineshaft previously excavated by Salisbury, and investigated the tops of a further two probable shafts (Holgate 1995; Baczkowski and Holgate 2017). Also recorded were in situ flint working floors, focused on the production of bi-facial axes, and including several fragments of Early Neolithic pottery. A full geophysics survey of the mine complex undertaken for this project in 2016 and 2019 indicated the probable existence of more working floors and mineshaft, or pits, to the south of the main complex.

Dating: Prior to this project only two radiocarbon dates have been obtained for mining on Long Down, both by Holgate. These dates, along with five radiocarbon dates obtained for this project in collaboration with the Neomine Project indicated that mining on Long Down started 4319–3543 cal BC at 95.4% probability range, but the bulk of the probability for the start date is in the range 4000–3500 cal BC. The end of the phase is in3484–2584 at a 95.4% probability range (Edinborough et al. 2019).

Current Condition: The main mine complex is well preserved, with only plough damage occurring to the east and south. Access is possible via a public footpath from the south of the complex.

Reports:
BACZKOWSKI, J., and HOLGATE, R. 2017. Breaking Chalk; The archaeological Investigations of Early Neolithic Flint Mines at Long Down and Harrow Hill, West Sussex, 1984-86. *Sussex Archaeological Collections,* 155. 1-30.

HOLGATE, R. 1995. Long Down Near Chichester, West Sussex, *Archaeologia Polona,* 33. 350-52.

SALISBURY, E. F. 1961. Prehistoric Flint Mines on Long Down, Sussex Archaeology Collections, 99. 66-73.

Site 6: Stoke Down – Chichester Group.	List Entry: 1018563
Location: Funtington, West Sussex.	**NGR:** SU 83374 09555
Bedrock Geology: North flank of hill: Newhaven Chalk Formation – Chalk. 72-86MYA Cretaceous Period. South flank of hill: Tarrant Chalk Member – Chalk. 72-84MYA - Cretaceous Period.	
Size: 100-150 mineshafts across a western and eastern complex.	

Details: Stoke Down is located below a false crest on a steep northeast facing slope overlooking the valley of the River Lavant to the southeast. In total c. 120 mines have been recorded, located between the 110 to 120m contours. The Stoke Downs mines are divided between two areas, an eastern and western complex.

There has only been one archaeological excavation of the flint mines on Stoke Down, undertaken in 1914 by Major Wade (1922) who opened several mineshafts and their short galleries in the western minefield. Dating of the mines was problematic, with few finds and an absence of diagnostic flintwork. The eastern mine has received no archaeological attention and is yet to be confirmed as a flint mine. A recent aerial assessment of Stoke Down (Barber 2014) has indicated that the eastern minefield is formed of similar crop marks to the western part, and is therefore likely to be an a second western mine complex. The chronology between the two mines is unclear, both mining areas may even represent one continuous mine field.

Dating: No radiocarbon dates have been obtained for Stoke Down. It is widely accepted to date from between 4000-3500 cal BC (Barber et al. 1999; Barber 2005), although this has never been substantiated.

Current Condition: Both areas of mines are in poor condition due to cultivation and Stoke Down is therefore currently on the Heritage at Risk Register.

Reports:

BARBER, M. 2014. Stoke Down, West Sussex: A Survey of the Neolithic Flint Mines and Associated Features. English Heritage Research Report Series, 71-2014.

WADE, A, G. 1922. 'Ancient flint mines at Stoke Down, Sussex', *Proceedings of the Prehistoric Society of East Anglia,* 4: 82-91.

Site 7: Nore Down – Chichester Group.	List Entry: N/A
Location: Compton, West Sussex.	**NGR:** SU 773131
Bedrock Geology: Lewes Nodular Chalk Formation - Chalk. Sedimentary Bedrock formed approximately 86 to 94 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.	
Size: 20 mineshafts	

Details: Nore Down is located on a sharp scarp slope on the west side of a dry valley, near the village of Compton. The earthworks of c. 20 mineshafts have been surveyed, which are oval in shape up to 6m in length. Only one small excavation has taken place on the mines (Aldsworth 1983), which exposed the top of a probable mineshaft. Few artefacts were recovered, but included a small amount of undated flintwork. The excavation was not conclusive and a subsequent survey conducted by the RCHME appears to have confirmed the site as a Neolithic flint mine.

Dating: No radiocarbon dates have been obtained for Nore Down.

Current Condition: The mines are not listed and are currently used for livestock grazing.

Reports: ALDSWORTH, F. G. 1983. Prehistoric flint mines on Nore Down, West Marden, *Sussex Archaeological Collections* 117, 251.

Appendix 2: Long Down Archive

2.1: Surface Collection Report

by Robin Holgate

In October 1984 the density of artifacts lying on the ploughed field surface on the eastern part of the site was recorded by walking transects spaced at 20m (Table 1). Intervals and noting the humanly-struck flints and pottery occurring within each 20m section of these transects. A well-defined dense concentration of axe roughouts and axe-thinning flakes c. 25m in diameter was recorded, along with a widespread low-density scatter of abraded Iron Age and Romano-British potsherds. The flint concentration represents a large flint working area, whilst the pottery probably results from agricultural activities in the 1st millennium BC and 1st-4th centuries AD.

Table 1: Flintwork from the surface collection/recording survey

	Long Down
Flakes/blades	301
Axe-thinning flakes	96
Chips	14
Cores	3
Roughouts/preforms	4
Hammerstones	
Scrapers	2
Cutting blades/flakes	1
Axe	2
Adze	1
Axe	1
Total	425

2.2: Excavation Records

Trench A + A2: Contexts

Order:

Context No.

Matrix colour, Matrix texture, Matrix consistency
Coarse components
Description
Interpretation
Matrix

(21)

Mid-grey brown, loam, friable.
Occasional very small fragments of chalk.
Turf-line – Worm sorted stone free horizon
Same as: (1)
Above: (22)

(22)

Mid grey brown, loam, friable.
Chalk lumps (small-medium) approx. 40% occasional flint nodules often fractured.
Sorted B horizon.
Same as: (2)
Below: (21). Above: (23)

(23)

White, chalk, compact.
Large – medium chalk blocks 80% approx. – occasional flint.
Layer of chalk rubble – with pea grit and degraded chalk at base. Interesting distinction between west east of trench with eastern side containing greater amount of pea grit.
Same as: (3) (24)
Below: (22). Above: (24)

(24)

White, chalk, compact.
Medium large chalk blocks – occasional nodules of flint (small – medium).
Rubble layer covering trench, again as in (23) distinction noticed between E-W of trench.
Same as: (23)

(25)

Creamy white, chalk, compact.
Occasional chalk lumps – small.
Chalk wash revealed after removal of (23) and (24). Divided into (25a) within S. shaft on basis of soil colour difference ((25a) is light brown in colour).
Below: (23) (24). Above: (26) (27)

(26)

White, chalk, compact.
Large chalk blocks.
Layer of chalk blocks revealed below chalk wash (25) in places this wash has become sealed in the crevices between blocks.
Below: (25)

The following SF were found in this fill:
13^ Axe roughout
14^ Axe roughout
15^ Axe roughout
16^ to 27^ Large cores with associated flakes

(27)

Yellowy white, chalk, loose.
Small – medium chalk lumps, 80%
Small - medium chalk lumps in silty chalk – very loose, situated to south of natural chalk pier. This layer may be equivalent to (14) in area A1.
Same as: (14)?. Below: (25). Above: (28)

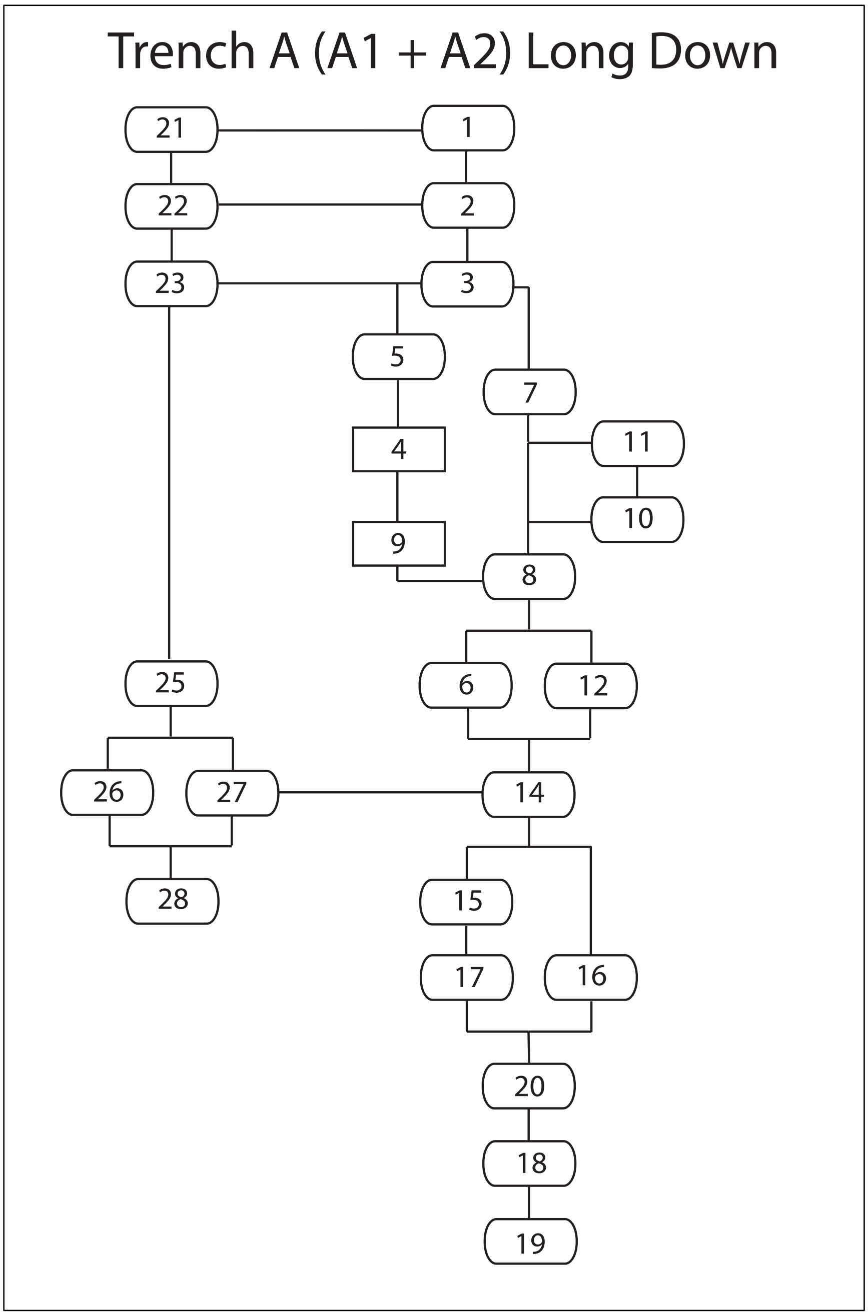
(28)

Light orange brown, silt, loose.
Small – medium chalk lumps – 70%.
Layer of small chalk rubble with greater amount of soil within it than layers above and adjacent.
Below: (27)

(29)

Light orange brown, silt, loose.
Small – medium chalk lumps – 70%
Layer of small chalk rubble with greater amount of soil within it than layers above and adjacent.
Same as (27)?
Below: (17)

Matrix for Trench A + A2



2.3: Excavation Records

Trench C: Contexts

(101)

Brown, loam, friable.

Medium to large flint nodules, occasional chalk lumps and pea grit.

Topsoil dark brown loam. Upper layer consists of small to medium flint nodules and occasional chalk lumps. Lower portion of layer flint nodules comprising to 60% large with increasing amounts of pea gravel.

Modern Plough soil

Above: (102)

(102)

Light brown, loam, friable.

Medium to large flint nodules, 80% of layer and pea grit and chalk fragments.

Light brown loam with large amounts of rubble (flint nodules) chalk lumps and fragments with pea grit.

Iron Age/Bronze Age plough soil.

Below: (101). Above: (103) (104)

(103)

Light greyish brown, loam, friable.

Large flint nodules to medium, small to medium, few pebbles, also large amounts of pea grit, 80% of layer.

Below: (102). Above: (104)

(104)

Light brownish orange, loam, friable.

Small to medium chalk blocks, chalks fragments and flecks, small to large flint nodules, occasional pea grit.

Below: (103) (102). Above (105).

(105)

Light brown beige, loam, friable.

Chalk fragments medium to small, few flint nodules, small to medium pebbles.

Light brown beige loam soil with coarse components, which are more compact than layers (104) and (107).

Below: (104). Above: (107) and natural

(106)

Same as (105)

White chalky layer with loamy matrix, light brown beige, looked in plan to be purely white chalk lumps, later found to be layer (105) with slightly larger lumps of chalk.

(107)

Light cream brown, loam, loose.

Medium – small lumps of chalk, small pea gravel pieces 20%.

Light cream brown loam with small gravel bits and occasional flint pieces.

Below: (105). Above: (108) (109)

(108)

Light cream brown, loam, friable/loose.

Chalk fragments 70%.

Light cream brown loam with many small to medium chalk fragments (70%) of layer).

Below: (107). Above: (109)

(109)

White.

Chalk rubble medium to large with smaller chalk fragments occasional small flints.

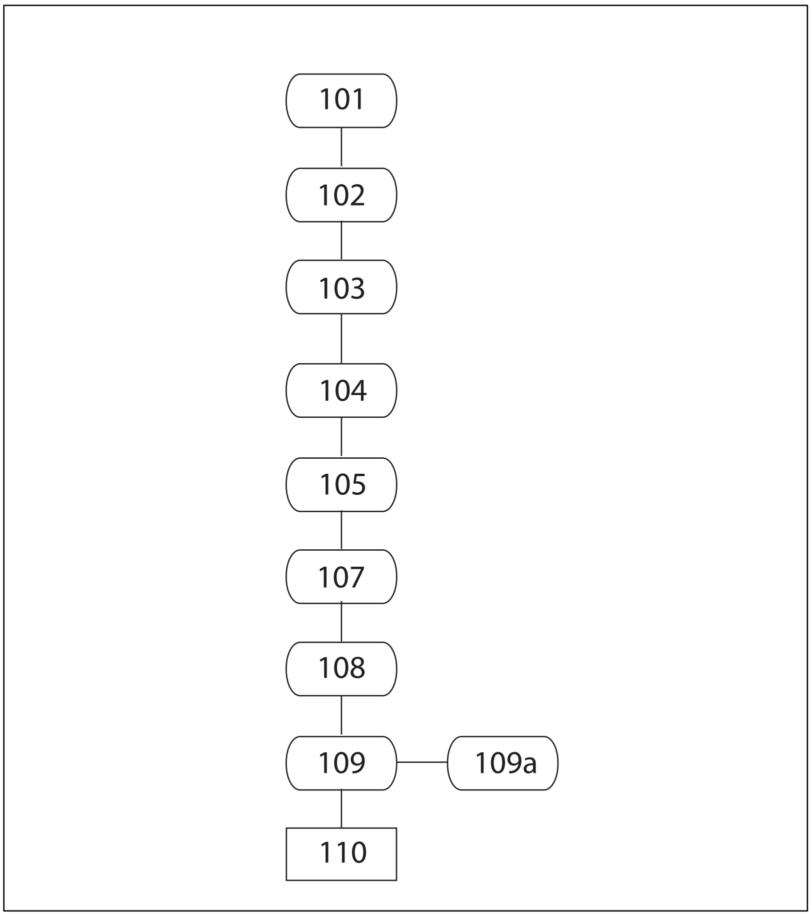
(109a) – Various chalk (large block) rubble fill of shaft, with very occasional broken flint nodules.

Below: (108).

[110]

Feature. Containing (101) (102) (103) (104) (105) (106) (107) (108) (109)
Flint mine.

Matrix for Trench C



2.4: Excavation Records

Trench D

(111)

Dark brown, loam, friable.

Medium to large chalk lumps occasional flint nodule small to medium gravel (pebbles).

Dark brown (topsoil) ploughed

Above: (117)

(112)

Light greyish brown, loam, friable (pea grit layer), differs from (103) in that it has fewer large flint nodules.

Below: (111). Above: (113)

(113)

Light brownish orange, loam, friable.

Small to medium chalk blocks, chalk fragments.

Light brownish orange loam with calcium carbonate precipitate (mold) in the layer.

Below: (104) (apart from, less flint nodules). Above: (114)

(114)

Mid dark brown, loam, friable.

Occasional nodules, chalk fragments and small to medium chalk blocks.

More heavily laden with mold than (113).

Below: (113). Above: (115)

(115)

Light cream brown, loam, loose.

Chalk fragments.

Light cream brown with many small to medium chalk fragments, 70% of layer.

Below: (114). Above: (116)

(116)

White.

Large blocks of chalk to medium.

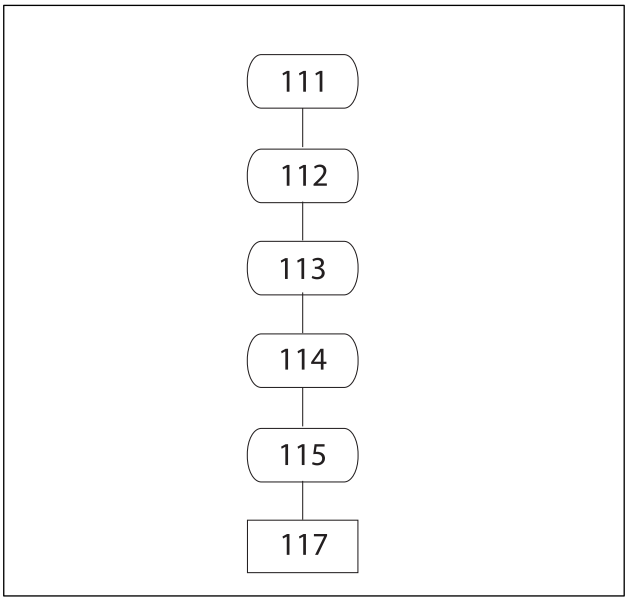
White chalky rubble (fill of shaft). Occasional charcoal flecks.

Below: (115). Above: Unexcavated

[117]

Feature. Flint mine

Matrix for Trench D



2.5: Excavation Flintwork

Table 1: The excavated flintwork from Long Down

Type	A	B	C	D	*Total*
Flakes					
With cortex: hard-hammer	396	418	69	7	890
soft-hammer	431	936	90	3	1460
Without cortex: hard-hammer	189	13	3	3	208
Soft hammer	194	27	4	2	227
Flakes total	1021	1394	166	15	2785
Blades					
With cortex: hard-hammer	-	-	-	-	-
soft-hammer	10	13	10	-	33
With cortex: hard-hammer	1	-	-	1	2
soft-hammer	4	20	12	-	36
Blades total	15	33	22	1	71
Axe thinning flakes					
With cortex: hard-hammer	260	1841	566	-	2667
soft-hammer	2004	9173	1247	-	12424
Axe thinning flakes total	2264	11014	1813	-	15091
Axe finishing flakes					
With cortex: soft-hammer	-	-	-	-	-
Without cortex: soft-hammer	1433	8509	45	-	9987
Axe finishing flakes total	1433	8509	45		9987
Other axe waste					
Chips	406	561	-	-	967
Shattered pieces	341	58	17	-	416
Quartered pieces	43	2	-	-	45
Tested nodules	23	4	-	-	27
Cores	17	9	4	-	30
Roughouts	6	9	1	-	18
Hammerstones	4	1	-	-	5
Other axe waste total	840	644	22		1506
End scraper	-	1	-	-	1
Side scraper	-	-	1	-	1
Knife	?1	1	-	-	2
Ovate knife	-	-	1	-	1
Misc. retouched piece	-	1	-	-	1
Flake tools total	1	3	2	-	6
Total	5574	21564	2070	16	29240
Fire-fractured flint	19	48	15	-	82

2.6: Small Finds

Table 1: Small finds from Long Down

S.F No:	Category	Trench	Context
1	Flint cluster	A1	(8)
2	Flint cluster (nest)	A1	(15)
3	Axe roughout	A1	(15)
4	Axe roughout	A1	(15)
5	Antler	A1	(15)
6	Large flint point	A1	(15)
7	Nest of flakes	A1	(15)
8	Scapula (shovel?)	A1	(15)
9	Nest of flakes	A1	(15)
10	Charcoal sample	A1	(16)
11	Pottery	A1	(17)
12	Nest of flakes	A1	(17)
13	Axe roughout	A2	(26)
14	Axe roughout	A2	(26)
15	Axe roughout	A2	(26)
16	Large core	A2	(26)
17	Large core	A2	(26)
18	Large core	A2	(26)
19	Large core	A2	(26)
20	Large core	A2	(26)
21	Large core	A2	(26)
22	Large core	A2	(26)
23	Large core	A2	(26)
24	Large core	A2	(26)
25	Large core	A2	(26)
26	Large core	A2	(26)
27	Large core	A2	(26)
28	Pottery	A2	17
29	Antler tool (tine tip)	A2	17
30	Charcoal	A2	17

2.7: **Pottery Report** *by Sue Hamilton*

Comments

All pieces, with the exception of one EIA basesherd (C1/103), are bodysherds. The Iron Age and Romano-British, or medieval pottery, was dated by Sue Hamilton and David Rudling.

Table 1: Pottery totals

Context	***Find no/ context***	***No of sherds***	***Description***
EIA			
C1/103	Sq A	1x	Medium-sized flint inclusions; brown outer and inner surface; black core.
C1/102	Sq C	1x	Medium-sized flint inclusions; brown outer and inner surface; black core.
C1/103	Sq B	1x	Base 'sherd. Medium-sized flint inclusions; brown outer and inner surface; black core.
C1/104	Sq B	1x	Medium-sized flint inclusions; brown outer and inner surface; black core.
IA			
D1/116		2x	Medium-sized flint inclusions; black outer and inner surface. Medium-sized flint inclusions; brown outer surface; black inner surface brown core.
LIA			
B9/52	Base of ploughsoil	2x	Medium-sized flint inclusions; brown outer surface; black inner surface. Medium-sized flint inclusions; brown surface and inner core.
B9/52-53	S	1x	Medium-sized flint inclusions; black inner surface fragment
R-B			
B13/52		1x	
B17/55		1x	
C1/102	Sq A	1x	
C1/103	Sq A	2x	
D1/114		1x	

Fieldwalking:

General	MIA
20/32	medieval
24/29	IA
24/31	EIA

2.8: Neolithic Pottery Report *by Professor Andy Merion Jones*

The sherds of pottery from Long Down appear to exhibit evidence of being derived from early Neolithic pottery forms (Table 1). They are from fine walled vessels, tempered with calcite or possibly burnt flint. Several of the more complete sherds have an obvious curvature suggesting they are from bowl forms (typical of the early Neolithic). In the case of the two sherds marked 7008/B9/54 Pottery A there is sufficient of the sherd remaining to tell that these sherds derive from neutral bowl forms of probable Carinated Bowl, as defined by Cleal (1992, 291-92). On the scant evidence available we are probably looking at vessels of Cleal's neutral inflected form. There were no rim forms recovered to confirm this tentative analysis.

On the basis of fabric, sherd thickness and firing profiles it may be that there are two or three groups of pottery, possibly representing different vessels. Group 1 includes: 7008/ B9/54; 7008/B9/52 P.2; 7008/B9/54 5; 7008/B9/52 'Mesolithic core'; 7008/B9/52 P. 5; 7008/B9/52 P.4 distinguished mainly by their differential firing profile Group 2 includes: 7008/B9/54 Pottery A, differentiated by the surface smoothing on these sherds. Group 3 includes: 7008/A1/6 find. No. 11; 7008/A2/17 Find no. 28; possibly 7008/B9/52-53; possibly 7008/B9/52 P. 3 differentiated by the dense fabric, and firing in a reduced atmosphere. Given the commonality in fabric across the group of sherds (all sherds are tempered by calcite or possibly burnt flint), and the variability of firing in prehistoric pottery in general we may be only looking at two or conceivably a single vessel represented here.

CLEAL, R. 1992. Significant form: ceramic styles in the earlier Neolithic of southern England, in N. Sharples and A. Sheridan (eds.) *Vessels for the Ancestors*, Edinburgh University Press. 286-306.

Table 1: Pottery totals

Context	*Find no/ context*	*No of sherds*	*Wieght*	*Description*
B9	54	4x	16g	Wall thickness: 7.39mm. Largest sherd length: 29.30mm. Clear evidence of differential firing- exterior oxidation, interior reduction. Evidence of exterior surface smoothing. Fabric: Numerous well-crushed inclusions of calcite (?).
B9	54 5	1x	6g	Wall thickness: 6.81mm. Length: 30.44mm. Clear evidence of differential firing. Evidence of smoothing on interior surface. Fabric: sparse inclusions of calcite (?).
B9	52 P1	1x	2g	Wall thickness: 6.55mm. Length: 27.16mm. Firing looks to have been in an oxidizing atmosphere. Rough smoothing of interior and exterior surfaces. Fabric: numerous well-crushed inclusions of calcite (?).
B9	52 P. 2	1x	3g	Wall thickness: 7.48mm. Sherd length: 20.71mm. Clear evidence of differential

				firing – exterior oxidation, interior reduction. Probable smoothing of exterior surface. Fabric: Numerous inclusions of calcite (?) of variable size (largest visible inclusion 3.38mm in diam.). Probably from same vessel as 54.
B9	52 P. 3	2x	1g<	Wall thickness: 4.44mm Length of largest sherd; 13.57mm. Look as if fired in reducing atmosphere. Fabric: sparse inclusions of calcite (?).
B9	52 P.4	1x	1g<	Wall thickness: 5.81mm. Length: 10.34mm. Clear evidence of differential firing. Fabric: sparse inclusions of calcite (?).
B9	52 P. 5	9x	8g	Wall thickness; 5.54mm Length of largest sherd: 14.74mm. Clear evidence of differential firing. Fabric: sparse inclusions of calcite (?)
B9	52	2x	2g	Wall thickness: 5.53mm. Length of largest sherd: 12.91mm. Clear evidence of differential firing. Fabric: sparse inclusions of calcite (?).
B9	52-53	3x	1g<	Wall thickness: cannot be determined. Looks as if fired in reducing atmosphere. Fabric: sparse inclusions of calcite (?).
B9	54	2x	27g	Wall thickness: 6.99mm Largest sherd length: 50.45mm. Rough smoothing of exterior and interior surfaces. Fabric: numerous (approx. 10-15%) inclusions of calcite (?). Both sherds clearly come from bowl forms (based on curvature). One sherd (the larger) is probably the lower part of the body of a neutral or inflected early Neolithic bowl form (after Cleal 1992).
A1	6 S.F No. 11	1x	9x	Wall thickness: 8.47mm. length: 36.31mm. Interior exhibits evidence of coil building (smoothed coils visible on surface). Exterior surface abraded. Firing looks to be in a reduced atmosphere, but only interior surface remains. Fabric: dense, sparse inclusions of calcite (?). Curvature of sherd suggests this is a wall from a Neolithic bowl.
A2	17 S.F No. 28	1x	9g	Wall thickness: 6.73mm Length: 41.97mm . Exterior surface abraded. Firing looks to be in a reduced atmosphere, but only interior surface remains. Fabric: dense, sparse inclusions of calcite (?). Curvature of sherd suggests

				this is from wall from a Neolithic bowl.

2.9: Scapula and Pick from Long Down *by Miranda Armour-Chelu*

1) Domestic ox scapula – weight 356grams - from right hand side of animal.
The spine of the scapula has been roughly detached which may have facilitated ts use as a shovel, however there is little evidence that it was ever used as such. There is very little abrasion where one expect, eg along the proximal edge of the scapula.

2) Red deer antler – weight 180grams – worked each end.
It is worked at each end and originally formed part of pick, before breaking during in use.

2.10: 1987 Radiocarbon Dates for Long Down *by the Oxford University Radiocarbon Accelerator Unit*

Table 1. Uncalibrated Radiocarbon dates: charcoal, 12th February 1987

OxA – 1063	Charcoal	3110 ± 80
OxA - 1088	Hazel Charcoal (Corylus sp) 7008/A1/16,10	3130 ± 60

Table 2. Calibrated BP dates, using Pearson and Stuvier (1986)

OxA – 1063 Mean	= 1410 BC
1sd range (68% confidence)	=1410 BC
2sd range (95% confidence)	= 1490-1310 BC
OxA – 1088 Mean	= 1420 BC
1sd range (68% confidence)	= 1490-1320 BC
2sd range (95% confidence)	= 1520-1260 BC

Table 3. Uncalibrated Radiocarbon dates: bone and antler; 6th August 1987

OxA-1151 antler implement	4900+/-100
OxA – 1152 ox scapula	5050+/-100

Table 4. Calibrated BP dates, using Reimer and Stuvier (1986)

OxA-1151 4900+/-100 BP	
Intercepts: one sigma 3790-3543 BC	
two sigma 3960-3383 BC	
Probabilities: two sigma	3960-3840 BC 15% probability
	3830-3500 BC 83%
	3409-3383 BC 2%
OxA-1152 5050+/-100 BP	
Intercepts: one sigma 3980-3708 BC	
two sigma 4040-3640 BC	

2.11: Radiocarbon Report *By Robin Holgate*

The antler and bone artefacts, along with the charcoal, Early Neolithic pottery and Neolithic flintwork, were recovered from layers of dumped chalk rubble over 1m. below the present ground surface. The antler and bone dates are consistent with the pottery and flintwork, but the charcoal dates seem too late. There are three possible interpretations. The Neolithic material could be residual; the charcoal could be intrusive; or the charcoal dates could be spurious. I do not think the Neolithic material is residual; the flintwork includes three clusters of *in situ* flint-knapping debris and all the Neolithic material is in fresh condition. The charcoal could be intrusive, but I do not know of any natural process which can inject charcoal 1m. below the ground surface. However, I see no reason why the two charcoal dates should be spurious.

If the incompatibility of the charcoal dates can be explained, then the antler and bone dates provide the first reliable C-14 dates for mining tools from flint mines on the South Downs found in association with other Neolithic artefactual material. These dates confirm the earlier date for the start of flint-mining in this region.

2.12: 2017 Radiocarbon Dates for Long Down *by Jon Baczkowski*

Background

This finds report records nine fragments of red deer (Cervus elaphus) antler and one incomplete cattle scapula (Bos taurus), prior to their sampling for the purpose of obtaining radiocarbon dates for the Neomine Project, directed by Stephen Shennan, and a PhD project, entitled *The Wider Environs of the Early Neolithic Flint Mines in Sussex* by the author, supervised by Professor Joshua Pollard.

All of the antler and the single cattle bone are from the Early Neolithic flint mine (4000BC -3500BC) located on Long Down, Eartham, West Sussex (List entry Number: 1017521). All the pieces included in this report were excavated directly from backfilled mineshafts by E. F Salisbury (1961), between 1954-55. Although only partially published, the excavator recorded all the pieces as coming directly from secure contexts in the upper backfill within individual mineshafts, or from flint workings floors directly related to mining. Therefore, the whole assemblage cannot directly be attributed to individual mineshafts or mining events, but can without doubt be identified as fragments of antler picks and a bone implement, fashioned and used by Neolithic miners during the working of the flint mines.

In selecting the samples particularly well preserved antler were avoided, as were pieces that showed restoration with glue, thus avoiding contamination. Finally, any antler that was in danger of becoming further fragmented during the sampling process were not selected. The ten selected samples therefore offer the best opportunity to obtain good results, without infringement on the rest of the assemblage. Larger assemblages of red deer antler fashioned as picks for Neolithic mining are well recorded and preserved from the numerous historic excavations of flint mines in Sussex, including Cissbury, Harrow Hill, Blackpatch and Church Hill, all located close to Worthing (Barber *et al.* 1999).

Identification

The nine fragments of antler are exclusively from red deer (Cervus elaphus) and all shows signs of heavy wear from their use as mine picks, including fractures, incisions, indentations and other damage. Apart from Sample 10, the remaining seven pieces are fragmented sections of the tine sections of the antler, with only Samples 4 and 6 identifiable as long brow tines. All the antlers come from adult male deer, aged between 2-9 years of age, being more precise on age is problematic with incomplete pieces. The other samples are from the bez tine, the trey tine or the crown, but as these pieces lack any clear diagnostic features, they are just identified as tine sections.

Sample 9 is a section of antler from a 6-8 year old animal, which although snapped retains its crown and brow tine. The presence of a crown demonstrates that this antler was collected after being naturally shed, rather than from being removed from a deceased animal. This indicates that the antler would have been collected when the red deer naturally shed their antler between mid-March and April.

Many other assemblages of similarly worn and damaged antler picks have been documented during excavation of other Neolithic flint mines in West Sussex (Barber *et al*. 1999). The wear and damage on the samples from Long Down are typical of their use as picks in flint mining and are compatible with antler from other the other flint mines.

The single bone fragment, Sample 10, is a broken basal end of a cattle (*Bos taurus*) scapula with its dorsal missing. Similar cattle scapula have been previously found in flint mine contexts, including one complete example from Long Down excavated in 1985, and they have long been recognised as possible mining implements (Barber *et al.*1999; Holgate 1995). Sample 10 appears to have been snapped its middle, between its dorsal and glenoid cavity. It is not possible to conclude if Sample 10 was used in the mining process, although there is some wear along its caudal border and spine. The specimen excavated in 1985 on Long Down showed no sign wear, although it was complete and may not yet have been used (Baczkowski and Holgate 2017).

Conclusion

The opportunity to obtain ten new radiocarbon dates for Early Neolithic flint mining in southern England from a stratigraphically secure context is an important and justifiable exercise. There is a general paucity of radiocarbon dates for Neolithic mining in Sussex, less than ten to date, resulting in some ambiguity over the chronology of mining in the region. The generation of ten new radiocarbon dates will therefore provide an important dataset with a much wider range to be studied and modeled, as the antler will likely originate from multiple episodes of mining.

As artefacts in their own right antler picks preserved data on the mining methodology and Neolithic social customs, for example Sample 9 demonstrates that the antler was collected after being naturally shed in the spring time. Similar antler pieces, retaining their crowns, are documented from the other Neolithic flint mines in Sussex and demonstrate that mining may have well taken place late spring, or early summer after the antler had been collected in the wider landscape. Other pieces in the assemblage, none selected for sampling, also show signs of being fashioned for the purpose of being used as picks, or punches, with sharp incisions, presumably caused by flint tools, used to fracture the antler (*See Plate 1: below*). Such damage has again been documented in the other Sussex antler assemblages and demonstrates that antler was processed prior to being used in the mines, indicating a degree of skill in its preparation for use as specific mining implements.

Some of the pieces in the Long Down archive may have been fashioned for use as punches to perforate the chalk bedrock and aid in the removal of flint nodules, although it is impossible to know if any of the samples were used in this way, as all the pieces selected are broken at their butt. Therefore, the samples all been used and suffered damage in the mining process before being discarded in the backfill of mines, either as waste or as symbolic objects.

Finally, as flint mining is a decisive marker for the spread of Early Neolithic cultural customs across southern from continental Europe (Baczkowski 2014), the results from this project will greatly improve knowledge and chronologies on an significant period of prehistory, not only for southern England and the British Isles, but also continental Europe.

Method of recording

All photography was carried in the photolab at the University of Southampton's Archaeology department, using a a Nikon D80 digital SLR fitted with a 50mm lens on Friday the 20th of Janurary 2017 by the author. All orginal drawings were also produced by the authour, with assitance by Professor Josuha Pollard.

Plate 1: Other antler impliments not included in this sample, showing signs of being fabricated for use as punches.

BACZKOWSKI, J. 2014. Learning by Experience: The Flint Mines of Southern England and Their Continental Origins, *Oxford Journal of Archaeology,* 33, 2. 135–153.

BACZKOWSKI, J., and HOLGATE, R. 2017. Breaking Chalk; The archaeological Investigations of Early Neolithic Flint Mines at Long Down and Harrow Hill, West Sussex, 1984-86. *Sussex Archaeological Collections,* 155. 1-30.

BARBER, M., D. FIELD., and P. TOPPING. 1999. *The Neolithic Flint Mines of England,* London: English Heritage.

HOLGATE, R. 1995. Long Down Near Chichester, West Sussex, *Archaeologia Polona,* 33. 350-52.

SALISBURY, E. F. 1961. Prehistoric Flint Mines on Long Down, *Sussex Archaeology Collections,* 99. 66-73.

Sample 1 (LD 56/17-4)

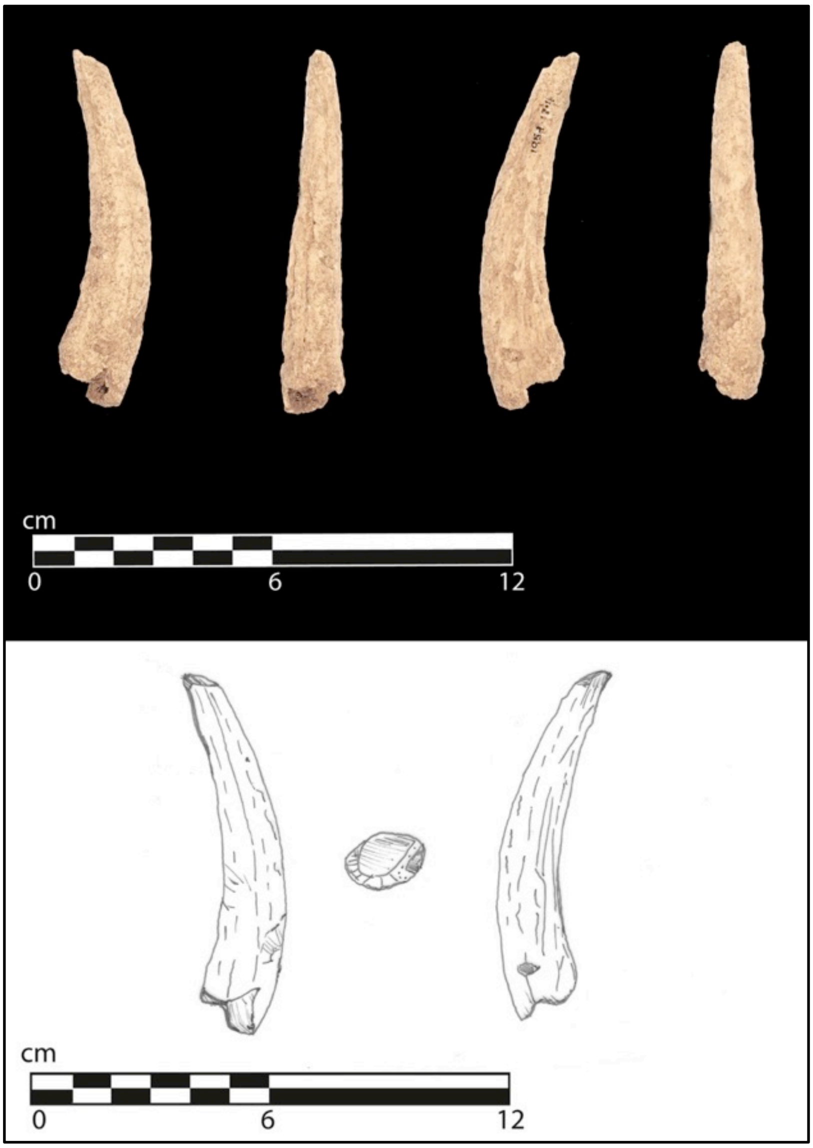
A tine from a red deer (Cervus elaphus) antler. Broken at tip and fractured at base. Has damage presumably from use as a pict, which likely resulted in the fracturing at its base.

Measurements: 84.76mm long x 24.37mm at base x 8.01 at tip.
Weight: 16g.

Sample 2 (LD 56/17-4)

The tine from the antler of a red deer (Cervus elaphus), with a snapped tips and fractured base. Has damage presumably from use as a pict, which likely resulted in the fracturing at its base.

