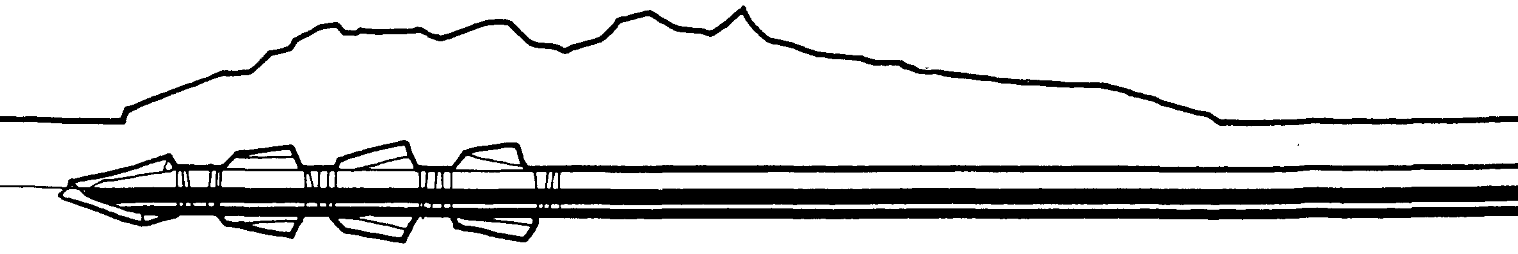
WJ

RHUM: MESOLITHIC AND LATER SITES AT KINLOCH

CR WICKHAM-JONES

To the people of Rhum,
past, present and future.

Frontispiece: A selection of lithic debris from the site at Kinloch illustrating the variety of raw material used. (Photograph – I Larner)



RHUM

MESOLITHIC AND LATER SITES AT KINLOCH

EXCAVATIONS 1984–86

CR WICKHAM-JONES

WITH

A CLARKE B FINLAYSON K HIRONS D SUTHERLAND
AND P ZETTERLUND

AND CONTRIBUTIONS BY

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K EDWARDS D GRIFFITHS D JORDAN M KEMP S LEE
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R PARISH AND OTHERS

ILLUSTRATION

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Finally, the hard core who kept the author on the right track: Ann Clarke, John Terry and Jack Stevenson. Without their hard work and patient encouragement this volume would not exist.

CR Wickham-Jones
Edinburgh
June 1989

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NB: With the exception of the main author, the work of individual contributors is denoted at the head of the relevant piece of text.

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ILLUSTRATIONS

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The site archive is held at the National Monuments Record of Scotland, 54 Melville Street, Edinburgh, where it may be consulted on application.

INTRODUCTION AND NOTES TO THE VOLUME

This volume is the report of the archaeological excavations that took place on the island of Rhum between 1984 and 1986 (Wickham-Jones 1989; Wickham-Jones and Sharples 1984; Wickham-Jones and Pollock 1985). The text not only contains details of the stratigraphical remains on site, and in particular the large body of mesolithic material recovered, but also describes the approaches that were taken to the excavation and to the associated analyses. Further sections of the volume describe these detailed analyses of the artifactual assemblages as well as the environmental and geophysical studies that were carried out in conjunction with the excavations. There is a section on the use of raw materials in the west of Scotland taking the picture beyond Rhum and the final section presents an interpretation of the site and of its place in the early settlement of Scotland.

Detailed information relating to the methods and results of analyses and the full accounts of specialist work are included in microfiche sheets at the back of the volume. They also contain catalogues of the contexts and of certain artifacts. The catalogue of the flaked lithic assemblage is not included in the volume because of its great size; this catalogue is held at the National Monuments Record of Scotland.

It is hoped that this volume, as well as appealing to those with an interest in the early prehistory of Scotland, will also be of particular help to those who may embark on similar projects.

THE SPELLING OF RHUM

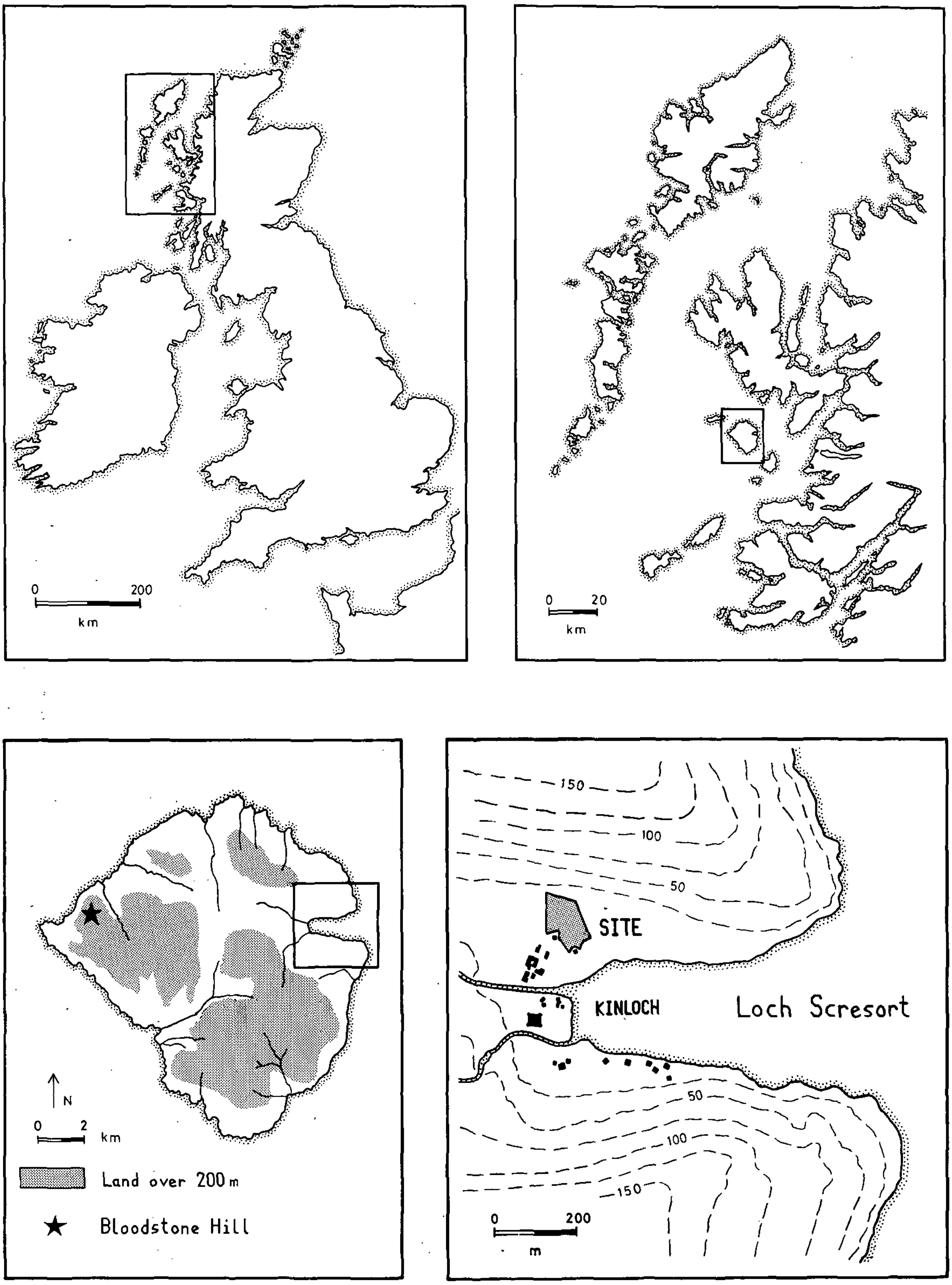
Although the original name of the island is 'Rum', the modern version 'Rhum' is used throughout this volume. This is the form in which the island now appears on most maps and gazetteers.