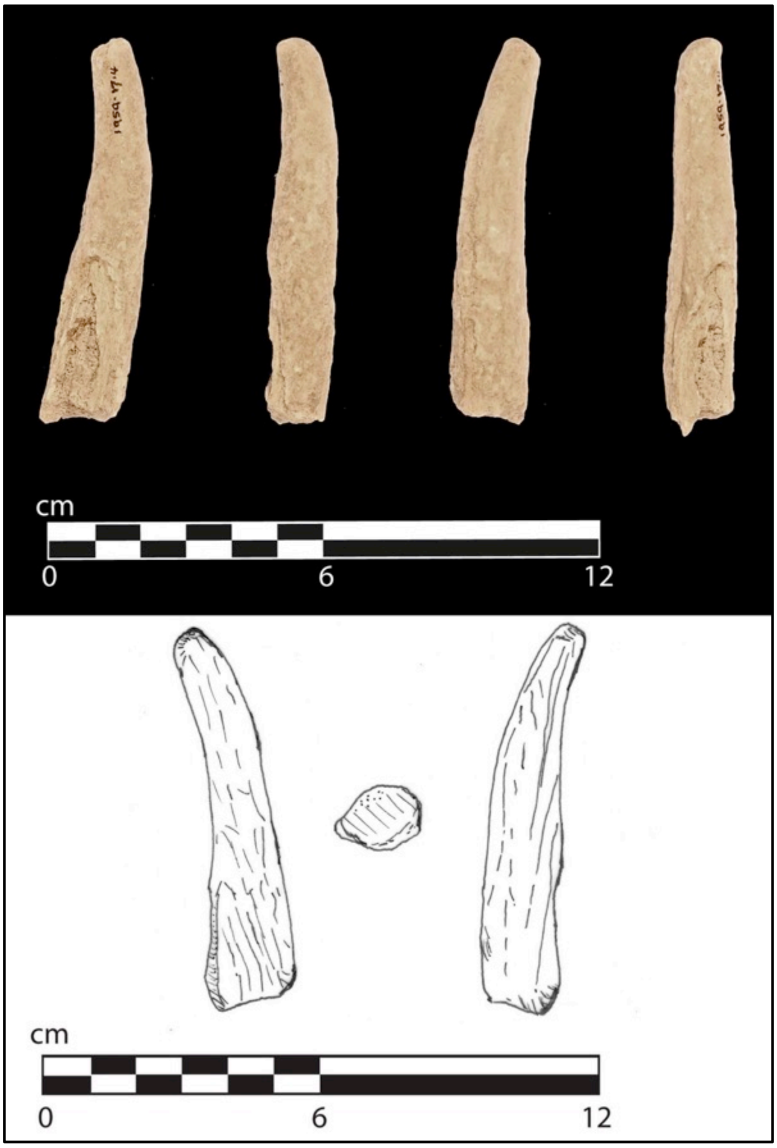
Measurements: 107.63mm long x 23.61mm at base x 10.26mm at tip.
Weight: 18g.



Sample 3 (LD 56/17-4)

The tine from an antler from a red deer (Cervus elaphus) antler. Broken at tip and fractured at base. The tip is heavily worn, presumably from use as a pict, which likely resulted in the fracturing at its base.

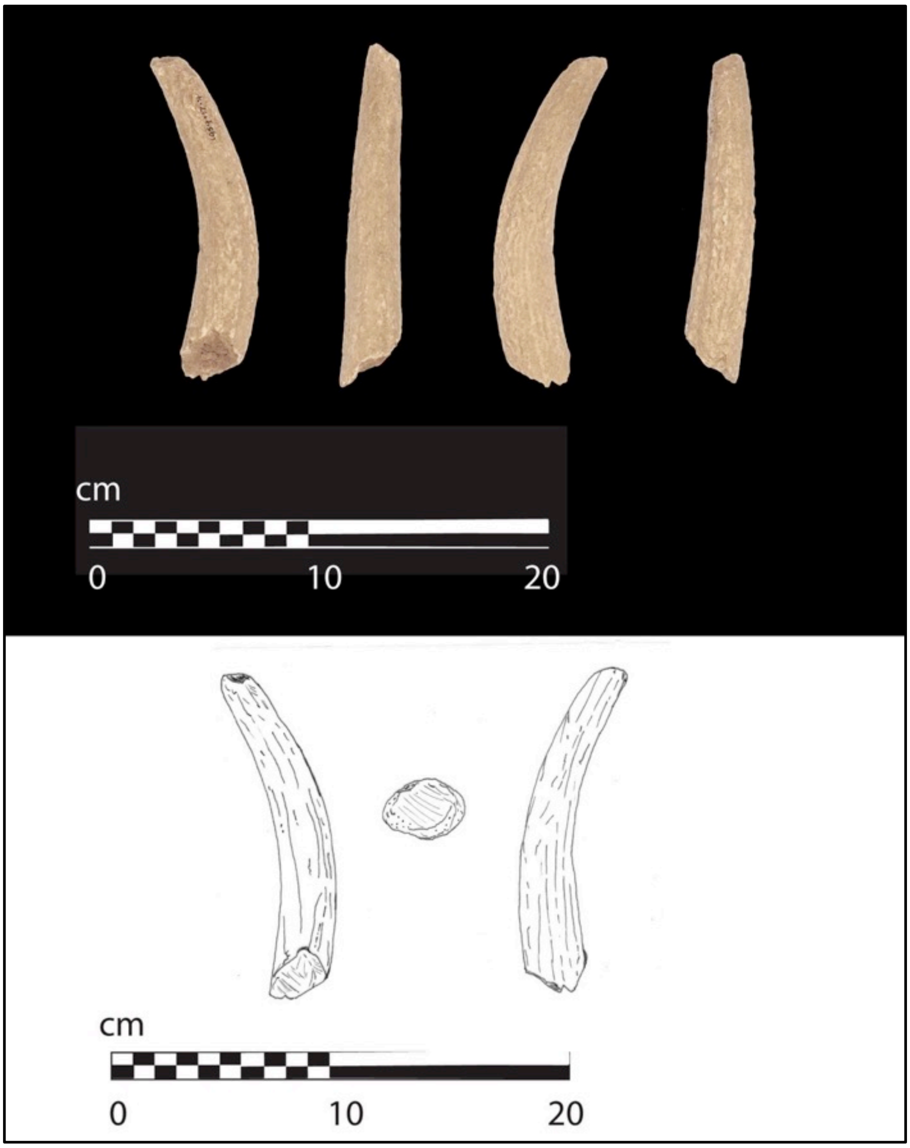
Measurements: 107.14mm long x 21.96mm at base x 12.02mm at tip. Weight: 21g.



Sample 4 (LD 56/17-4)

A tine from the antler of a red deer (Cervus elaphus). Probably a brow tine. Broken at tip and fractured at its base, probably from use a pick.

Measurements: 134.69mm long x 26.78mm at base x 14.59mm at tip.
Weight: 43g.



Sample 5 (LD 56/17-4)

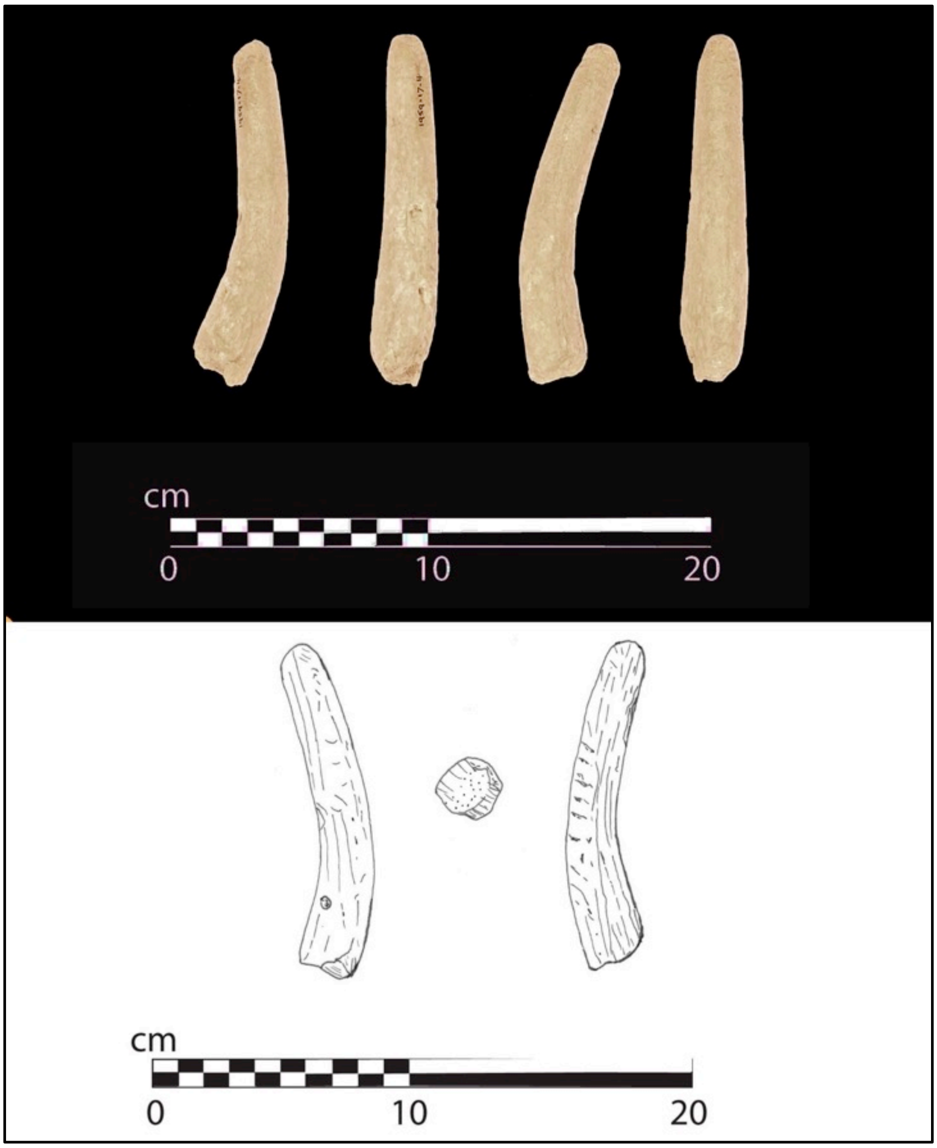
The tip section of the tine part of a red deer antler (Cervus elaphus). Broken at base, with very worn tip and wear and cuts marks along its side, from use as a pick.

Measurements: 69.32mm long x 20.63mm at base x 7.51mm at tip.
Weight: 13g.

Sample 6 (LD 56/17-4)

The brow tine from the antler of a red deer (Cervus elaphus). Cut and wear marks along its edge and very worn at its tip, resulting from its use as a pick. There are two shallow perferations of unknown purpose or origin towards its center.

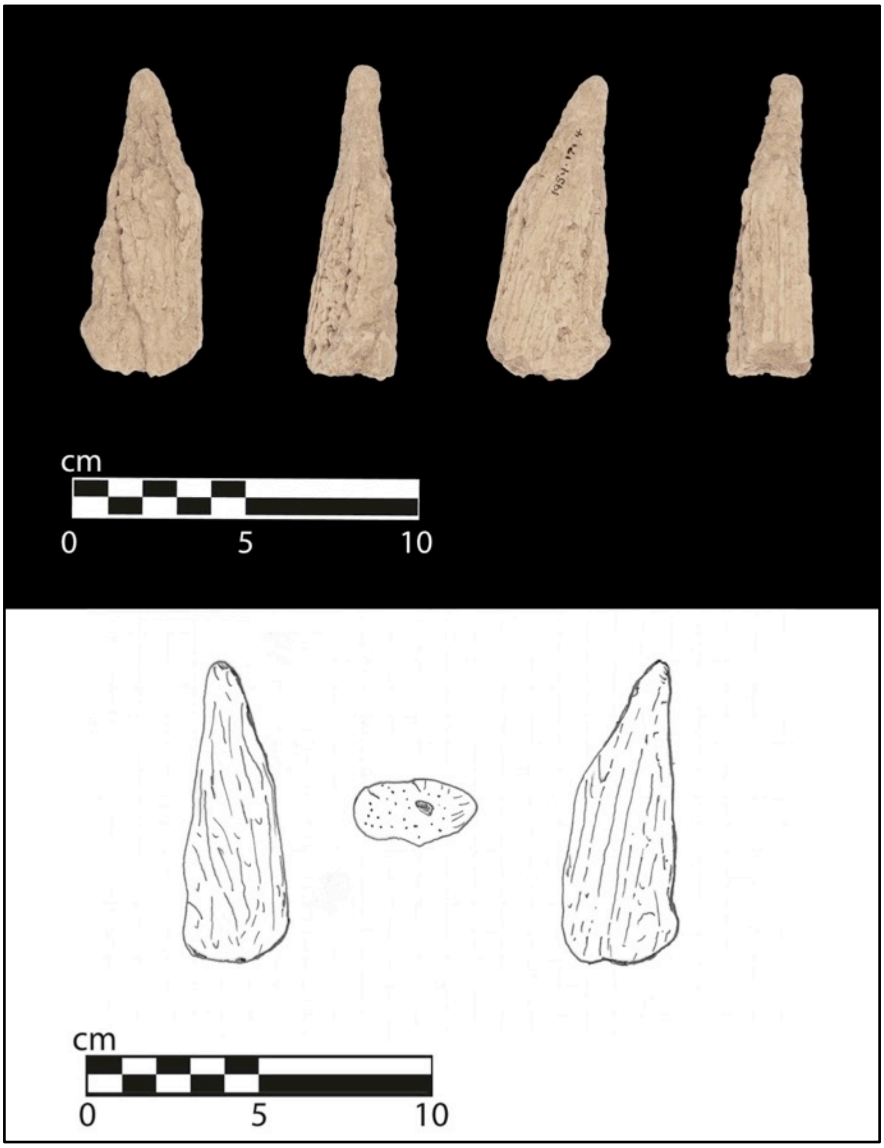
Measurements: 122.60mm long x 24.19mm at base x 15.27mm at tip.
Weight: 35g.



Sample 7 (LD 56/17-4)

The broken tip of tine from the antler of a red deer (Cervus elaphus). Wear around its tip and fractured at its base, from use as a pick.

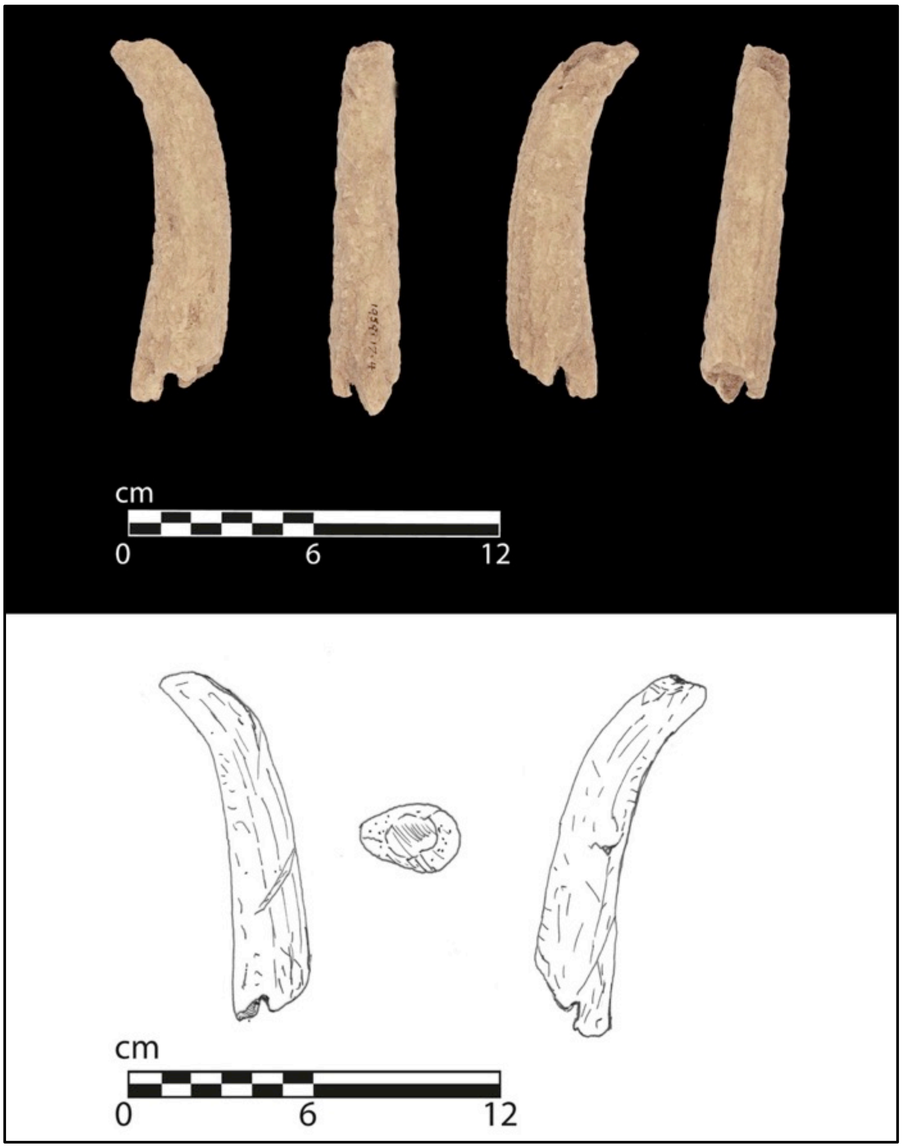
Measurements: 85.03mm long x 39.75mm at base x 9.16mm at tip.
Weight: 23g.



Sample 8 (LD 56/17-4)

Tine from the antler of a red deer (Cervus elaphus). Broken at its tip and a distinctive fracture at its base, indicative of a high energy break. Cut marks and wear marks along its edge and side, from use as a pick.

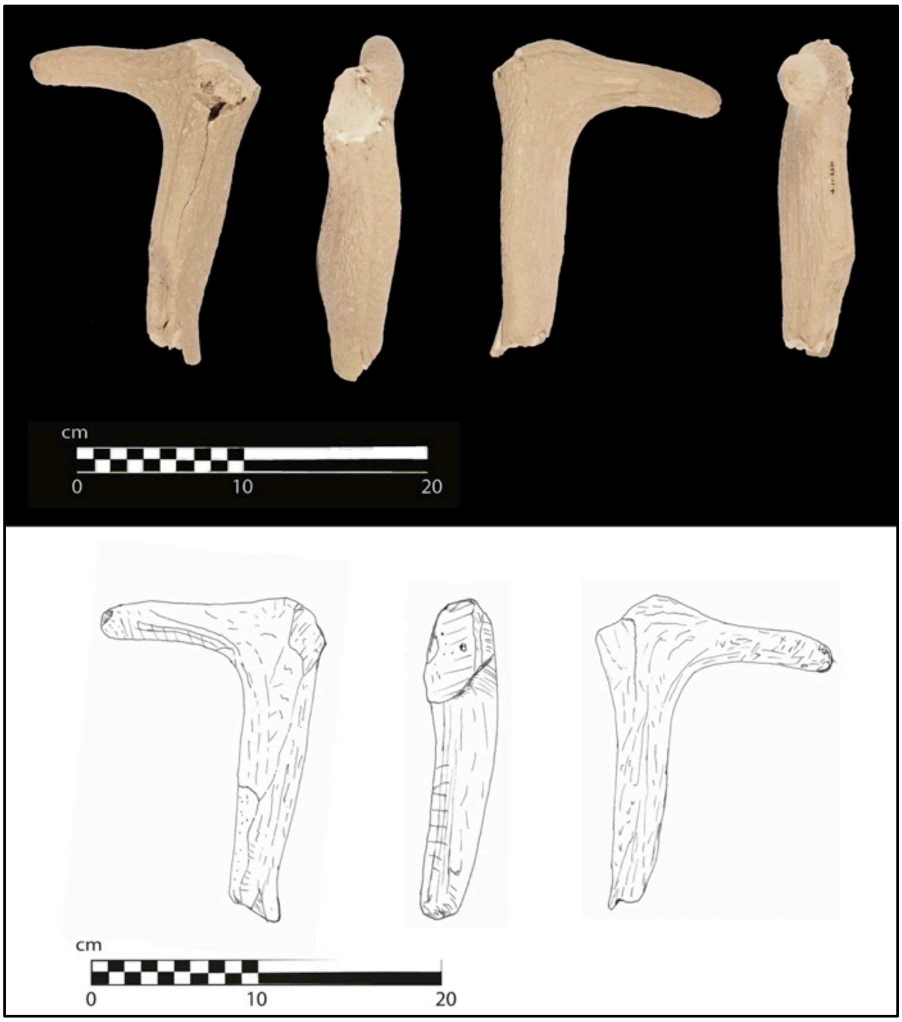
Measurements: 108.64mm long x 23.13mm at base x 14.29mm at tip.
Weight: 27g.



Sample 9 (LD 56/17-4)

Large section of antler from a red deer (Cervus elaphus). Still retaining its coronet, idicating that it was naturall shed. The brow tine is still attached, which has cut marks and wear from its use as a pick. Above the brow tine there is a fracture that has resulted from a high energy break, probably during use.

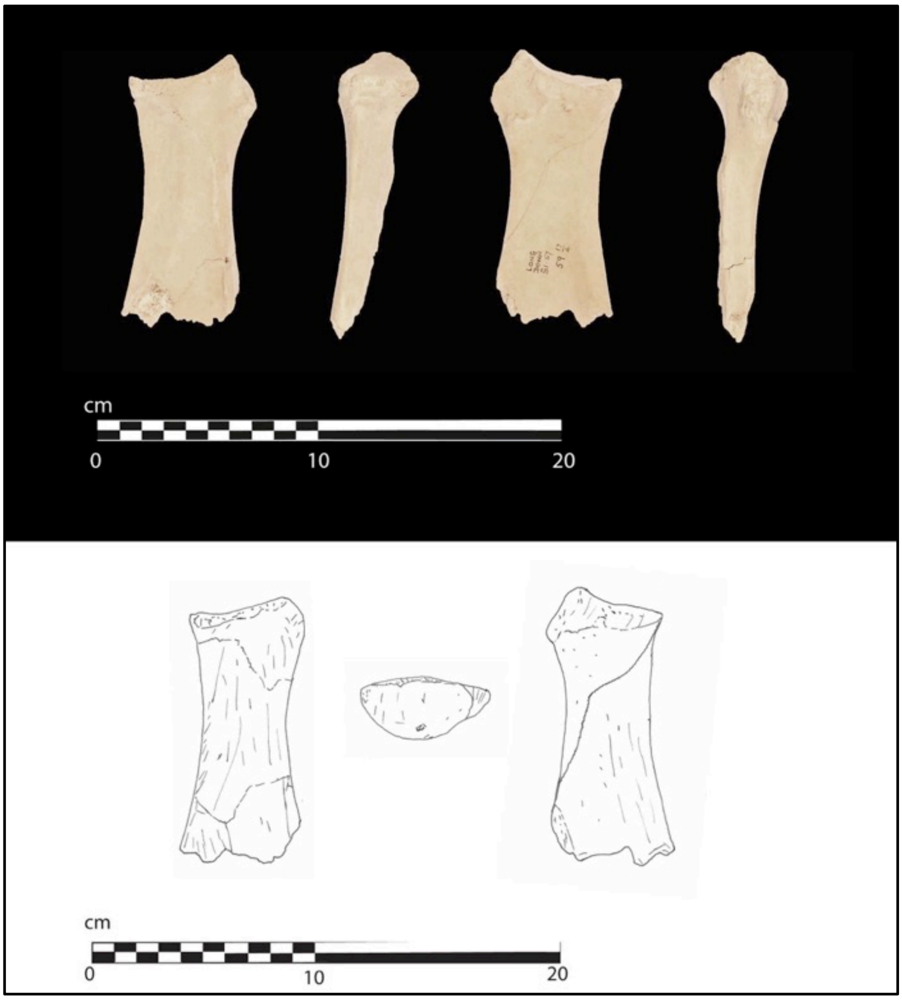
Measurements: 178.80mm long x 20.17mm at base x 12.22mm at tip.
Weight: 163g.



Sample 10 (LD 56/17-4)

The broken basal end of a cattle (Bos taurus) scapula with its dorsal missing. Fractured at its neck end and with a large crack above the glenoid cavity. Some wear along its caudal border and the spine appears to be worn, or broken off, possibly resulting from its use as a mining implement, such as shovel.

Measurements: 137.00mm long x 37.03mm at base x 28.68mm at tip.
Weight: 52g.



RADIOCARBON DATING CERTIFICATE
01 June 2017

Laboratory Code: GU43947

Submitter: Kevan Edinborough
University College London (NEOMINES) 31-34 Gordon Square
UCL Institute of Archaeology London
WC1H OPY

Site Reference: Long Down
Context Reference: 1
Sample Reference: 17

Material: Antler; Unknown

Result: Failed: insufficient carbon.

RADIOCARBON DATING CERTIFICATE
01 June 2017

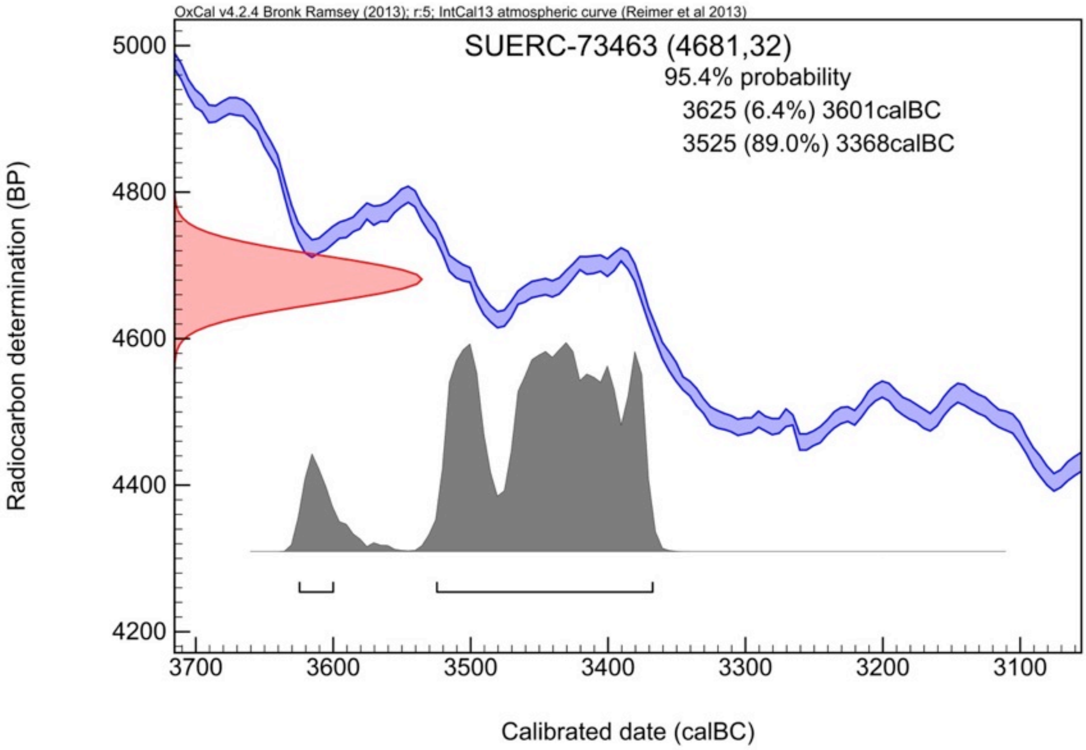
Laboratory Code: SUERC-73463 (GU43948)

Submitter: Kevan Edinborough
University College London (NEOMINES) 31-34 Gordon Square
UCL Institute of Archaeology London
WC1H OPY

Site Reference: Long Down
Context Reference: 2
Sample Reference: 18

Material: Antler; Unknown
δ 13C relative to VPDB -23.3 ‰
δ 15N relative to air 7.4 ‰
C/N ratio (Molar) 3.3

Radiocarbon Age BP: 4681 ± 3



N.B. The above 14C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email Gordon.Cook@glasgow.ac.uk or telephone 01355 270136 direct line

RADIOCARBON DATING CERTIFICATE
01 June 2017

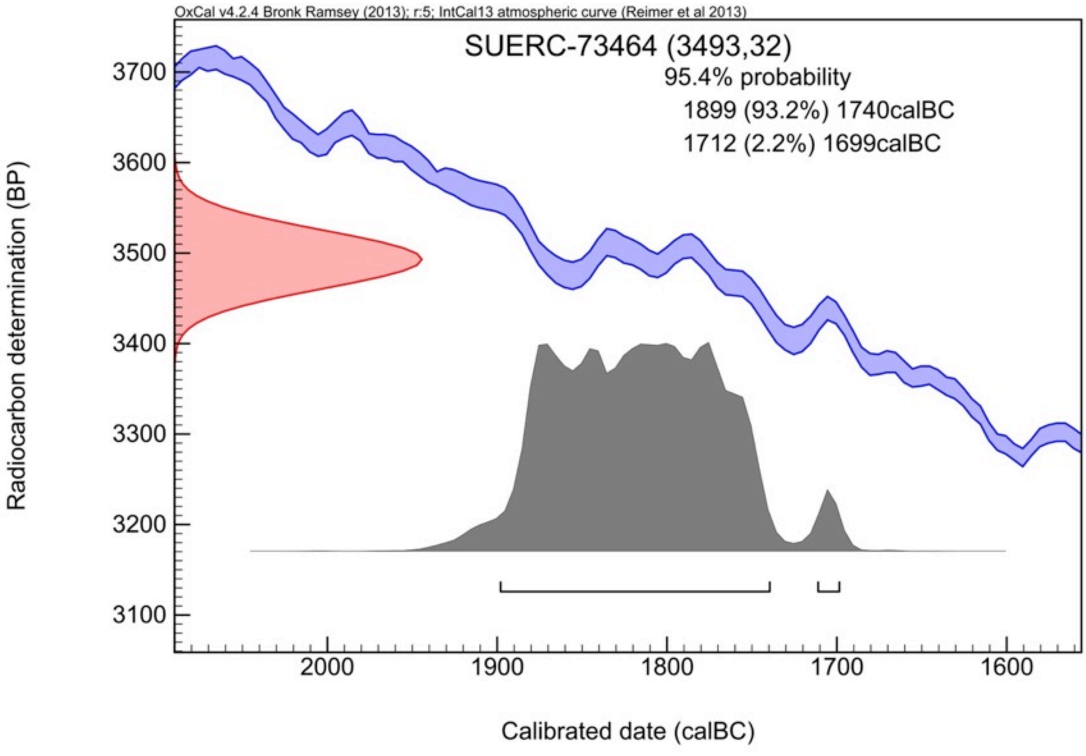
Laboratory Code: SUERC-73464 (GU43949)

Submitter: Kevan Edinborough
University College London (NEOMINES) 31-34 Gordon Square
UCL Institute of Archaeology London
WC1H OPY

Site Reference: Long Down
Context Reference: 3
Sample Reference: 19

Material: Antler; Unknown
δ 13C relative to VPDB -22.4 ‰
δ 15N relative to air 5.5 ‰
C/N ratio (Molar) 3.1

Radiocarbon Age BP: 3493 ± 32



N.B. The above 14C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email Gordon.Cook@glasgow.ac.uk or telephone 01355 270136 direct line

RADIOCARBON DATING CERTIFICATE
01 June 2017

Laboratory Code: GU43950

Submitter: Kevan Edinborough
University College London (NEOMINES) 31-34 Gordon Square
UCL Institute of Archaeology London
WC1H OPY

Site Reference: Long Down
Context Reference: 4
Sample Reference: 20

Material: Antler; Unknown

Result: Failed: insufficient carbon.

RADIOCARBON DATING CERTIFICATE
01 June 2017

Laboratory Code: GU43951

Submitter: Kevan Edinborough
University College London (NEOMINES) 31-34 Gordon Square
UCL Institute of Archaeology London
WC1H OPY

Site Reference: Long Down
Context Reference: 5
Sample Reference: 21

Material: Antler; Unknown

Result Failed: insufficient carbon.

RADIOCARBON DATING CERTIFICATE
01 June 2017

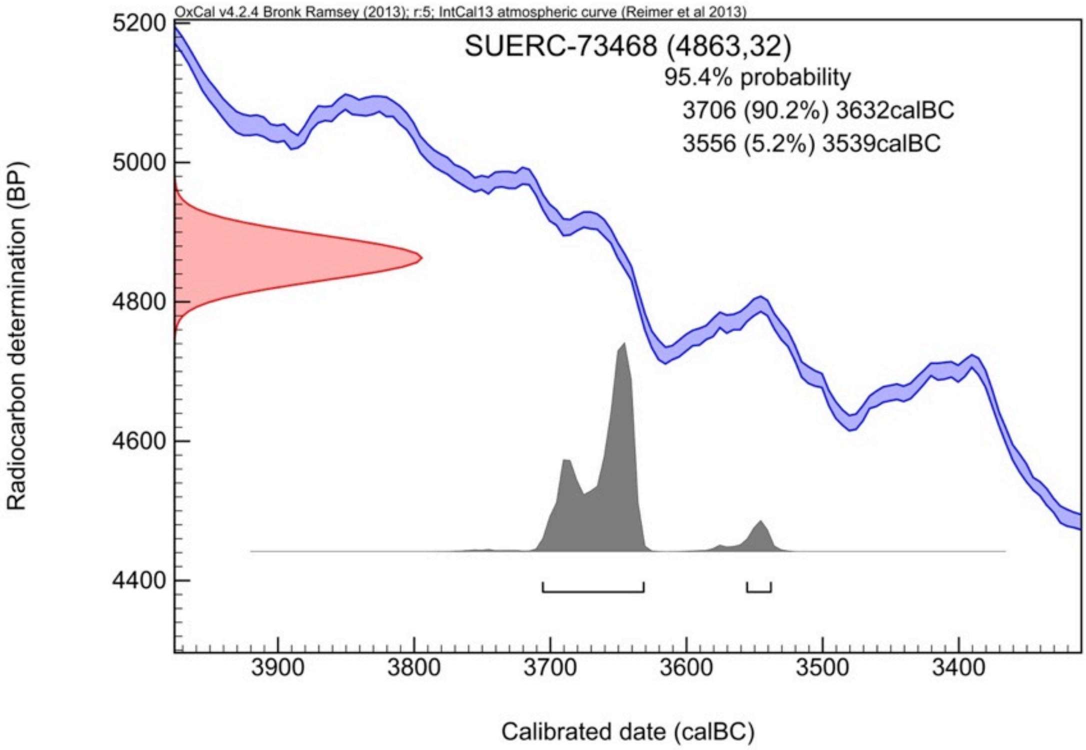
Laboratory Code: SUERC-73468 (GU43952)

Submitter: Kevan Edinborough
University College London (NEOMINES) 31-34 Gordon Square
UCL Institute of Archaeology London
WC1H OPY

Site Reference: Long Down
Context Reference: 6
Sample Reference: 22

Material: Antler; Unknown
δ 13C relative to VPDB -22.6 ‰
δ 15N relative to air 4.7 ‰
C/N ratio (Molar) 3.3

Radiocarbon Age BP: 4863 ± 32



N.B. The above 14C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email Gordon.Cook@glasgow.ac.uk or telephone 01355 270136 direct line.

RADIOCARBON DATING CERTIFICATE
01 June 2017

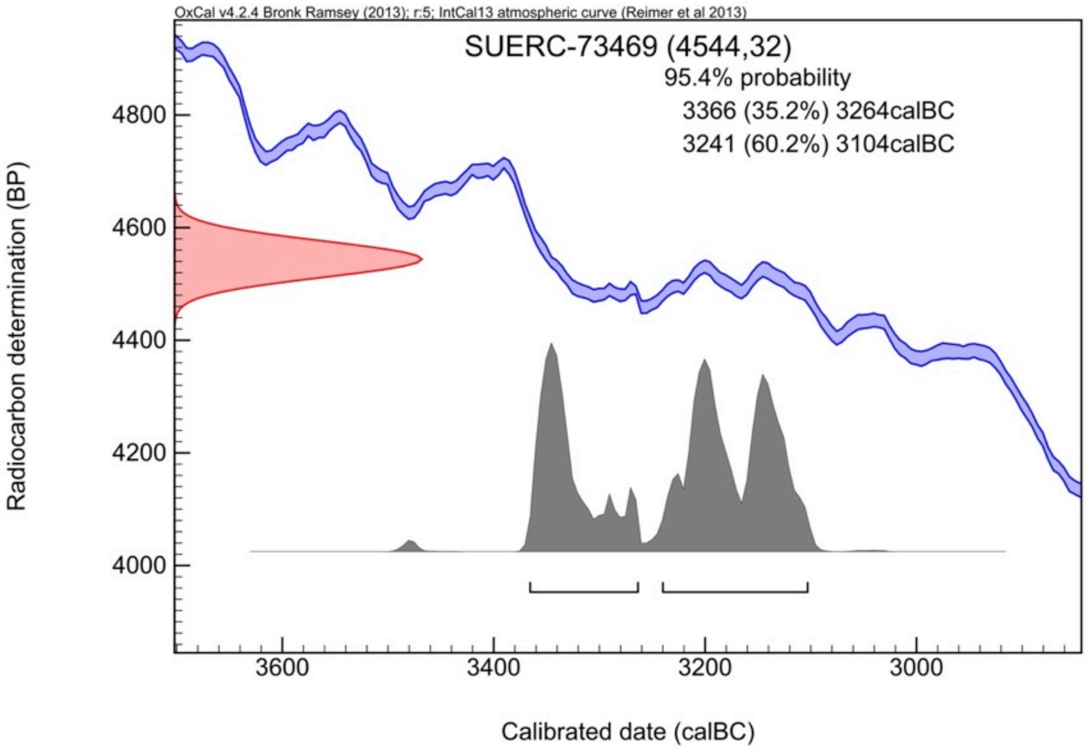
Laboratory Code: SUERC-73469 (GU43953)

Submitter: Kevan Edinborough
University College London (NEOMINES) 31-34 Gordon Square
UCL Institute of Archaeology London
WC1H OPY

Site Reference: Long Down
Context Reference: 7
Sample Reference: 23

Material: Antler; Unknown
δ 13C relative to VPDB -21.5 ‰
δ 15N relative to air 5.6 ‰
C/N ratio (Molar) 3.3

Radiocarbon Age BP: 4544 ± 32



N.B. The above 14C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email Gordon.Cook@glasgow.ac.uk or telephone 01355 270136 direct line.

RADIOCARBON DATING CERTIFICATE
01 June 2017

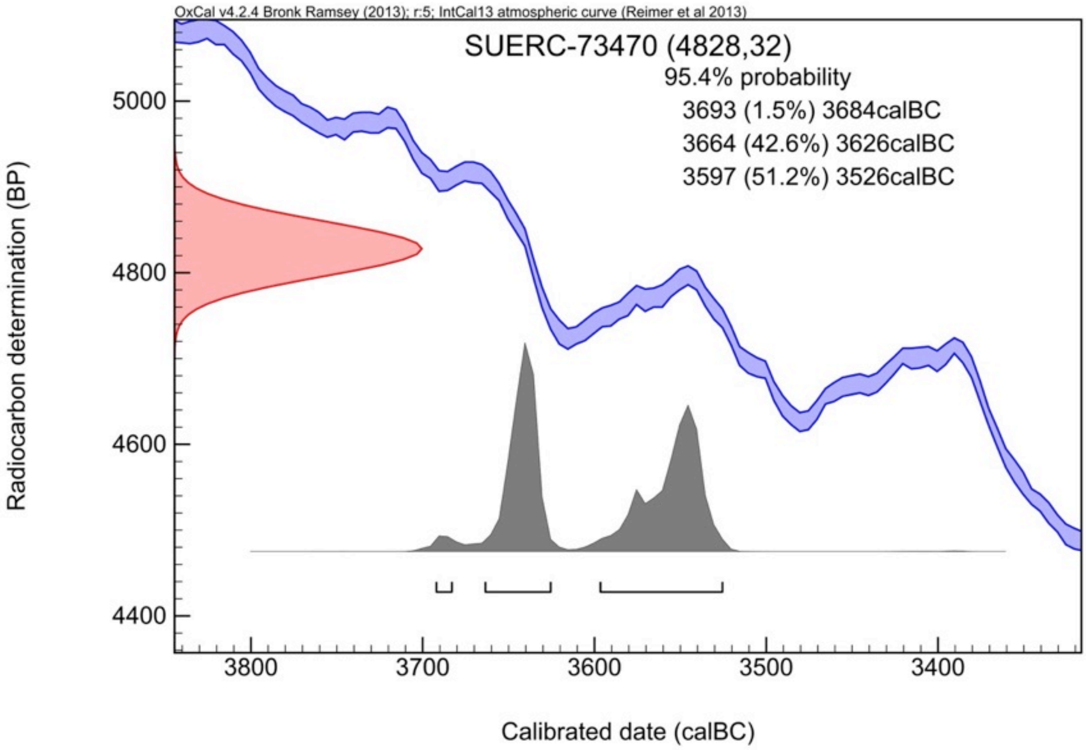
Laboratory Code: SUERC-73470 (GU43954)

Submitter: Kevan Edinborough
University College London (NEOMINES) 31-34 Gordon Square
UCL Institute of Archaeology London
WC1H OPY

Site Reference: Long Down
Context Reference: 8
Sample Reference: 24

Material: Antler; Unknown
δ 13C relative to VPDB -23.0 ‰
δ 15N relative to air 6.5 ‰
C/N ratio (Molar) 3.2

Radiocarbon Age BP: 4828 ± 32



N.B. The above 14C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email Gordon.Cook@glasgow.ac.uk or telephone 01355 270136 direct line.