RADIOCARBON DETERMINATIONS

Throughout the volume, all radiocarbon determinations are given in uncalibrated years before present (AD 1950), and the standard form 'BP' is used. Thus 8590±95 BP represents a date from 8685 – 8495 uncalibrated radiocarbon years before AD 1950 (see Chapter 10, table 24).

ORDNANCE DATUM

The Datum on Rhum established by the Ordnance Survey is specific to that island and hence it is referred to throughout the volume as Rhum Local Datum 'Rhum L.D.'. The bench marks on the most recent 1:10,000 maps of Rhum have the values (in metres) of the survey reported (in feet) in the 2nd edition 1:10.560 Ordnance Survey maps and the Rhum Datum is related to a low-tide position. Surveyed altitudes on Rhum are therefore not strictly comparable to mainland altitudes which relate to Newlyn Datum, a mid-tide reference level. As there is a tidal range of around 4m on Rhum, the Rhum Datum (Rhum L.D.) may be considered, broadly, to be 2m below Newlyn Datum.



ILL 1: Location maps.

1 THE ISLAND BACKGROUND AND THE DISCOVERY OF THE SITE

THE PHYSICAL AND ECOLOGICAL BACKGROUND

Rhum lies twenty four kilometres due west of the fishing harbour of Mallaig. It is one of the northern Inner Hebrides and it forms the largest of the four Small Isles (Ill 1). These islands (Rhum, Eigg, Muck and Canna) are grouped into the Small Isles parish and administratively they constitute a part of the Lochaber District, Highland Region. Rhum covers some 200 square kilometres, much of which is mountainous and barren.

The island incorporates a diverse geology (Ill 2a) (Emeleus 1987). The oldest rocks are Precambrian: much of the north and east of the island comprises Torridonian sandstones and shales but there are pockets of Lewisian Gneiss in the south. Small exposures of Triassic and Jurassic limestones survive elsewhere. The geological map is, however, dominated by Tertiary volcanic activity. The growth of a large Tertiary volcano in the southern half of the island resulted in the formation of a wide variety of igneous rocks which are surrounded by a ring fault. Much later, a further fault developed, running north-south down the middle of the island.

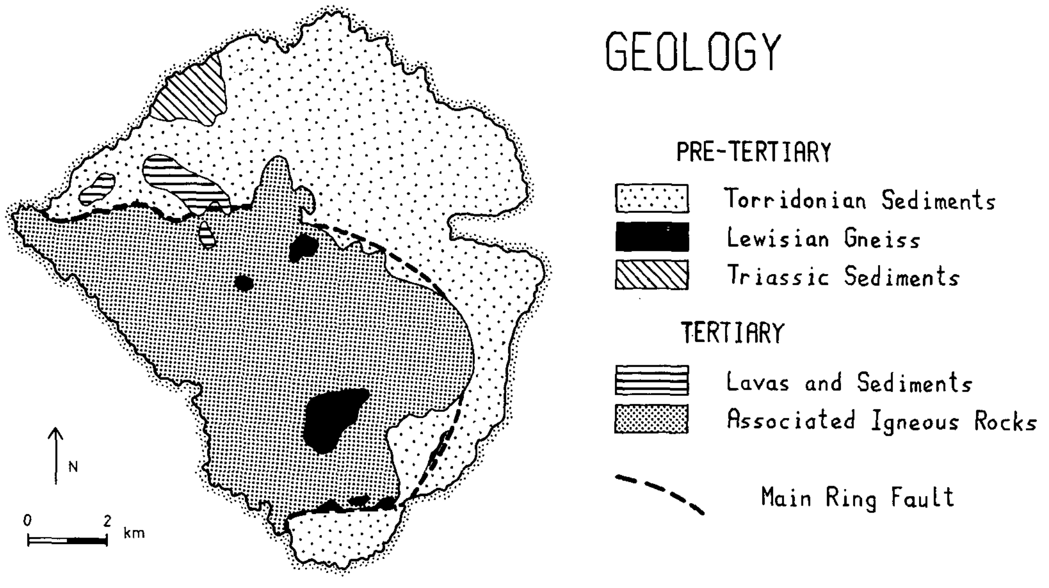
The geomorphology is described in detail in Chapter 12. Since the Tertiary period considerable erosion has reduced the original volcano to its roots, resulting in the ring of sharp peaks in the south of the island. To the north, the Torridonian sandstones are now tilted to the north-west and have weathered unevenly to produce a series of inclined benches, clearly visible along the north side of Kinloch Glen. During the Pleistocene, Rhum was greatly affected by the glaciations and it supported its own valley glaciers in the last (Loch Lomond) re-advance. Around the coasts. traces of the fluctuating sea levels of the late glacial and early postglacial periods are much in evidence.

Much of the island is overlain by peat of varying thickness, but in better drained areas thin, often unstable, soils have developed. The soils reflect the varied geology of the island (Ill 2b) (Emeleus 1987, 25–6). Flatter, fertile areas do exist on the coast at the mouths of the glens, and quartz marine sands occur in some areas, notably at Kilmory. Elsewhere the coastline consists of high cliffs, sometimes with rocky beaches at their foot.

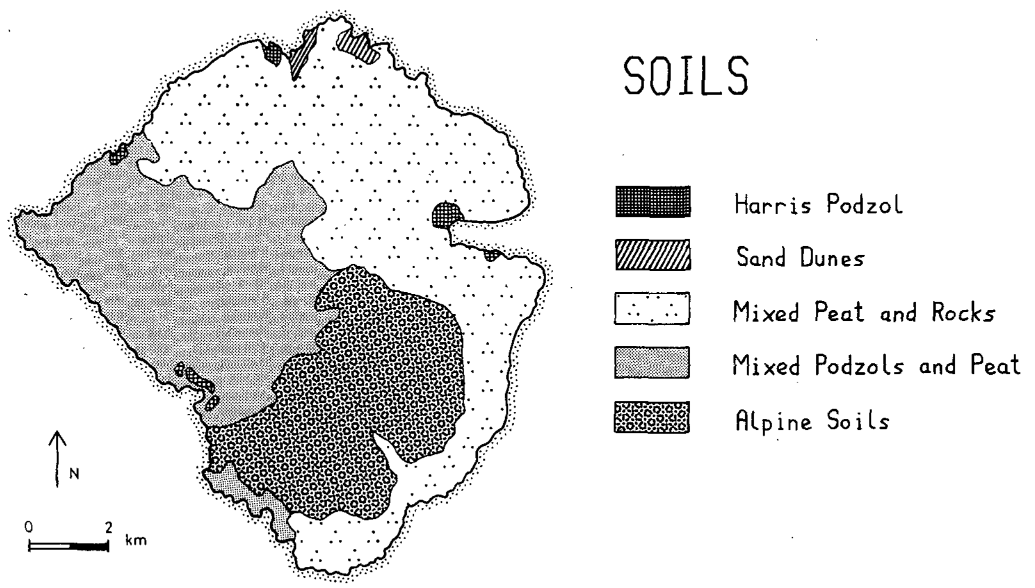
The steep topography of Rhum has lead to great local variations in climate, with the peaks casting their own rainshadows (NCC 1974, 8–13). The temperature today is generally mild, but winters can be cold and frosty. Rainfall is high, particularly in the east, and gusting winds, blowing down the glens, are common. The island is not short of fresh, running water. Two main rivers, the Kinloch and the Kilmory, drain the numerous mountain streams of the interior to the east and north respectively; smaller rivers and burns run down the wide glens. In line with the variation in rainfall, however, there can be considerable variation in the abundance of fresh water throughout the course of any one year.

Much of Rhum is covered by wet heath and blanket bog dominated by heather, but there are areas of grassland, particularly in the better drained parts and on the more developed soils (Ill 2c). On the high peaks herb-rich grassland has developed in association with colonies of Manx shearwaters. Limestone soils are only present in small patches and they do not produce the rich vegetation that might be expected. There is no surviving native woodland, but some mixed scrub remains in sheltered hollows and along the sides of deep gulleys (Chapter 11).

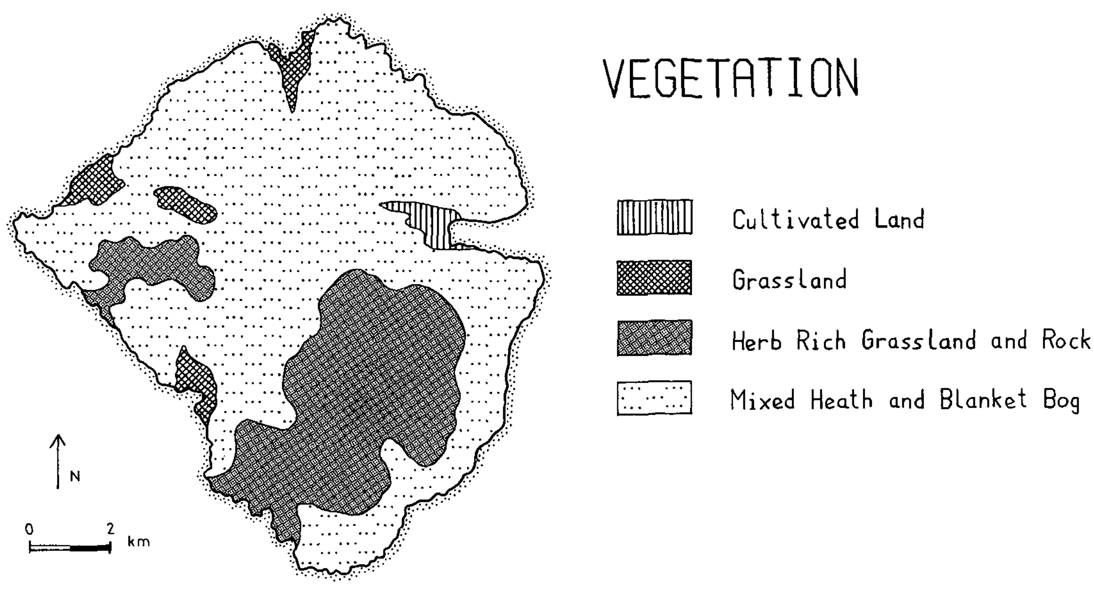
Rhum today supports a limited range of species (Clutton-Brock and Ball 1987, 143–55). Much research is currently taking place on the present fauna, but little is known about the history of any



ILL 2: Rhum:
a. Geology (after Emeleus 1987).



b. Soils (source NCC vegetation survey and map 1970).



c. Vegetation (source Macaulay Institute soil survey and map 1969).

of the island species. The acid soils mean that few areas have the organic preservation to permit analysis of the development of the postglacial fauna. One or two midden sites are known; they are preserved in caves (RCAHMS 1983, nos 8, 15), but no excavation of the remains has taken place. Midden excavation would be most interesting, for it would provide information on the antiquity of the species of Rhum and extend knowledge of the resources available to the early settlers of the island.