RADIOCARBON DATING CERTIFICATE
01 June 2017

Laboratory Code: GU43955

Submitter: Kevan Edinborough
University College London (NEOMINES) 31-34 Gordon Square
UCL Institute of Archaeology London
WC1H OPY

Site Reference: Long Down
Context Reference: 9
Sample Reference: 25A

Material: Antler; Unknown

Result: Failed: insufficient carbon.

RADIOCARBON DATING CERTIFICATE
01 June 2017

Laboratory Code: GU43956

Submitter: Kevan Edinborough
University College London (NEOMINES) 31-34 Gordon Square
UCL Institute of Archaeology London
WC1H OPY

Site Reference: Long Down
Context Reference: 9
Sample Reference: 25B

Material: Antler; Unknown

Result Failed: insufficient carbon.

RADIOCARBON DATING CERTIFICATE
01 June 2017

Laboratory Code: GU43957

Submitter: Kevan Edinborough
University College London (NEOMINES) 31-34 Gordon Square
UCL Institute of Archaeology London
WC1H OPY

Site Reference: Long Down
Context Reference: 10
Sample Reference: 26

Material: Antler; Unknown

Appendix 3: Harrow Hill Archive

3.1: Surface Collection Report *by Robin Holgate*

The surface artifact density in the area of the site under plough was recorded in October-November 1984 by walking transects spaced at 20m (Table 1). Intervals and collecting the humanly-struck flints and pottery lying within each 20m. section of these transects. One part of the area surveyed produced a dense concentration of axe roughouts and axe-thinning flakes c. 50m. in diameter. The north-west part of the surveyed area, which overlay Clay-with-Flints, yielded a low density scatter of late Bronze Age-Iron Age potsherds and hard hammer-struck flint debitage.

Table 1: Flintwork from the surface collection/recording survey

	Harrow Hill
Flakes/blades	2033
Axe-thinning flakes	198
Chips	
Tested nodules	3
Cores	49
Roughouts/preforms	76
Hammerstones	
Scrapers	27
Knives	3
Piercers	1
Cutting blades/flakes	1
Notches flakes	2
Miscellaneous retouched flakes	8
Axe	72
Chisel	1
Sickle	1
Total	2475

3.2: **Later Prehistoric and Roman Pottery** by Sue Hamilton

The surface collection survey produced 32 fragments of Bronze and Iron Age pottery; a further 35 sherds were recovered by excavation, although none came from undisturbed later prehistoric contexts. With the exception of one basesherd, all were bodysherds (Table 1 and 2). Five were represented:

Fabric 1
Very coarse, medium abundant flint-tempered ware with thick walls, oxidised surfaces and reduced core. Middle to Late Bronze Age fabric type. One sherd from the surface collection.

Fabric 2
Grog-tempered ware with oxidised surfaces. Probably Deverel-Rimbury fabric. Two sherds from the excavation.

Fabric 3
Medium to coarse, medium abundant flint-tempered ware with more reduced than oxidised surfaces and cores. Late Bronze to Early Iron Age. Twenty six sherds from the survey; twenty seven from the excavations.

Fabric 4
Fine to medium grade quartz tempering with medium abundant flint tempering. Some surfaces are burnished. Late Bronze to Early Iron Age. Six sherds from the survey

Fabric 5
Medium abundant grog and medium abundant fine quartz sand-tempered ware. One flat slightly out-turned basesherd was recovered. One flat, slightly out-tuned basesherd was recovered. Probably slightly out-tuned basesherd was recovered. Probably cooking jar fabric (Hamilton 1977, 94). Late Iron Age. Five sherds from the survey.

Table 1: Sherd numbers according to fabric type from the excavations

Fabrics	1	2	3	4	5	Total
Contexts						
Unstratified			1			1
B/1			2	1		3
C/1			1			1
K/1		1				1
K/12			1			1
K/12 S/F 6			1	4		5
W1/1			3			3
W3/1			2			2
W22/1			3			3
W25/1			2			2
W26/1			1			2
W28/1			1			1
W34/1			2			2
W35/1			5			5
W38/41			1			1
W40/1			1			1

W41/1			1			1
TOTAL		2	28	5		35

Table 2: Sherd numbers according to fabric surface collection survey.

Fabrics	1	2	3	4	5	Total
Collection units						
20/15			1			1
20/22			12			12
21/21			4			4
21/22			1			1
22/16					3	3
22/19					1	1
24/14	1					1
24/18			2			2
25/14			3			3
30/20					1 base	1
35/19			3			3
TOTAL	1		26			32

HAMILTON, S. 1977. The Iron Age pottery, in M. Bell, Excavations at Bishopstone, *Sussex Archaeology Collections,* 115. 83–117.

3.3: Excavation Records: Contexts Sheets for all Trenches

Order:

Context No.

Matrix colour, Matrix texture, Matrix consistency
Coarse components
Description
Interpretation
Matrix

(1)

Dark Brown, clay loam, silt loam, friable
Chalk fragments and flint nodules
Soil horizon
Above 1.

(2)

White, silt, loam, form
Chalk fragments and blocks c. 90%
Chalk rubble horizon
Below 1. Above 3.

(3)

White, silt, firm
Chalk fragments – 90%

Chalk Rubble
Below 1. Above 4.

(4)

Dark orange brown, clay, firm
Chalk fragments – 20%
Clayey horizon
Below 3. Above 5.

(5)

Light orange brown, clay, firm
Small chalk fragments – 40%
Clayey horizon
Below 4. Above 6.

(6)

White, silt, loose
Chalk fragments – 90%
Chalk rubble horizon

(7)

White, chalk, firm,
Chalk fragments
Chalk natrual
Same as 6? Below 1. Above 5.

Note: For further Test Pit Context Sheets please see attached Compact Disc

3.4: Excavation Records: Context Sheets for Drift Mines

Order:

Context No.

Matrix colour, Matrix texture, Matrix consistency
Coarse components
Description
Interpretation
Matrix

Trench F (8)

Off white, silt, loose
Chalk blocks and fragments
Loose/various chalk rubble
Below 2. Above 15.

(15)

Dark orange brown, clay silt, friable
Chalk fragments
Below 2/8. Above 25

(25)

Cream, silt/clay loam, loose
Various chalk rubble
Loose lens of chalk rubble
Below 8/5

Trench G (9)

White, orange, clay with chalk, compact
Chalk fragments – 90%
Compact chalk layer with degraded clay/natrual
Below 2. Above 10

(10)

Off white, silt, loose
Chalk fragments of varying sizes 09-98%
Chalk rubble
Below 9. Above 19

(18)

Dark orange brown, clay, firm
Odd chalk fragments
Below 2. Above 19

(19)

Orange brown, clay loam, friable
Small chalk fragments
Below 18. Above 10

Trench J (11)

Off white, silt, loose
Large chalk blocks and chalk fragments 95%
Various chalk rubble + occasional flint nodules, some tested
Below 2

Note: For further Test Pits K/Q, W4, W20, W22, W52 Context Sheets please see attached Compact Disc

3.5: Geophysical Investigation of Ancient Flint Mines, Harrow Hill, Sussex

by Andrew J. Smith

This investigation was one of a preliminary nature in an attempt to discover whether changes in substructure, due to ancient flint mines, could be located using electromagnetic, geophysical techniques.

Harrow Hill is located in the heart of the South Downs, not far from Arundel. It lies in the Duke of Norfolk's estate and permission had to be obtained from him to allow the survey to be carried out.

The area is well known for its flint mines and several investigations have been carried out in the past. The previous studies have been mainly excavations and geophysical techniques have not yet been used.

The previous investigators were;
  Carmen 1924-1925
  Holleyman 1936
  Sieveking 1982 and 1984

Figure 1 shows the outline of the most likely places for ancient flint mines and also the areas in which the above investigators undertook their work.

The survey

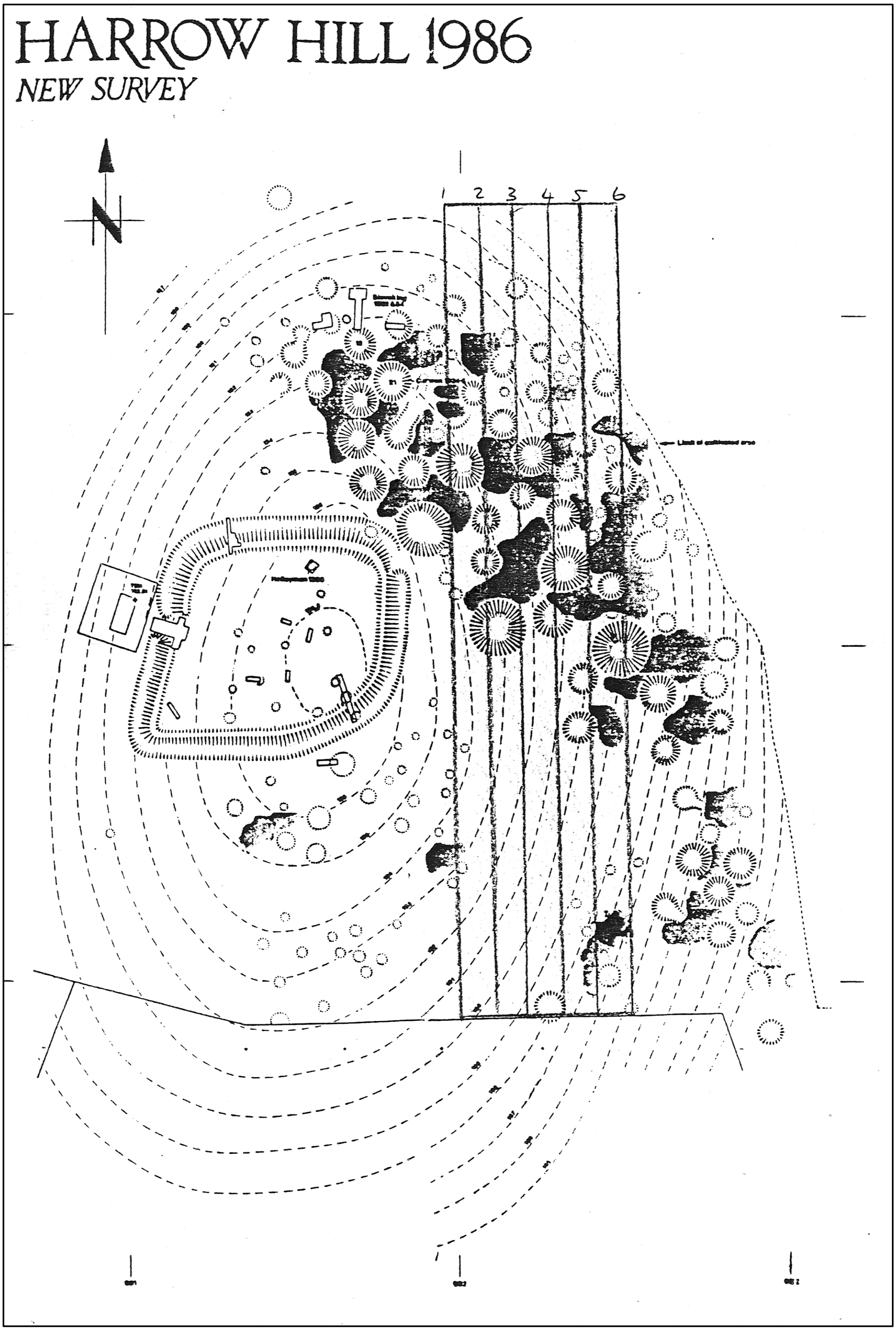
The EM 31 was used for this survey and an area 250x60m was covered. Six traverse lines were set out as shown on the attached Harrow Hill plan and readings were taken at 5m intervals on each traverse line.

As a check the instrument was pivoted through 90 degrees at various places over the site to see if any changes in readings would result. No difference was observed ands so only one reading was taken per station.

Results

The results were processed by computer and isometric and contour plots were obtained. It can be seen from both of these that some marked disturbance in the readings is detected as the instrument passes over the area known to contain flint mines.

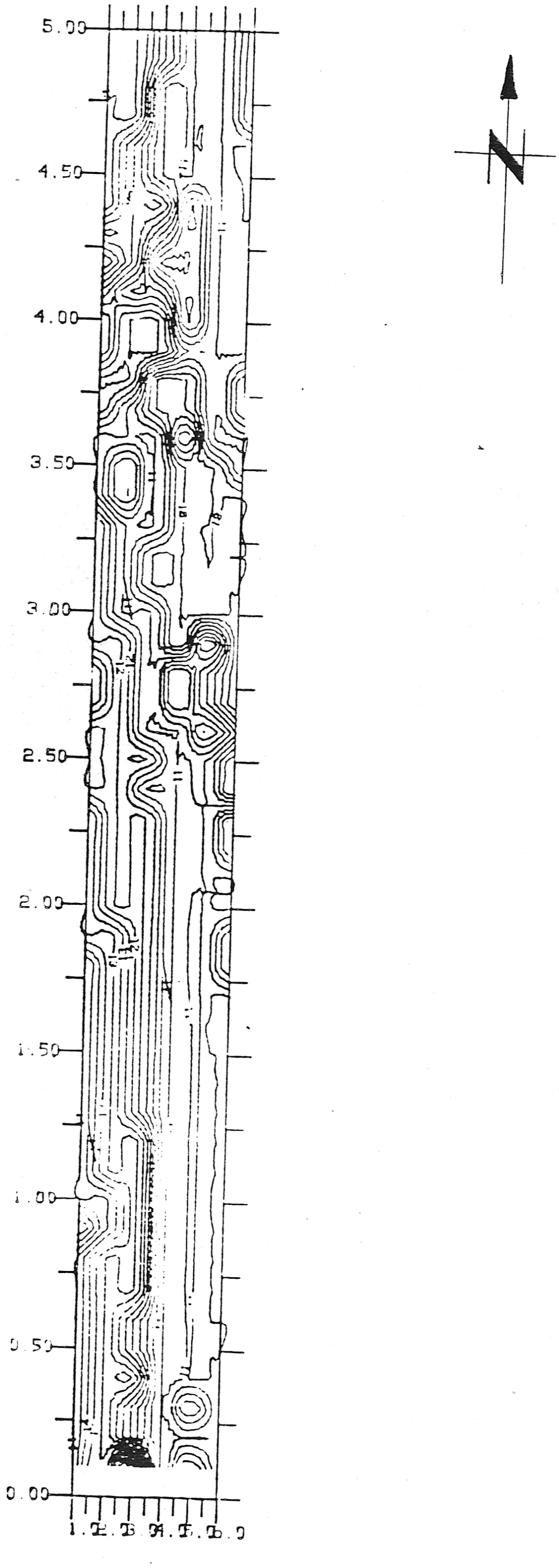
10.9 No other cause could be attributed to these disturbances and it can be stated that the electromagnetic device used was able to detect the presence of flint mines.

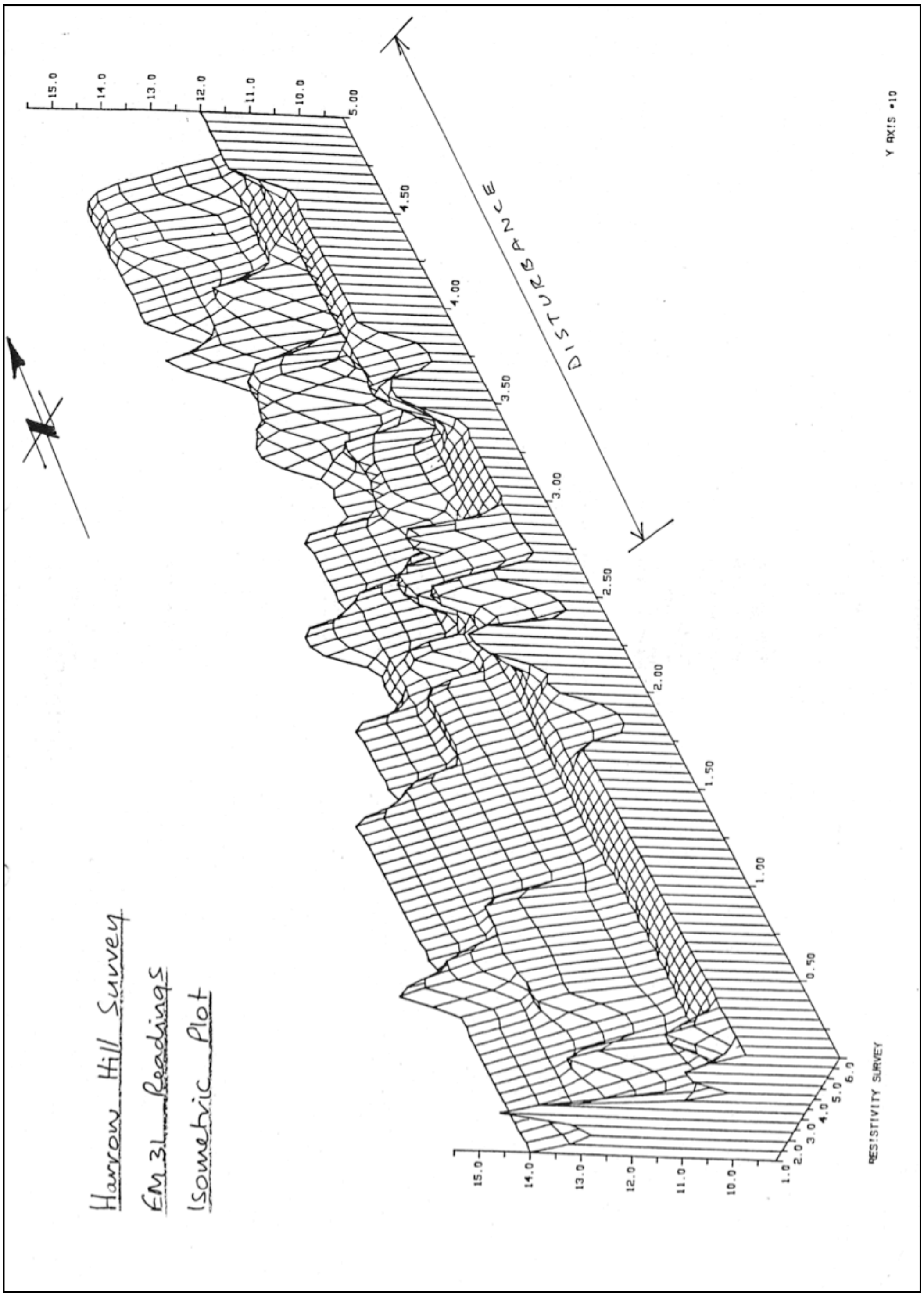

HARROW HILL 1986
NEW SURVEY
N
1 2 3 4 5 6

Harrow Hill Survey

EM 31 Results

Contour Plot





Harrow Hill Survey
EM 31 Readings
Isometric Plot
DISTURBANCE
RESISTIVITY SURVEY
Y AXIS *10

3.6: Excavation Flintwork

Table 1: The excavated flintwork from Harrow Hill

Type	*Drift Mines*	*Working Floor*	*Total*
Flakes			
With cortex: hard-hammer	201	582	783
soft-hammer	343	1215	1558
Without cortex: hard-hammer	10	63	73
Soft hammer	15	163	178
Flakes total	569	2023	2592
Blades			
With cortex: hard-hammer	2	5	7
soft-hammer	21	76	97
With cortex: hard-hammer	2	5	7
soft-hammer	9	63	72
Blades total	34	149	183
Axe thinning flakes			
With cortex: soft hard-hammer	278	556	834
Without cortex: soft-hammer	175	586	761
Axe thinning flakes total	453	1142	1595
Finishing flakes			
With cortex: soft-hammer	-	15	15
Without cortex: soft-hammer	14	70	84
Axe finishing flakes total	14	85	99
Chips	46	288	334
Quartered pieces	1	1	2
Tested nodules	3	6	9
Cores	1	5	6
Roughouts	5	14	19
Pre-forms	-	3	3
Flake tools			
Knife	1	3	4
Piercer	-	1	1
Misc. retouched piece	1	1	2
Total	1128	32135	4863
Fire-fractured flint	1	13	14

3.7: Small Finds

Table 1: Small finds from Harrow Hill

S.F No:	Category	Trench	Context
1	Flint cluster	A1	(8)
2	Flint cluster (nest)	A1	(15)
3	Axe roughout	A1	(15)
4	Axe roughout	A1	(15)
5	Antler	A1	(15)
6	Large flint point	A1	(15)
7	Nest of flakes	A1	(15)
8	Scapula (shovel?)	A1	(15)
9	Nest of flakes	A1	(15)
10	Charcoal sample	A1	(16)
11	Pottery	A1	(17)
12	Nest of flakes	A1	(17)
13	Axe roughout	A2	(26)
14	Axe roughout	A2	(26)
15	Axe roughout	A2	(26)
16	Large core	A2	(26)
17	Large core	A2	(26)
18	Large core	A2	(26)
19	Large core	A2	(26)
20	Large core	A2	(26)
21	Large core	A2	(26)
22	Large core	A2	(26)
23	Large core	A2	(26)
24	Large core	A2	(26)
25	Large core	A2	(26)
26	Large core	A2	(26)
27	Large core	A2	(26)
28	Pottery	A2	17
29	Antler tool (tine tip)	A2	17
30	Charcoal	A2	17

Appendix 4: Harrow Hill and Long Down Geophysics

4.1: Harrow Hill Section 42 application and 2019 survey results.

SECTION 42 LICENCE APPLICATION: April 2019

HARROW HILL PREHISTORIC FLINT MINE: 1015239, PATCHING, WEST SUSSEX

By Jon Edward Baczkowski, MA, PhD Candidate.

Project outline

This Section 42 proposal outlines an intended geophysical survey (Fig. 1) of the Neolithic flint mines located on Harrow Hill, Patching (TQ 08162 09986). The survey will form a key part of a PhD project undertaken by the author and the University of Southampton, titled *The Early Neolithic Flint Mines of Southern England and their wider Enviro* (supervised by Professor Joshua Pollard). The aim of the project is to gather archaeological data from landscapes surrounding Early Neolithic (4000 – 3500BC) flint mine complexes, by a combination of archaeological techniques. A geophysical survey is integral to the project, as it will allow, for the first time, the full extent and nature of the subterranean workings associated with the Neolithic mines to be mapped.

This is a justifiable and rich avenue of research, as currently only the visible surface remains of shafts and their accompanying spoil heaps define the full extant of the mine complex on Harrow Hill. It is also likely that the mine workings extend across a wider area than has been previously recognised, or that other archaeological features, such as pits, or areas of activity, such as flintworking floors, may exist beyond the core mining area. Other forms of mining, such as the small adit quarries discovered on Harrow Hill (Holgate 1995, Baczkowski and Holgate 2017) may also exist in these under researched areas. The use of current geophysical survey equipment, supplied by the University of Southampton, will enable the project to collect data at a level of detail not used before at a Sussex Neolithic flint mine complex, thus the project will expand knowledge of these important and early monuments in non-evasive manner, whilst enhancing knowledge of the extent of Neolithic activity.

Outline of Long Down flint mines and research objectives

Dated to the very start of the Early Neolithic, a defining period of British prehistory, the Sussex flint mines remain amongst the earliest and most important class of monuments to be permanently ingrained in the English landscape (Barber *et al* 1999). Recently, interest in the flint mines of Sussex has renewed, as they are now recognised as one of the earliest monumental expressions in the British Isles, clearly associated with Early Neolithic practices introduced from Continental Europe (Baczkowski 2014, Teather *et al* 2019). The sinking, and extraction of flint from deep shafts is viewed as a key component of the 'Neolithic Package', a set of characteristics core to the development of Neolithic ideologies and lifestyle. Flint mines fossilize the customs of cultural groups living in a period of great environmental change and ideological reorientation and remain an important class of monument, central to understandings of the cultural interactions, exchanges and practices of communities that mark the start of the British Neolithic.

The mine complex located on Harrow Hill, Patching, is the second largest in Sussex, only the mines on Cissbury hill, some 8km to the southeast of Harrow Hill are larger. On its eastern flank are the hollows and spoils associated with around 160 Neolithic mineshafts. There have been several major seasons of archaeological investigation at the mine complex, most notable by Dr. Eliot Curwen and Cecil Curwen (1926) and by Gale Sieveking (McNabb *et al* 1996). Both these excavations focused entirely on shafts located within the main minefield, revealing a complex and deep next work of shafts connected to multiple extraction galleries. The data collected from the excavations did much to advance understandings on the Early Neolithic extraction process, but little on activities occurring in the wider minefield.

In 1986 a small, sample excavation by Robin Holgate (Baczkowski and Holgate 2017) increased knowledge beyond the main mine complex, revealing the presence of short adit quarries along the eastern flank of Harrow Hill. No dating evidence was recovered and the exact relationship of this area of extraction with the deep mines was not established. However, the discovery of such extraction features highlighted the potential of new archaeological discoveries on Harrow Hill, especially away from the main minefield. Of note was also the excavation of a large pit on New Barn Down, c. 600m south of Harrow Hill, in 1934 by the Curwen's (1934), which contained flint implements fashioned from mining waste, Carinated Bowl pottery and a small assemblage of animal bone. Recent radiocarbon dating of the New Barn Down pit has shown that it is contemporary with mining activity (Baczkowski 2019, between 3950-3800 cal BC, indicating that it relates to a community involved with extraction activity at the Harrow Hill mines. Such features may relate to settlement, or other such activity undertaken close to Harrow Hill by mining communities.

The key objectives of the geophysical survey are to:

- Research a small area to the south of the main mines on Harrow Hill, within the area where Holgate conducted the excavation in 1986, and;
- To reveal the size and extent of the quarries and reveal any features related to mining that are not visible on the surface, such as pits or evidence of structures, and;
- To investigate the presence of any archaeological features, such as pits or structures, which maybe associated with mining activity and located in the wider extraction landscape, and;
- Finally, to progress knowledge of Neolithic mining practices on Harrow Hill, but also allow the boundary of the mines to be mapped, thus aiding in future assessment of the scheduled area of the mine complex.

Methodology

It is proposed to conduct a magnetometer survey with use of a Geoscan Research FM256 fluxgate gradiometer, and the resulting data processed in Geoscan Research Geoplot 3. The fluxgate gradiometer survey will be conducted using 20m by 20m grids with readings taken at 0.5m intervals along traverses spaced 1m apart at a resolution of 0.1nT. The final plots created in Geoscan Research Geoplot for the earth resistivity and fluxgate magnetometer surveys will be composed using ArchGIS

10.6. Data will be despiked and interpolated, and the resulting enhanced plots are used to create interpretive and georeferenced plots.

Timing and personnel

A provisional date for the survey to be conducted will between the 2nd to the 7th of May 2019. Ground conditions will be perfect for survey during this month. Experienced volunteers and staff will help with the survey. The survey will be directed by the authour, with technical advice from Kristian Strutt, senior geophysicist from the Archaeological Department at the University of Southampton.

Reporting

A full technical report on the work, appropriately illustrated, will be produced within four months of the fieldwork. Copies will be deposited with Historic England, the OASIS database and with Worthing Museum and Art Gallery. A further report covering all the areas of the research project may also be submitted for publication in the *Sussex Archaeology Collections*, or other such suitable journal.

Bibliography

BACZKOWSKI, J., and HOLGATE, R. 2017. Breaking Chalk; The Archaeological investigations of Early Neolithic flint mines at Long Down and Harrow Hill, West Sussex, 1984-86. *Sussex Archaeological Collections,* 155. 1-30.

BACZKOWSKI, J. 2014. Learning by Experience: The flint mines of Southern England and their Continental origins. Oxford Journal Of Archaeology 33: 2. 135–153.

-2019. Making Connections: A Fresh Analysis of an Early Neolithic Pit and its contents. *Oxford Journal Of Archaeology* 38.4. Submitted

BARBER, M., FIELD, D., and TOPPING, P. 1999. *The Neolithic Flint Mines of England,* London: English Heritage.

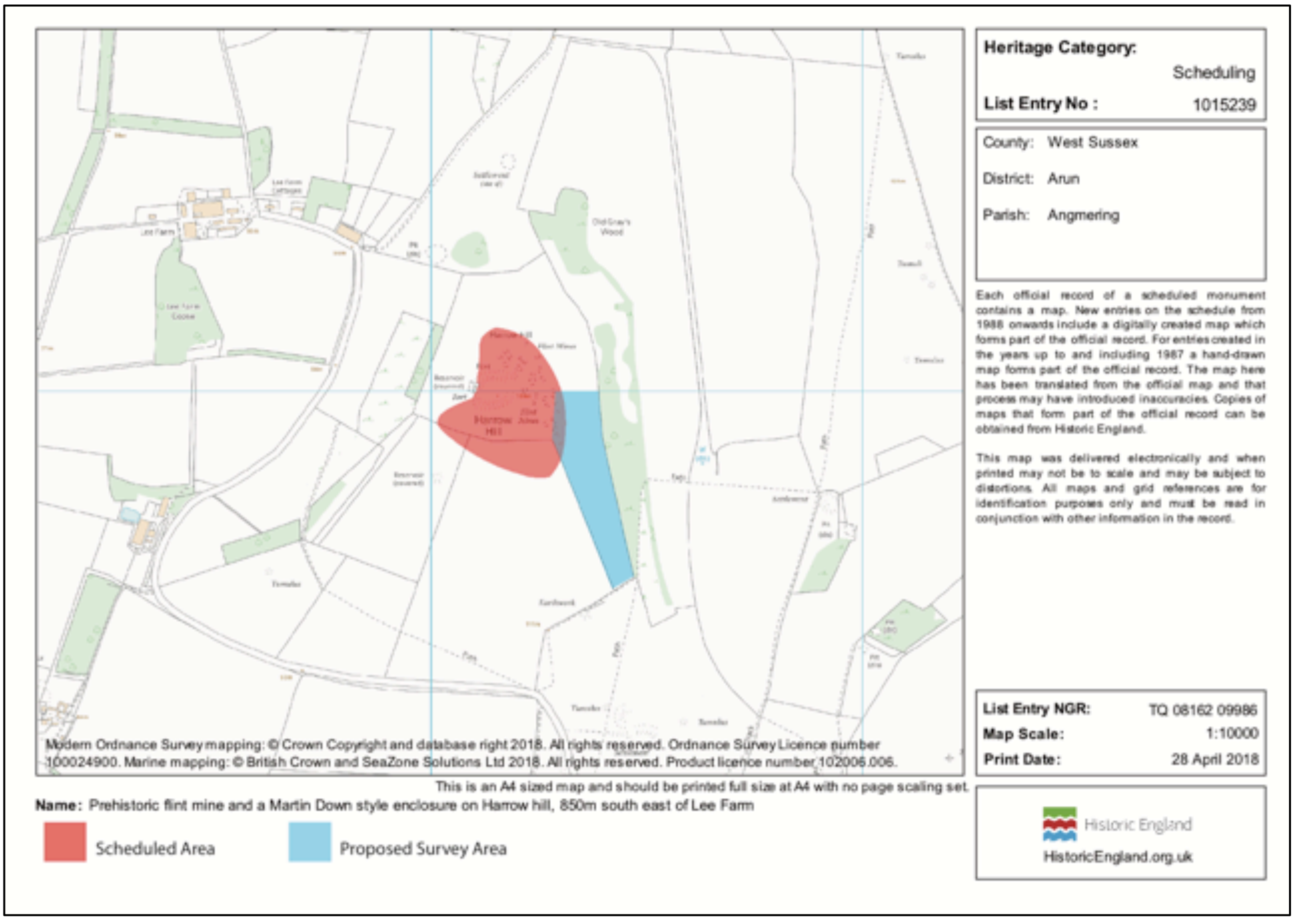
CURWEN, E., and CURWEN, E. C. 1926. Harrow Hill flint mine excavation 1914-5, *Sussex Archaeology Collection,* 67. 103-38.

CURWEN, E, C. 1934. A Late Bronze Age farm and a Neolithic pit-dwelling on New Barn Down, *Sussex Archaeological Collections,* 75. 137-70.

HOLGATE, R. 1995. Harrow Hill near Findon, West Sussex, *Archaeologia Polona,* 33. 347-350.

MCNABB, J., FELDER, P. J., KINNES, I., and SIEVEKING, G. 1996. An archive report on recent excavations at Harrow Hill, Sussex, *Sussex Archaeological Collections,* 134. 21-37.

TEATHER, A., TOPPING, P., and BACZKOWSKI, J. 2019. *Mining and Quarrying in Neolithic Europe: A Social Perspective,* London: Oxbow Books.

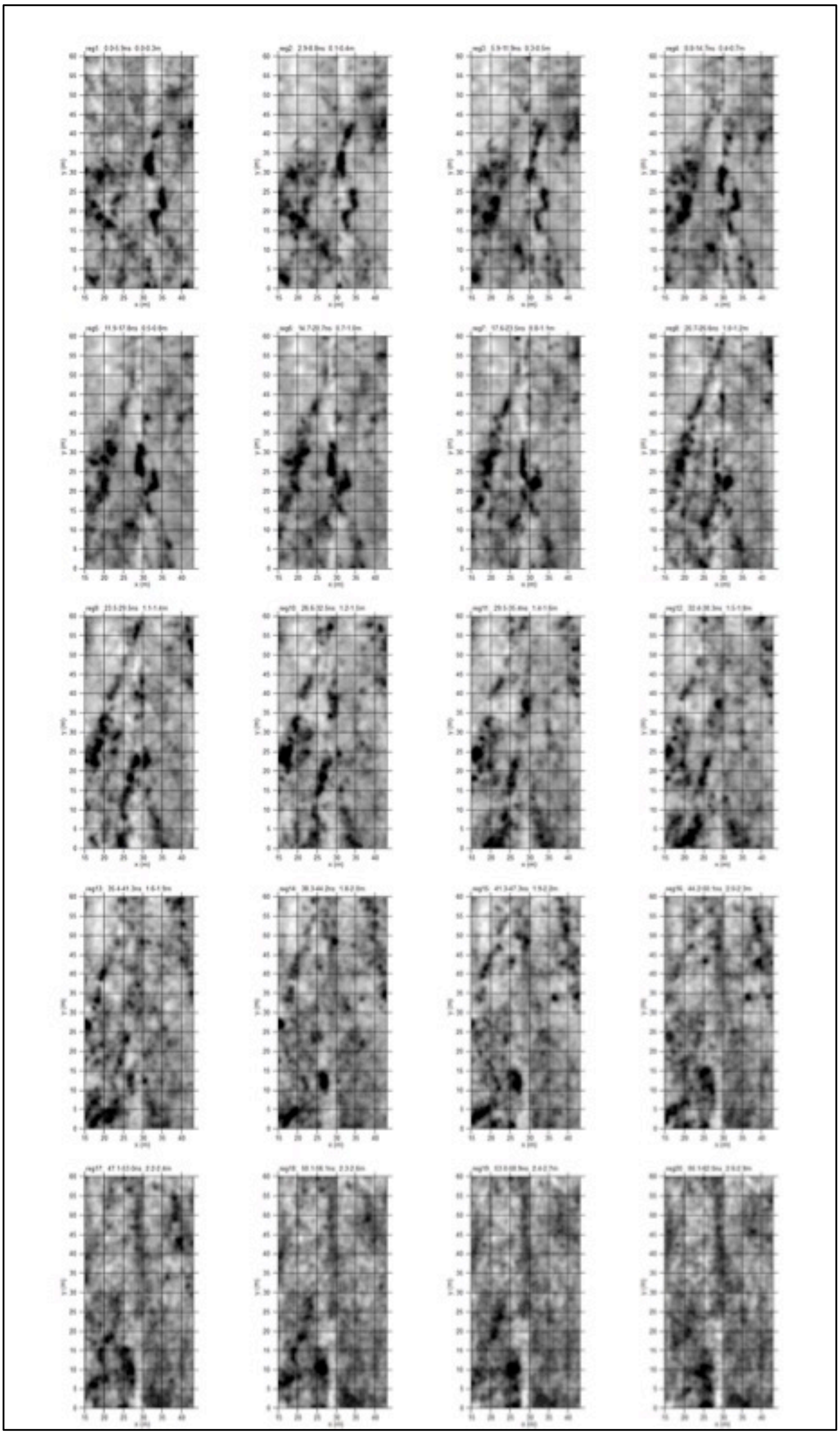


Area of proposed survey, Harrow Hill, 2019.

Harrow Hill mag survey grid 2019.

Harrow Hill mag survey results 2019.

Harrow Hill GPR survey results 2019.



Harrow Hill GPR survey results 2019.

4.2: Long Down Section 42 application and 2019 survey results.

SECTION 42 LICENCE APPLICATION: April 2019

LONG DOWN PREHISTORIC FLINT MINE: 1017521, EARTHAM, WEST SUSSEX

By Jon Edward Baczkowski, MA, PhD Candidate.

Project outline

This Section 42 proposal outlines an intended geophysical survey (Fig. 1) of the Neolithic flint mines located on Long Down, Eartham (SU 93138 09357). The survey will form a key part of a PhD project undertaken by the author and the University of Southampton, titled *The Early Neolithic Flint Mines of Southern England and their wider Enviro* (supervised by Professor Joshua Pollard). The aim of the project is to gather archaeological data from landscapes surrounding Early Neolithic (4000 – 3500BC) flint mine complexes, by a combination of archaeological techniques. A geophysical survey is integral to the project as it will allow, for the first time, the extent and nature of the subterranean workings associated with the Neolithic mines to be mapped.

This is a justifiable and rich avenue of research, as currently only the visible surface remains of shafts and their associated spoil heaps define the full extant of the mine complex on Long Down. It is also likely that the mine workings extend across a wider area than has been previously recognised, or that other archaeological features, such as pits, or areas of activity, such as flintworking floors, may exist beyond the core mining area. Other forms of mining, such as the small adit quarries discovered at other mines, such as on Harrow Hill (Holgate 1995a, Baczkowski and Holgate 2017) may also exist in these under researched areas. The use of current geophysical survey equipment, supplied by the University of Southampton, will enable the project to collect data at a level of detail not used before at a Sussex Neolithic flint mine complex. The project will expand knowledge of these important and early monuments in non-evasive manner, whilst enhancing knowledge of the extent of Neolithic activity.

Outline of Long Down flint mine and research objectives

Dated to the very start of the Early Neolithic, a defining period of British prehistory, the Sussex flint mines remain amongst the earliest and most important class of monuments to be permanently ingrained in the English landscape (Barber *et al* 1999). Recently, interest in the flint mines of Sussex has renewed, as they are now recognised as one of the earliest monumental expressions in the British Isles, clearly associated with Early Neolithic practices introduced from Continental Europe (Baczkowski 2014, Teather *et al* 2019). The sinking, and extraction of flint from deep shafts are viewed as a key component of the 'Neolithic Package', a set of characteristics core to the development of Neolithic ideologies and lifestyle. Flint mines fossilize the customs of cultural groups living in a period of great environmental change and ideological reorientation and remain an important class of monument, central to understandings of the cultural interactions, exchanges and practices of communities that mark the start of the British Neolithic.

The small flint mine complex located on Long Down comprises of the surface remains left by roughly 30 or so mineshafts. Only two episodes of archaeological investigation have occurred on Long Down, between 1955-58 by E. F. Salisbury (1961) and in 1985 by R. Holgate (1995b). Although both were small-scale excavations, they confirmed the presence and date of the Early Neolithic mines. However, due to the limited size of the excavations there still remain key questions on the nature of the mining on Long Down, especially on the size of the mining area and the form of the underground workings.

The results of a recent program of radiocarbon dating (Baczkowski and Holgate 2018, Edinborough *et al*), carried out for the project, *Supply and demand in prehistory? Economics of Neolithic mining in NW Europe*, has demonstrated that both Early Neolithic and Late Neolithic mining appears to have been undertaken on Long Down. It is hoped that the proposed survey will specifically identify extraction features from the later phase of Neolithic mining. The discovery of such features will expand knowledge of later Neolithic mining techniques, a form of extraction that is unknown in Sussex, but recorded elsewhere in England, including at Grimes Graves, Norfolk.

Overall, key objectives of the geophysical survey are to:

- Research the size and arrangement of the subterranean mine-workings, especially for the existence of underground galleries, quarries and other such mine feature, and;
- To define the boundary of the mines, to both understand the scale of extraction on Long Down and to aid in future assessment of the scheduled area, and;
- To expand knowledge of later Neolithic mining practices, and;
- Finally, to investigate the presence of any archaeological features, such as pits or structures, which maybe associated with mining activity and located in the wider extraction landscape.