THE HISTORICAL BACKGROUND

Before the recent excavations there was no unequivocal evidence for prehistoric settlement on Rhum earlier than the fourth millennium BC. Early prehistoric activity was attested by a number of lithic scatters and isolated lithic finds. These were for the most part undated, but they included a few late neolithic/bronze age type fossils such as barbed-and-tanged points (eg Ill 59.14 found in 1982 on Hallival). In 1983 the Royal Commission on the Ancient and Historical Monuments of Scotland recorded eight probable burial-cairns on Rhum (RCAHMS 1983, nos 1–4), but no evidence relating to the exact nature of the prehistoric occupation of the island had ever been examined in detail. It was known, however, that the lithic scatters, together with others on the neighbouring islands and mainland, made use of a siliceous rock loosely termed bloodstone. This rock was thought to be peculiar to Rhum, and some form of centrally based 'trade' had previously been postulated for its distribution and use (Ritchie 1968, 117–21).

The evidence for the later prehistoric occupation of Rhum is confined to three poorly preserved promontory forts. Even the earlier medieval period is only sketchily known: seventh-century cross slabs are preserved at Bagh na h-Uamha and at Kilmory (RCAHMS 1983. nos 16–17). Many of Rhum's prominent landmarks bear norse names (eg Askival, Trolleval, and Hallival), and these presumably result from the norse occupation of the Hebrides. However, with the exception of a midden deposit in one of the island caves that may tenuously be associated with the norse period, there are no certain remains from any norse settlement on Rhum (RCAHMS 1983, no 8).

The historic settlement of Rhum has been well documented (Love 1983; 1987; RCAHMS 1983, nos 18–47). Medieval and later permanent settlement has only ever been supported in the small, isolated pockets of fertile land that lie at the mouths of the major glens. In the early 19th century the island was cleared by the landowner and all but one family left for the Americas. Today, the glens are abandoned and the only settlement of any size is at Kinloch on the east coast. In 1957 the island was sold to the Nature Conservancy Council to be a National Nature Reserve and since then NCC have managed it, carrying out some replanting of the native woodland, and encouraging a variety of research work.

THE DISCOVERY AND POTENTIAL OF THE SITE

In 1983, at the invitation of the Nature Conservancy Council, officers of the Royal Commission on the Ancient and Historical Monuments of Scotland visited Rhum to carry out an archaeological survey. The lack of modern development has ensured that the settlement remains of the recent past are well preserved on Rhum, but it also means that earlier, prehistoric material has only rarely been uncovered. The work of the Royal Commission therefore resulted in the location of a wealth of field information relating to the historical occupation of the island, but it shed little light on the survival of earlier remains (RCAHMS 1983). These, ironically, are only to be found where development does take place.

During the Royal Commission visit to Rhum, routine agricultural activities by NCC staff led to the discovery of the site. One of the fields at Kinloch was ploughed slightly deeper than before and many flakes of bloodstone were disturbed. Amongst these the ploughman recognised a barbed-and-tanged arrowhead (Ill 59.13). This was shown to the Commission surveyors who visited the field and collected a sample of the surface material which they brought to the attention of the author (RCAHMS 1983, no 11).

The surface collection was composed almost entirely of local bloodstone, with some flint. There was only one diagnostic artifact (the arrowhead noted above), but the presence of many blades and flakes, together with much debris, indicated a large assemblage with a high quality of knapping. Excavation of the site would doubtless reveal detail of the poorly known prehistoric occupation of Rhum. Moreover, the quality of the sample indicated that analysis would provide much information upon the techniques of manufacture of the stone tools, and possibly of their use. This was of particular interest because the local presence of an abundant, high quality source of raw material such as bloodstone is rare in Scottish prehistory (Wickham-Jones 1986). In consequence the site at Kinloch offered the unusual chance to examine the management of a resource and to assess the influence of raw material on assemblage formation. As bloodstone was also used on prehistoric sites elsewhere on the west coast of Scotland a further dimension was added to the intended project (Chapter 13 below). Although it has been traditionally regarded as the result of trade (Ritchie 1968, 117– 21), the widespread occurrence of bloodstone had not been studied in detail. Information from the site at Kinloch, together with an examination of other existing assemblages, would provide the chance to investigate the nature of such 'trade' in more detail. With this potential in mind, a research strategy was drawn up and submitted for funding to the Scottish Development Department (Historic Buildings and Monuments) and permission was sought from the Nature Conservancy Council to carry out archaeological excavation at Kinloch.

2 THE EXCAVATION: STRATEGY AND TECHNIQUES

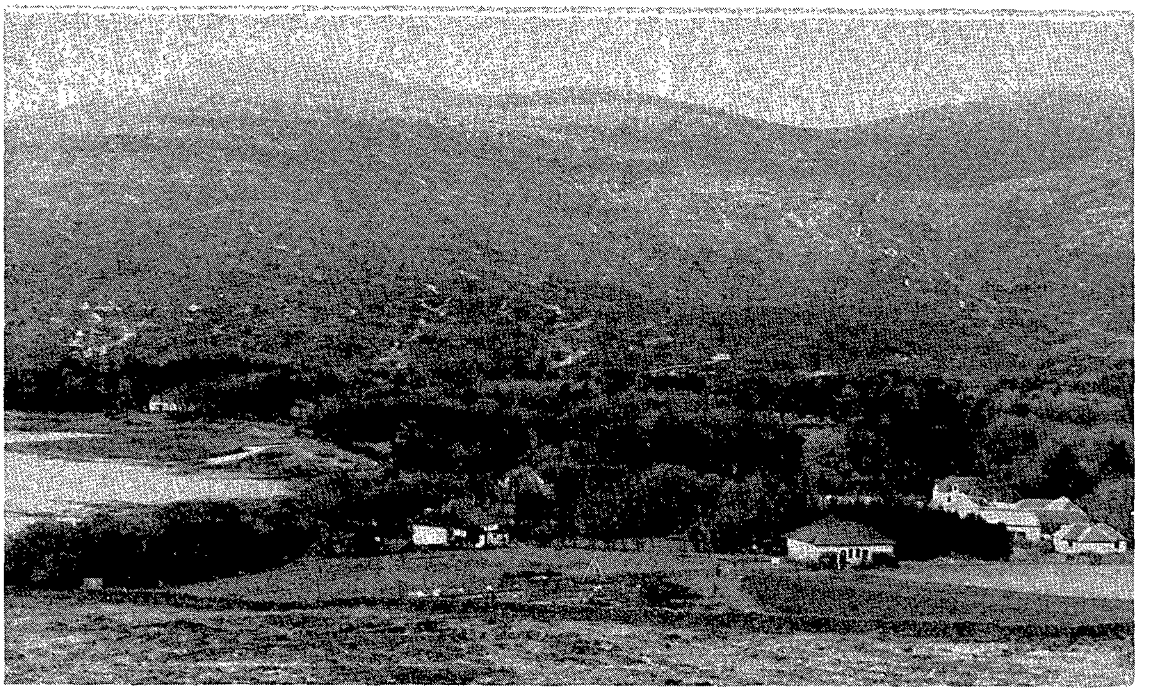
INTRODUCTION

The excavated site of Kinloch is situated on the east coast of Rhum (NM 403 998), at the head of Loch Scresort (Ills 1 and 3). It is preserved in a cultivated field at the eastern end of a band of agricultural land, known as the Farm Fields. It lies between 11–15m above sea level, on a gently sloping terrace of glacial gravels.

Before excavation the site was known only by the surface lithic scatter which indicated the presence of a large assemblage mainly composed of bloodstone, a chalcedonic silica that outcrops on the island. There was no surface indication of structural remains, nor were any cropmarks recorded from the field. A preliminary visit to Rhum and an examination of the extant work on the soils of the area, suggested that conventional methods of surface exploration, such as resistivity survey or field walking, would be impractical and of doubtful value. The site lies on a coarse gravel terrace 12m above sea level. It had presumably been subject to years of cultivation, and when excavation commenced it was covered with a thick layer of abundant growth, predominantly dockens.

Whatever the site, it is a truism that the finds recovered manually during excavation are not the sum total of finds lying within the archaeological contexts. Material is missed for many reasons, not least because artifacts may be small; they may blend into the background matrix, be of a type with which the excavator is not familiar, or be excavated in adverse weather conditions (Bang-Andersen 1985: Clarke 1978). The problems of visibility and partial recovery affect the excavation of lithic assemblages in particular, because large quantities of small artifacts are frequently present, especially where the manufacture of stone tools has taken place. For several years wet sieving has been used to ensure that a better sample of material is collected (Payne 1972; Levitan 1982: Woodman 1982) and, as Kinloch had been identified as primarily a lithic site, it was clear from the outset that a programme of sieving would be necessary.

The sieving at Kinloch had a second important role: it was used to assist with the excavation of the ploughsoil over the site. Ploughsoil is itself a feature of anthropogenic origin, derived from the mixing of any soil that might have built up over the archaeological remains. If the ploughsoil is not deep then the upper parts of the archaeological features are frequently destroyed and incorporated into the ploughzone together with their artifactual contents. For this reason there exists a relationship between the artifacts within any feature and the artifacts of the ploughsoil above, even when the artifacts within that topsoil have been moved from their point of origin. At Kinloch the ploughsoil was shallow and contained large quantities of artifactual material. In contrast to the original expectations, agriculture over the site had never been intensive, so there was a good possibility that some spatial patterning of the artifacts might have survived in the ploughsoil and that this would relate to the features below. At the same time, however, the disturbed nature of the ploughsoil meant that it did not merit full manual excavation. Instead, a programme of wet sieving the ploughsoil across the site grid was used to recover the artifacts. In this way the survival of archaeological information could be assessed, while allowing the trenches to be opened relatively quickly.



ILL 3: Kinloch from the N; the excavation site lies in the foreground.

THE FIRST SEASON

The strategy of the first season was divided into two. Firstly, the field had to be sampled with the aims of examining the distribution of the lithic scatter, quantifying its contents, and locating possible anthropogenic features. Secondly, there was detailed excavation; with the aims of assessing the survival of stratified features, and obtaining datable material.

SAMPLING THE FIELD

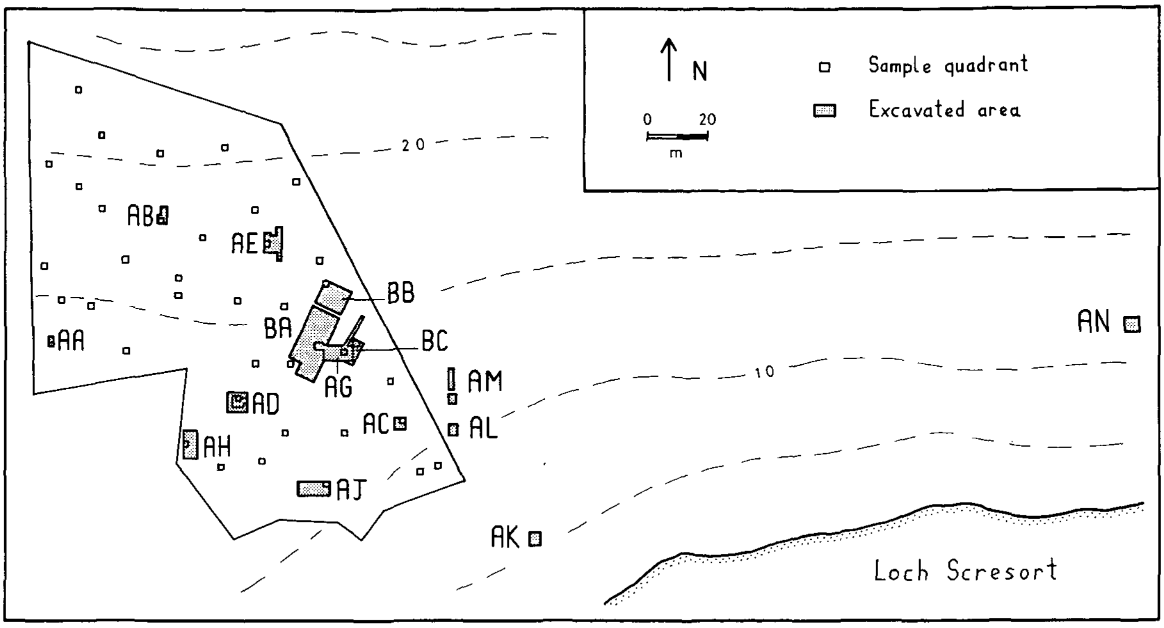
METHODS

A stratified random sample of quadrats was set up across the field (Cherry *et al* 1978, 410) to allow the examination of the ploughsoil over 1% of its area (Ill 4). In all 38 quadrats were created, each of $4m^2$. This system was used to provide as complete a coverage over the field as possible whilst avoiding the biases resulting from the regular grid selection of squares (Blower *et al* 1981, 20). The quadrat size was chosen to enable recognition of any surviving subsoil features. The sample size was minimal, but it was large enough to determine gross patterning across the field.