Methodology

The survey at Long Down will involve the use of two geophysical techniques, Ground Penetrating Radar (GPR) and magnetometry (Mag). Results from these techniques are dependent on the geology of the particular area, and whether the archaeological remains are derived from the same materials. Both techniques have been chosen because the geological and pedological conditions are considered favorable for GPR and Mag techniques, due to the chalks, clays and slits known to fill the mining and other archaeological features on Long Down, all of which cut into the solid chalk bedrock.

G.P.R uses an electromagnetic radar wave propagated through the soil to search for changes in soil composition and structures. The variations in the Relative Dielectric Permittivity (RDP) in different deposits produce reflections in the profile data of the survey. Lower frequency survey antennae (50Mhz or 100Mhz) are generally used for geological survey, whereas higher frequency antennae (250Mhz, 500Mhz or 800Mhz) are utilised for archaeological surveys.

Scans for the GPR survey will be conducted at 0.0295m along traverses spaced at 0.25m intervals. The collected data will be analysed using REFLEX software, with each traverse analysed as an individual profile to allow a manual abstraction of archaeological features.

To suppliant and allow for a comparison of data with the GPR results a Fluxgate magnetometer survey will be carried out using a Geoscan Research FM256 fluxgate gradiometer, and the resulting data processed in Geoscan Research Geoplot 3. The fluxgate gradiometer survey will be conducted using 20m by 20m grids with readings taken at 0.5m intervals along traverses spaced 1m apart at a resolution of 0.1nT. The final plots created in Geoscan Research Geoplot for the earth resistivity and fluxgate magnetometer surveys will be composed using ArchGIS 10.6. Data will be despiked and interpolated, and the resulting enhanced plots are used to create interpretive and georeferenced plots.

Marking out of the site grid will be undertaken with a differential Leica global positioning system (GPS) and/or an automated total station. Grid points will be visibly referenced using temporary surface markers, therefore minimising ground disturbance. The data will be transformed in the field to Ordnance Survey co-ordinates using survey tie-in information.

Timing and personnel

The survey is scheduled to take place from the 23rd to the 28th of May, 2019. Permission has been granted from JH and FW Green Ltd, managers of Long Down on behalf of the landowner, Eartham Estate. This month will minimise disturbance to the workings of the estate and also offer good ground conditions for the survey take place on.

Experienced volunteers and staff from the University of Southampton will help with the survey. The survey is to be directed by Jon Baczkowski, with technical advice from Kristian Strutt and Dominic Barker, senior geophysicist's from the Archaeological Department at the University of Southampton.

Reporting

A full technical report on the work, appropriately illustrated, will be produced within four months of the fieldwork. Copies will be deposited with the Eartham Estate, Historic England, the OASIS database and the Novium Museum, Chichester. A further report covering all the areas of the research project may also be submitted for publication in the *Sussex Archaeology Collections*, or other such suitable journal.

Bibliography

BACZKOWSKI, J., and HOLGATE, R. 2017. Breaking Chalk; The archaeological Investigations of Early Neolithic Flint Mines at Long Down and Harrow Hill, West Sussex, 1984-86, *Sussex Archaeological Collections,* 155. 1-30.

- 2018. Neolithic Flint Mining In Southern England: New Radiocarbon Dates For Long Down, West Sussex. And Their Implications, *Past* 88. 2-5.

BACZKOWSKI, J. 2014. Learning by Experience: The flint mines of Southern England and their Continental origins. Oxford Journal Of Archaeology 33: 2. 135–153.

BARBER, M., FIELD, D., and TOPPING, P. 1999. *The Neolithic Flint Mines of England,* London: English Heritage.

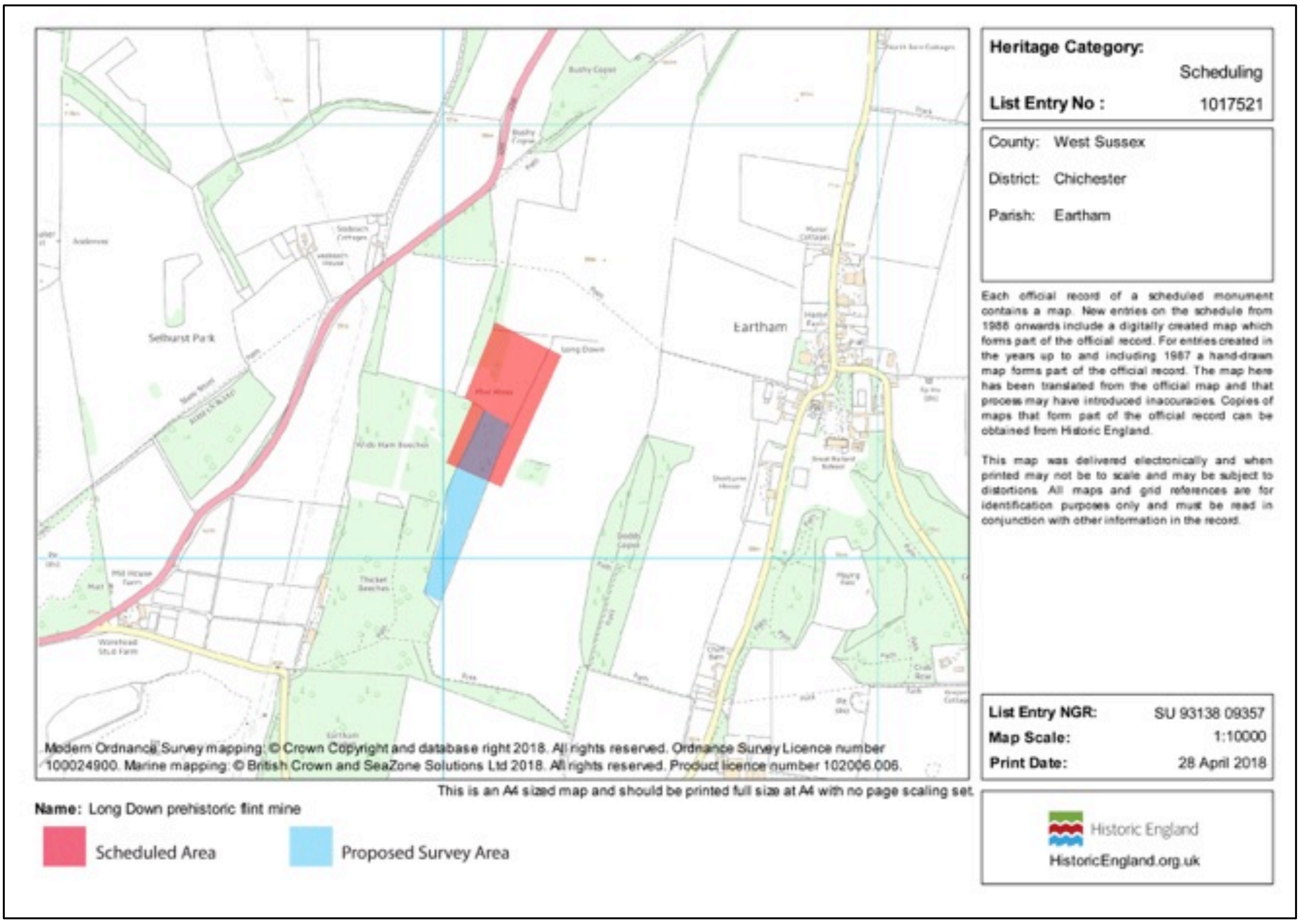
EDINBOROUGH, K., SHENNAN, S., TEATHER, A., BACZKOWSKI, J., BEVAN, A., BRADLEY, R., and SCHAUER, P. 2019. New Radiocarbon Dates Show Early Neolithic Date of Flint-Mining and Stone Quarrying in Britain, *Radiocarbon*, 62: 1. 75-105.

HOLGATE, R. 1995a. Harrow Hill near Findon, West Sussex, *Archaeologia Polona,* 33. 347-350.

- 1995b. Long Down Near Chichester, West Sussex, *Archaeologia Polona,* 33. 350-52.

SALISBURY, E. F. 1961: Prehistoric Flint Mines on Long Down. *Sussex Archaeology Collections,* 99. 66-79.

TEATHER, A., TOPPING, P., and BACZKOWSKI, J. 2019. *Mining and Quarrying in Neolithic Europe: A Social Perspective,* London: Oxbow Books.



Area of proposed survey, Long Down, 2019.

Long Down mag survey grid 2019

Long Down mag survey results 2019

Appendix 5: Chapter Five flintwork reports and notes.

5.1: Harrow Hill survey flintwork.

During June 2019 flintwork associated with Early Neolithic flint mining on the southern flank of Harrow Hill was surveyed and recorded. The area surveyed contained a dense scatter of debitage from the production of bi-facial axes. The supply of the raw material is almost certainly from the numerous flint mines located on Harrow Hill and within the survey area. All pieces were photographed, measured weighed and left in their original location. The pieces were individually number, beginning with 1, and given the pre-fix, **AX**. Notes were taken on each piece and all were surveyed with Leica GPS rover unit and plotted in ArcMap.

In total of fifteen individual pieces weighing a total of 4,754g (Table 1) were surveyed. All pieces can be dated to the Early Neolithic period. They are described as follows:

AX1
A Medium sized complete bi-facial axe roughout that has been lightly exposed to heat. The piece is patinated white, with some black and orange staining. During manufacture a large deep plunging flake has been removed from its butt end, this is probably the reason for its discard.

AX2
A small complete bi-facial axe roughout. It is well formed and has with no obvious flaws or knapping errors. It is patinated white with areas of black staining.

AX3
The tip-end section of a bi-facial axe roughout. It was more than likely broken during manufacture as no fresh damage was noted. It is patinated white with a small area of thick white rough cortex.

AX4
The butt end of a bi-facial axe roughout that was damaged post-deposition evidenced by a fresh break. It is patinated white with black and orange staining. It is also lightly burnt.

AX5
A small and complete bi-facial axe roughout with a deep flake scar at its tip, resulting from an overshot knapping trike during manufacture, probably the reason for its discard. It is patinated white and in relatively fresh condition, with no post-depositional damage. The length of the AX5, less than 120mm, is small and it can be classified as a miniature axe.

AX6
A large and crude bi-facial axe preform with a deep hinge fractured flake scar at its tip, the result of an overshot knapping strike and probably the reason for its discard. It is patinated white and black staining, but no post-depositional damage.

AX7
A medium size bi-facial axe roughout, it has an unusual slightly curved profile and right-angled truncation at its butt end, which could have been an effort to turn it into a core. Alternately, it is knapping error, the results of a hard strike. It is patinated white with black and orange staining, but with no fresh damage.

AX8
The small part of a crude bi-facial preform axe. It has been snapped and probably discarded. It is patinated white with heavy black staining. A flake has been removed from its tip in recent history, possibly the results of plough damage.

AX9
A small complete bi-facial axe roughout with a deep plunging flake scar across its mid-section, the removal of which was contemporary with its manufacture and is possibly the reason for its discard. It is patinated white with black and orange staining. It can be classified as a miniature axe.

AX10
A large and complete bi-facial axe roughout with clear natural flaw, more than likely the reason for its discard. It is thin for its size, less than 10mm, possibly because of an attempt to remove the flaw, which was unsuccessful. On one side it is stained almost completely black. Its other side is yellow, evidence of sun damage and indicating it has been exposed on the ground surface for a sustained period of time.

AX11
A small complete bi-facial prefrom axe, which has only been partially develop prior to its discard, possibly due to a natural flaw. It is patinated white with black staining and no evidence of fresh damage.

AX12
A large piercing implement produced from a primary flake, possibly debitage from bi-facial axe manufacture. The edge of its tip has semi-abrupt re-touch along both edges and it tip has possible evidence of use-wear on its tip from a boring action. It is patinated white with patches of black staining.

AX13
A long thick blade that has been utilized as scraper and appears to have been struck from a core. It has semi-abrupt re-touch around the edge of its bulb end. It is off-white, indicating it has been exposed to the sunlight for a notable duration.

AX14
A large core produced on a piece of mining waste with thick cortex. Single faced with a well-developed platform and some signs of platform preparation. Several flakes have been removed along its single face, which would have c. 70mm in length. It is patinated white with black staining.

AX15
A large bi-facial roughout, lunate in profile it could represent a sickle blank. Compete and has a deep flakes scar at its butt, which was probably the reasons for its discard. It is patinated white with black staining. A rare and unusual piece, although other finer examples are recorded from the Sussex flint mines.

AX No.	Type	**Length** mm (L x W)	Weight
1	Roughout	138 x 27	467g
2	Roughout	123 x 24	265g
3	Roughout	108 x 29	208g
4	Roughout	117 x 18	221g
5	Roughout	141 x 18	448g
6	Pre-form	163 x 58	520g
7	Roughout	129 x 21	412g
8	Preform	107 x 35	306g
9	Roughout	113 x 22	295
10	Roughout	1173 x 31	513g
11	Preform	142 x 23	249g
12	Implement	146 x 19	241g
13	Blade	94 x 16	72g
14	Core	71 x 41	216g
15	Sickle	158 x 24	320g
Totals	15		4,754g

Table 1: Flintwork totals

Results and significance

The assemblage is small, but significant. It is typical for Early Neolithic flint mines, including axes resulting from various stages of production. The axes appear to have been worked rapidly, with several examples discarded due to knapping errors and others because of natural flaws. Several of the roughout axes are complete and it is not clear why they were discarded. They could have been stockpiled for collection at a later date. The axes are clearly associated with a working floors close to flint mines in the survey area, also evidenced by a large volume of debitage recorded in the same area, including many large primary flakes and also axe thinning flakes.

The sickle, core, scraper and piercer are typically Early Neolithic, being large and robust implements (Gardiner 1988; Butler 2005). The blade and core are sizable examples and demonstrate that good quality and large flint nodules were readily available, presumably from the flint mines. Such pieces are in keeping with more domestic activates, rather than directly diagnostic of mining. The piercer, or borer, is comparable to an example found on New Barn Down, less than 600m south of Harrow Hill. Of particular note if the probable sickle blank, which is a rare form of implement and clearly dated to the Early Neolithic.

5.2: Church Hill survey flintwork.

A small of flintwork was recovered from the area of the Early Neolithic flint mines on Church Hill in late summer 2018. The location of each piece was recorded with a hand-held Garmin GPS, prior to their removal to Worthing Museum. Further surveying work was undertaken in September 2018 to plot the locations of working floors, associated with the flint mines and the production of bi-facial axes. The relationship between the working floors and collected axes is not known.

For this report the pieces were measured and weighed. Further photography was undertaken for this thesis. A total of eight pieces, weighing a total of 1,294g were collected and recorded (Table 2). The pieces were individually number, beginning with 1, and given the pre-fix, **FW** and are described as follows:

FW1

A complete small delicate finely worked pick/chisel, produced from a flake and therefore is not a core tool. It is trapezoid in profile, it is lightly patinated pale grey to white and is in fresh condition with only one small recent chip. It is bifacially worked with semi-abrupt and/or invasive retouch around all edges and its tip has been developed with a series of flake removals. The tip is not sharp and has been blunted, more than likely through use rather than post-depositional damage, as all other edges are fresh. The piece is clearly Early Neolithic in date and is difficult to classify and will be discussed below, along with the other examples.

FW2

The butt end of pick/chisel, snapped at its mid point it is patinated white and has no fresh damage. Trapezoid in profile the piece is manufactured from a flake. Bifacially worked with semi-abrupt and/or invasive retouch the piece has been more than likely been snapped in manufacture, as part of it does not appear to be finished.

FW3

The short tip end of a fine pick/chisel, it is lightly patinated pale grey to white. It is clearly technologically the same as both WF1 and WF2 and is trapezoid in profile. The point of its break is notable, as it is clearly the result of an impact horizontal to its central axis that has formed a hinge fracture. It therefore probably snapped in use, rather than in manufacture.

FW4

A long thin blade or backed knife. It is lightly patinated grey and has a very small and diffuse bulb of percussion and evidence of platform preparation at its proximal end, indicating it was probably struck from a blade core. In profile it is indicative of a backed knife, with a prominent ridge along it central axis. It also has abrupt retouch along one edge, probably to blunt it for handling. The piece is therefore likely to be a tool and can be classified as a backed knife, comparable with the similar, albeit finer example from Pit X, New Barn Down (Chapter Six, Paragraph 6.5).

FW5

A small complete bifacial axe roughout, patinated white. It has some iron staining and has probably been exposed long for some light weathering to occur. Like several of the examples from Harrow Hill the piece is towards the smaller size for a roughout and could be classified as a large miniature axe. A small flaw, in the form of a deep area of cortex, is probably the reason for its discard, as it appears there some effort to remove the flaw.

FW6

A large bifacial axe roughout, it is lightly patinated grey to white. A classic example of a flint mine produced bifacial axe in size and form with a wide profile and tapering butt end. Its reason for discard is obvious, having a large step fracture horizontally from its tip. The quality of the raw material is high and there are no signs of internal flaws, therefore the facture results from a knapping error, possibly due to an incorrect angled strike.

FW7
The butt end of a pick/chisel, thick and patinated white. The piece has been well rolled and has probably been exposed to the elements for a number of years. It is the same in profile and form as the pick/chisels and appears to have snapped in use, rather than in manufacture, as it is broken in a similar fashion and place to WF3.

FW8
A complete miniature bifacial axe roughout that is lightly patinated grey to white. The piece can be described as tear-shaped, its form matches the larger mine examples, such as WF6. There is no obvious reason for its discard and the piece is finely worked.

FW No.	**Type**	**Length** mm (L x W)	**Weight**
1	Tool	12 x 1	89g
2	Tool	87 x 26	92g
3	Tool	66 x 15	24g
4	Tool	129 x 14	74g
5	Roughout	121 x 38	222g
6	Roughout	169x 53	614g
7	Tool	72 x 16	68g
8	Roughout	108 x 28	111g
Totals	8		1,294g

Table 2: Church Hill flintwork.

Results and significance

The assemblage is notable and can be dated to the Early Neolithic. Included is a distinct form of bi-facially worked pick, or chisel, totaling four pieces. These define clear categorization and clearly associated with the Early Neolithic flint mines. Similar examples have been recorded from Sussex, such as an example from Pit X, New Barn Down, close to the Harrow Hill flint mines, and several from the Cissbury Hill mines, c. 2km east of Church Hill. They are more delicate than large picks, such as those recorded from Long Down (See below), which were possibly used in mining. Their size and fineness suggest they were produced for a specialist activity, possibly associated with mining or other unspecified craft activity.

The other pieces in the assemblage are typical flint mine products, being axes of various size, form and recording various stages of the production of bi-facial axes. The long blade re-fashioned, as backed knife is impressive, measuring 129mm in length and clearly dated to the Early Neolithic. Such a pieces would have been struck from a sizable core requiring a large raw nodule, presumably sourced from the Church Hill mines. Of the axes, the most notable is the tear-shaped FW8, a fine and well-made piece that measures 108mm in length and can categorized as a miniature axe.

The purpose of these pieces is unknown and they could be for woodworking or more non-functional reasons.

5.3: Long Down survey flintwork.

During archival research undertaken for this project twenty or more boxes were encountered at the stores of the Novium, Chichester, which contained flintwork collected during the excavation of the Early Neolithic flint mines on Church Hill, Chichester, conduced by E. F Salisbury between 1955-1958. None of the pieces have been fully published and warrant further analysis, beyond the limited scope of this project. Some of the pieces in archive, c. 25%, appear to be dated to the Late Neolithic or Early Bronze Age and included large ovate, or discoidal reforms. Such pieces were also recorded during fieldwork conduced in 1985 by R. Holgate (See Chapter Three of this thesis). All the pieces were either excavated directly from a mineshaft, or from working floors and spoil heaps located close by.

For this project a selection of the clearly Early Neolithic types were analysed. These were measured and weighed. Further photography was undertaken for this thesis. A total of nine pieces, weighing a total of 1,462g were recorded (Table 3). The pieces were individually number, beginning with 1, and given the pre-fix, **AXE** and are described as follows:

AXE1
A well formed miniature bi-facial axe preform. It is a complete example and patinated white with no obvious flaws.

AXE2
A small pick produced on a robust, thick flake from axe manufacture. Patinated white, it has a slightly curved profile in section.

AXE3
Complete bi-facially worked axe with no obvious flaws. It is well made and in fresh condition, with no obvious flaws.

AXE4,
Narrow pick produced on a thick flake, probably the waste from axe production. It is crudely knapped and has possible damage on its tip.

AXE5
Fine bi-facially worked axe no obvious flaws. It is a narrow example and can be classified as a miniature axe. It is patinated white and in fresh condition.

AXE6
Crude short thick pick, produced on probable axe manufacturing waster. Some damage on tip, possibly from use. A thick white to buff cortex remains on some surfaces.
AXE7
Short pointed pick produced on a flake. Fairly crude and shows signs of damage, possibly dues to its use. It has a small area of thick white cortex and the blue colour of the raw flint showing through its white patination.

AXE8
Short robust bi-facially worked axe, narrow to almost pick like profile. It has damage, possibly dues to use. It is patinated white.

AXE9
Pick like implement produced on a flake, possible use-wear on tip and vey crude. It is patinated white.

AXE No.	**Type**	**Length** mm (L x W)	**Weight**
1	Axe	98 x 52	130g
2	Pick	126 x 69	229g
3	Axe	128 x 78	342g
4	Pick	129 x 42	101g
5	Axe	105 x 62	105g
6	Pick	118 x 54	149g
7	Pick	97 x 51	110g
8	Axe	112 x 73	166
9	Pick	124 x 42	130
Totals	9		1,462g

Table 3: Long Down flintwork.

Results and significance

The pieces recorded are only a small component of a much larger assemblage and are typical of Early Neolithic flintwork associated with a flint mine. The most notable part of the assemblage is the picks, which all produced from thick flakes and not bi-facially knapped. These are likely to have been used in mining, probably for breaking chalk in the shafts or galleries. Other examples are recorded from the Sussex mines and demonstrate the difference between the mine products, axes such of those recorded, and more robust, practicable pieces used in the extraction process. The axes, which like the other examples documented here, are on the small size. It is not known why large axe roughouts are scarcer in the assemblage. This may imply that the smaller axes were, like the picks, manufactured for activities associated with mining and did leave the mines, although, it is noted that few of the examples in this assemblage were broken in production, nor show obvious signs of flaws. The production and use of these small, or miniature axes therefore remains unknown.

5.4: Cissbury flintwork

During the course of this project a small assemblage of flintwork was examined, which was held in the archives of Barbican House, Lewes. All the pieces in the assemblage are labeled as originating from '*Nr Cissbury*'. Although their precise provenance is not known, they are suspected to originate from the west or southern flank of Cissbury Hill, were mines are known to exist that are not visible as surface remains, unlike them main complex. They are therefore included here, as they mostly produced on axe thinning flakes and are good examples of Early Neolithic types.

For this report the pieces were measured and weighed. Further photography was undertaken for this thesis. A total of nine pieces, weighing a total of 1,462g were recorded (Table 4). The pieces were individually number, beginning with 1, and given the pre-fix, **CF** and are described as follows:

CF1
A short, thick end/side scraper with semi-abrupt retouch around all but one edge. The piece is unpatinated, dark to light grey with and thick white cortex. It is produced on a probable curving axe thinning flake, which has been further worked on one edge to produce a tear-shaped form. It has also had its bulb of percussion removed during its re-working, a method seen on other Early Neolithic scrapers, most notably several examples from Pit X, New Barn Down (See Chapter Six).

CF2
A short robust end/side scraper produced on an axe-thinning flake with thick cortex. It is patinated white and similar in form to **CF1**.

CF3
A moderately thick, worked end/side scraper probably produced on an axe-thinning flake. It has thick white cortex and is milky mid to light grey in colour. Part of its bulb has been removed. It is a fine example of an Early Neolithic scraper.

CF4
A long-ended scraper produced on a thick long blade, it has with thick white cortex along one side and it patinated white. It is comparable in form to example No.47 from Pit X, New Barn Down (See Chapter Six). Its end has been developed by semi-abrupt re-touch and its bulb has been removed.

CF5
A fragment of a short thick end scraper, it has been lightly exposed to heat and is light grey in colour. It is of similar form example No. 43 from Pit X, New Barn Down (See Chapter Six).

CF6
A small long-ended scraper produced from thick blade like flake with an area of thick white cortex. The piece is unpatinated, medium to light milky grey. It has been well used and has possible use-wear along one edge.

CF7
A moderately size long-ended scraper produced on plunging blade, more than likely an axe-thinning flake. It is unpatinated and has small area of thick buff cortex. Its bulb end has been truncated and the retouched, in the same manner as its tip. One edge appears to have been blunted, and it may have also been used a backed knife.

CF8/9
Two fragments of bi-facially worked axe roughouts, probably broken during manufacture. AX8 appears to have been reused as scraper, as it has a small amount re-touch along one edge, more likely resulting from use, rather than direct percussion.

CF No.	Type	**Length** mm (L x W)	Weight
1	Tool	62 x 26	74g
2	Tool	63 x 17	48g
3	Tool	68 x 17	73g
4	Tool	98 x 19	87g
5	Tool	52 x 20	41g
6	Tool	67 x 17	43g
7	Tool	84 x 14	49g
8	Roughout	114 x 33	285g
9	Roughout	119 x 48	313g
Totals	9		1,013g

Table 4: Cissbury flintwork.

Results and significance

Because of the uncertain provenance of the assemblage any discussion is limited, however, several observations are worthy of their inclusions. Firstly, like Pit X on New Barn Down this assemblage demonstrate the re-use of mining waste, in this case bi-facial axe thinning flakes, to be re-fashioned into other forms of implements. The forms, being scrapers, may have been used in more domestic based activities at sites located close the Cissbury Hill mines. The colour and high quality raw material evidenced in several of the pieces, a milky dark grey with bluish hue is of note and hints at the original colour of the Cissbury mine flint. Naturally, it cannot be proved if the pieces originate from the Cissbury mines, although the thick white to buff cortex visible on many of the pieces is typical of raw mine flint and is noted in all the assemblage recorded in this thesis.

Bibliography

BUTLER, C. 2005. *Prehistoric Flintwork*, The History Press, Tempus Publishing.

GARDINER, J. 1988. *The Composition and Distribution of Neolithic Surface Flint Assemblages in Central Southern England,* Unpublished PhD thesis, University of Reading. Wessex Archaeology Reports 32, Wessex Archaeology.

Appendix 6: Chapter Six Gazetteer.

6.1: Chichester area.

Site 1: Baxondale Road.	**HER No:** CD 9994
Location: St Richards Hospital, Chichester, West Sussex	**NGR:** SU 8790 0585
Date of Fieldwork: 2006	
Height: 22m – 25m aOD	
Geology: Lambeth Group - Clay, Silt And Sand. Sedimentary Bedrock formed approximately 48 to 59 million years ago in the Palaeogene Period. Local environment previously dominated by swamps, estuaries and deltas.	
Type: Archaeological Evaluation and Watching Brief	
Company: Foundation Archaeology	
Report: KING, R. and D. KING. 2010. St Richards Hospital, Chichester, West Sussex, Archaeological Evaluation and Watching Brief, Unpublished Report No. 507.	

Summary

An archaeological evaluation excavation at Baxendale Road, Chichester, recorded evidence of a series of small pits containing Early Neolithic pottery, plain Bowl and Decorated Bowl, and a large assemblage or worked flints. Traces of a Roman Enclosures were also recorded.

Baxendale Road is located on the Sussex coastal plain, located on a superficial Head deposit of flint gravels overlaying Lambeth Group clays, silts and sands. A large deposit of alluvial clay, silt, sands and gravels overlies the Lewes Nodular Chalk Formation directly to the east of the Site. This alluvial is deposited by the River Lavant, a winterbourne chalk stream flowing north to south from the edge of the South Downs across the coastal plain. The setting of the Site is both coastal and riverine.

Neolithic Features

In total four pits were excavated, Features **121**, **122**, **124** and **128**, which contained Early Neolithic pottery and flint work and were grouped close together at the southern end of the site. The four pits ranged in size from the smallest, Feature **122**, sub-circular and 0.50^{ø} and 0.10m deep, and the largest, Feature **120**, sub-circular and 1.0m long, 0.80m wide and with a depth of 0.30m. All the pits broadly steep or gently sided with flat bottoms and were all filled with a dark brown friable clay with flint gravel inclusions and occasional charcoal. The proximity of the pits to each would strongly suggest that they were all broadly contemporary and may relate to the same occupation event.

Flintwork

Worked flint was recovered from the fills of three of the pits, (Features 121, 125, 129) and totaled 117 pieces. Generally, all the flints were in fresh condition, with little evidence of patination, edge damage or being rolled. Both hard and soft-hammer working techniques were represented and there was evidence that several different episodes of flint working present, although there were no refits. The flint seems to have been sourced from either clay-with-flints or gravel resources, presumably within the vicinity of the Site.

There was a lack of cores and the majority of the assemblage was flakes and blades, suggesting in the specialist report that the pieces had been deliberately gathered or was from an 'utilisation site were flakes and flakes tools were being used and maintained'. The soft hammer flakes were predominantly small blade like flakes with abraded platforms and feathered terminals, produced on small gravel nodules. A single leaf shaped arrowhead was recovered from pit, Feature 120, along with four end scrapers and one side scraper. Other tools included an awl from pit, Feature 124 and a serrated flake from pit, Feature 128.

Pottery

Across the four pits a total of 206 potsherds, weighing 2740g, were recovered from a minimum of 15 vessels. The fabric present in the assemblage is uniformly single flint-tempered, with rare to sparse ill-sorted angular flint inclusions. With regards to form the pottery fits within the Windmill Hill style of plain Bowl and Decorated Bowl style, associated with causewayed enclosures, however, as it pointed out in the report, it lacks the decoration found on pottery from Sussex site, such as the Trundle and Whitehawk.

The assemblage is mostly plain hemispherical bowls of neutral or closed form, deeper bowls and small bowls, or cups. Three of the bowls had lugs, one of which was perforated. Rims varied everted to heavily rolled and only one had a decoration in the form of oblique incised lines along its top. The bowls varied from thick to thin walled and six had deliberately smoothed services. None of the bowls had evidence for cooking.

No carinated forms are present and the stylistically the assemblage can almost certainly be dated to between the later 38th to mid 37th century cal BC.

Environmental

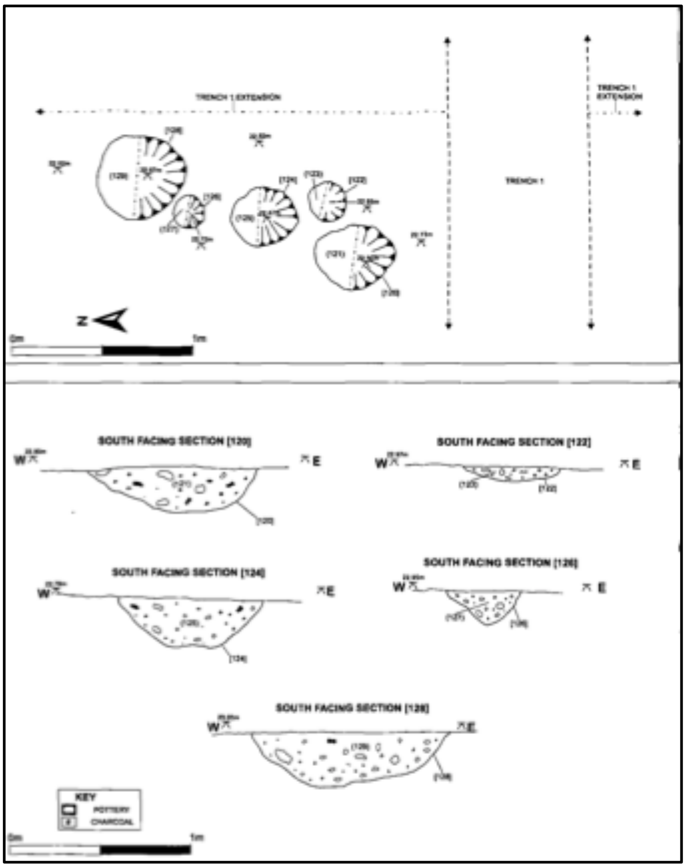
A small amount of charred plant remains and wood charcoal were sampled from the fills of the pits. Only a small amount of charred grain were present and they were highly fragmented, making species identification difficult, although a single grain from pit, Feature **128** was tentatively identified as emmer and another from pit, Feature **124**, was possibly barley. The possible remains of charred Rosaceae fruit flesh was also found in the fill of pit, Feature **128**.

Better results were obtained from the analysis of the wood charcoal fragments. Species identified included oak (*Quercus*), hazel (*Corylus avellana*), hawthorn group (Pomoideae), blackthorn/cherry (*Prunus*), ash (*Fraxinus excelsior*), elm (*Ulmus*), ivy (*Hedera helix*) and buckthorn (*Rhamhus cathartica*). The sample was dominated mostly by oak and hazel, typical of other Early Neolithic pits in Sussex (See below), as well as a smaller amount of ash and hawthorn.

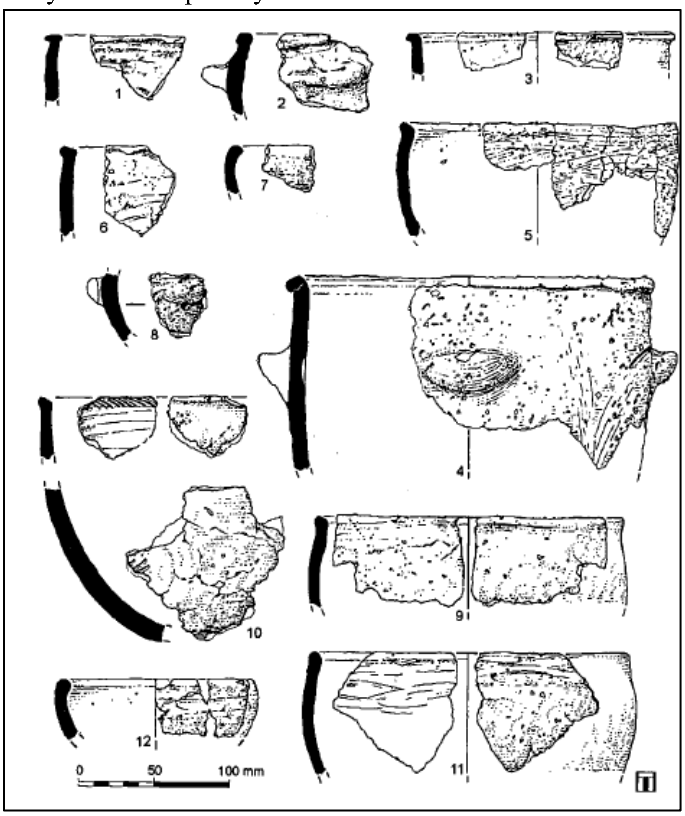
The environmental data indicated that the pits were opened in either a woodland margin, clearing or scrubland. The larger species, oak, ash and hazel seem to have been utilised for fuel, as large limbs were burnt, as well as smaller diameter brushwood from the smaller species. It was concluded that the environmental data is indicative of an episode of localised woodland clearance.

Location of Site

Neolithic Pits: Plans and Sections



Early Neolithic pottery



Site 2: Drayton Quarry	**HER No:** CD 4124
Location: West Drayton, Chichester	**NGR:** SU 8887 0416
Date of Fieldwork: 1997 - 2005	
Height: 9m – 12m aOD	
Geology: London Clay Formation - Clay, Silt And Sand. Sedimentary Bedrock formed approximately 48 to 56 million years ago in the Palaeogene Period. Local environment previously dominated by deep seas	
Type: Strip, map and sample	
Company: Southern Archaeology - AOC Archaeology Group - Archaeology South-East - Northamptonshire Archaeology	
Report: BROWN, J. 2010. The Archaeological Landscape of Drayton Quarry, Chichester, West Sussex: Excavations 1997-2005, Unpublished Report.	
Pottery Report: SEAGER-THOMAS, M. 2010. The Drayton Early Neolithic Pottery Assemblage. The West Sussex Coastal Plain's first pottery, Artefact Services Technical Reports 23.	

Summary

Drayton quarry is located approximately is located roughly 2km southeast of Baxondale Road and is broadly in the same landscape and geological setting. London Clay overlies by superficial deposits of gravels, silts, and patches of sand, typical of the Lavant Fan Gravels and other deposits coastal plain in the vicinity of Chichester. The southern part of the quarry is thought to have been marginal wetland until the Late Neolithic and two paleochannels, both small streams, were found crossing this part of the Site.

Excavation of Drayton quarry was undertaken in a series of evaluations and watching briefs between 1997-2005 by several commercial archaeological units. A large amount of early to middle Neolithic features was recorded on-site, including a possible ‘cursus’ monument, an enclosure and a series of aligned pits. Only two features, a pit and a gully, can be properly dated to the Early Neolithic. Both Early Neolithic features contained large amounts of Carinated Bowl vessels and flintwork.

Neolithic Features

Only two features can be recognised as Early Neolithic, due to the presence of Carinated Bowl pottery in their fills. The first was a pit, located in the northern end of the Site, Pit 6, which contained 39 sherds of pottery and an unspecified amount of flintwork. Unfortunately, records of its dimensions have been lost and there is little no information on its form. It appears that Pit 6 was an isolated feature, well north of the main mid and late Neolithic activity in the center of the Site. Four other pits were recorded in the vicinity of Pit 6, although these were undated and it not known if they were related.

A second feature, Pit 690, was excavated around 159m to the east of Pit 6. There is much ambiguity over form and date of this feature in the excavation reports and it seems to have been closer to small gully or a ditch terminal, than an actual pit. There is also uncertainty over its date, as it was found within an area of a Late Bronze Age urn cemetery, pits and ditches. Pit 690 was significant due to the recovery of 206 potsherds of plain and carinated pottery, the largest such assemblage in Sussex. Such a large assemblage of well preserved Early Neolithic material would seem to indicate that they were not re-deposited in a Late Bronze Age feature, especially as similar gullies have been found on the coastal plain. Again, there is no information on the lithic assemblage recovered from Pit 690, frustrating any further analysis and interpretation.

Flintwork

It is impossible to assign any of the flintwork described in the report to the two pit features. Generally, the Early Neolithic material recovered across the Site is typical of other coastal site in Sussex, with soft hammer and hard hammer-struck debitage and flint sourced from the immediate vicinity utilised. There is nothing in the assemblage that is specifically diagnostic of the Early Neolithic, such as leaf-shaped arrowheads and bi-facial/polished axes. Blade production is reported in association with Early Neolithic contexts, presumably the pits. A small number of multiple-faced cores on good quality flint were also recovered from unstratified contexts across the Site.

Pottery

Analysis of the pottery assemblage from the pits was successful in identifying an early and important assemblage of pottery, most notably of Carinated Bowl forms. From Pit 6 an opened mouth (Neo Pot 1), burnished fine to medium ware carinated bowl form vessel, made from very fine clay rings or coils, was recovered. The sandy fabric of this vessel contained sparse fine to medium flint, some burnt, with quartz sand and varied between oxidised to unoxidised, dark grey to dark red brown in colour. Overall, the form of this vessel (Neo Pot 1) falls within the open classic carinated, as termed by Cleal (2004).

The second pot recovered from Pit 6 was a small beaded rimsherd (Neo Pot 2), probably of simple an open bowl form (Cleal 2004). The fabric of this vessel was distinctly different to Neo Pot 1, with a rough finish and comprised of a medium sandy quartz matrix with coarse very large burnt flint inclusions, mostly oxidised and red brown to dark grey in colour.

In Pit 690 a further 206 potsherds were recovered, accounting for ten separate vessels, including carinated and plain Bowl form. Forms included, open bowl, a possible dish, or closed bowl form, a possible large open-mouthed carinated bowl and a large open bowl with weak carination, possibly an inflected open form proposed by Cleal (2004). Generally, the vessels had sandy fabrics with medium to very large granule-sized burnt flint, mostly unoxidised and red brown to dark grey in colour.

Another rimsherd from Pit 690 (NEO Pot 11) was largely non-diagnostic, but possibly a neutral plain Bowl. The final potsherd (Neo Pot 12) from Pit 690 was a hemispherical bowl with applied and impressed decoration around its rim, is highly worn, unlike the rest of the assemblage, and is therefore probably intrusive. Lastly, a further possible large open-mouthed carinated bowl form (Neo Pot 3), fine and burnished, was not assigned to a context was similar another to vessel (Neo Pot 8).

The assemblage is the largest of carinated forms found in Sussex. The smaller assemblage, two different pots, from Pit 6 is almost certainly stratigraphically secure from an Early Neolithic context. However the larger assemblage from Pit 690 is more problematic, as little information is offered on its context and an indication in the report that it may be residual. Nonetheless, the Pit 690 assemblage is in a fresh condition, apart from Neo Pot 12, and cannot have moved far from its original place of deposition.

Environmental

Only one environmental sample was recovered during the fieldwork, from the fill (Context 7) of Pit 6. From this sample a small quantity of charcoal was examined, which was dominated by oak, probably indicating its use as firewood. The second largest species present was *Prunus* (blackthorn, cherry, plum etc.) and a small amount of alder. The samples contained a similar array of species as found in the pit groups at Baxondale Road, again showing that oak may have been used as fuel and that the pit was dug in area with shrub species, indicating a marginal woodland, either recently cleared or in the process of being cleared. The overall setting of the Site, close to a wetland margin, may imply that wood in his area was thinning out on the edge of a wet and open environment.

CLEAL. R. 2004. The Dating and Diversity of the Earliest Ceramics of Wessex and South-west England, in R. Cleal and J. Pollard (eds.), *Monuments and Material Culture: papers in honour of an Avebury archaeologist: Isobel Smith,* Hobnob Press. 164-192.

Further Notes

Further analysis of the pottery was undertaken for this project. Nothing new was noted, except for a large bag of unwashed potsherds not noted in the original report from Pit 6. In general, the vessels are quite large, robust and not of the same high quality as the finer Carinated Bowls from New Barn Down, Long Down, Peacehaven and Cissbury. In form and general size the vessels share similarities with the larger vessels from New Barn Down, Pit X and Pit Xa. These vessels are c. 250mm$^{\varnothing}$ and are only similar to the finer smaller bowls in general form, being s-shaped baggy bowls with simple rims. These large vessels, such as the majority from Drayton, seem to be copies of the finer vessels.

One fabric, SVCF, is similar in composition to the Carinated Bowl from Cissbury, being sparse fine sandy matrix; 3% coarse sand to very small pebble-sized burnt flint; laminar.

Overall, it the assemblage from Drayton is not overly typical of Carinated Bowl assemblages, being mostly based on larger crude vessel and with lack of finer forms. Chronologically, the assemblage from Pit 690 seems to be slightly later than Pit 6, as the forms and fabrics seem to be edging towards a plain Bowl horizon, combined with the possible inclusion of a decorated vessel, Neo Pot 12. However, such variation in form should not discount an early date in favour of marginally later one (Cleal 2004), but with a lack of clear radiocarbon dates for either features such distinctions are impossible to make.

NEO pot 4. A large open-mouth, fine to medium burnished carinated bowl, with unusual ripple burnish inside the rim. A sandy quartz fabric with fine flint and medium to coarse sand-sized burnt flint, unoxidised and dark grey in colour.

NEO pot 6. An open bowl form, slightly out turned rim, with similar fabric to NEO pot 1.

NEO pot 7. A possible dish, or closed bowl form. A similar fabric to NEO pot 1.

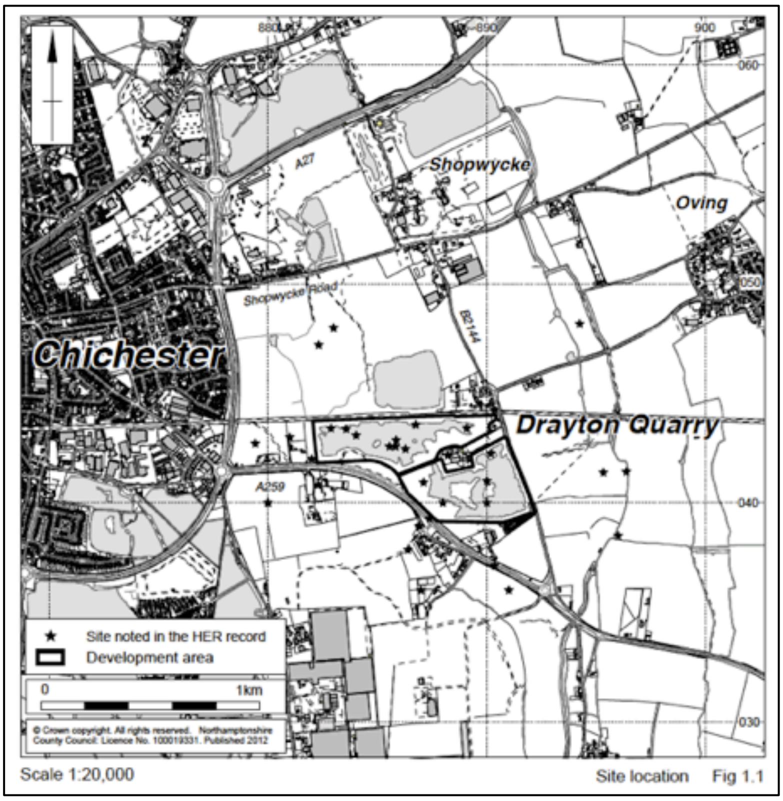
NEO pot 8. A possible large open-mouthed carinated bowl, of medium thickness with a fine sandy matrix with occasional medium to very course sand-sized burnt flint, oxidised to unoxidised, burnished and buff to light grey.

NEO pot 9. An open bowl form roughly finished in a fine fabric formed with very fine rings or coils. Similar fabric to NEO pot 1.

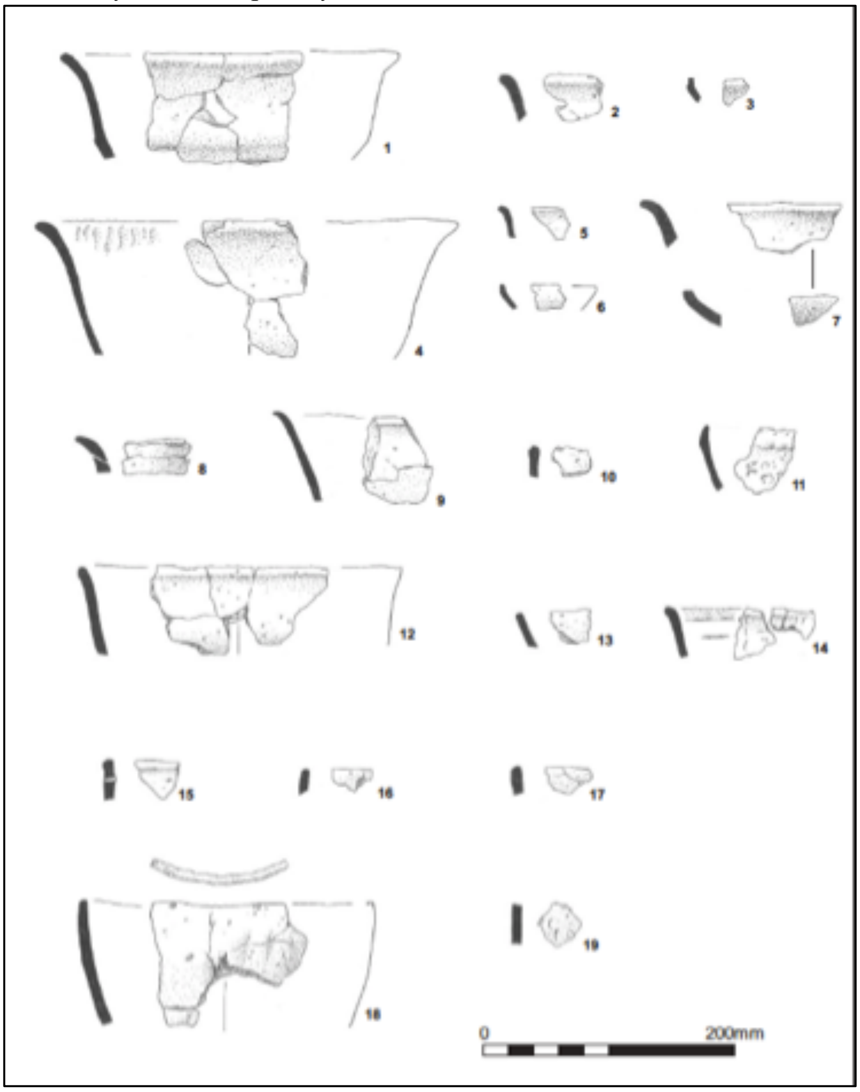
NEO pot 10. An open bowl form roughly finished and burnished in a coarse fabric, with a fine sandy matrix containing coarse sand to very small pebble-sized burnt flint, laminated, unoxidised and dark brown in colour.

NEO pot 13. A large open bowl with weak carination, possibly an inflected open form proposed by Cleal (2004). The fabric of the pot had a sandy matrix with medium to very large granule-sized burnt flint, mostly unoxidised and red brown to dark grey in colour.

Site Location



Early Neolithic pottery



Site 3: Claypit Lane	**HER No:** N/A
Location: Claypit Lane, Westhampnett	**NGR:** SU 8840 0660
Date of Fieldwork: 2000-2001	
Height: c. 27m aOD	
Geology: Aldingbourne Raised Storm Beach Deposits, 2 - Gravel. Superficial Deposits formed up to 3 million years ago in the Quaternary Period. Local environment previously dominated by shoreline. Bedrock - Lambeth Group - Clay, Silt And Sand. Sedimentary Bedrock formed approximately 48 to 59 million years ago in the Palaeogene Period. Local environment previously dominated by swamps, estuaries and deltas.	
Type: Archaeological Evaluation - Strip, map and sample	
Company: Wessex Archaeology	
Publication: CHADWICK, A, M. 2006. Bronze Age burials and settlement and an Anglo-Saxon settlement at Claypit Lane, Westhampnett, West Sussex, Sussex Archaeological Collections, 144. 7-50.	

Summary

Claypit Lane is located roughly 2km directly north of Drayton Quarry and about 1.5km northeast of Baxondale Road. The Site is on the edge of the coastal plain, around 1.5km south of the South Downs. Like the other Chichester site, the geology on-site comprised of raised beach deposits, gravels and brickearth subsoils overlaying Lambeth Group clays, silt and sands.

Claypit Lane was excavated in three phases between September 2000 and September 2001. Due to time constraints, and the composition of the on-site geology, it is likely that features may have been missed in the fieldwork. Fortunately the post-excavation work was detailed and much information was collected from the one Early Neolithic feature excavated.

Neolithic features

Only one Early Neolithic feature was excavated at Claypit Lane, Pit 9050, which contained two or more plain Bowls, a knapping waste and 'high proportion of retouched tools'. Pit 9050, was bowl shaped feature, measured c. 1m^{ø} and was located in the eastern part of the Site in an area relativity free of archaeological features. Several small pits containing Grooved Ware pottery, and therefore dated to the Late Neolithic, were found roughly 400m to the northwest of Pit 9050. Apart from a scattering of Bronze Age cremation urns in its general vicinity, Pit 9050 can be considered as an isolated feature, although it must be noted that large areas of the Site were not excavated and the possibility of other early features should not be ruled out.
A radiocarbon date of 3800-3635 cal. BC (94.4% probability) was obtained from hazel charcoal recovered from the pit. Its inclusion here can be warranted by it fairly early dating, its location and for comparisons with the other early pits in the Chichester area.

Flintwork

In total, 34 flakes and blades, along with nine re-touched tools were recovered from Pit 9050. The flakes in the assemblage were mostly the debitage of core trimming, both soft and hammer-struck. Blades accounted for 20% of the assemblage and a blade core was also found. The re-touched tools, 18% of the assemblage, included six end-scrapers, with possible re-sharpened edges and there was an 'edge flaked knife, a probable broken scraper, and a naturally backed knife'.

The lithic assemblage is typical of Early Neolithic techniques, with blade production and re-touched implements, including end scrapers manufactured on thick flakes. The assemblage is interpreted as a ritual deposit, due to the presence of an edge-flaked knife and utilised backed blade, alongside pottery.

The pieces selected for deposition accord unusually record a single knapping event and include the original core, blades and complete and re-touched tools, including scrapers and the two knife like implements, both reasonably uncommon in assemblages of this period. Therefore, the assemblage can be considered as curated, with careful selection of pre-worked tools occurring before deposition in the Pit 9050.

Pottery

At least two separate vessels are recorded from Pit 9050, one a plain rim corresponding to forms, and an undiagnostic rim, possibly an open bowl. Two fabrics types are recorded in the assemblage, FL9, a sandy quartz clay matrix with large quantities of calcinated flints and grey to reddish brown in colour and FL10, a sandy quartz clay matrix with abundant fine to medium calcinated flints and light brown to grey in colour.

Environmental

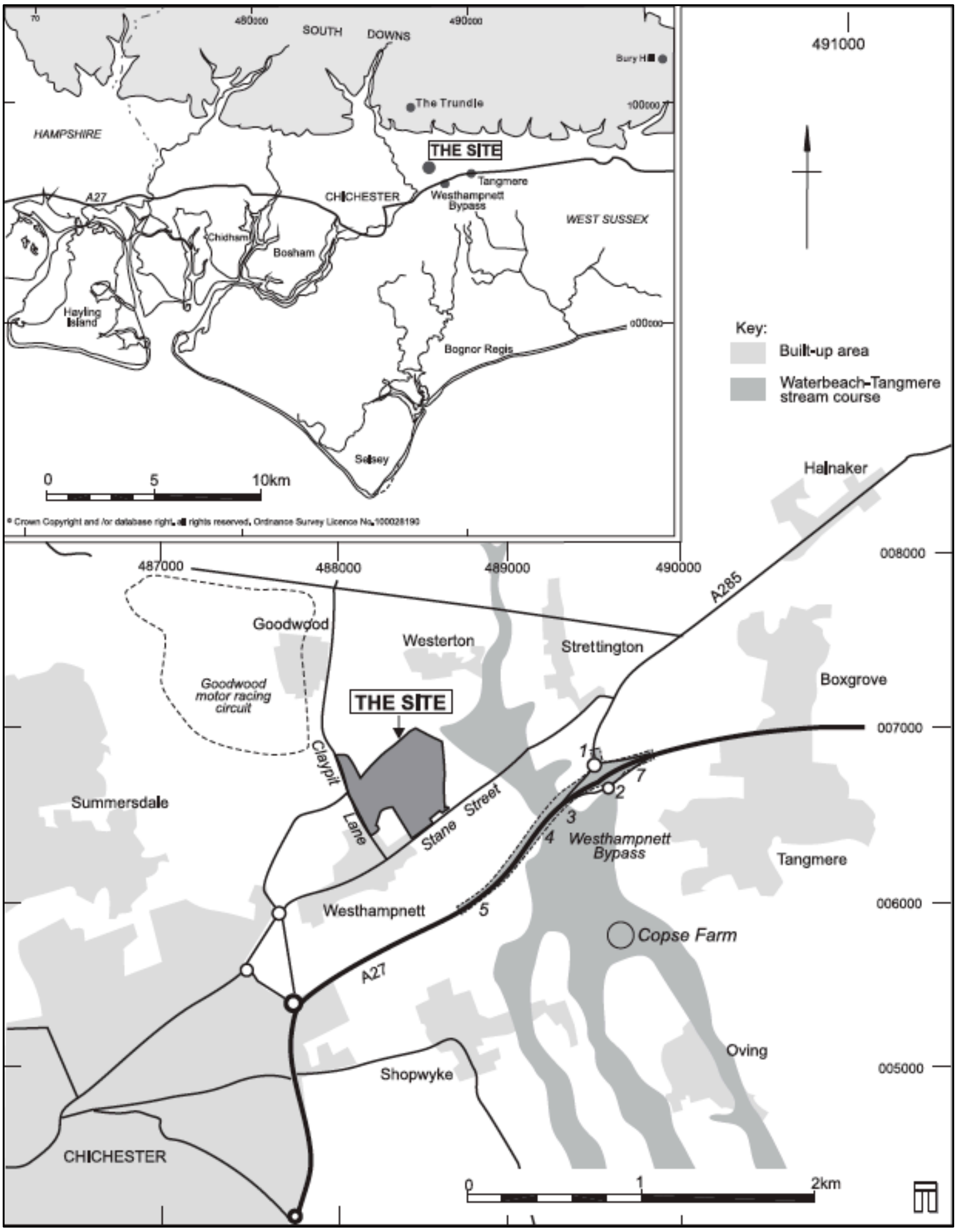
Analysis of the environmental sample from Pit 9050 included charred plant remains and charcoal. The charred plant remains included two grains of wheat; one possibly spelt (*Triticum spelta*) and a half-grain of emmer (*Triticum dicoccum*), and small fragments of cereals and two hazelnut shells. The charcoals included the following species, oak, hazel and hawthorn and were considered as fuel debris.

Further Notes

The flintwork and pottery was analysed during this project. Of particular interest was the edge-flaked knife. This was in fresh condition and had probably not been used prior to deposition. Therefore, it probably represented a piece made especially for deposition. It is very similar in form to the large knife from Pit X, New Barn Down. It is of high quality flint, possibly not sourced locally to the Site.

The pottery is undoubtedly plain Bowl, but compared to other assemblages is fine and of good quality. A comparison could be the fine bowl from 2 South Coast Road Peacehaven. This would fit well with the radiocarbon dates obtained for Pit 9050, indicating that it is early in the proposed chronology for plain Bowl.

Site location



6.2: West Sussex area.

Site 1: Manor Hill	**HER No:** MWS 10363
Location: Manor Hill, Burgess Hill	**NGR:** TQ 3280 1970
Date of Fieldwork: 2011	
Height: 40m – 55m aOD	
Geology: Weald Clay Formation - Mudstone. Sedimentary Bedrock formed approximately 126 to 134 million years ago in the Cretaceous Period. Local environment previously dominated by swamps, estuaries and deltas.	
Type: Archaeological Evaluation	
Company: Thames Valley Archaeological Services South	
Report: WALLIS, S. 2011. *Land off Manor Road, Burgess Hill, West Sussex: An Archaeological Evaluation for J S Bloor Homes Ltd,* Unpublished Report 10/92, Thames Valley Archaeological Services Ltd.	

Summary

Manor Hill is a low-lying south facing hill, with on-site geology of Wealden Clay bedrock overlain by a Head deposit of gravels and sands. The site can be considered as located in the Weald, with the South Downs located roughly 7km to the south and the current coastline around 17km.

Neolithic Features

In total three pits produced twenty fives sherds of possible Early Neolithic pottery, and a small amount of flintwork. Due to huge uncertainly dating the features, they are mentioned here with caution and only warrant a brief entry. The three pits were tightly grouped and all measured, between 0.5m-1.5m^{ø}, and were surrounded by a small group of post-holes. The large Pit 13 produced the majority of the pottery and all the flintwork.

Flintwork

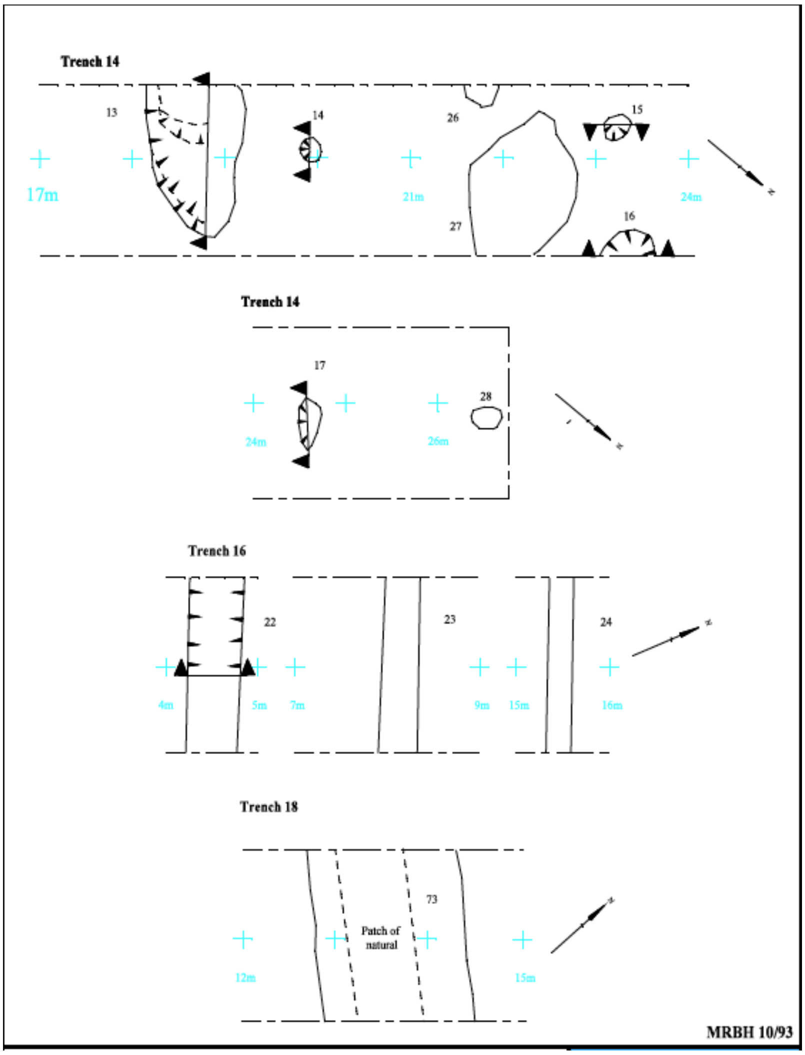
The small flint assemblage from Pit 13 consisted of a flakes produced on a coarse green to grey chert, a core fragment of black flint and an end scraper made from a light brown flint cherty inclusions. A further 10 struck flints were recovered from unstratified contexts around the Site. It is reported that none of the flint work was diagnostic of any period and it was therefore given a broad Neolithic to Bronze Age date.

Pottery

Examination of the pottery revealed that it was medium to fine ware with low to moderate medium sized burnt flint inclusions and red brown to black in colour. The majority of the small assemblage was bodysherds, but a few feature sherds indicated that the pot form consisted of simple rims. The source of the fabric was considered to be local, with the flint inclusions likely to have originated from the chalk to the south. An Early Neolithic date is favoured, due to the fineness of the some of the sherds and the presence of plain rims.

Site Location

Neolithic Features



Pit 18 in Trench 16, south facing section

Site 2: Millfield	**HER No:** MWS 11695
Location: Southwater, Horsham	**NGR:** TQ 1625 2544
Date of Fieldwork: 2012	
Height: 50m – 30m aOD	
Geology: Weald Clay Formation - Mudstone. Sedimentary Bedrock formed approximately 126 to 134 million years ago in the Cretaceous Period. Local environment previously dominated by swamps, estuaries and deltas.	
Type: Archaeological Evaluation	
Company: Archaeology Southeast	
Report: DOHERTY, A. 2013. Archaeological Excavations at Millfield, Southwater, Horsham, West Sussex: A Post Excavation Assessment and Updated Project Design Report, Unpublished Report No. 5506. Archaeology South East.	

Summary

Millfield is located in the heart of West Sussex, 5km south of Horsham and approximately 22km north of the current coastline and some 14km north of the South Downs. The underlying geology of the Site is described as mudstone of the Wealden Clay Group.

Neolithic Features

Three small pits were recorded, all situated within vicinity of each other, SG185, SG159 and SG171. The three pits were uniformly shallow and all measured c. 1m$^{\o}$. Pits SG159 and SG171 contained a small amount pottery, with SG185 containing a small assemblage of nine pieces of struck flint, but no pottery. The struck flint is reported as almost entirely consisting as debitage; mostly bladelets or thin soft-hammer struck flakes, showing blade removals and platform preparation. Local flints appear to have utilised and it was assigned a Late Mesolithic to Early Neolithic date range.

Flintwork

The struck flint is reported as almost entirely consisting as debitage; mostly bladelets or thin soft-hammer struck flakes, showing blade removals and platform preparation. Local flints appear to have utilised and it was assigned a Late Mesolithic to Early Neolithic date range.

Pottery

The pottery was sparsely very-ill sorted flint in a dense silty matrix. Each pit contained a rimsherd, a thin-walled vessel of open profile from SG171 and a thick walled vessel with a crude bead rim from SG159. Although the pottery is described as Early Neolithic plain Bowl ware, there is level of ambiguity over its identification, as it is extremely rare in the Weald and there were certain similarities with post-Deverel-Rimbury wares. However, an Early Neolithic date was favoured.

Site Location

Site 3: North Bersted	HER No: MWS 11255
Location: Bognor Regis	**NGR:** SU 9220 0105
Date of Fieldwork: 2012	
Height: c.4m aOD	
Geology: River Terrace Deposits (undifferentiated) - Sand, Silt And Clay. Superficial Deposits formed up to 3 million years ago in the Quaternary Period. Local environment previously dominated by rivers (U)	
Type: Archaeological Evaluation	
Company: Thames Valley Archaeological Services South	
Report: TAYLOR, A. 2012. Land at North Bersted Phase 6, Bognor Regis, West Sussex: An Archaeological Evaluation for Berkeley Homes (Southern) Limited. Report 07/135c Thames Valley Archaeology Ltd.	

Summary

North Bersted is located on the coastal plain, less than 5km from the modern shoreline and located on brickearths, with gravels. Out of ten evaluation trenches excavated, only one contained evidence from the Early Neolithic, in the form of two gullies. An evaluation recorded two gullies dated to the Early Neolithic. Finds included a miniature axe.

Early Neolithic Features

The larger of the two gullies (7300) excavated was on a north-south alignment and measured 0.65m wide, with a depth of 0.09m and with a single fill of sandy clay, which contained two pieces of fire fractured-flint and a miniature axe. This gully (7300) truncated a second smaller gully (7302), which was on north-northwest by south-southeast alignment and measured 0.38m wide x 0.11m, and was filled by a single deposit of silty clay, from which a single Early Neolithic potsherd was recovered.

Flintwork

Only one piece of flintwork was recovered, a probable miniature axe found in Gully 7300. This piece 'measured 60mm long, 29mm wide at the blade and tapering to 15mm at the butt'. The piece appears damaged, either during knapping or in use.

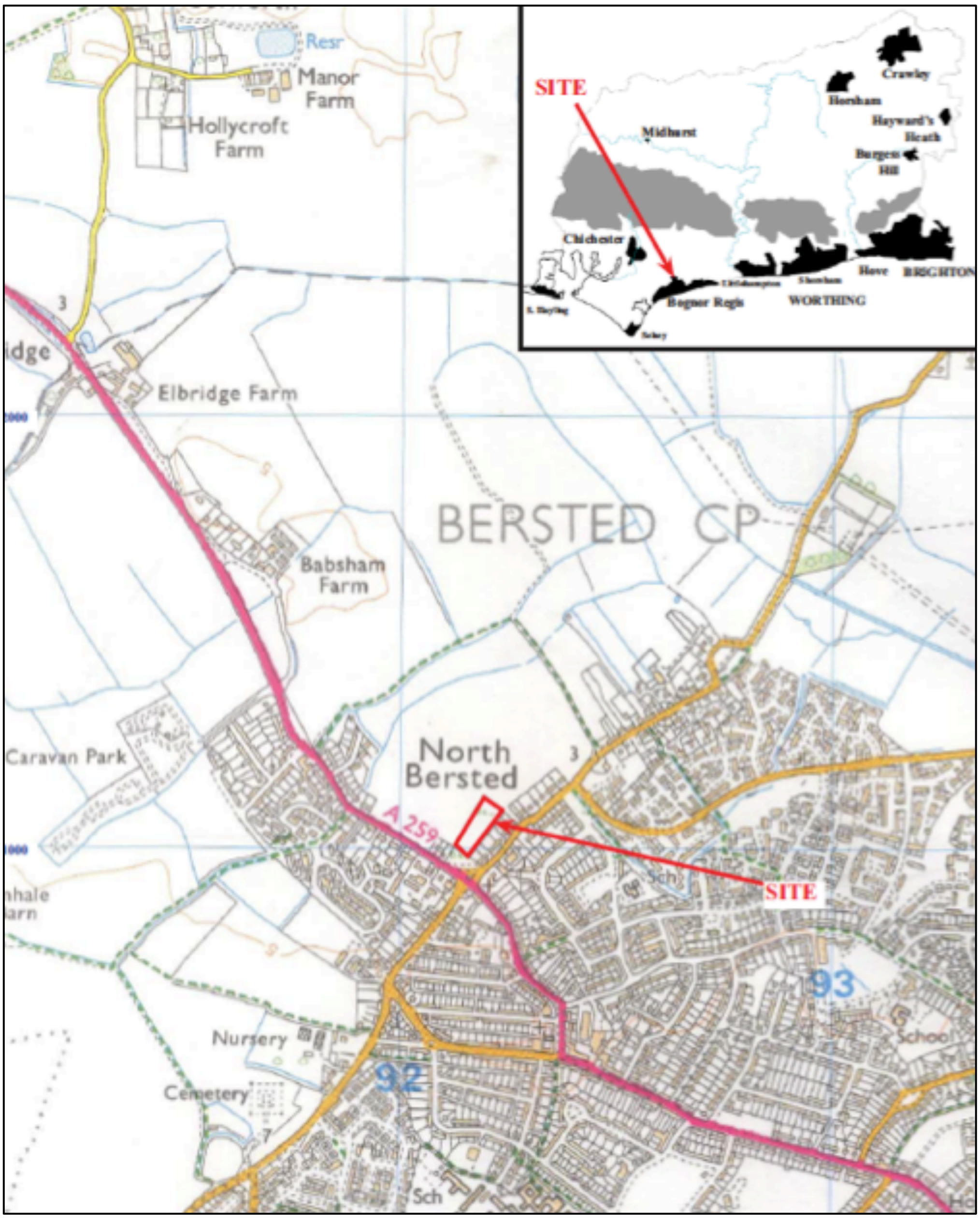
Pottery

A single fragment of Early Neolithic potsherd was recovered from the Site, from Gully 7302, it has a laminar fabric, with moderate amounts of coarse burnt flint and is similar to Fabric 1, described by Drewett (1980), comprised of a grey to reddish brown ware with smoothed sides and poorly fired.

Further Notes

Miniature axes are of interest and possibly were procured at some of the flint mines, with several examples recovered from Church Hill and Long Down.

Site Location



Site 4: Titnore Lane	**HER No:** MWS 8010
Location: St Barnabas Hospice, Colombia Drive, Worthing	**NGR:** TQ 10490 04030
Date of Fieldwork: 2008	
Height: 13m – 10.5m aOD	
Geology: River Terrace Deposits (undifferentiated) - Sand, Silt And Clay. Superficial Deposits formed up to 3 million years ago in the Quaternary Period. Local environment previously dominated by rivers (U).	
Type: Archaeological Evaluation **-** Strip, map and Sample	
Company: AOC Archaeology Group	
Reports: SYGRAVE, J. 2005. Lower Northbrook Farm, Titnore Lane, Worthing: An Archaeological Evaluation Report. ASE Report NO. 2171. CLARKE, C. 2009. St Barnabas Hospice, Titnore Land, Goring-by-Sea, West Sussex: A Post-Excavation Assessment Report. AOC Archaeology Group.	
Publication: CLARKE, C. 2012. Exploration of the Sussex coastal plain through time: Excavations at Titnore Lane, Goring-By-Sea, West Sussex, Sussex Archaeological Collections, 150. 5-46.	

Summary

The site is located on the Sussex coastal plain, east of Worthing and c. 3km north of the current coastline. A large open excavation was carried with a total five features dated to the Early Neolithic were recorded, a long gully and four pits.

Early Neolithic Features

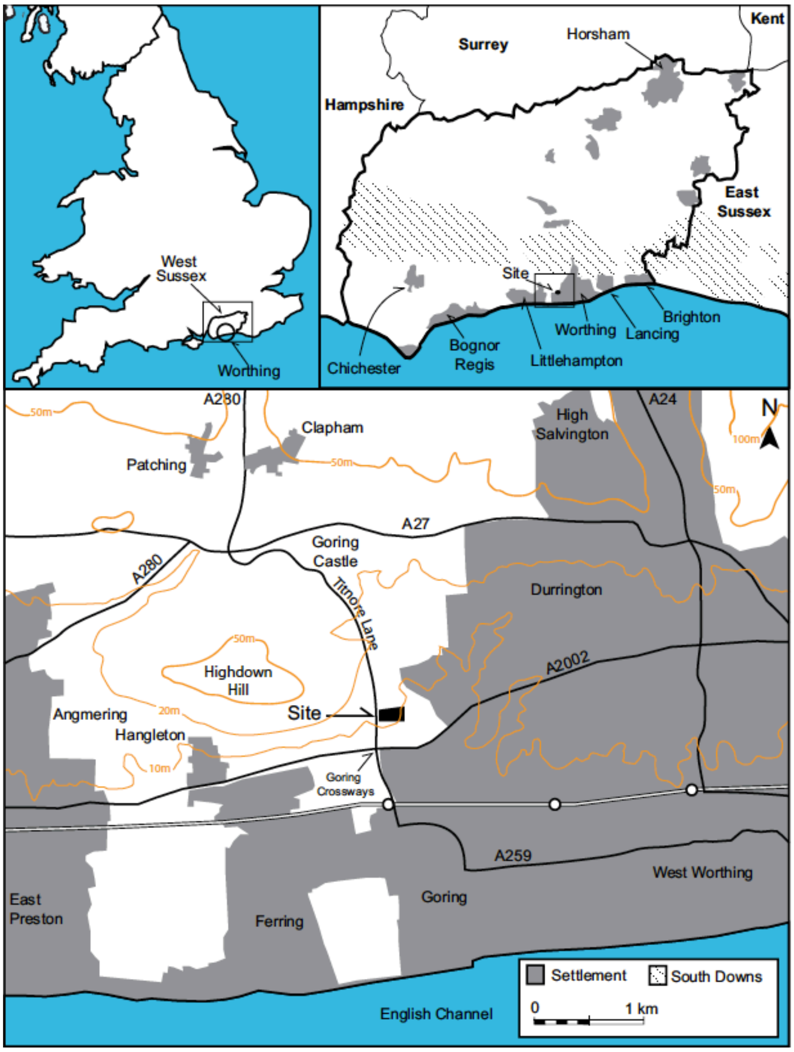
In the western part of the Site a group of four shallow pits were excavated, Contexts 1597, 1599, 1601 and 1603, which were oval shaped and measured between 300mm to 1m in diameter. Only one of these features produced an artefact, the butt end of a polished axe.

Around 50m east of the pits was a shallow curvilinear gully, Context 874, measuring 4.5m in length. The gully was an isolated feature and once excavated was found to contain up to 60 plain Bowl potsherds. There is little data on the pottery in the excavation report, beyond being mostly undecorated bodysherds.

Flintwork

The only worked flint from the features was the butt end of a polished axe. The axe was thick-butted, stained orange and with a small amount of cortex present, which unusually had been polished. A second fragment of polished axe was found unstratified in subsoil.

Site Location



6.3: New Barn Down, Case Study 1

Site: New Barn Down	**HER No:** MWS3364
Location: Patching, Arundel	**NGR:** TQ 0846 0917
Date of Fieldwork: 1933	
Height: 97m aOD.	
Geology: Tarrant Chalk Member - Chalk. Sedimentary Bedrock formed approximately 72 to 84 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.	
Type: Open excavation	
Company: Worthing Archaeology Society	
Publication: CURWEN, E, C. 1934. A Late Bronze Age farm and a Neolithic pit-dwelling on New Barn Down, Sussex Archaeological Collections, 75. 137-70.	

6.4: Pottery Report by Professor Andy Merion Jones

Pit X

The 14 potsherds from Pit X are outlined next, all were identified and analysed in person, except for the plain bowl, which was illustrated by the Curwen's.

FS1/Pot 1.

An exceptionally fine bodysherds, showing a clear pronounced carination and flaring towards where its rim would be. Dark brown to black in colour and sandy clay fabric with occasional medium sized quartz grains and abundant small quartz. Exceptionally fine and well made, with smoothed walls inside and out and fired in a reduced atmosphere. Possible decoration close to rim. Fabric non-local to Sussex.

FS2/Pot 2.

A rimsherd, with a simple slightly outturned rim and reasonably fine. Reddish brown with a sandy quart rich matrix. Occasional small burnt flints, poorly sorted and some penetrating through its wall. Unoxidised and clear signs of the inner wall being smoothed. Belongs to Pot 2. Local fabric to Sussex, from sandy soils not found in the immediate vicinity of New Barn Down.

FS3/Pot 2.

Two sherds that refit. One is a rimsherd and the other a bodysherds, with no rim present. Simple rim, very slightly outturned, the bodysherds shows the pot was clearly carinated with a probable s-shaped profile. Its outer wall is mid reddish brown, whilst its inner wall is dark grey to black, it appears this is due to the sherds being exposed to fire after being broken, as the burning does not match between potsherds. Same fabric as FS3, unoxidised and shows clear signs of its inner wall being smoothed. Very fine coils visible.

FS4/Pot 2.
Three rimsherds that refit. Plain and very slightly out turned rim. Belong to Pot 2, but are not burnt on the inside as FS3 is. Unoxidised, differential firing and light brownish grey on its inner wall and mid reddish brown on its outer. Clear smoothing marks on its inner wall.
Pit Xa

FS5/ Pot 1.
Two rims sherds that refit. Almost certainly belong to Pot 1 from Pit X. Very fine fabric with a plain, delicate rim with an almost imperceptible out turned lip. Same fabric is FS1, not local to Sussex, as it is quartz rich clay soils. Fired in a reduced atmosphere

FS6 and FS7/ Pot 3.
One bodysherds and one rimsherd, originally illustrated as refitting, but have become unattached and suffered damage. Simple slightly rim slightly out turned, thin walled and showing a clear pronounced s-profile, almost certainly carinated. Light reddish brown with clayey matrix with occasional small to medium small burnt flints, some penetrating the walls. Not a typical fabric for Sussex, possibly from clay rich soils as no sandy quartz is present in its matrix, such as found in the Weald. Very well made and unoxidised, outside appears to have been lightly burnished giving it a smooth, slightly grey finish.

6.5: The Radiocarbon Dates

Two radiocarbon dates were obtained from New Barn Down, Pit X and PitXa. New Barn Down start date is between 4475-3807 with 95% confidence and a median start date of 3956 BCE.