For excavation each quadrat was subdivided into four single-metre-squares. Each square was excavated separately by shovelling out the ploughsoil down to the underlying layer, whether natural or otherwise. Excavation of the sample did not involve any work in the layers below. There was no hand collection of artifacts from the ploughsoil, but all of it was sieved: the NW and SE squares of each quadrat were dry sieved, and the NE and SW squares were wet sieved through a 3mm mesh. All of the sieved residues were sorted on site, and the artifactual material was removed and catalogued. In this way it was possible to relay information about the finds promptly into the excavation strategy. Comparison of the two sieving methods showed that wet sieving was more efficient, indeed essential, to recover the microlithic element of the assemblage; this technique was used in all later work.

RESULTS

The lithic scatter was confined to the S third of the field (Ill 5). It contained a number of microliths, suggesting that the site might be dated earlier than previously thought. Across the field a number of features survived below the ploughsoil.



ILL 4: Location of the sample quadrats and of the excavation trenches, [AA–AE, AG–AH, AK–AN, & BA–BC.]

DETAILED EXCAVATION

METHODS

In order to examine a selection of the exposed features, five of the sample quadrats were expanded and subject to conventional excavation. These quadrats were selected for their diverse nature, and they were widely scattered to assess the subsoil. In order to test the association of lithic artifacts with the features and to locate any prehistoric features elsewhere in the field, two of the quadrats (AC & AD), lay within the scatter, whilst three (AA, AB, AE), were situated outside of the scatter (Ill 4).

Within the area of the lithic scatter the ploughsoil was wet sieved in units of $1m^2$; outside the scatter it was discarded without sieving as it was almost barren of lithic finds. Where possible, the stratified artifacts were collected on site and their positions recorded; in addition all contents were wet sieved and any remaining material collected. The larger contexts were subdivided into 0.25m × 0.25m units as research has shown this to be the optimal grid size for the recovery of locational data for artifacts (Fischer 1979: Woodman 1982, 180).

RESULTS

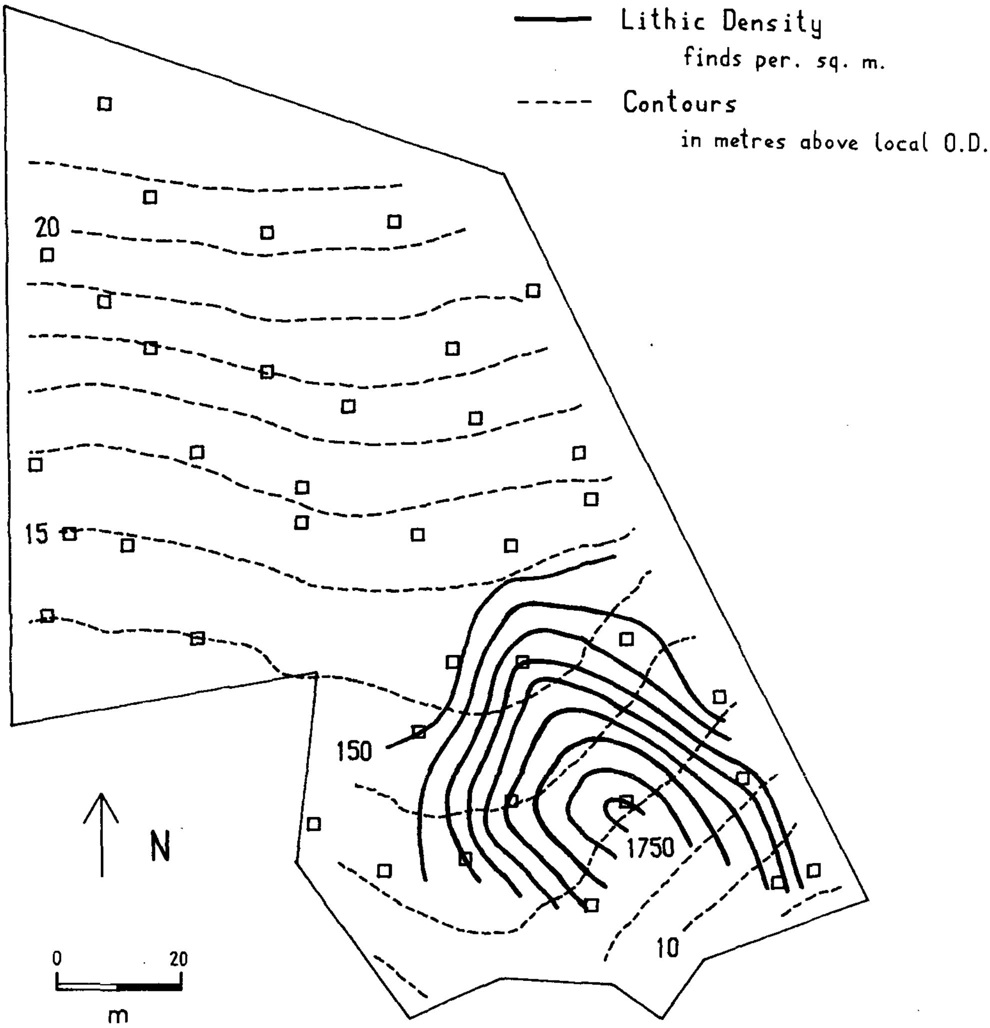
Archaeological features did survive in association with the lithic scatter, and carbonised material sufficient for two radiocarbon determinations was collected from one of them (Pit AD 5). Outside the lithic scatter, all the features examined were either natural or recent. The area of prehistoric remains therefore appeared to be represented on the surface of the field by the lithic scatter. Although no certain edges to the site were located, a minimum area for the remains was calculated to be in the order of $4500m^2$.