RADIOCARBON DATING CERTIFICATE
01 June 2017

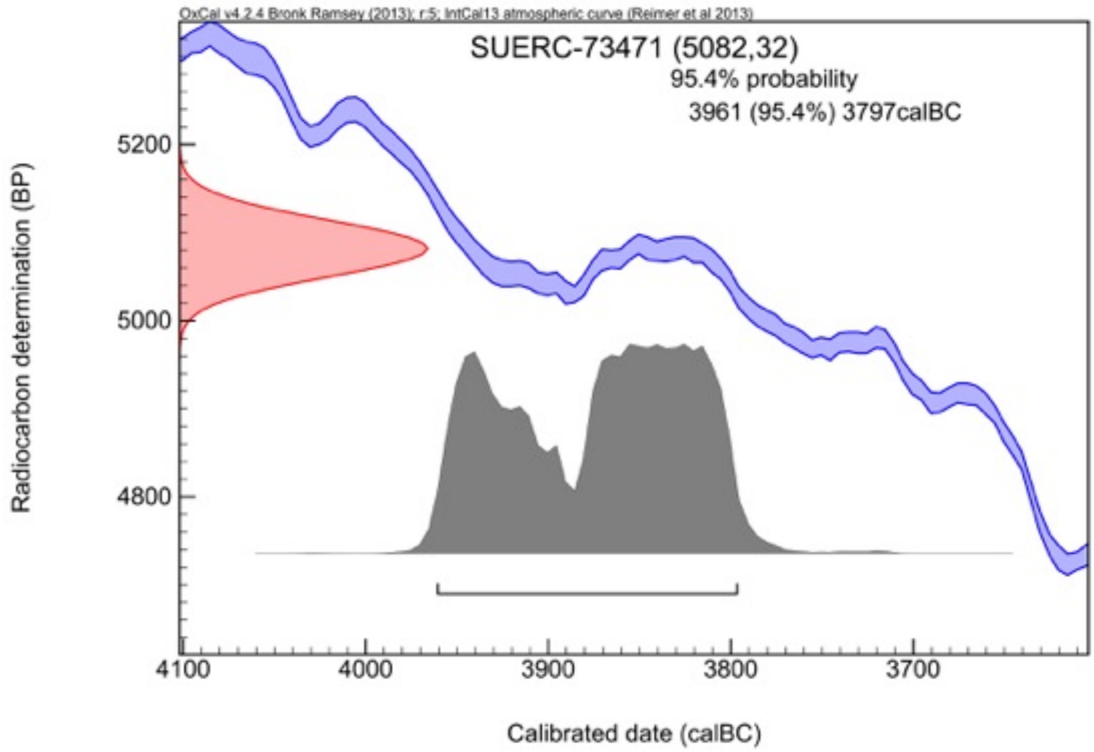
Laboratory Code: SUERC-73471 (GU43958)

Submitter: Kevan Edinborough
University College London (NEOMINES) 31-34 Gordon Square
UCL Institute of Archaeology London
WC1H OPY

Site Reference: New Barn Down
Context Reference: Pit X
Sample Reference: 27

Material: Charcoal; Ash
δ 13C relative to VPDB 24.7 ‰

Radiocarbon Age BP: 5082 ± 32



RADIOCARBON DATING CERTIFICATE
01 June 2017

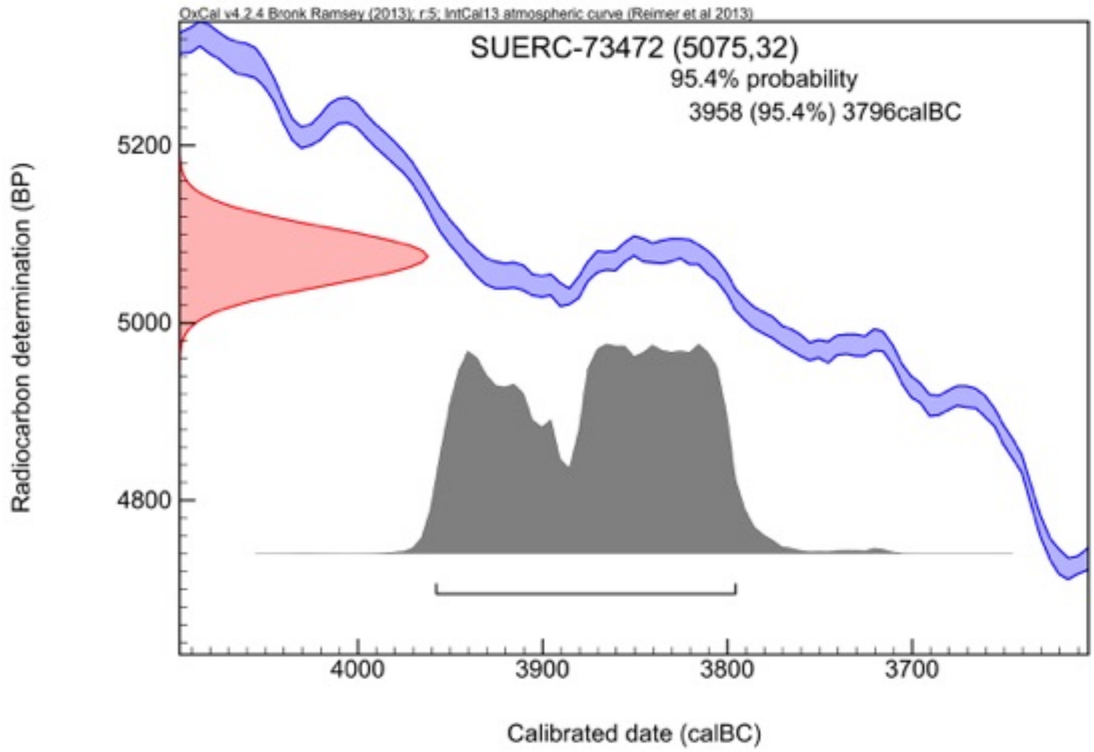
Laboratory Code: SUERC-73472 (GU43959)

Submitter: Kevan Edinborough
University College London (NEOMINES) 31-34 Gordon Square
UCL Institute of Archaeology London
WC1H OPY

Site Reference: New Barn Down
Context Reference: Pit X
Sample Reference: 28

Material: Charcoal : Ash
δ 13C relative to VPDB -24.8 ‰

Radiocarbon Age: BP: 5075 ± 32



6.6: Flintwork Report by Jon Baczkowski with comments from Professor Joshua Pollard

All of the flint is pale blue/gray. Cortex where present is thick and white, typical of chalk bedrock sourced flint. All the pieces are produced on the waste from axe-production, being mostly large primary hard hammer-struck flakes. The source flint appears to have been freshly mined, as there are no signs of weathering. All the pieces have been exposed to varying degrees of heat.

Pit X

No. 42.

Massive end and side scraper produced on a waste-flake from a large nodule, grey to white patination with chalky white cortex. Fine regular semi-abrasive retouch along it edge and a large chip removed (de-commissioning chip?). Almost certainly fashioned from a secondary hard hammer-struck flake with a large, plain platform. (85mm long x 89mm wide x 29mm thick).

No. 43.

End and side scraper produced on secondary waste-flake, unpatinated dark grey in colour with thick chalky white cortex. Has been lightly exposed to heat, resulting in mottling and fracturing, especially notable on its ventral proximal end. Irregular semi-abrasive retouch along its distal edge and a plain platform. (59mm long x 45mm wide x 19mm thick).

No. 44.

End scraper produced on secondary waste-flake with thick chalky white cortex. Has been exposed to heat, resulting in fire-fracture scars throughout. Missing its platform and on its distal edge there are traces of semi-abrasive re-touch, where the edge has not been damaged by fire. (57mm long x 45mm wide x 19mm thick).

No. 45.
Large flake or knife produced either on an axe thinning-flake or from a large core. Mostly grey to white patination, but unpatinated and bluish black in places, has a small amount of thick chalky white cortex. Soft hammer-struck with minimal invasive re-touch along left hand side, small regular re-touch on bulb end and minimal regular re-touch on right hand side. Also fire damage and use related/micro flaking on its right hand side. (111mm long x 51mm wide x 13mm thick).

No. 48.
Broken pick, traditionally called a 'Celt', of a type known from the Sussex flint mines, including Harrow Hill, with its blade end missing. Unpatinated dark grey flint with its cortex is removed. The pick has been fashioned with thick extensive bi-facial flaking and it has remnant of a polished surface close to its broken end and along it middle side. The traces of polish may indicate that it is a re-worked polished axe. Has been exposed to heat, which has resulted in various fire fracture damage. (116mm long x 41mm wide x 24mm thick).

No. 50.
A narrow flake, scalene triangular in section. Unpatinated and blue in colour with thick chalky white cortex. Small regular marginal alternative re-touch for half its cutting edge and has a hinged fractured flake scar on it dorsal side. Platform formed from an old and patinated implement or core and is smoothed on its distal end through heavy use. (56mm long x 2mm wide x 9mm thick).

Pit Xa
N0. 46.
Large knife or sickle, produced on a long axe-thinning flake, patinated grey with a small amount of chalky cortex remaining on its platform. There is extensive marginal semi-invasive and inverse re-touch along the right hand side and the left had side has been left naturally sharp. The implement seems to have been very lightly heated, but not burnt, and its distal end tip has been broken off, possibly before it deposition.

No. 47.
An elongated end scraper, or knife, fashioned from a rejuvenation or axe-thinning flake, grey patination and with a thick white un-weathered cortex. Hard hammer-struck with and with a plain platform. Regular marginal and semi-abrasive re-touch on its dorsal side at its distal end, which forms a scraping edge. Micro-flaking along its right hand side. Appears to have been lightly burnt, in a similar fashion to No. 46. (90mm long x 40mm wide x 12mmm thick).

No. 49.
Large side scraper formed from the broken blade end of a polished axe, traditionally known as a 'Celt', with numerous known examples known from Sussex flint mines. Unpatinated and dark grey to black, almost certainly good quality mine sourced flint. The original axe appears to have been a particularly fine and highly polished specimen with facetted edges, it also appear to have been given a final sharpen/grinding before deposition into Pit Xa, as there is no sign of use on its cutting edge and it remains noticeably sharp. The axe has been broken roughly half way with

force, which has left a small, but prominent bulb of percussion. A platform has then been developed from which a large outward plunging flake has been removed, taking most of he right side of the axe with it. The left hand side of the axe has then been retouched to form a scraper like edge. The scraper has then been exposed to heat resulting in fire fracturing on both sides and its end. (95mm long x 52mm wide x 18mm wide).

No. 51.
A small micro-denticulate serrated blade, unpatinated and dark grey to black in colour, soft hammer-struck with a plain platform. Regular re-touch on distal end, along its right hand side and halfway along its left hand side giving a serrated edge. Use-wear resulting in rounding of both edges. Has been exposed to heat, resulting in mottled fire damage on its ventral side. (59mm long and 21mm x 7mm thick).

6.7: Stone Report with comments from Dr Rob Ixer

Stone 1.
Described by the Curwen's as a 'small piece of a grain-rubber of lower greensand, including parts of the grinding surface'. A waterworn, unworked, fine-grained indurated sandstone and originally a beach cobble. The flat weathered surfaces are a light olive grey (5Y 6/1 -5Y 7/1 on the Geological Society of America rock-color chart) and the broken surface is similar, 5Y 6/1 -5GY 6/1. The sandstone is very fine-grained (average grain size <187µm, fine sand size) with rare mica flakes and pink feldspar. No geological origin is possible and a thin section would add little archaeologically useful information. It appears to have been used. One surface has an area of pitting, the pits are 1.0mm in diameter and may be in a non-random pattern. Both surfaces show short, thin linear scratches (more characteristic of a thin blade than anything else) and these too may not be natural. The two rounded edges have been used for 'rubbing' one has a dark gloss on its edges and many thin striae. It is an enigmatic artefact, a natural beach cobble that has been used for rubbing/polishing and later 'decorated'.

Further to its identification the rubbing stone has been photographed using RTI, which has revealed several distinctive and purposeful lines, or striations, scratched onto its surface, on both of its sides. The piece has also been broken in half, with a small bulb of percussion notable in its centre along its break and finally two flakes seems to have knapped, one from each corner.

Stone 2.
Originally described by the Curwen's as 'part of a fine-grained sandstone rubber'. The artefact is an ovate hammer-stone, on an unworked waterworn beach coble. The rounded surfaces are pale yellow and the fine-grained sandstone is rich in quartz. One side appears to has been worn smooth through use and on the other side there is a series of lightly defined lines, probably as a result of a rubbing action. The entire edge of the stone has pit marks and indentations, typical of a hammer-stone. Finally, part of its edge has been damaged, resulting in the removal of flake, possibly due to a forceful impact with a hard material.

6.8: Charcoal Report by Dr. Alex Pryor

Tin 2/Bag 2; Pit X; NBD soot

The contents of the bag were sieved to separate the >2mm fraction, which was then skimmed. The charcoal is highly fragmented and degraded, and under magnification most of the lumps are in fact balls of sediment stuffed with charcoal dust. The macrocharcoal that survives is fragmented almost into flakes from individual tree rings. I have selected some of the larger charcoal fragments which appear to be the same species as in TIN3.

Tin 3/bag 3; Pit X

The contents of the bag was skimmed, and at least two species of hardwood are present here. No obviously small-diameter pieces or pieces with bark attached were noted. No seeds or non-wood charcoals were observed.

Several larger pieces with minimal ring curvature were selected corresponding to the wood-type that appeared most common and studied under high-powered microscope. The pieces were identified as European ash (Fraxinus excelsior) based on the following observed features:

- Distinct growth ring boundaries
- ring-porous wood
- Simple perforation plates with minute intervessel pits in an alternate arrangement
- Rays 1-3 cells wide that were all procumbent

Site Location

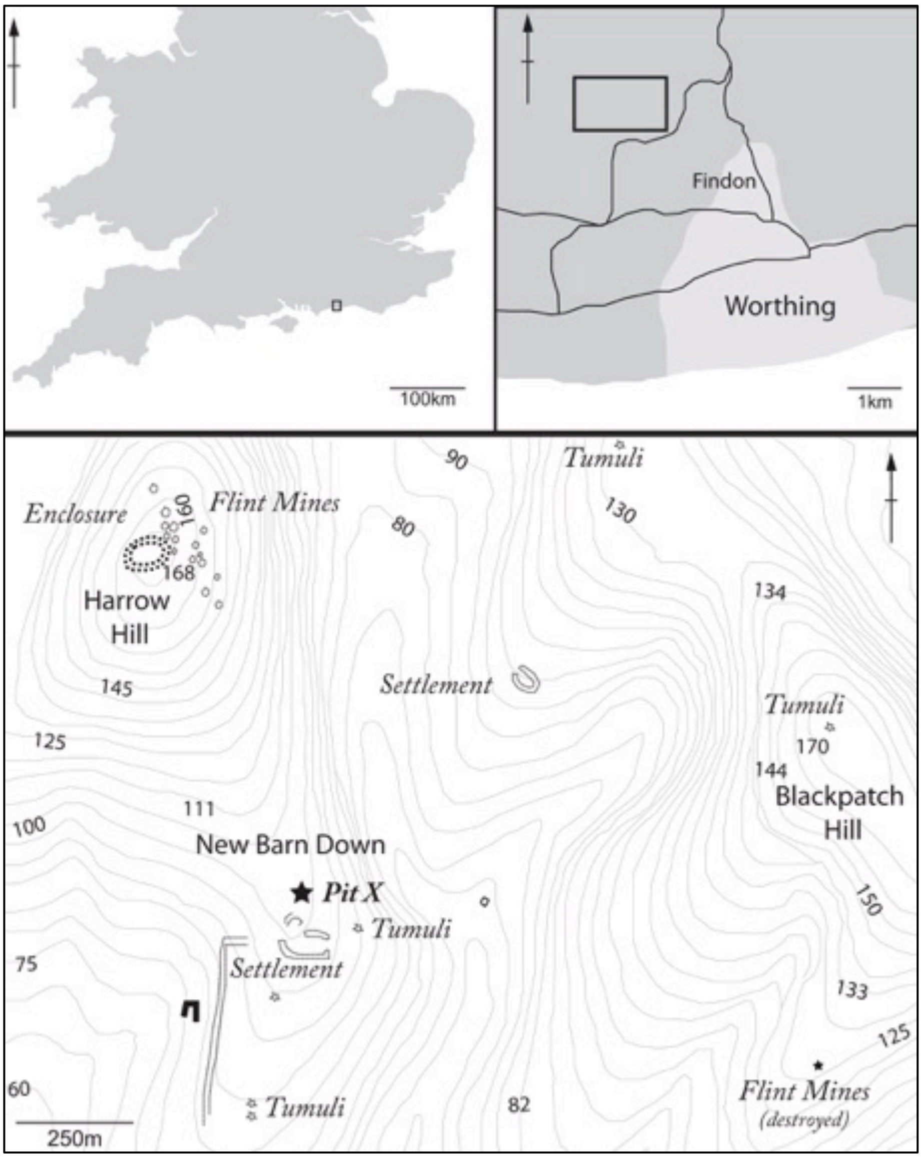
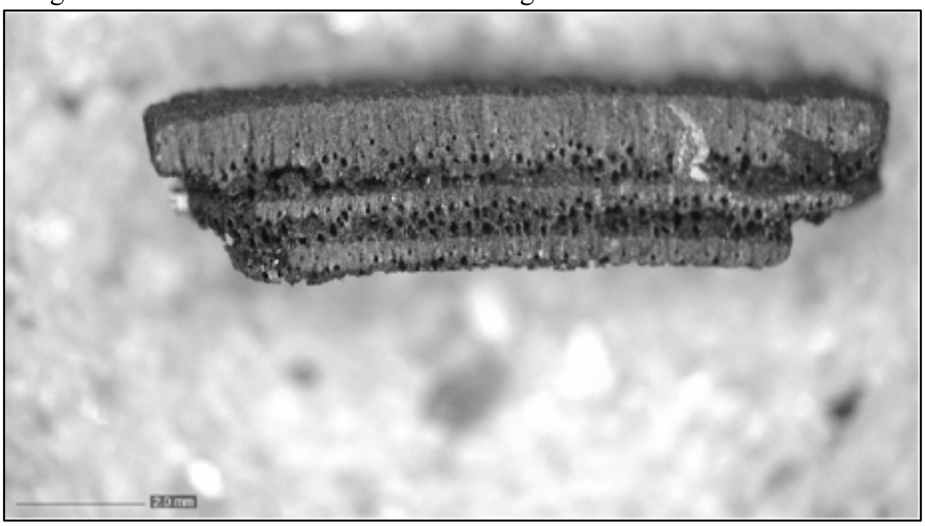
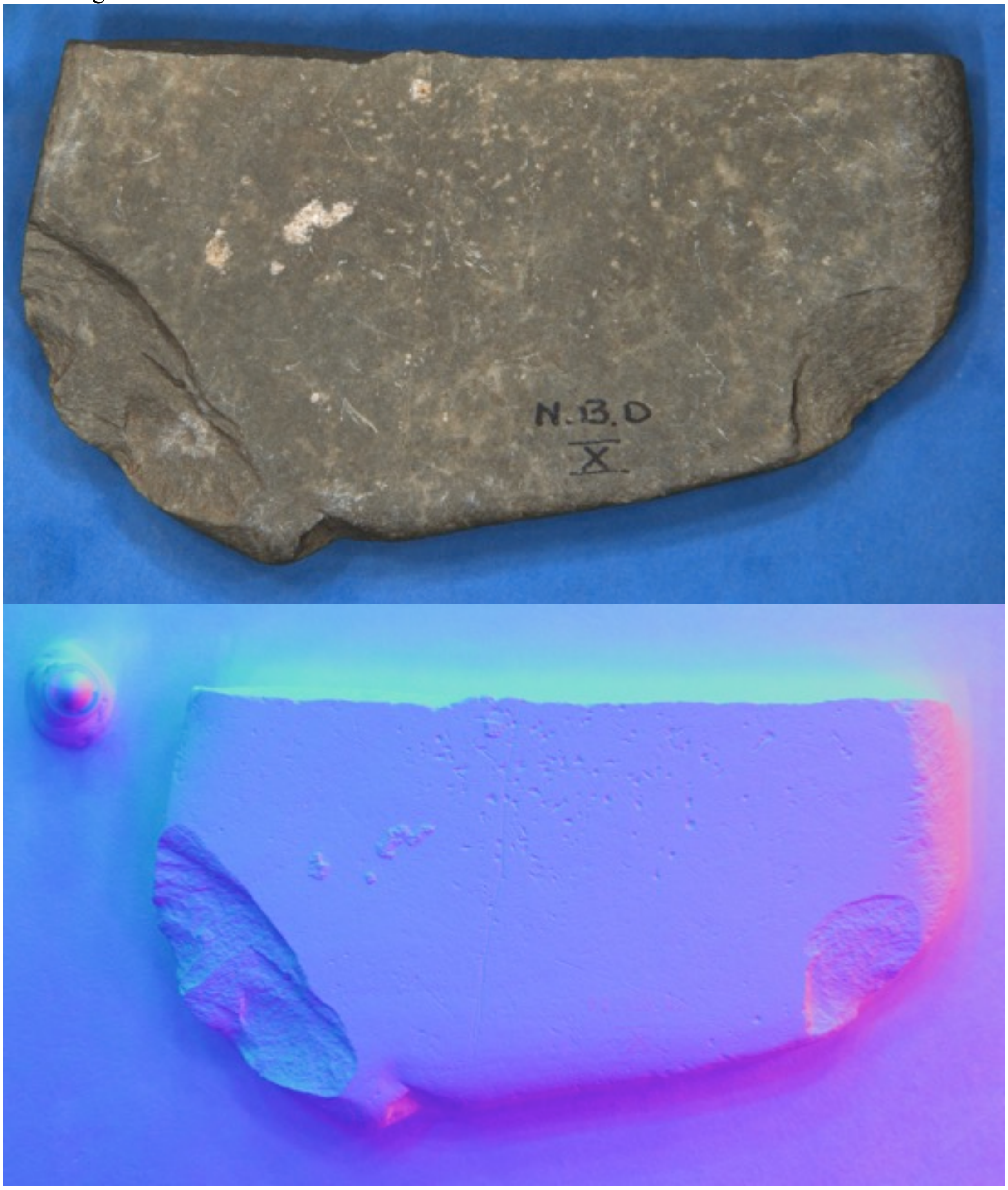


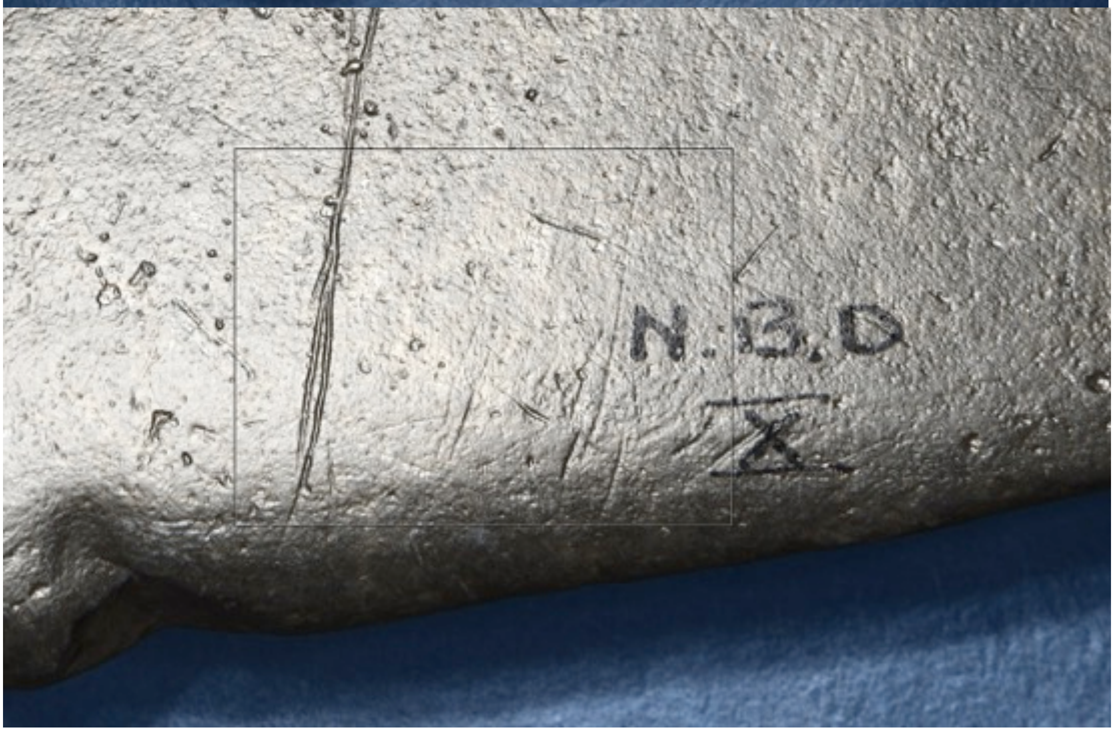
Image of ash charcoal from Tin 3 at x25 magnification



RTI images of Stone 1




N.B.D
X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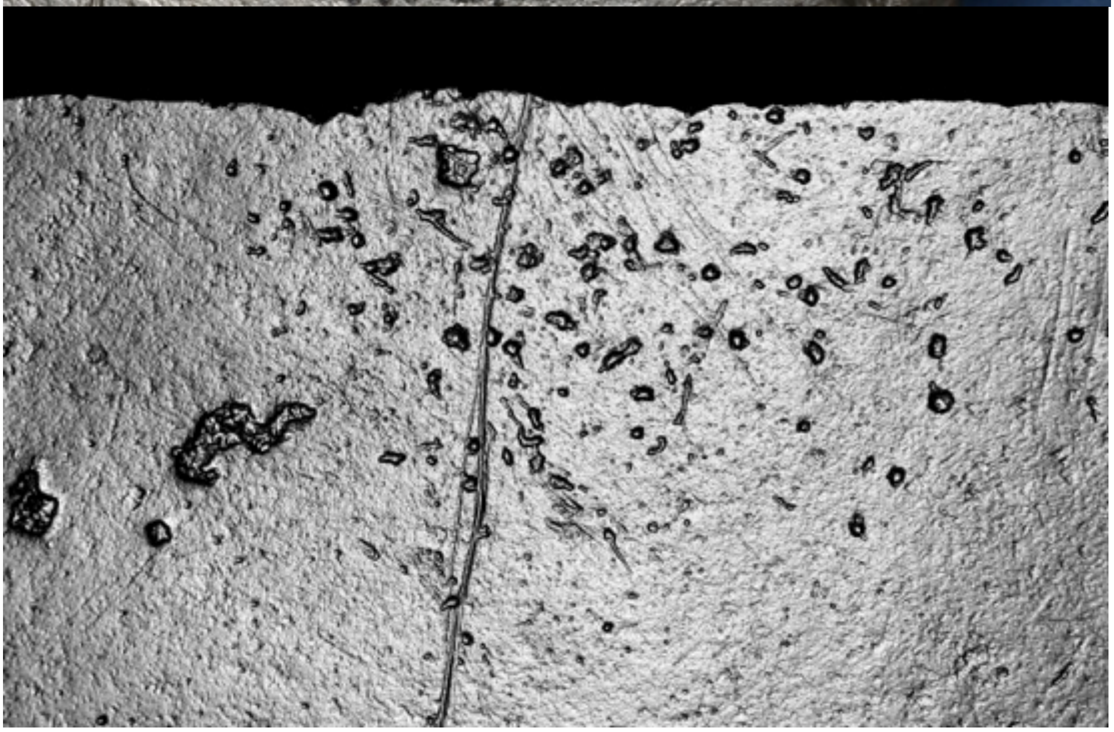


6.9: East Sussex area

Site 1: Lower Hoddern Farm	**HER No:** MES 18927
Location: Peacehaven	**NGR:** TQ 41922 01542
Date of Fieldwork: 2009	
Height: 20m – 45m aOD	
Geology: Clay-with-flints Formation - Clay, Silt, Sand And Gravel. Superficial Deposits formed up to 23 million years ago in the Quaternary and Neogene Periods. Local environment previously dominated by weathering processes (U). Head - Silt, Sand And Gravel. Superficial Deposits formed up to 3 million years ago in the Quaternary Period. Local environment previously dominated by subaerial slopes (U). **Bedrock:** Newhaven Chalk Formation - Chalk. Sedimentary Bedrock formed approximately 72 to 86 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.	
Type: Strip, map and sample.	
Company: Archaeology South East	
Report: HART, D. 2010. *A Post-Excavation Assessment and Updated Project Design for Excavations at the Brighton and Hove Wastewater Treatment Works, Lower Hoddern Farm Peacehaven, East Sussex (Stage 3).* Unpublished Report No. 2010098. Archaeology South East.	
Publication: HART, D. 2015. Around the Ancient Track: Archaeological Excavations for the Brighton and Hove Water Treatment Works and Adjacent Housing at Peacehaven, East Sussex, Spoil Heap Publications.	

Summary

Lower Hoddern Farm is a downland location with chalk geology and overlooking the current coastline that is located a little over 1km to the immediate south. However, this area of downland has superficial deposits of Brickearths and sandy Loess soils. It is these fertile and easy to cultivate sandy soils upon which Early Neolithic activity was concentrated on at Lower Hoddern. The open excavation of over 30 hectares revealed a concentration of Early Neolithic activity on high ground in the northeast corner of the Site, mostly in the form of small, shallow pits, postholes, gullies, buried soils and flint scatters.

Early Neolithic Features

In total twenty-six pits and features were recorded scattered across the northeastern part of the Site, all of which varied in size, form and content. These features were divided into six sub-groups, primarily according to their size and form, rather than their spatial distribution. The group consisting of the largest pits (Group 245) included three pits, (635, 786 and 1202), which were all sub oval in plan, with mostly irregular, shallow to sharpish sloping sides and concave bases, up to c.2.5m$^{\o}$ and up to c.0.9m in depth. All the pits appeared to have been rapidly backfilled. Noteworthy finds from the pits included a fragment of saddle quern and rubbing stone from Pit 635, along with Early Neolithic pottery, recovered from Pit 1202. A series of AMS radiocarbon dates were obtained from pits 635 and 1202, indicating that they date to between 3730-3490 cal BC.

The second group (Group 246) comprised of four smaller pits, sub-circular and up to c.1.40m$^{\varnothing}$ and c.0.7m in depth (648, 774, 777 and 783). Artefacts included a polishing stone from Pit 738, along with a large assemblage of pottery.

The next two pit groups (Group 247 and 254), consisted of small, sub-circular and circular features, up to c.1.15m$^{\varnothing}$ and c.0.6m in depth. Finds from these pits included potsherds, including fragments possibly from the same vessel that were dispersed between the features, a polishing stone from Pit 644, a fragment of saddle quern from Pit 720 and a grinding stone from Pit 766.

Next was Group 248, made up of two irregular intercutting features (743 and 724), which contained few artefacts and may have been three throws. Group 249 consisted of five possible postholes, which although undated, were believed be contemporary with some of the pits due to their proximity to dated features.

Examination of the distribution of the pits, and the way they are grouped, infer that there is certain level of chronological observable, possibly relating to at least a minimum of four different episodes of activity. This is key, as the pits seem largely contemporary with each other and therefore may only relate to seasonal activity over a few years, possibly even only one or two years.

Pit A 777 was interpreted as containing a 'special deposit' of c. 14,500 microfossils of charred grains, 87% of which was wheat and 23% barley. The pit was not interpreted as a grain store, as there was evidence of silting in its base, inferring that it had been left open before being backfilled. Also, the predominance of wheat was interpreted as purposeful selection, which combined with a lack of artefacts indicated that the pit was intentionally filled with charred cereals, possibly deliberately in a symbolic driven process.

The results of five radiocarbon dates from four different contexts indicate that activity began sometime between 3770-3630 cal BC (91% probability) and 3690-3640 cal BC (68% probability), ending between 3645-3470 cal BC (95% probability), or 3649-3595 cal BC (50% probability). The dates infer that activity was limited to a few years, anything from between 1-150 years, although certain aspects of the archaeological evidence, such as the tight clustering of pits and uniformity of pottery types, probably indicates that the site was visited seasonally for only a few separate years.

Flintwork

In total 458 pieces of Early Neolithic flint work was recovered from the pits. Flakes made up by far the largest percent of the assemblage with 328 pieces, 124 of which were from Pit 21. Next were blade and blade-like flakes, thirty-two and twenty-five pieces respectively, followed by twelve bladelets and ten serrated blades. Overall, the flintwork was distributed evenly across the features, with the larger Pits 635 and 1202, producing fifty-three and fifty pieces respectively, with flakes accounting for most of the assemblage from each. The rest of the pits varied from between one, in Pit 777, to 150 in Pit 21, with an average of around thirty pieces per feature.

Blade production was dominant, with flakes removed from single and multi-platform cores, six of which were found in total. Implements were relatively scarce, with one leaf-shaped arrowhead, five end scrapers and one knife. Most of the implements recovered were serrated blades, but compared to Bishopstone, only a total of ten were recovered. Surprisingly, for an Early Neolithic site in Sussex, there were only five axe-thinning flakes. Of interest were four flakes from ground implements, including three from Pit 21, which may have derived from flint sourced from flint mines. Apart from the polished flakes, most of the flint appears to have been sourced locally, either immediately on-site from surface deposits, or from beach deposit, including a small amount of Bullhead flint.

The pottery

A large assemblage of Early Neolithic pottery was recovered during the excavation, 949 potsherds in total, virtually all of which can be classified as plain Bowl. Two fabrics dominated the assemblage, FL5 a sandy matrix with ill-sorted flint inclusions of various sizes, and FL17, a coarse flint-tempered fabric. Most vessels were thick walled and crudely made with laminar and ill-sorted flint inclusions, some of which were flaked, rather than crushed. Three AMS dates were obtained from carbonised residue on potsherds, including 3640-3370 cal BC from Pit 1204, and 3710-3620 cal BC form Pit 640, associated with a date of 3660-3520 cal BC obtained from a wheat grain from within the same context.

Regarding form, the majority of the vessels are recorded as being neutral, with occasional open or closed profiles. Rims were plain and squared, with a few examples beaded or slightly out-turned. There were a few carinated forms with open profiles and also small cup like vessels with closed profiles. A small amount of the assemblage, 5%, was decorated, mainly consisted of oval shaped lugs and one vessel with incised lines along its shoulder.

An attempt was made in the post-excavation analysis of the pottery to re-fit some of the potsherds, from both individual pits and between features. The exercise proved that some of the potsherds from the large pits (Group 245) re-fitted, but none from the other pit groups. It was concluded that some of the potsherds from the smaller pits might have cross-fitted. It was proposed that because some of the larger potsherds from one pit possibly re-fitted with smaller sherds from another, the larger potsherds were deposited directly into the pits, with the smaller fragments being re-deposited in backfill of another pit located close-by.

Chronologically and stylistically the assemblage is clearly dated to between the mid 38th to 37th centuries BC, supported by the radiocarbon dates obtained from the pits and pot residual. There is a complete absence of any Carinated Bowl vessels in the assemblage. Decorated vessels were sparse, in keeping with none-causewayed enclosures assemblages in Sussex. It is unclear if the assemblage slightly pre-dates, or is contemporary with the Sussex enclosures.

Environmental evidence

A large and varied set of environmental data was recovered from the pits during the excavation. Charred plant remains were present in thirteen of the pits, including wild, domesticated varieties and cereals.

The species present are typical of those recovered from other Early Neolithic pits in Sussex and was dominated by barley (*Hordeum vulgare*), with glume wheat, either emmer or spelt also present. Interestingly, a large count of spelt grains was recovered from Pit 777, with over 14,500 items. A small amount of flax and pulses, including Celtic/broad beans and some vetch/bean/pea, were also present, although it was felt that none were in a large enough quantity to demonstrate purposeful cultivation.

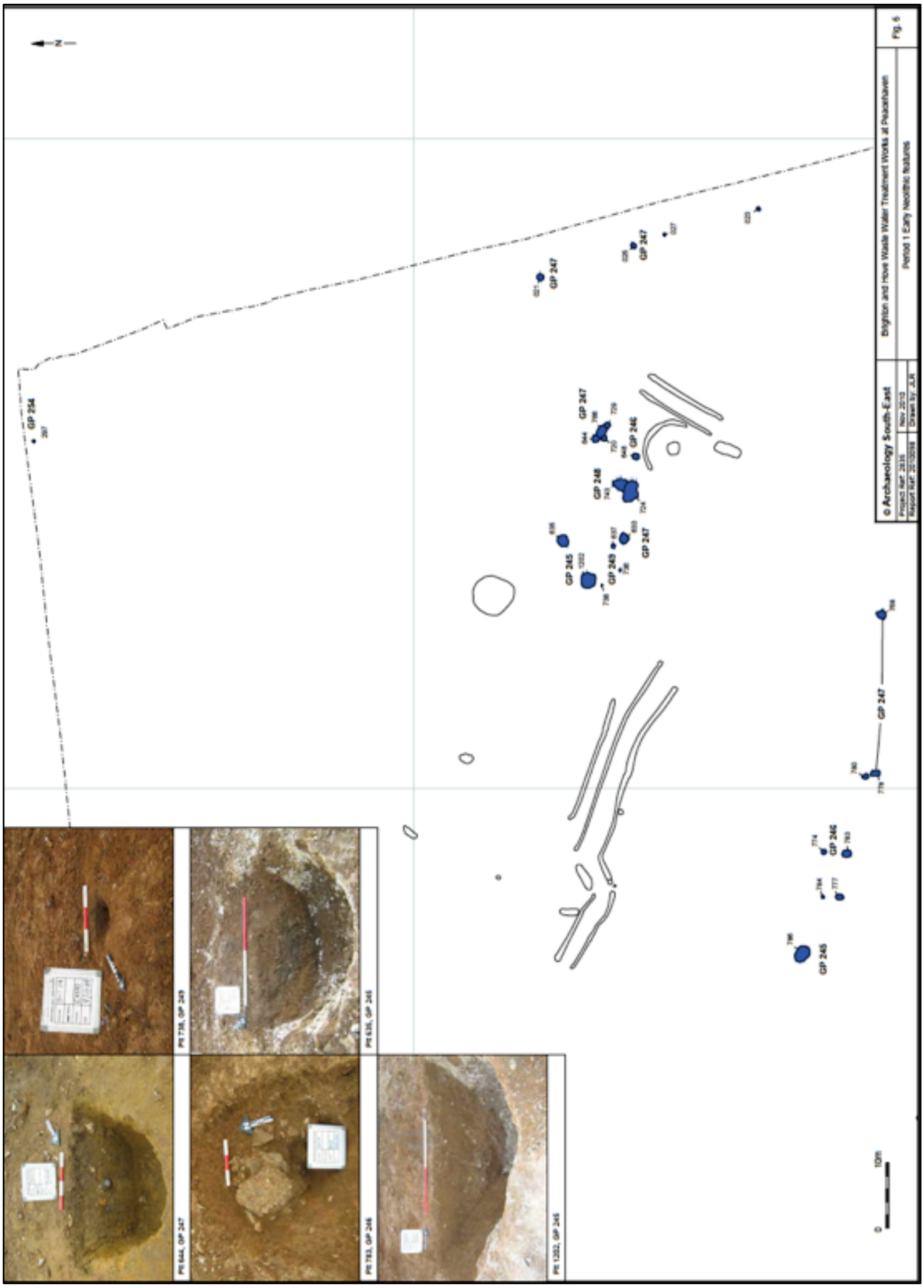
The remains of wild plant were much fewer than the cultivated plants, but included goosefoot, knotgrass/dock and vetch. There was also a few fragments of hazel shell present in pits, 635 and 648, which were interpreted as food waste.

In total ten samples of charcoal were analysed from three pit groups, 245, 246 and 247. A wide range of species seems to have been utilised for fuel and species identified included oak, Rosaceae, wild cherry/blackthorn, alder, beech, ash, hazel, rose, honeysuckle, hornbeam and willow/popular. The charcoal assemblage shows that the local environment included both dry and damp woodland, evidenced by alder.

The results indicate that the environs around the Site were mixed, with open areas of cultivation, probably focused on the Loess soils, and areas of both dry and damp woodland. There was a lack of evidence for the utilisation of marine resources, and the Early Neolithic community, or communities active at Lower Hoddern Farm were focused on a substance based on cultivation of mixed cereals and some pulses, combined with wild plants.

Stone Artefacts

A small assemblage of quern stone fragments was excavated from the pits. Two stones fragments were recovered From Pit 636, including a non-diagnostic piece and an incomplete rubbing stone, and Pit 720 produced a small fragment of the lower part of a saddle quern.



Early Neolithic features

Site 2: 1 South Coast Road	**HER No:** MES 455/16
Location: Peacehaven	**NGR:** TQ 4252 0062
Date of Fieldwork: 2016-2017	
Height: *c*.47.7-50.7m aOD	
Geology: Lambeth Group - Clay, Silt And Sand. Sedimentary Bedrock formed approximately 48 to 59 million years ago in the Palaeogene Period. Local environment previously dominated by swamps, estuaries and deltas. **Bedrock:** Tarrant Chalk Member - Chalk. Sedimentary Bedrock formed approximately 72 to 84 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.	
Type: Archaeological Evaluation - Strip, map and sample.	
Company: Chris Butler Archaeological Services Ltd	
Report: BACZKOWSKI, J. 2017. Post Excavation Assessment Report For A Strip, Map And Sample Archaeological Excavation At 1 South Coast Road, Peacehaven, East Sussex, BN10 7AE. CBAS0754. Unpublished Report	

Summary

1 South Coast Road is located close to the coastline in the south of Peacehaven. A large lithic scatter and 21 Early Neolithic pits were recorded during two phases of archaeological fieldwork.

Early Neolithic Features

A total of 14x pits can be accurately dated to the Early Neolithic, including Pit 1 (Cut 016), Pit 2 (Cut 020), Pit 5 (Cut 010), Pit 10 (Cut 035), Pit 11 (Cut 045), Pit 12 (Cut 047), Pit 13 (Cut 051), Pit 14 (Cut 058), Pit 15 (Cut 060), Pit 16 (Cut 071) Pit 19 (Cut 078), Pit 17 (Cut 074), Pit 18 (Cut 076) and Pit 20 (Cut 089).

The pits of most interest to this research were Pits 1 and 2.

Pit 1

Pit 1 was oval in plan, 0.8m wide and 0.32m deep. In section Pit 1 had a moderately steep concave sides, slightly irregular on its north side, and a convex base. Pit 1 contained a single deposit, composed of friable mid brown to dark grey silty clay, with occasional flint gravel and moderate amounts of charcoal inclusions. The flintwork assemblage recovered from Pit 1 contained 116 pieces of struck flint and 12x fragments of fire-fractured flint. Diagnostic flintwork, datable to the Early Neolithic period (4000-3300 BC) included 3 serrated blades and debitage typical of blade production. The pottery assemblage in Pit 1 totaled 22x potsherds, including feature sherds belonging to carinated and bowl form vessels, typical of the Early Neolithic period. An environmental sample taken from Pit 1 contained charred seeds, rare cereal grain and/or chaff remains and a quantity of charcoal.

Pit 2
Pit 2 was located c. 0.55m to the northwest of Pit 1 and initially observed in plan as a small half-oval feature, truncated in its northern side by a large concrete foundation slab. Once the concrete footing was removed by machine it became apparent that Pit 2 was actually a large, deep circular pit, which despite being truncated by the concrete footing to a depth of 0.3m, was well preserved. Pit 2 measured 0.62m wide, 1.06m in depth and with steep vertical sides and a concave base, giving it the appearance of a large post-hole in section. Two deposits were recorded in Pit 2, Fill 021, composed of soft orange brown sandy silt with occasional small flint gravels and Fill 032, composed of friable dark brown silty clay with occasional small flint gravels. Both deposits contained significant assemblages of Early Neolithic flintwork and pottery. The flintwork included 12x serrated pieces and 10x blades from Fill 021, and 2x serrated pieces and 7x seven blades from Fill 032, both deposits also included axe thinning flakes and upwards of 40+ small chips. Pottery was also recorded from both deposits, including a total of 63x potsherds from Fill 021, and 18x from Fill 032. Feature sherds revealed cross- fit between both deposits in Pit 2 and a minimum of 3 vessels, all diagnostic of Early Neolithic forms, including a carinated bowl form and a small hemispherical cup, or bowl. Environmental sampling of both deposits (Sample No. 3 and 4) contained charred seeds, possible cereal grain and/or chaff and a large amount of charcoal. It is likely that Pit 2 was backfilled in a single event but with two deposits, with the difference between Fill 021 and 032 possibly due to more organic material being present in the primary deposit.

The Flintwork

Pit 1
This largish pit contained 116pieces of worked flint. Diagnostic pieces include 3x serrated pieces, produced on fine blades and a thinning blade from the production of a bi-facial axe, with a small area of re-touch. 16x whole and snapped blades are also present, several of which show platform preparation. The pieces in the feature are typically Early Neolithic, except for 2x blades, both snapped, and a bladelet, which have a pale blue to white patination and are almost certainly Mesolithic and therefore residual in this pit.

Pit 2
The largest collection of flintwork recovered from a single feature during the fieldwork was from Pit 2, amounting to 241pieces. The assemblage from Pit 2 is notable due to the high volume of serrated pieces recovered from it (14 pieces), accounting for 63% of the total found across the whole Site (22 pieces). The serrated pieces are produced on parallel–sided blades with small platforms, with a smaller amount on fine, wide flakes. The majority of the serrated pieces also retain areas of cortex. The serrations, or denticulations, are either u, or v-shaped and are predominantly neatly arranged along flat edges, although on one unusual flake the serrations are along a curved ventral edge. Other diagnostic pieces in Pit 2 included 2 axe-thinning flakes and a number of blades. A small amount of residual Mesolithic flintwork was also recovered from the Pit 2. A large number of chips were also recovered from environmental samples taken from Pit 2, indicating the final working of implements occurred close to the pit. The assemblage from Pit 2 is typical of the Early Neolithic, with serrated pieces, axe-thinning flakes, and evidence of platform preparation and use of both soft and hard hammer.

The Pottery

The Neolithic pottery assemblage is composed of 169x sherds (367g) from a total of fifteen individual contexts, nine of which are pits, one is a probable natural feature and two can be considered as open sub-soil deposits (Table 1). The assemblage can be dated to the Early Neolithic period (4000-3300 cal BC), belonging to both the Carinated Bowl (3950-3680 cal BC) and the Plain Bowl pottery traditions (3850-3470 cal BC) (Cleal 2004). Within three of the contexts (Pits 1, 2 and 21) many of the sherds are reasonably large, fresh and include some cross joins, indicating they are contemporary with the pits. Few large sherds are recorded in the other features, with a small amount appearing rolled, implying they are residual, or may have been in open deposits, such as middens, before being deposited into features.

Fabrics

The majority assemblage is flint-tempered, although flint inclusions are generally sparse and either fine to medium, with the exception of fabrics CF, CFG, FMF and MCFQ (Table 4). Flint tempering is also absent from one fabric, FSG and recorded in very low quantities in others, including SFFO, SFFS, SFQ, SFMF and FMFQ. The flint is either white and calcined, or burnt and bluish in colour. All fabrics are naturally backed in quartz rich pebbly sands, varying between fine to coarse, as in SFQ. Other naturally occurring inclusions include occasional grog fragments, although it is difficult to differentiate between these and Fe-oxide nodules. Several of the vessels are particularly fine and well made. These are mostly limited to Pit 2, and include fabrics FSG and SFQ, the latter of which is of unusual good quality and is only associated with a single carinated vessel, Neopot 1.

Overall, fabrics are typical of other Early Neolithic assemblages in Sussex, such as West Drayton (Seager Thomas 2010) and Lower Hoddern Farm (Hart 2015), with flint backing, albeit in sparse to medium amounts, and sandy quartz soils. There is nothing in the fabric sequence to suggest non-local geology has been used to manufacture the vessel. As is the case with other early pottery assemblages in Sussex there is nothing of note to connect the South Coast Road pottery to other sites, apart from the general form of the vessels. Certainly, the best-represented fabric in the assemblage, FMF, poorly fired and unoxidised, was recovered from both open and closed deposits across the Site and is more than likely produced locally.

Form

Only a few feature-sherds are present in the assemblage making identification of diagnostic forms difficult. Two vessels are noted in Pit 2, firstly Neo Pot 1, a finely made large carinated bowl with a plain, slightly heavy rolled rim and distinctive banded burnishing within its interior (Plate 17). Although, Neo Pot 1 is only identifiable from a single rimsherd and several bodysherds, with no evidence with the angle of the inflection it fits well with either a classically open, or neutral carinated form as proposed by Cleal (2004). The second vessel from Pit 2 is Neo Pot 2, a fine, small plain hemispherical cup, or bowl, with a simple, slightly out-turned rim. Small fine cups of a similar form are known in Sussex and often accompany assemblages dominated by Carinated Bowls, such as the assemblage from New Barn Down (Curwen 1934). A second carinated vessel, Neo Pot 3, was recovered from Pit 1, consisting of a bodysherd showing a sharpish inflection with a slightly out-turned profile above the carination, towards its rim. Unfortunately, no rim was present, but the vessel was likely to have had an open profile, fitting well with a classic carinated form (Cleal 2004). The vessels fabric (FMFQ), the thinness of the wall and the burnished finished fits well with potsherds in Pit 2, and it is possible they are from the same bowl, therefore indicating a cross-fit and link between the features. There are very few diagnostic sherds in the rest of the assemblage, apart from two probable lugs, one from Pit 21 and one from a buried soil deposit (Context 069), although both are heavily rolled and fragmented.

Regarding technology, many of the potsherds recorded were well made fine to medium walled vessels produced in oxidised environments. Apart from the site wide FMF, which tends to be poorly fire and unoxidised. Burnishing is present on many of the potsherds and is often preserved on the outer and inner walls, ranging between red to brown in colour and varying between coarse to fine. One interesting exception is the carinated bowl from Pit 2, which appears to have a horizontally banded like burnish on its interior.

Further Notes on the pottery

The pottery from 1 South Coast Road is a relatively small assemblage, however pottery from the Early Neolithic, especially from closed deposits is not common in Sussex and in general the rest of the British Isles. The assemblage is therefore of regional and national significance. The assemblage includes a minimum of two carinated vessels and a single plain hemispherical bowl. Assigning both carinated vessels to the Carinated Bowl tradition is difficult based on the two features sherds, as Neo Pot 1 lacks a carination and Neo Pot 2 a rimsherd. However, both vessels have certain characteristics that fit well with the Carinated Bowl tradition, such as relatively thin walls, a high level of manufacture and finish. The Carinated Bowl is the earliest pottery tradition in the British Isles (Whittle *et al.* 2011) and is represented by fine finished, well-manufactured open or neutral bowls with simple or rolled over rims, undecorated and with a change in angle low on the body wall, known as an inflection (Cleal 2004). The Carinated Bowl tradition is followed swiftly by the Plain Bowl and Decorated Bowl tradition, although with a high degree of overlap. Both traditions are evident from 1 South Coast Road, making it comparable in date and form to other early assemblages from Sussex recovered from pits, including New Barn Down, Worthing (Curwen 1934), Drayton Quarry, Chichester (Seager Thomas 2010) and Bishopstone, Seaford (Bell 1977). Finally, a level of caution is expressed in fully assigning Neo Pot 1 to the Carinated Bowl tradition, due to its heavy rim that is more associated with the Plain Bowl tradition. However, due to the fineness of its body and quality of manufacture, Neo Pot 1 may lie between the two traditions, inasmuch as it represents characteristics of both.

The nearest comparable pottery to the 1 South Coast Road pottery is possibly the assemblage recovered from excavations of pit groups at Lower Hoddern Farm, some of which has been radiocarbon dated to between 3700-3600 cal BC (Hart 2015). However, the Lower Hoddern Farm pottery lacked 'true' Carinated Bowl and was dominated by coarse fabric thick walled neutral form bowls, typical of Plain bowl wares. A better comparison is possibly the assemblage of carinated and plain Bowl vessels recovered from Rookery Hill, Bishopstone (Bell 1977). However the carinated forms in the Bishopstone assemblage were decorated and may possibly be closer to the causewayed enclosure horizon than the 1 South Coast Road pottery. Nonetheless, one aspect that is striking between the 1 South Coast Road and the Bishopstone assemblages is the presence of serrated flint blades at both sites, a specialist Early Neolithic implement, deposited within pits alongside pottery.

BARCLAY, A. 2007. Ceramics of the south-east: new directions, South East Research Framework resource assessment seminar.

- 2002. Ceramic lives, in, A. Woodward and J. D. Hill (eds.), Prehistoric Britain: ceramic basis, PCRG Occasional Publications, Oxford. 85-95.

BELL, M. 1977. Excavations at Bishopstone, East Sussex, *Sussex Archaeological Collections*, 11. 83-117.

CURWEN, E, C. 1934. A Late Bronze Age farm and a Neolithic pit-dwelling on New Barn Down, *Sussex Archaeological Collections*, 75. 137-70.

CLEAL, R. 1992. Significant form: ceramic styles in the earlier Neolithic of southern England, in, N. Sharples and A, Sheridan (ed.), *Vessels for the Ancestors*, Edinburgh University Press. 286-306.

D, HART. 2015. *Around the Ancient Track: Archaeological Excavations for the Brighton and Hove Water Treatment Works and Adjacent Housing at Peacehaven, East Sussex*, Spoil Heap Publications.

HERNE, A. 1998. A time and a place for the Grimston Bowl, in J. C Barrett and I. A. Kinnes (eds.), *The Archaeology of Context in the Neolithic and Bronze Age: Recent trends,* Sheffield: Department of Archaeology and Prehistory, University of Sheffield. 9-29.

Prehistoric Ceramics Research Group. 2010. The Study of Prehistoric Pottery; General Policies and Guidelines for Analysis and Publication. Occasional Papers No's 1 and 2, 3rd Edition.

POLLARD, J. 2001. The aesthetic of depositional practice. World Archaeology, 33. 315-33.

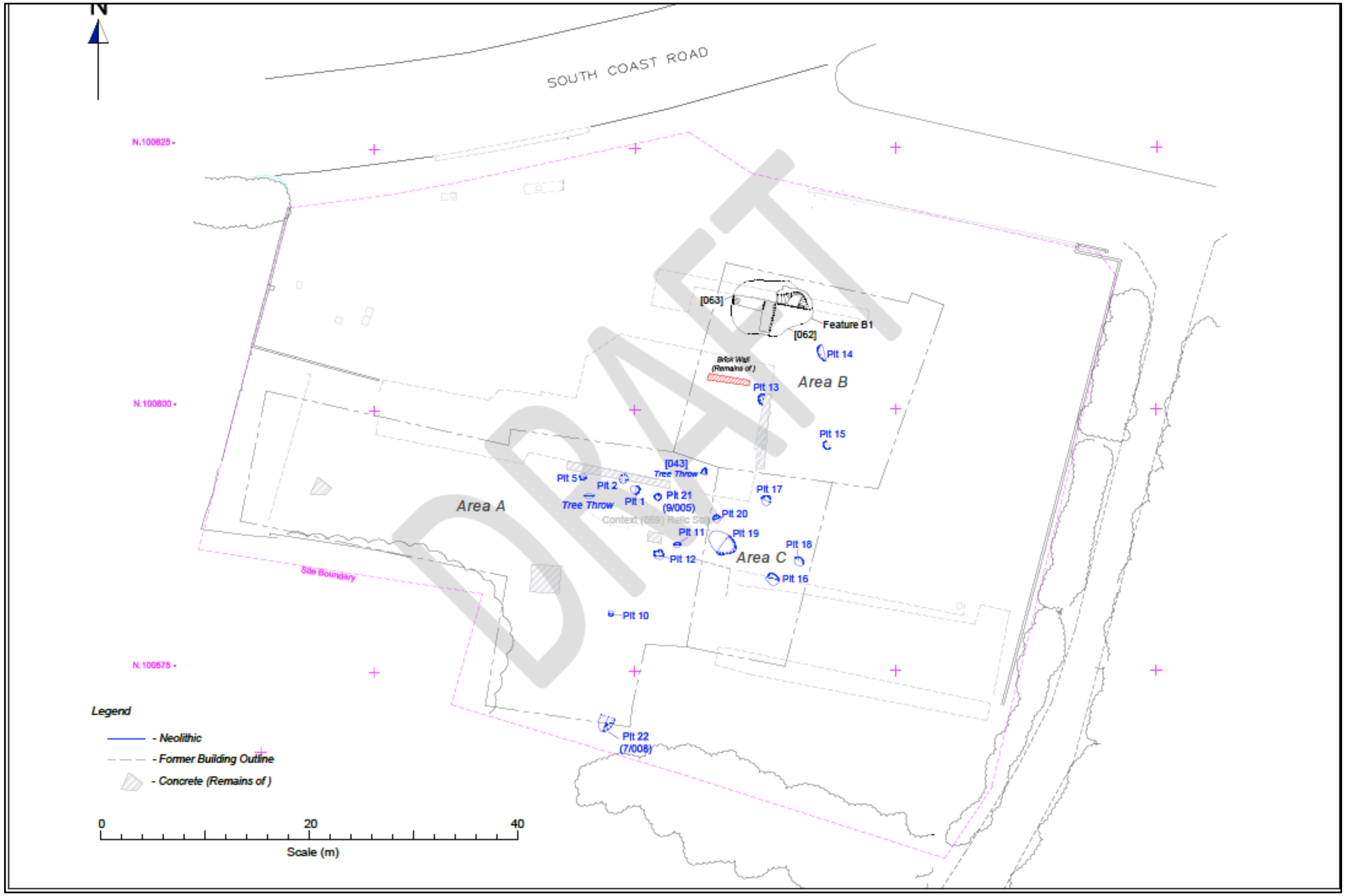
SEAGER THOMAS, M. 2010. The Drayton Early Neolithic pottery assemblage; The West Sussex Coastal Plains earliest pottery. Artefacts Services Technical Reports, 23.

SEAGER-THOMAS, M. 2010. *The Drayton Early Neolithic Pottery Assemblage. The West Sussex Coastal Plain's first pottery*, Artefact Services Technical Reports 23.

WHITTLE, A., HEALEY, F., and BAYLISS, A. 2011. *Gathering Time: Dating the Early Neolithic Enclosures of Southern Britain and Ireland, Volume 1 – 2*, Oxford: Oxbow Books.

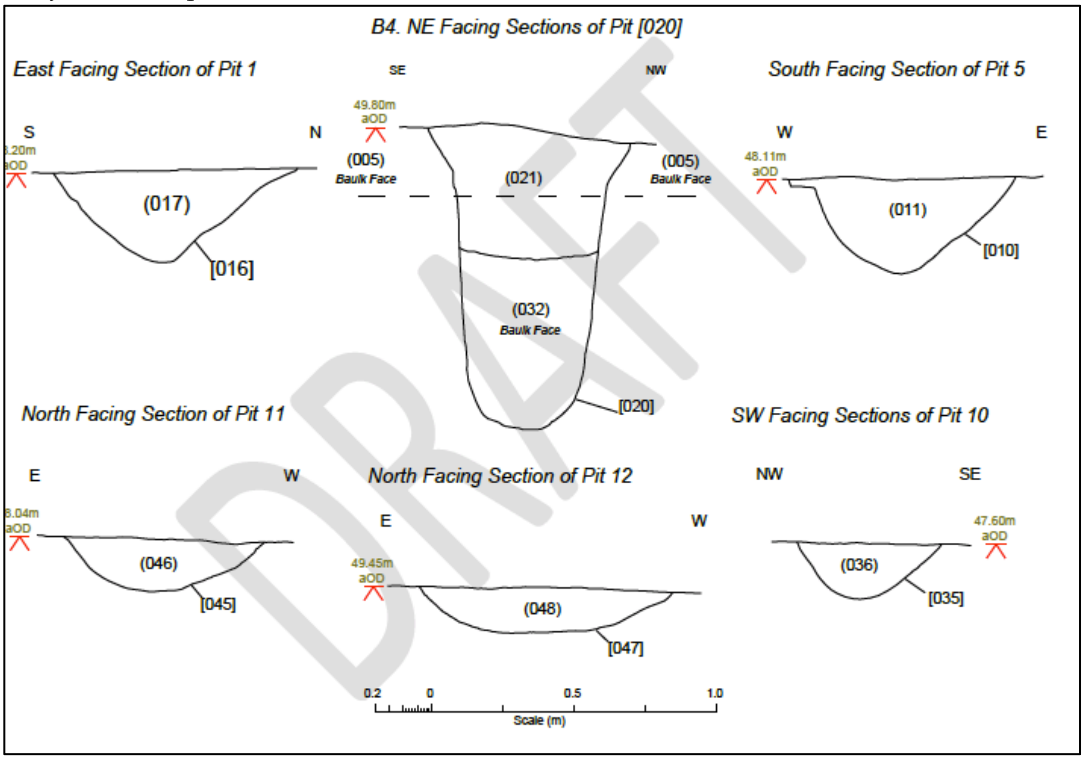
Pottery Fabrics

Fabric Code	Summary	Description	Finish
FMF	Fine to medium flint	Fine sandy matrix, c. 3% small to medium angular burnt flint	Unoxidised (dark grey) fine burnishing
CFG	Coarse flint with grog	Sandy clay matrix, c. 7% medium to large flints, c. 3% sparse grog or Fe- oxide nodules	Oxidised (red) exterior unoxidised interior (grey), rough burnishing
MCFQ	Medium to coarse flint with quartz sand	Fine sandy matrix, c. 3-7% medium to coarse burnt flint, c. 1% sparse grog or Fe-oxide nodules	Oxidised (light grey) interior, finely burnished (red) exterior
FMFQ	Fine to medium flint with quartz sand	Fine sandy matrix, c. 2-3% fine to medium calcined flint, abundant fine natural quartz	Oxidised (light grey) finely burnished exterior (brown to red)
SFMF	Sparse fine medium flint	Fine sandy matrix, c.1% fine flint, rare medium flint, abundant fine natural quartz	Oxidised (grey) fine burnishing interior
SFQ	Sparse flint and quartz sand	Sandy quartz rich matrix, c.1 fine burnt flint, c.1% and c. 30% fine to medium rounded quartz	Unoxidised (dark grey to black) finely burnished interior
CF	Coarse flint	Sandy matrix, c. 3-5% coarse burnt flint	Oxidised (brown – red). Burnished interior.
FSG	Fine sand	Sandy matrix, c. 1% small Fe-nodules	Oxidised (red grey), interior and exterior fine burnishing (grey)
SFFS	Sparse fine flint and shell	Sandy matrix, c. 1% fine flints, c. 1% fine shell	Unoxidised (grey) burnished (red)
SFFO	Sparse flint and Fe-nodules	Sandy matrix, c. 1% fine flint, c. 1% Fe-nodules	Oxidised (red)



Early Neolithic Features

Early Neolithic pits: Sections.



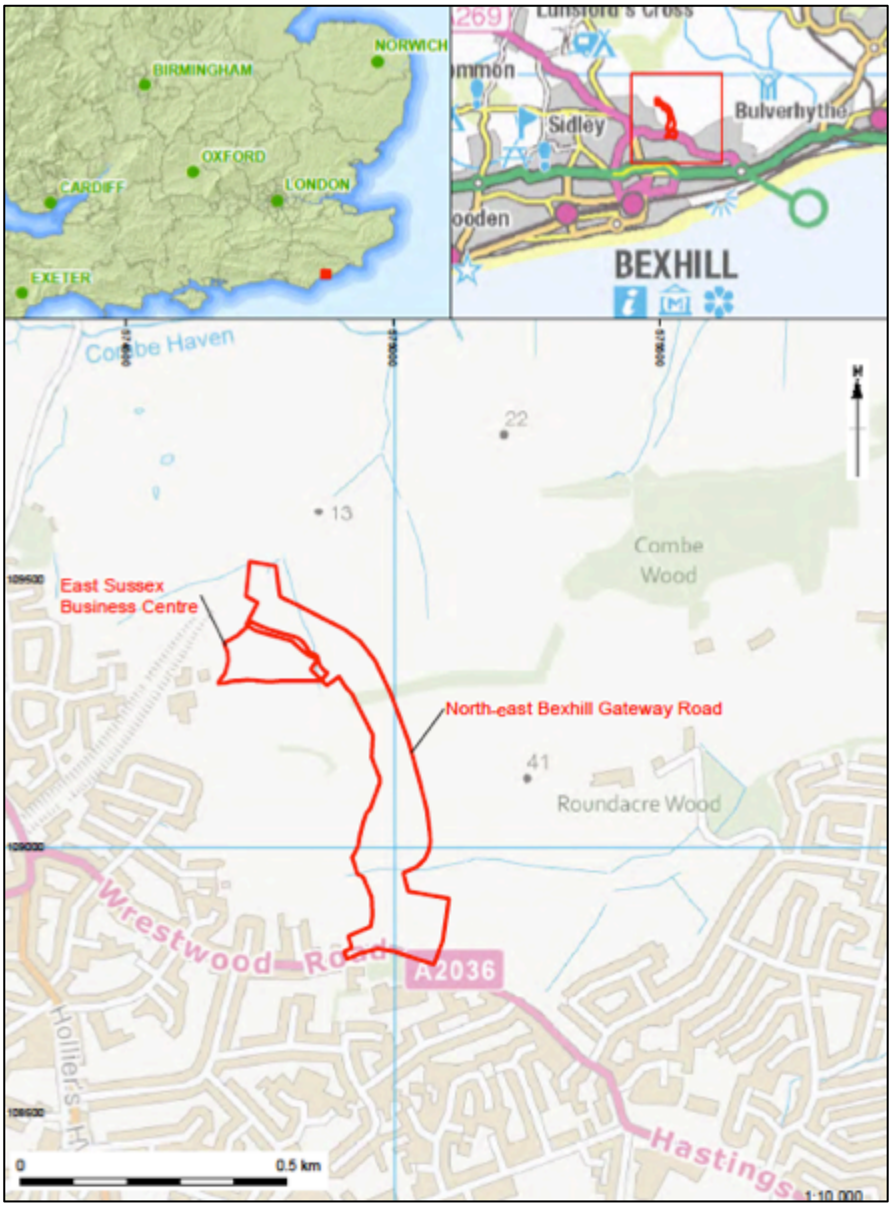
Site 3: 2 South Coast Road	**HER No:** N/A
Location: Peacehaven	**NGR:** TQ 42544 00678
Date of Fieldwork: 2017	
Height: 53m – 50m aOD	
Geology: Lambeth Group - Clay, Silt And Sand. Sedimentary Bedrock formed approximately 48 to 59 million years ago in the Palaeogene Period. Local environment previously dominated by swamps, estuaries and deltas. **Bedrock:** Tarrant Chalk Member - Chalk. Sedimentary Bedrock formed approximately 72 to 84 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.	
Type: Strip, Map and Sample	
Company: Pre-Construct Archaeology	
Report: CIPIN, I., and DOUGLAS, A. 2017. 2 South Coast Road, Peacehaven, East Sussex, BN10 8SI: An Archaeological Assessment. *Pre-Construction Archaeology Report No. R13048*. PCA Ltd.	
Summary: The earliest evidence for human activity on the site was a substantial assemblage of worked and burnt flint much of it dated to the Mesolithic and early Neolithic periods. Analysis of the lithics suggest that the site was visited perhaps seasonally over a long period of time and may have been a 'home base' style of settlement.	

Site 4: Keymer Avenue	**HER No:** MES 18989
Location: Peacehaven	**NGR:** TQ 4174 0121
Date of Fieldwork: 2007	
Height: 44m – 38m aOD	
Geology: Lambeth Group - Clay, Silt And Sand. Sedimentary Bedrock formed approximately 48 to 59 million years ago in the Palaeogene Period. Local environment previously dominated by swamps, estuaries and deltas. **Bedrock:** Tarrant Chalk Member - Chalk. Sedimentary Bedrock formed approximately 72 to 84 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.	
Type: Archaeological Evaluation and Strip, Map and Sample	
Company: Archaeology South East	
Report: RICCOBONI, P. 2008. Archaeological Investigations at Keymer and Seaview Avenues, Peacehaven, East Sussex: Post Excavation Assessment and Project Design for publication. Unpublished Report No.2008029. Archaeology South East.	
Summary: In total 25x shallow pits were recorded. Three of the pits contained Early Neolithic pottery identified as plain Bowl ware. Other pits contained a mix of flintwork, dated to the Late Mesolithic to Early Neolithic, and fire cracked-flint. Many of the pits may have been tree-bowls.	

Site 5: Seaview Avenue	**HER No:** MES 18994
Location: Peacehaven	**NGR:** TQ 4205 0104
Date of Fieldwork: 2007	
Height: 44m – 38m aOD	
Geology: Lambeth Group - Clay, Silt And Sand. Sedimentary Bedrock formed approximately 48 to 59 million years ago in the Palaeogene Period. Local environment previously dominated by swamps, estuaries and deltas. **Bedrock:** Tarrant Chalk Member - Chalk. Sedimentary Bedrock formed approximately 72 to 84 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.	
Type: Archaeological Evaluation and Strip, Map and Sample	
Company: Archaeology South East	
Report: RICCOBONI, P. 2008. Archaeological Investigations at Keymer and Seaview Avenues, Peacehaven, East Sussex: Post Excavation Assessment and Project Design for publication. Unpublished Report No.2008029. Archaeology South East.	
Summary: On the Seaview Avenue site, three features were recorded to contain Early Neolithic pottery and flintwork. A small amount of Early Neolithic flintwork and plain Bowl pottery was recovered from the pits. A further 12 undated shallow pits were also recorded, possibly representing tree-bowls.	

Site 6: Gateway Road	**HER No:** N/A
Location: Gateway Road and East Sussex Business Centre, Bexhill	**NGR:** TQ 7491 0934
Date of Fieldwork: 2014	
Height: 35m – 51aOD	
Geology: Ashdown Formation - Sandstone, Siltstone And Mudstone. Sedimentary Bedrock formed approximately 134 to 145 million years ago in the Cretaceous Period. Local environment previously dominated by swamps, estuaries and deltas.	
Type: Strip, Map and Sample	
Company: Oxford Archaeology South	
Report: POOLE, C., E BIDDULPH., and C. CHAMPNESS. 2015. North-east Bexhill Gateway Road and East Sussex Business centre. Post Excavation Assessment, Issue3, Oxford Archaeology.	
Summary: Early Neolithic activity was moistly recorded in the flintwork recovered from the site, including blades and part of a polished implement. A semi-circular segmented ditch forming a possible curvilinear enclosure approximately 40^{ø}, was tentatively dated to the Early Neolithic. It was interpreted as a possible causewayed enclosure, as it slightly oval and composed o segmented ditch sections. One pit contained possible transitional Mesolithic - Early Neolithic flintwork and burnt clay.	

Site Location



Site: Bishopstone	**HER No:** DES8825
Location: Rookery Hill, Bishopstone, Seaford	**NGR:** TQ 4675 0083
Date of Fieldwork: 1967 - 1975	
Height: 50m aOD	
Geology: Newhaven Chalk Formation - Chalk. Sedimentary Bedrock formed approximately 72 to 86 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.	
Type: Open excavation	
Company: Brighton and Hove Archaeological Society	
Publication: BELL, M. 1977. Excavations at Bishopstone, East Sussex, *Sussex Archaeological Collections*, 11. 83-117.	

Summary

Bishopstone is located on south facing spur of land, less than 1km north of the current coastline and the river Ouse to the west. The site geology is Upper Chalk bedrock and the hill is a patchwork of thin calcareous soils, deposits of Clay-with-Flints and pockets of sands. Excavations on Bishopstone were undertaken yearly from 1967 to 1975, the last four years of which were directed by Martin Bell with volunteers from Brighton and Hove Archaeology Society (Bell 1977). During this period a large multi-phase site was excavated, with almost continuous occupation present from the Neolithic to the Anglo-Saxon period.

Early Neolithic Features

In total eight pits and six gullies dated to the Early Neolithic period were investigated on Bishopstone.

Pit 357 was roughly circular in plan with vertical sides and a flat floor. The pit measured 2.5m in diameter and 0.85m in depth. Distinct episodes of backfilling had occurred in the pits, starting with a primary fill of silty grey chalk with charcoal inclusions, possibly compressed by tramping. Little weathering of the pit had occurred before a 0.5m thick layer of chalk rubble was introduced backfilled over the silty chalk to within 0.3m of the pits top.

A short period of weathering ensued before three shallow scoops were dug, within the largest of which in the middle of the pit a hearth was found. The last episode of backfilling was undertaken a short while after the digging of the small pits with more chalk rubble and brown earth. Finds were reported to be abundant throughout the fill, with the most in the upper deposits and included sixty struck flints, 153x potsherds representing up to thirty two different vessels, a saddle quern and a considerable amount of marine molluscs, in the form of mussel shells.

The largest pit excavated was Pit 711, oval shaped in plan, with straight vertical sides, a flat bottom and measuring 3.5m long x 2m wide and 1.54m deep. The top of Pit 711 hade been truncated by an Iron Age pit (712). No weathering had occurred to the pit and it seemed to be immediately backfilled with chalk rubble and soil. Considerable fewer artefacts were deposited Pit 711 than in Pit 357, and included four pieces of worked flint, a rubber stone and three potsherds.

Other large pits included Pit 570, an oval shaped feature 4m^{ø}, which was 0.4m deep and contained flints from an episode of knapping, probably with material extracted from the pits bottom, and a small hearth that had only been used once. The pit was allowed to naturally backfill.

Another large pit was the irregularly shaped Pit 710, measuring roughly 3m in diameter and 1.5m in depth. It southern half was oval in shape with tapered sides, a series of scoops had been dug along it northern edge. The pit was with a thin topsoil and then chalk rubble, upon which a small hearth had been placed. Like Pit 711, finds were scarce and included, a probable axe roughout, three struck flints and a sandstone rubber.

A further six small pits were discovered; all were circular or oval in plan and bowl shaped in section, shallow and between 2m to 0.84m^{ø}. All contained flint work and potsherds, with one pit containing a flake of foreign stone, possibly a polished axe, and one a sarsen rubber. These features were interpreted as grain storage pits, with one assumed to be for holding water as it appeared to be lined with clay.

In total four gullies were recorded, ranging depth from between 0.06m and 0.3m, most were filled with chalk rubble. Two of the gullies, numbers 16x and 616x had flint work in their fills and No. 16 also contained a single potsherd. The other gullies were empty and one, No. 701, joined two Early Neolithic pits. It was concluded that the gullies were either associated with chalk quarrying, or were for drainage, possibly for structures.

The Flintwork

Flintwork

Over 700 pieces of struck flint was recovered during the excavations, exploiting flint from at least five different sources, mostly local river gravels and Clay-with-Flint deposits. The features contained well-known Early Neolithic implements. Attention is paid to those from Pit 357, as they form a well-stratified assemblage of Early Neolithic types that can be used for comparison with other collections.

Serrated flakes dominated the assemblage in Pit 357, accounting for 68.2% of the assemblage. These were produced on parallel blades with small platforms. Their ventral sides were re-touched with multiple v-shaped or u-shaped notches to create distinctive serrated edges. They are interpreted as specialist tools for cutting processing plant material, as use-wear analysis revealed that the serrated edges were polished.

Other finished implements in Pit 357 were a bifacial axe with no signs of being polished (See below), possibly produced on mined flint, two leaf-shaped arrowheads, both very fine examples, nine end scrapers of varying sizes, some showing heavy use and glossed surfaces, possibly related to woodworking, a broken blade segment from a knife or sickle and four various re-touched flakes. A further thirty-four pieces of debitage mostly damaged flakes were also recovered.

Only four finished implements were recovered from Pit 711, including an end scraper, with cortex present, a side scraper on a thick flake, a hollow scraper with a wide re-touched cavity resulting in an a concave scraping edge, produced on a think primary flake, and a thin serrated or denticulated flake, with its bulb of percussion removed.

The flintwork recovered from the other pits mostly consisted of debitage, in the form of blades and flakes. From the Pit 570 62x flakes were recovered, plus a re-touched piece and eight cores, all seemingly relating to a single knapping event. Of greater interest was a small assemblage collected from Pit 710, comprising of a probable bi-facial worked axe roughout, two hollow scrapers and a large bifacially flaked knife. Of the six smaller pits, all contained flint work, except for Pit 620, this mostly comprised on debitage, with the exception of a side scraper from Pit 706.

Only two of the gullies contained struck flint, including a side scraper, a re-touched awl and a retouched scraper from No 16. The other gully, No 616, contained 112 pieces of debitage and 14x implements, including a side scraper, a hollow scraper and a backed knife.

The Pottery

Out of a total of 170x Early Neolithic potsherds, 153x were located in Pit 357, with only seventeen from the other features, including three from Pit 711. Therefore, much of report on the pottery is dominated by analysis of the pottery from Pit 357, as its assemblage is representative of the other potsherds. A minimum of thirty-two vessels was identified in Pit 357, with a four different flint backed fabrics present. Forms included closed-bowls, including one with decoration, a lugged bowl and a plain straight-sided bowl.

One carinated bowl sherd was found in Pit 357, Vessel 16, which had faint parallel vertical incised lines on its carination. Two other potsherds of a similar fabric and form were found in Pits 711 and 620.

Carinated forms are under represented, with only one vessel from Pit 357, one from Pit 711 and one from Pit 620. The majority of the assemblage from Pit 357 is closed or straight-sided bowls, with simple rims, a lugged vessel and at least three decorated vessels, including the carinated bowl. In consideration of these last features, and the dominance of plain Bowls, Pit 357 cannot be regarded as belonging to the Carinated Bowl tradition. One bowl, Vessel 16, is a carinated form and notably finer than the others, but such forms do continue into the plain Bowl tradition and this example had decoration, which is not typical of genuine Carinated Bowl, but is similar to decorated forms from Coombe Hill causewayed enclosure.

The stone

A small stone artefact assemblage was recovered from the Site, most can be considered as imports and only those from the pits will be considered here. The most significant artefacts were a polished axe or pebble from Pit 700, a rubbing stone from Pit 710, identified as fine grained sandstone and a rubbing stone from Pit 711, part of a large broken beach pebble, which after breaking appears to have been used as a rubber.

The stone artefacts are all associated with processing, probably cereal, and are mostly made from beach pebbles sourced locally, either from erratic sandstones collected on the South Downs or imported from primary sources wider afield. The two stone artefacts from New Barn Down show that similar range was resources were being exploited, and it is notable that a connection is again made with the coast through the use of beach pebbles.

Environmental evidence

A series of samples were obtained during the fieldwork, mostly from Pit 357 and one from Pit 570. Data was sorted into three main categories, land mollusca, plant remains, charcoals and animal bone. Analysis is of this data revealed much about the local environment of Bishopstone and a small amount about the diets of the Neolithic communities.

Land Mollusca

Three samples were taken from Pit 570, from which fourteen species of mollusca were identified in total. Identification of these species revealed the environment in the immediate area was closed, probably indicating woodland and scrub. However, there was a background of grass loving species, indicating that woodland clearance had began possibly began in the area, by what scale was difficult to conclude, but at minimum scrub had been cleared.

Analysis of the mollusca species from the top of Neolithic Pit 357 showed that the surrounding area was a mixed open and scrub environment, possibly a ‘mosaic of grassland and scrub. It was concluded that there was a chronological relationship between what was presumed the earlier Pit 570 and later Pit 357, showing that the area was being cleared and turned to open grassland.

A significant amount of mussel shells were collected from Pit 357, these are presumably the waste from a large fest and must have been sourced from the local seashore. One shell had been perforated and was possibly an ornament.

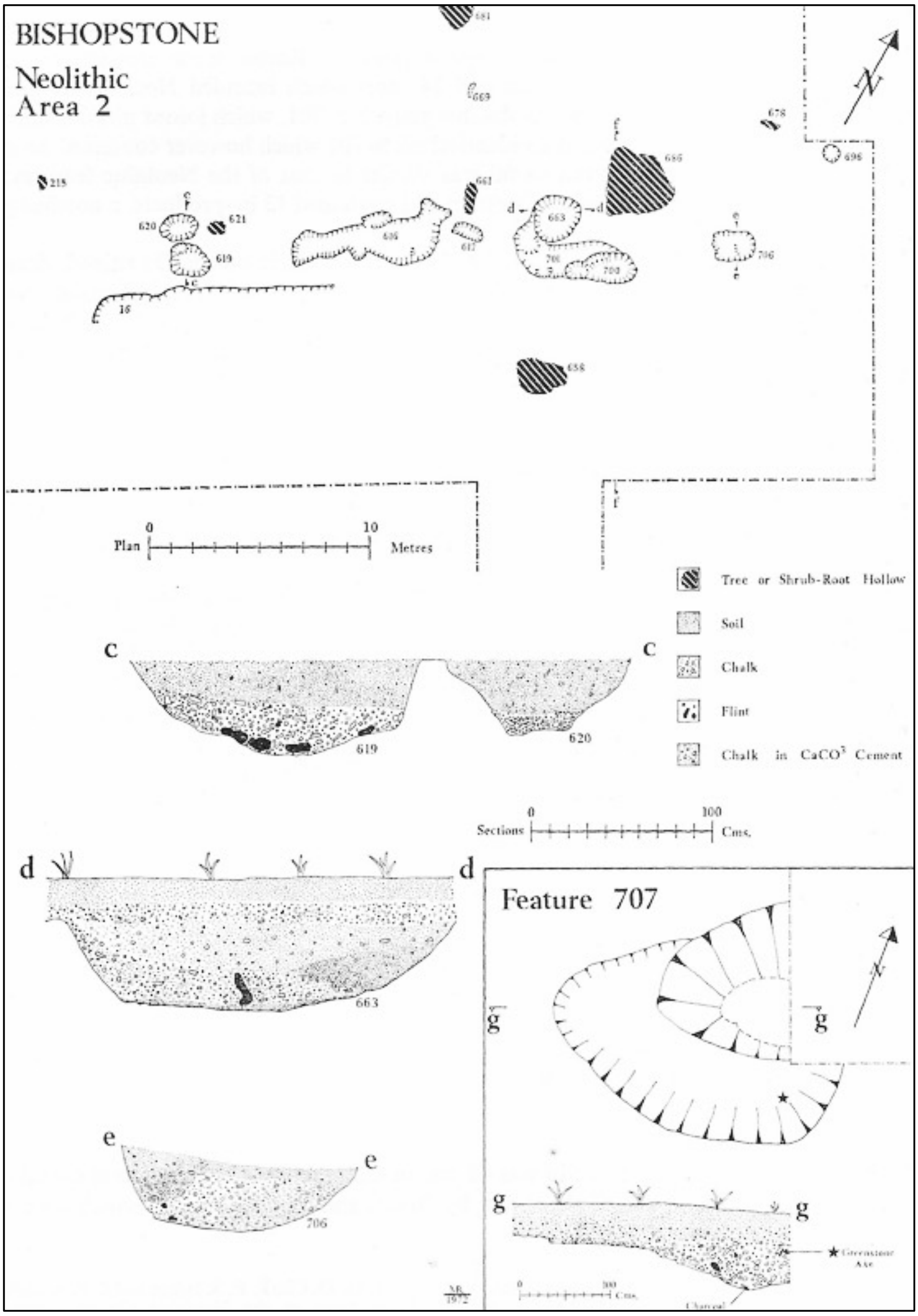
The charcoal

Charcoals samples were taken from the hearths in Pit 570 and 357, with a reasonably wide variety of species identified. The charcoals from Pit 570 proved to be from oak, hazel and hawthorn, in keeping with a wooded environment. Oak dominated the charcoal assemblage from Pit 357, followed by ash, hazel hawthorn and one sample of yew. It is unclear if the oak was brought to the Site as fuel, or was felled close-by, as the other species are more typical of scrubland inferred by the mollusca.