THE SECOND SEASON

The strategy of the second season had two aims: the detailed examination of the prehistoric evidence; and the investigation of the survival of archaeological features outwith the present field boundaries, to the E of the site.

METHODS

Four trenches (AD, AG, AH, AJ) were excavated, spread across the area of apparent mesolithic remains (Ill 4). Each was centred on known features or areas of high lithic density. One (AD) expanded a trench opened in the previous season; the other three (AG, AH, AJ) were set out around sample quadrats. In addition, three 2m × 2m test pits (AK, AL, AM) were excavated outside the field wall to the S and E, and one 5m × 5m trench (AN) was



ILL 5: The sampling of the ploughsoil: location of the sample quadrats and lithic density.

opened 300m to the E of the site to test the nature of one of the numerous other lithic scatters along the N shores of Loch Scresort (Ill 4).

Within each trench the ploughsoil was shovelled out in 1m squares. Artifacts were collected manually, and only 25% of the ploughsoil from each square was sieved and sorted. The ploughsoil proved to vary considerably in depth and its base (considered as a 'cleaning layer'), was removed by trowel and sieved in total. Below this all stratified contexts were fully sieved after the artifacts had been recovered manually; large units were first subdivided, as in the previous season. Towards the end of the season Trench AH was opened and, in order to speed up excavation, the manual collection of artifacts from the ploughsoil was stopped, but sieving continued as before.

RESULTS

Mesolithic pits and hollows did survive across the site, and the gully of a former burn was revealed towards the E edge of the field. This gully had been deliberately infilled with rubble (including both pottery and lithic material), suggesting later human activity. The trenches were, however, too small to make sense of the complex of surviving features, and the preservation conditions varied greatly across the site. Only in one area (AG) did a finer subsoil combine with a greater accumulation of ploughsoil to assist in the creation, preservation and recognition of archaeological features. Outside the field, to the E, a concentration of artifacts provided evidence for prehistoric activity, but the test pits revealed considerable truncation and disturbance, and no features survived. Further away, in Trench AN, the deposits were shallow, and unremarkable.

THE THIRD SEASON

The strategy of the third season had three aims: to examine the horizontal patterning of the mesolithic features, to investigate the stratigraphical detail of the fills of some of those features and to examine further the evidence for neolithic activity on site.

METHODS

A trench (BA/BB/BC), of 450 m^2, was stripped; it crossed the area of better preservation and ran across the infilled watercourse to the N of the mesolithic remains (Ill 4). In accordance with the lie of the land and of the archaeological features the orientation of the site grid was changed so that the trench could be set to cover the area of interest, whilst avoiding the coincidental alignment of the modern ploughmarks with the old site grid. For post-excavation analysis concordance of the two grids was facilitated by the use of a computerised site planning and recording system. In order to speed up the opening of the trench, information from the ploughsoil was sacrificed. Although the removal of ploughsoil still took place according to the site grid, only material from the cleaning layer within each metre unit was sieved and sorted. As this cleaning layer was of variable size, a four bucket constant was selected for sieving; this allowed both the absolute and the relative patterning of the lithic assemblage across the trench to be seen. Artifacts observed during the shovelling of the ploughsoil were recovered by hand, and below the ploughsoil excavation of the stratified contexts continued as before.

COMMENT

The removal of the plough layer revealed a considerable number of features and, despite the speeding up of the initial processes, it was still not possible to excavate everything in the time available. Ideally, a further season of excavations should have been undertaken to complete the area opened. As this was not possible, the results presented here, and their attendant interpretation, must rely to some degree upon inference. In any case, a considerable amount of the site, including some of the better preserved area, lies undisturbed should others wish to evaluate the archaeological evidence further.

THE UNDERSEA SURVEY S BUTLER

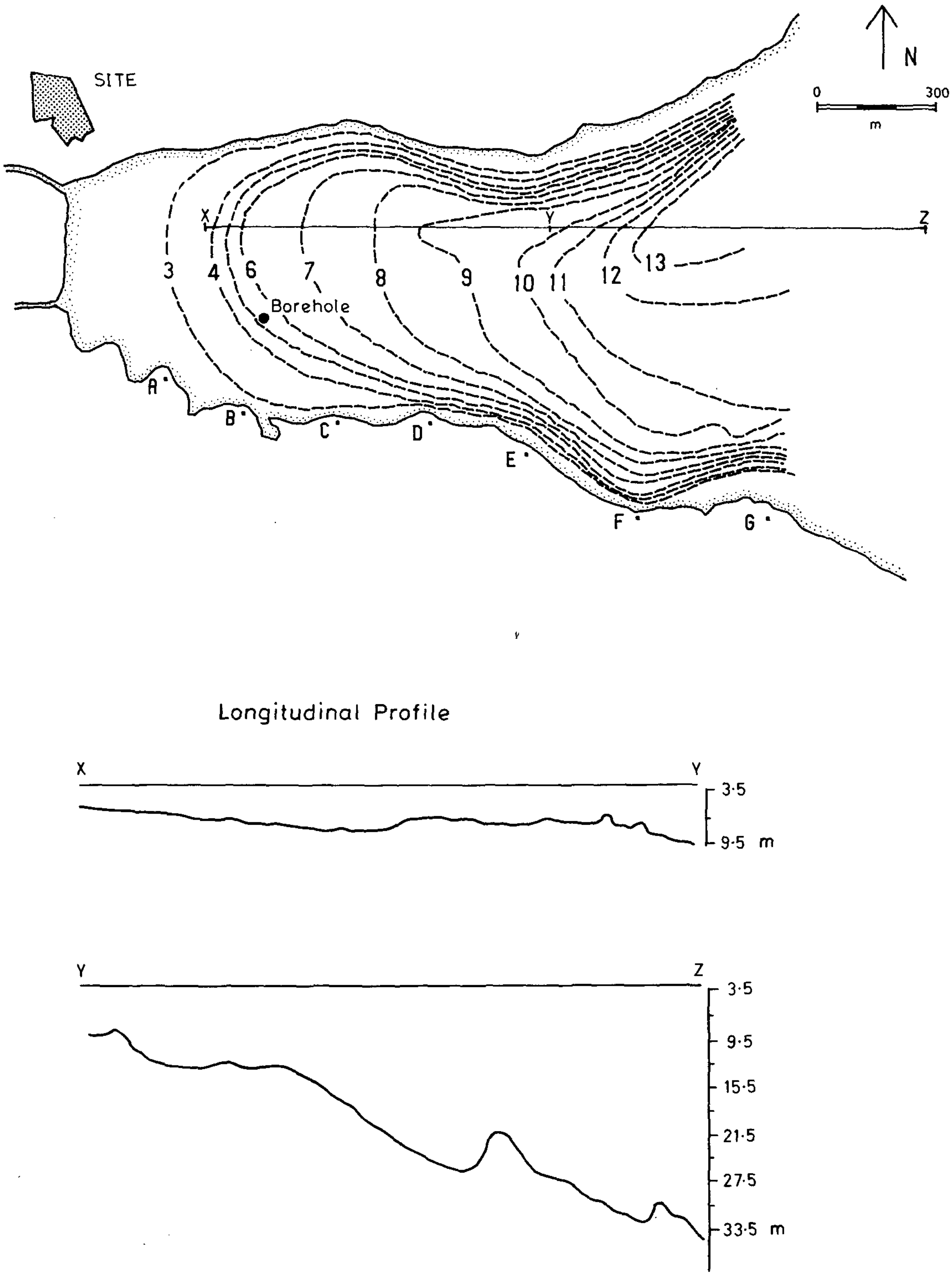
Loch Scresort is fed by a number of freshwater streams and it is open to the sea to the E; consequently its sedimentation consists both of material washed from the surrounding land and of material brought in by seawater. It is therefore possible that the stratified deposits within the loch may contain useful palaeoenvironmental evidence relating to the landscape around the archaeological site at the head of the loch. Furthermore, in view of the postglacial changes in sea level there is the possibility that evidence for lower local shorelines may survive beneath the waters of the loch. Finally, archaeological remains from a period of relatively low sea level may lie submerged below the loch. An underwater project was designed to investigate these possibilities by combining scientific research methods with scuba diving techniques. This work was carried out as a joint project with the Institute of Oceanographic Sciences.