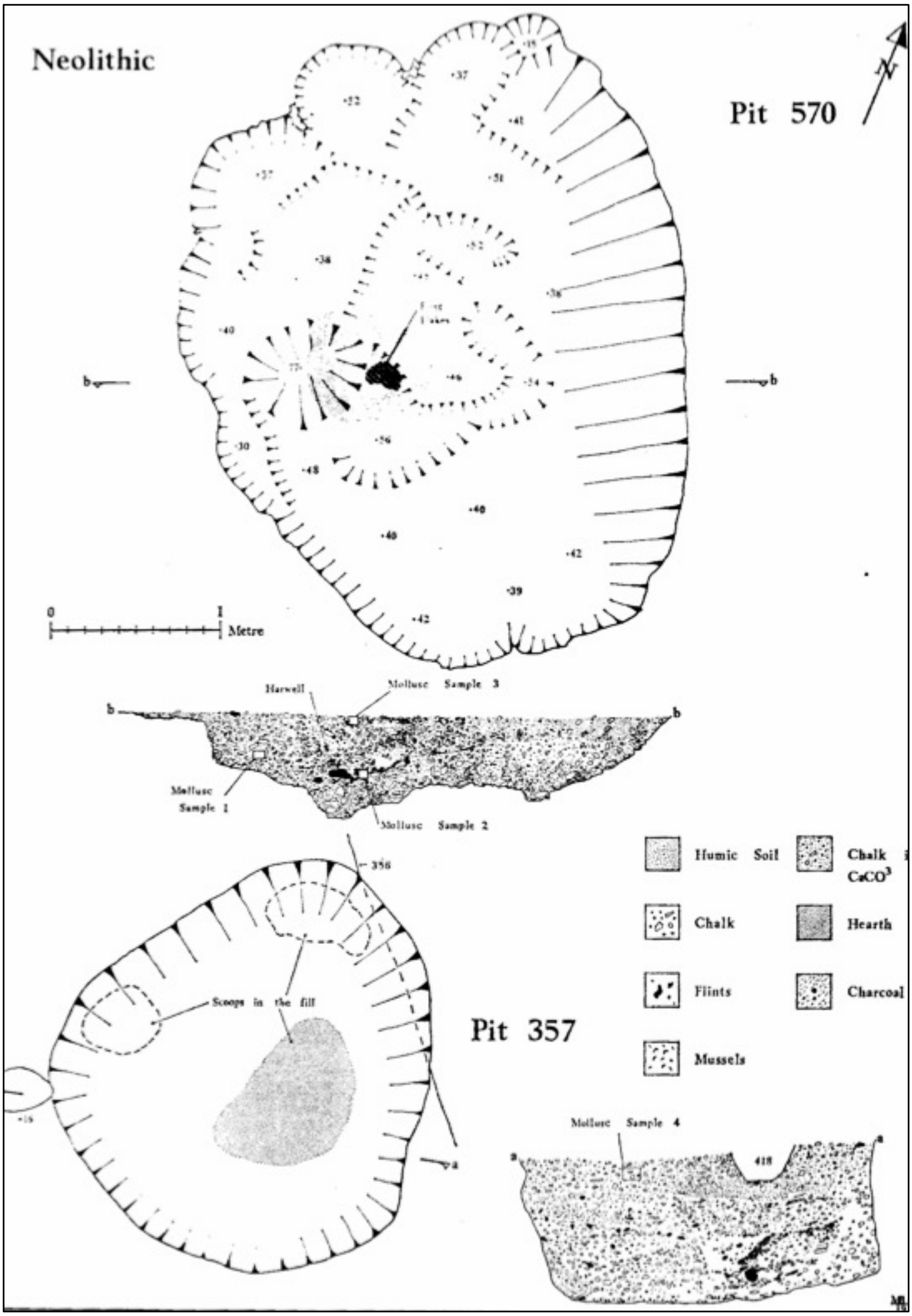
Numerous carbonised cereals were also found in Pit 357, with three species present, six-row barley (*Hordeum vulgare*), emmer wheat and another wheat (*Triticum* sp.). Common weeds were also found mixed with these cereals, including Common Knotgrass (*Polygonum aviculare*), Fat Hen (*Chenopodium album*) and Chickweed (*Stellaria media*), all species that populate arable and wasteland.

The bone

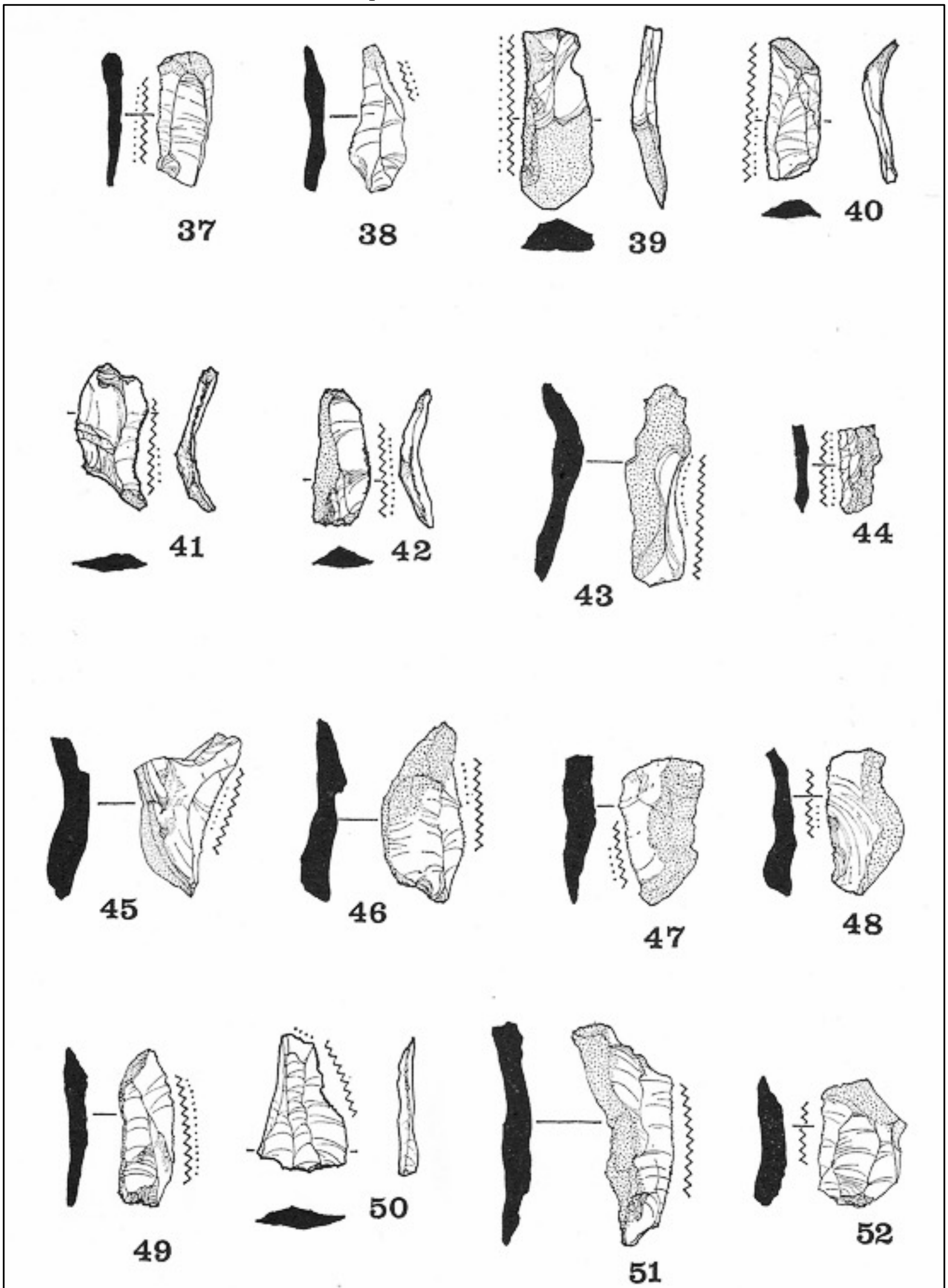
Fourteen animal bones were recovered from Pit 357, with four different species present, including sheep (*Ovis.* sp.) that accounted for eight of the collected bones. There were also three pig bones (*Sus.* sp.) two cattle bones (*Bos*. sp.) and a single fragment of Roe Deer antler. It was not clear if the antler represented a fragment of a implement used to excavate the pit.



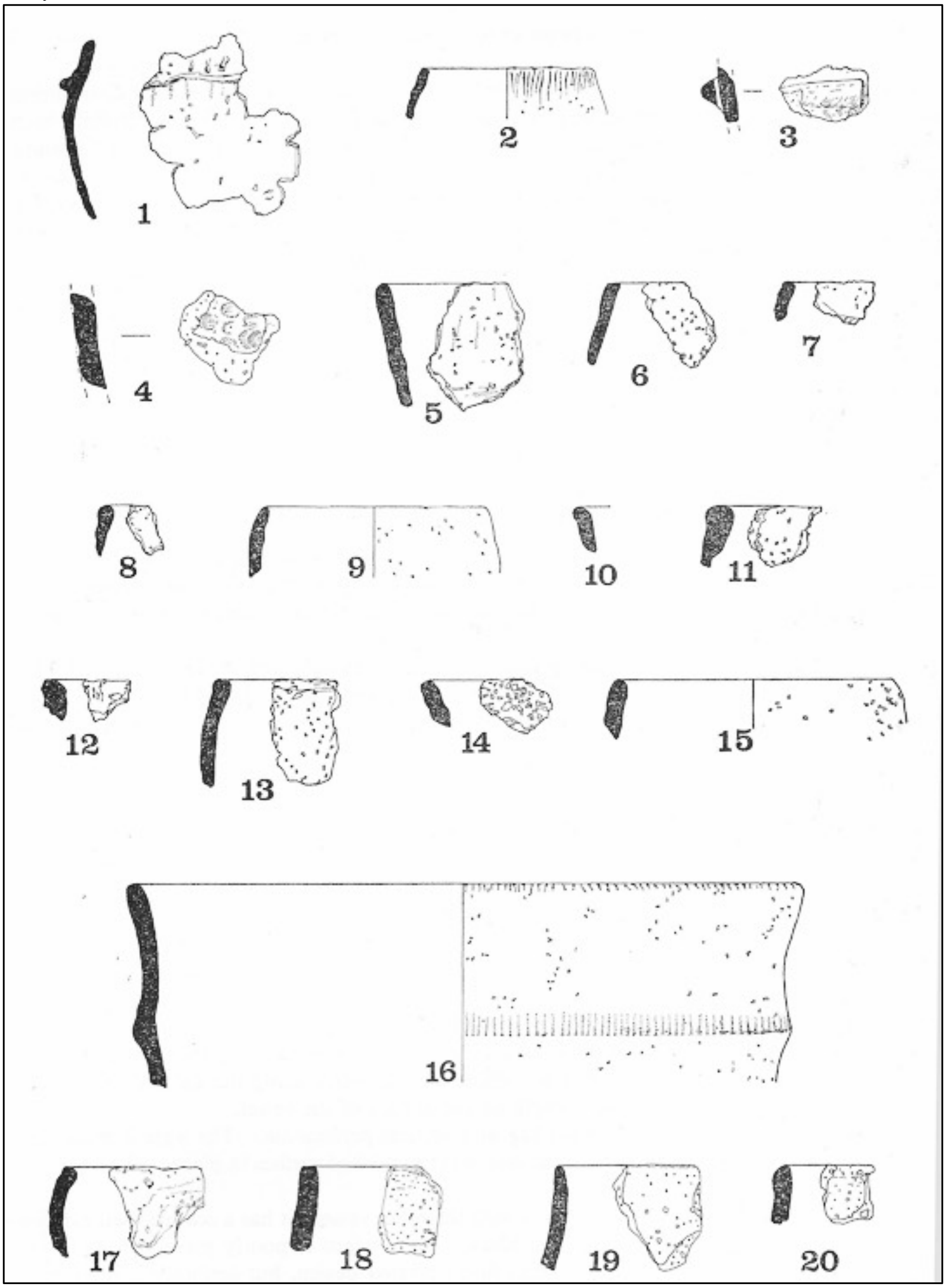
Plan and sections of Pits 570 and 357



The flintwork from Pit 357; serrated pieces

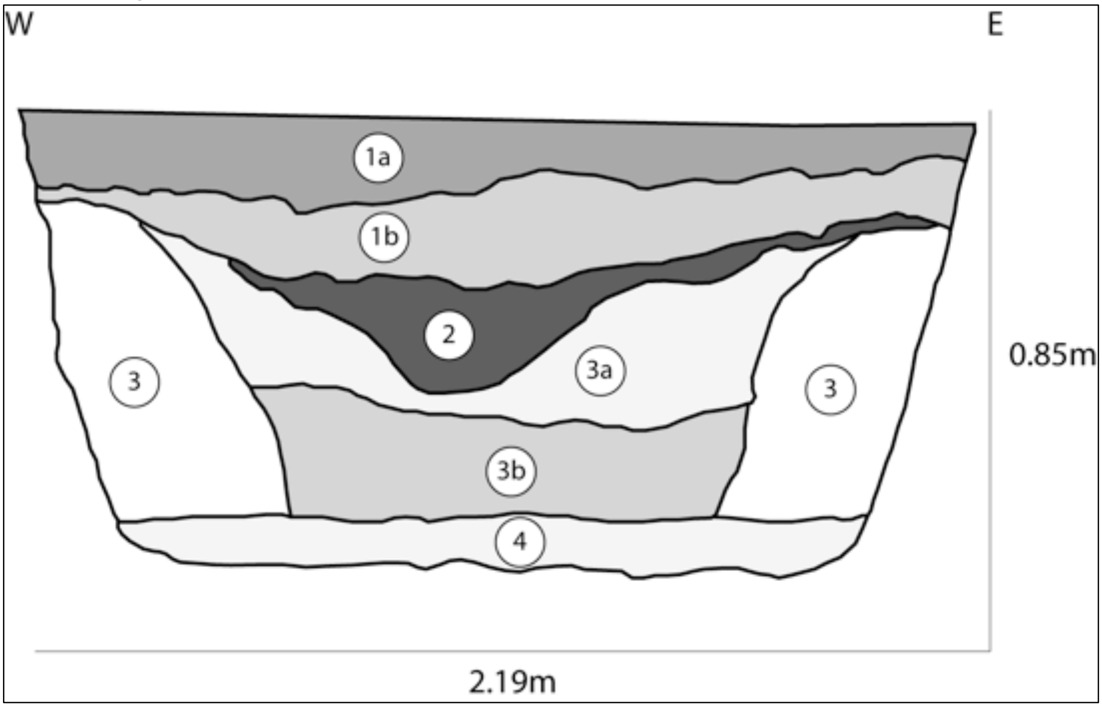


Early Neolithic vessels from Pit 357



6.10: Stratigraphic sequence of deposits in Pit 357

South facing section of Pit 357



(1a) Hard compacted chalk 'lumps' in calcium carbonate and dark brown earth. Backfilled?

(1b) Same as above, but more cemented and hard.

(2) Hearth layer. Very fine ash with 'Charcoal of grasses, twigs and wood was abundant, and pieces of chalk and s serrated blade also showed the effects of heat (p.9)'. The hearth was contained within a scoop.

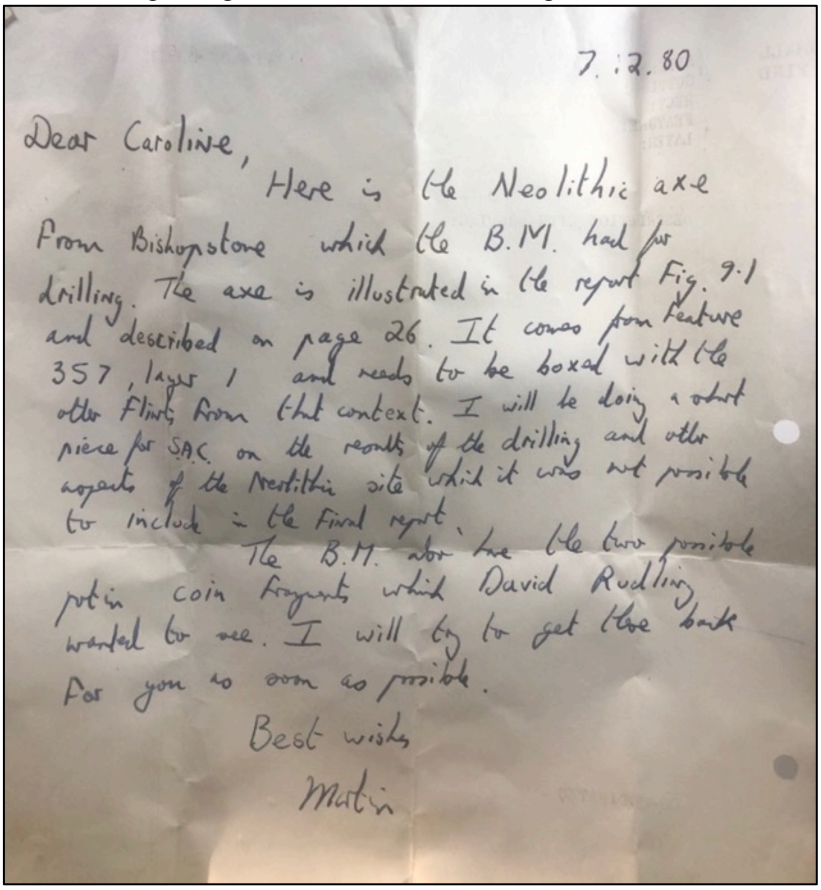
(3) Chalk rubble in light clay. Similar deposit to **(4)**.

(3a) Chalk rubble soil cemented with calcium carbonate. Weathered for while before the hearth scoop was cut into it.

(3b) Hard chalk rubble containing large numbers of mussel shells.

(4) Compacted dark grey chalk silt with tiny charcoal fragments. A trampled deposit on the base of the pit. Similar to **(3),** but with more charcoal. Containing flint, shells and pottery.

Letter dated 7/2/1980, regarding the British Museum dating of the axe from Pit 357



7.2.80

Dear Caroline,

Here is the Neolithic axe from Bishopstone which the B.M. had for drilling. The axe is illustrated in the report Fig. 9.1 and described on page 26. It comes from feature 357, layer 1 and needs to be boxed with the other flints from that context. I will be doing a short piece for SAC on the results of the drilling and other aspects of the Neolithic site which it was not possible to include in the final report.

The B.M. also have the two possible potin coin fragments which David Rudling wanted to see. I will try to get these back for you as soon as possible.

Best wishes

Martin

6.11: NERC Radiocarbon dating application

Application for NERC funded radiocarbon dates
Project: The Early Neolithic flint mines of Sussex and their wider environs.
Lead: Professor Joshua Pollard
Researcher: Jon Baczkowski
University of Southampton

Background to project
It is proposed to obtain radiocarbon dates for an Early Neolithic pit located in Bishopstone, West Sussex, excavated by Martin Bell and the Sussex Archaeological Society in the 1970's (Bell 1977). Earliest Neolithic pits in southern England, and especially in Sussex, are rare and remain poorly dated, despite their importance in tracking the start of the period. The dates will support a PhD project undertaken by Jon Baczkowski, titled *The Early Neolithic flint mines of Sussex and their wider environs*, supervised by Professor Joshua Pollard of the University of Southampton. The project aim is to investigate the Early Neolithic flint mines of Sussex and their landscape context by relating them to communities and practices in the immediate and wider landscape.

To date, the project has successfully gathered radiocarbon dates on flint mining, and wider Early Neolithic activities across Sussex, both from archival research and new fieldwork. New radiocarbon dates have been obtained from both mine (Baczkowski and Holgate 2017, Edinborough *et al* 2019) and non-mining contexts, including from an Early Neolithic pit containing mining material and early ceramics (Edinborough *et al* 2019, Baczkowski 2019). These new dates have enlightened the chronology of mining across the region and also the spread of Earliest Neolithic practices. The research is both timely and nationally important, due to increasing knowledge on the dissemination of material culture, settlement patterns and the establishment of social practices at the start of the Neolithic, one of the most significant episodes in the prehistory of the British Isles.

Aims of the project and dating application
A major aim of the project is:

> to identify and date Earliest Neolithic archaeological features in Sussex that provide a connection to flint mining.

Of particular interest are features, such as pits, which contain Carinated Bowl pottery, the earliest ceramic tradition in the British Isles. Demonstrating a link between communities who manufactured and used Carinated Bowl with those who mined flint is a core objective of the project, as potsherds have been recovered from mine contexts. This avenue of research led to the reappraisal of an Early Neolithic pit located close to the Harrow Hill mines which contained a small assemblage of notably fine Carinated Bowl vessels and also flint work sourced from the nearby mines (Baczkowski 2019). The pit dated to the mid 40th century BC, making it amongst the earliest pottery in the British Isles. More importantly it proved that the pit was contemporary with extraction activity at the neighbouring Harrow Hill mines. The project is committed to the continued dating of features in Sussex that demonstrate links to the flint mines, by inclusion of mined material, such as axes, but also Carinated Bowl pottery.

The aim of this application is:

> to date potential Earliest Neolithic presence and practices at Bishopstone, close to the River Ouse estuary. This will be achieved via dating of materials from a major pit deposit belonging to a group of such features excavated in the 1970s.

The pit group is significant for revealing the economy of an Earliest Neolithic community living on the South Coast, including their dietary habits, their agricultural practices and the craft industries they practiced (Bell 1977). The feature selected for dating, Pit 357, was the most artefactual rich of the twenty or so excavated and contained an unusually large assemblage of cultural material. Artefacts recovered included a large amount of flintwork, including an axe, pottery, animal bone and almost unique for an Early Neolithic pit, over 2000 fragments of marine mollusc shells. The pit was interpreted as being representative of an occupation event, and also contained evidence of plant collection and processing, in the form of macrofossils and serrated flint blades. Of interest to this project was the recovery of a well-made Carinated Bowl and a flint axe, the latter of which was sampled by the British Museum and demonstrated to have originated from the mines located on Cissbury Hill, Worthing (Craddock *et al* 1983).

No accurate dates have yet to be obtained for Pit 357, two charcoal samples submitted for dating in 1977 appear to be intrusive, giving 1st millennium BC date ranges. In view of the advances in radiocarbon dating and with renewed interest in the study of the Early Neolithic, specifically its chronology (Whittle *et al* 2011), the dating of Pit 357 will contribute significantly to this project and to knowledge of the period at a regional and national level.

A core objective of the dating is to establish a date for the Carinated Bowl vessel recovered from Pit 357. The dating of the pit will aid, alongside the date already obtained for New Barn Down, in establishing the spread and chronology of Carinated Bowl in the region. Certain aspects infer the development of ceramic traditions, for example, the presence of basic decoration on the Bishopstone vessel may indicate that it is later in date than the fine and undecorated bowls from New Barn Down. Without dating Pit 357, this hypothesis, which has been previously assumed for Carinated Bowl (Cleal 2004), cannot be tested. A third larger assemblage of Carinated Bowl from a pit in Chichester (Seager-Thomas 2010) is also being dated as part of this project, via a program of lipid analysis in collaboration with the University of Bristol. The pottery assemblage from Bishopstone is not large enough for lipid analysis and radiocarbon dating remains the best option. Lastly, a smaller assemblage of Carinated Bowl from a pit group located in Peacehaven (Baczkowski 2017), close to Bishopstone, is being radiocarbon dated via developer funding and also in collaboration with this project. Therefore, the dates obtained for Bishopstone will form part of a dataset that will inform knowledge on the chronological development of Carinated Bowl, by allowing comparison with other Sites located both in the study area and southern England.

Finally, of upmost importance is establishing a link with flint mining sites located some distance from Bishopstone. Recent research has helped enhance understandings of the chronology of flint mining in Sussex (Edinborough *et al* 2019), with results indicting a start date close to 4000 cal BC and an end date around 3500 cal BC. Key to this project is the dates obtained from the Cissbury mines, which indicate that mining was still underway towards 3500 cal BC, notably later than at other Sussex mines. A small assemblage of Carinated Bowl was found in mineshaft at Cissbury (Lane Fox 1876), which is comparable to the example from Bishopstone. Therefore, the presence of a Cissbury axe at Bishopstone, combined with Carinated Bowl vessels at both sites would appear to demonstrate a link. The nature of this connection is difficult to understand and it is unknown whether direct movement of communities, or trade links, resulted in the Cissbury axe becoming deposited at Bishopstone. However, the dating of the Pit 357 will demonstrate whether there is a chronological overlap with extraction activity at Cissbury.

Wider archaeological context

The project and dating of Pit 357 is framed directly within wider studies on the character of the transition to Neolithic lifestyles in Britain and other parts of northwestern Europe. A long running debate centres on the pace of this transition, with arguments based on either rapid replacement of indigenous communities by Continental farmers, versus long-term cultural acculturation and integration (Rowley-Conwy 2004, Thomas 2013, Sheridan 2011, Brace *et al.* 2018). The introduction of ceramics to the British Isles is often cited as key to understanding cultural change in the Early Neolithic, specifically because sophisticated pottery arrives suddenly in the archaeological record (Sheridan 2010). Therefore, the dating of Pit 357 will add to growing knowledge on the dating and distribution of early ceramics in southern

England, by placing the pit chronologically and allowing for comparisons with dated pottery assemblages. The results of the dating with be placed within a chronological framework that will enrich and support other dates obtained in this project, such as New Barn Down, but will also contribute to national debates on the dating and spread of early ceramics.

The dating will further contribute to advancing knowledge on the composition of occupation during the Early Neolithic. When Pit 357 was originally excavated little was known about Early Neolithic settlement patterns, with debates focusing on the lack of structures in the archaeological record. Despite being interpreted as evidence of occupation (Bell 1977), it has only been in recent decades that the importance of Neolithic pits and their contents have been widely accepted as being associated with settlements (Pollard 1999, Garrow 2007, Anderson-Whymark and Thomas 2012), despite the lack of structures. The study of pits has since become crucial to developing narratives on Neolithic lifestyles, with particular focus on the contents of the pits and their spatial distribution (Garrow 2005). The radiocarbon dates obtained for Pit 357 will form a major component of the re-evaluation of the feature and an important Early Neolithic occupation site.

Finally, the study of flint mining is once again core to research on the spread and dissemination of Early Neolithic culture in southern England (Teather *et al* 2019). Recent research has focused on the chronology of mining (Edinborough *et al* 2019), echoing similar studies on Neolithic monuments (Whittle *et al* 2011), the introduction of mining to southern England (Baczkowski 2014) and finally the cultural meaning of flint mining (Teather *et al* 2019). Establishing a date for Pit 357 is important for expanding the story of mining beyond the immediate extraction horizon, because of the presence of a mine sourced axe and Carinated Bowl pottery from a pit focused site. Obtaining a date for Pit 357 is important for understanding and linking settlement sites and occupation patterns in the Early Neolithic of southern England. Overall, the dating of Pit 357 links directly into ongoing debates on Early Neolithic occupation and allows for greater understanding on its development, settlement practices and finally the spread of early ceramics.

Details of selected samples

Materials recovered from Pit 357 (See Appendix Figure 1) include animal bone, antler, charcoal, marine mollusc shell and plant macrofossils (See Appendix Table 1 and 2). All was collected from secure closed deposits contained within the pit and included charcoal from a 'hearth' dump in layer 2. A large assemblage, over 2000 fragments, of marine molluscs shells was also recovered from layers 3a and 3b. All the material is considered related to Neolithic activity (though potential issues with some of the charcoal are noted below).

> 11 dates are requested, comprising: 2 samples each on charcoal roundwood from layers 2 and 4; 2 samples each on animal bone from layers 3 and 3b; 1 sample on antler from layer 3b; and 1 sample each on marine molluscs from layers 3 a and 3b.

Possible problems in interpretation

Potential problems relate to contextual integrity, taphonomy and sample storage. The earlier charcoal dates obtained during the 1970s suggest either some of this material may be intrusive or a problem with the original dates. Other material, including the animal bone, antler, marine shell and at least some of the charcoal from the hearth dump in layer 2 and base of the feature (layer 4), should be integral. Such material will not date the digging and filling of the pit per se, but should date the occupation event(s) that generated the material, which is the key issue at hand.

The material selected for radiocarbon dating has been correctly stored in a museum archive since the 1970s (See Appendix Figure 2). Radiocarbon dates have been successfully obtained on deer antler from the Sussex flint mines (Edinborough *et al* 2019), which have been held in similar archive conditions to the Bishopstone examples and thus preserved collagen. Also charcoals from other Neolithic pits, when short-lived species are identified, have proved archaeologically consistent radiocarbon dates (Baczkowski 2019).

Assessment of possible interpretive problems
By obtaining dates on a range of materials from different layers within the pit, issues of contextual integrity and taphonomy can be evaluated. None of the samples have been treated with PVA or other organic preservative agents that might affect the radiocarbon determinations.

Other fieldwork or dating effort planned
No other fieldwork is planned for Pit 357, however radiocarbon dates are currently being obtained for other Sussex Neolithic pits.

Bibliography

ANDERSON-WHYMARK, H., and THOMAS, J. (eds). 2012. *Regional Perspectives On Neolithic Pit Deposition: Beyond The Mundane.* Neolithic Studies Group Seminar Papers 12. Oxford: Oxbow Books.

BACZKOWSKI, J. 2019. Making Connections: A Fresh Analysis Of An Early Neolithic Pit And Its Contents, *Oxford Journal Of Archaeology*, 38.4. Submitted.

- 2017. Post Excavation Assessment Report For A Strip, Map And Sample Archaeological Excavation At 1 South Coast Road, Peacehaven, East Sussex, BN10 7AE. CBAS0754. Unpublished Report.

- 2014. Learning By Experience: The Flint Mines Of Southern England And Their Continental Origins, *Oxford Journal Of Archaeology,* 33: 2, 135–153.

BACZKOWSKI, J., and HOLGATE, R. 2017. Breaking Chalk; The Archaeological Investigations Of Early Neolithic Flint Mines At Long Down And Harrow Hill, West Sussex, 1984-86, *Sussex Archaeological Collections*,155, 1-30

BELL, M. 1977. Excavations At Bishopstone, East Sussex, *Sussex Archaeological Collections,* 11, 83-117.

BRACE, S. *et al.* 2018. Population Replacement in Early Neolithic Britain. https://www.biorxiv.org/content/biorxiv/early/2018/02/18/267443.full.pdf

BROWN, J. 2010. *The Archaeological Landscape Of Drayton Quarry, Chichester, West Sussex: Excavations 1997-2005*, Unpublished Report.

CLEAL, R. 2004. The dating and diversity of the earliest ceramics of Wessex and South-West England. In R. Cleal and J. Pollard (eds), *Monuments And Material Culture: Papers In Honour Of An Avebury Archaeologist: Isobel Smith,* East Knoyle: Hobnob Press, 164-19.

CRADDOCK, P. T., COWELL, M.R., LEESE, M. N., and HUGHES, M. J. 1983. The trace element composition of polished flint axes as an indicator of source. *Archaeometry* 25, 135–63.

EDINBOROUGH, K., SHENNAN, S., TEATHER, A., BACZKOWSKI, J., BEVAN, A., BRADLEY, R., and SCHAUER, P. 2019. New Radiocarbon Dates Show Early Neolithic Date of Flint-Mining and Stone Quarrying in Britain, *Radiocarbon*, 62: 1, 75-105.

GARROW, D., BEADSMOORE, E., and M. KNIGHT. 2005. Pit Clusters And The Temporality Of Occupation: An Early Neolithic Site At Kilverstone, Thetford, Norfolk, *Proceedings Of The Prehistoric Society,* 71, 139-57.

GARROW, D. 2007. Placing Pits: Landscape Occupation And Depositional Practice During The Neolithic, in East Anglia, *Proceedings Of The Prehistoric Society,* 73, 1-24.

LANE FOX, A. 1876. Excavations In Cissbury Camp, Sussex: Being A Report Of The Exploration Committee Of The Anthropological Institute For The Year 1875, *The Journal Of The Anthropological Institute Of Great Britain And Ireland,* 5, 357-90.

POLLARD, J. 1999. 'These Places Have The Moments': Thoughts On Settlement Practices In The British Neolithic, in J. Brück and M. Goodman (eds), *Making Place In The Prehistoric World: Themes In Settlement Archaeology,* London: University College Press. 76-93.

ROWLEY-CONWY, P. 2004. How the West was Lost: A Reconstruction of Agricultural Origins Britain, Ireland, and Southern Scandinavia, *Current Anthropology,* 45, 83-113.

SEAGER-THOMAS, M. 2010. *The Drayton Early Neolithic Pottery Assemblage. The West Sussex Coastal Plain's First Pottery*, Artefact Services Technical Reports 23.

SHERIDAN, A. 2011. The Early Neolithic of south-west England: new insights and new question, in S. M. Pearce (ed.), *Recent Archaeological Work in South-Western Britain: Papers in Honour of Henrietta Quinnell*, British Archaeological Reports British Series 584. 21-39.

- 2010. The Neolithization of Britain and Ireland: The 'Big Picture', in B. Finlayson. and G, Warren (ed), *Landscapes in Transition,* Oxbow Books. 89-106.

TEATHER, A., TOPPING, P., and BACZKOWSKI, J. 2019. *Mining and Quarrying in Neolithic Europe: A Social Perspective,* London: Oxbow Books.

THOMAS, J. 2013. The Birth of Neolithic Britain: an interpretative approach. Oxford: Oxford University Press.

WHITTLE, A., HEALEY, F., and BAYLISS, A. 2011. *Gathering Time: Dating The Early Neolithic Enclosures Of Southern Britain And Ireland* Vol 1 – 2. Oxford: Oxbow Books.

Table 1: Samples by Context

List of samples to be submitted for dating: **Pit 357 Bishopstone**	
Layer 2	Charcoal macro fossils
Layer 3a	Marine molluscs animal bone
Layer 3b	Marine molluscs animal bone antler
Layer 4	Charcoal

Table 2: Samples by type and species

Type	**Species**
Charcoal	Oak (*Quercus sp.*) Hazel (*Corylus sp.*) Ash (*Fraxinus sp*.) Hawthorn (*Cratagus sp.*) Yew (*Taxus baccata*)
Plant remains	Emmer (*Triticum dicoccum*) Barley (*Horndeum vulgare*) Fat Hen (*Chenopodium album*)
Animal bone	Cattle (*Bos sp.)* Sheep (*Ovis sp*.) Pig (*Sus. sp*.)
Deer antler	Roe (*Capreolus capreolus*)
Marine mollusc	Mussel (*Mytilus edulis*) Oyster (*Ostrea edulis*) Common cockle (*Cardium edule*) Pullet carpet shell (*Cardium edule*) Common limpet (*Patella vulgata*)

Appendix 7: Carinated Bowl

7.1: Bishopstone

Carinated Bowl rimsherd, Pit 711

Magnification x3.5

Fabric assessment
A fine ware composed of a clay matrix with regular small to medium angular inclusions of calcined and un-burnt crushed flints (1mm<) and moderate amounts of smaller quartz grains, feldspars and rare iron oxides. Pale grey to buff in colour it unoxidised, with no indications of a burnish. Its origin is likely to clay soil geology, numerous deposits of which are located close to Bishopstone.

7.2: Drayton

NEO Pot 8: Pit 691

Magnification x3

Fabric assessment

A fine ware, its fabric is sandy with moderate inclusions of small to occasional medium sized and coarse burnt flint. It is dark grey to brown (oxidized and unoxidised), with a black burnish applied to its inner wall with distinctive wipe horizontal wipe marks. Its origin is likely to be from any of the numerous sandy deposits in the Chichester or wider Coastal Plain area.

7.3: New Barn Down

Pot 1: Pit Xa

Magnification x3

Fabric assessment

An exceptionally fine ware, a sandy clay fabric with occasional medium sized veined quartz grains and abundant small quartz. It is dark brown to black in colour and fired in a reduced oxidized atmosphere. It is well made, with smoothed walls inside and out. Its fabric is none-local to Sussex and possibly from veined quartz geology located in the southwest of England, more than likely the south coast of Devon. Alternatively, it could have originated from quartz rich soils in the Brittany area of France.

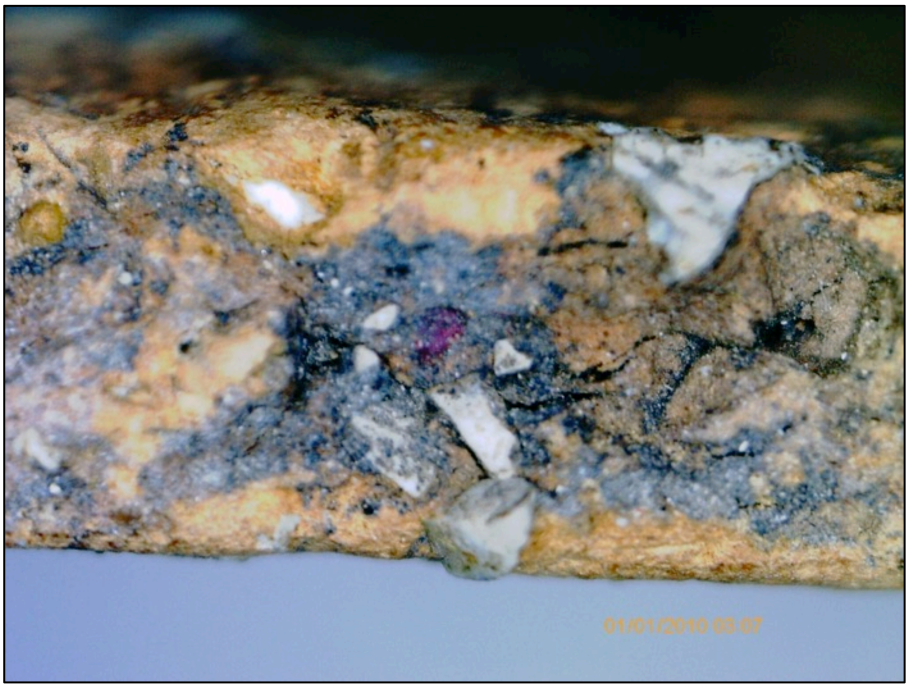
Pot 2: Pit X

Magnification x3.

Fabric assessment

A coarse-ware in a sandy quartz fabric with regular small to large (2mm<) sized angular and coarse burnt and occasionally un-burnt flints. Its outer wall is mid reddish brown, whilst its inner wall is dark grey to black, it appears this is due to the sherds being exposed to fire after being broken, as the burning does not match between potsherds. It is unoxidised and shows clear signs of its inner wall being smoothed and in section very fine coils visible. It is likely to originate from sandy clay deposits located to the south of New Barn Down on the Sussex Coastal Plain.

Pot 3: Pit Xa



Magnification x 3.

Fabric assessment

A very fine fabric with a clayey matrix and inclusions of occasional small to medium small angular burnt flints, some penetrating the walls. Rare feldspars and probable iron oxides are also present. Very well made and unoxidised, outside appears to have been lightly burnished giving it a smooth, slightly grey finish. Light reddish brown and not a typical fabric for Sussex, possibly from clay rich soils as no sandy quartz is present in its matrix, such as found in the Weald.

7.4: South Coast Road

Pot 1: Neo Pit 1

Magnification x3.5.

Fabric assessment

A very fine ware, in a very fine quartz rich granular fabric with occasional small burnt, or calcined flints. It is dark brown to black in colour and fired in a reduced oxidized atmosphere. It is well made, with smoothed walls on both surfaces. It has a black burnish on its inner wall with a distinctive horizontal wipe marks. It has been made from fine laminated coils. It is a very sandy fabric and its origin is likely to be from Loess deposits in the immediate Peacehaven area, or from similar sandy deposits on the wider Sussex Coastal Plain.

7.5: Long Down

Pot A: 7008/B9/54

Magnification x3

Fabric assessment
A well-made ware with a clay fabric with regular small to medium sized angular burnt and occasionally calcined flint. Reddish brown and fired in a reduced atmosphere with thin coils visible in section and smoothing marks on both surfaces. Its origin is likely to be from sandy clay deposits on the Sussex Coastal Plain to the south of Long Down, more than likely Brickearths.