AIMS

- to evaluate the potential of the sediments of the loch for the recovery of environmental information.
- to look for geomorphological indicators of changes in sea level.
- to look for possible areas of archaeological preservation.

METHODS

A general morphological survey of the sea bed was completed using echo-sounding equipment to collect data along seven transects (A – G) which crossed the loch in a N-S direction at 250m intervals, plus two E-W longitudinal transects (Ill 6). Each transect was surveyed in by theodolite, whilst an electronic tidegauge recorded the height of the sea surface, allowing all measurements to be corrected for tidal changes. The tidegauge datum was levelled into the nearest Ordnance



ILL 6: Loch Scresort: the morphology of the sea bed.
All depths are in m below Rhum L.D. A–G denote transect lines swum across the loch bed.

Survey benchmark in order that all depths could be expressed in metres below Rhum L.D. Diver observation along each transect was used to describe the nature of the loch bed. For this a swimboard was towed just above the loch bed by an inflatable launch to ensure that the diver remained on the transect. An underwater writing pad allowed the diver to note observations together with the time at which they were made and by ensuring that the inflatable maintained a constant speed these times could be used as a rough record of the locations of the observations. For the investigation of the sediments themselves, surface (ie loch bed) samples were collected by scooping the sediment into polythene bags by trowel, and trials were made for retrieving vertical sequences of deposits by manual (diver) use of an Eijkelkamp Gouge Corer.

SUMMARY

No archaeological deposits were observed, but there were geomorphological features that offered information relevant to an understanding of the landscape development. A summary analysis of the material recovered with the corer confirmed that palaeoecological data is preserved in the deep sediments of the loch, and that this should be relevant to the interpretation of the archaeological site, to studies of local shoreline change, and to the environmental history of Rhum. Further work on these deposits would be necessary to realise this potential.

A return trip was planned to obtain further samples and carry out more detailed work, but this area of research was abandoned because of lack of funding.

ARTIFACT ANALYSIS: THE ON-SITE PROGRAMME

A programme of on-site artifact cataloguing was undertaken in order to feed information about the artifacts back into the excavation strategy as work progressed. The on-site catalogue had to provide a basic record of the nature of the assemblage, and the following topics were selected as of particular relevance:

- the different materials utilized.
- the types of artifact present.
- the locations of any burnt material.

METHODS

After washing, artifacts were sorted according to the seven different fields:

1 Type
2 Sub-type
3 Classification
4 Material
5 Condition
6 Recovery method
7 Location

and the information was encoded and recorded (mf 1:C8–C9). Three-dimensionally recorded finds were treated individually; finds recovered from the sieved residues were batched by type and context. An experienced lithic specialist was present throughout the excavation in order to keep up with the large quantity of lithic artifacts recovered. The basic catalogue was simple and speedy to apply; the relevant codes were quickly learnt and on average 2000 pieces could be catalogued in any one day. Other artifactual material was scant (Chapter 9) but information relating to the different types of artifact was all treated in the same way. The recording and rapid field analysis of this information was assisted by the use of hand-held computers and portable personal computers (Sharp PC–1500As and Sharp PC–5000s) and programs were supplied by D Powlesland from the Heslerton Parish Project.

BENEFITS

Information about the basic composition of the assemblage was provided throughout excavation. Broad spatial differences in both the types of artifact present and the different materials in use were identified, and concentrations of burnt or abraded material were revealed. Using this information a preliminary report of the assemblage was drawn up on completion of each field season for the interim reports of the project. The basic structure of the assemblage was then used for more detailed analysis.

By the end of excavation the assemblage was organised by context into groups of like artifacts. No specific detail about the nature of the assemblage was recorded: spatial variation could be identified but not explained, and the manufacturing techniques and possible functions of the different parts of the assemblage were unknown. The overall size of the lithic assemblage was large but the on-site catalogue provided information about the parent population from which a strategy of post-excavation sampling could be devised.

ARTIFACT ANALYSIS: THE POST-EXCAVATION PROGRAMME

In line with the overall research strategy, the post-excavation analysis was designed to examine specific aspects of the assemblage:

- the variation of raw materials used
- the manufacturing techniques in use
- the types of artifact produced
- the spatial variation in the deposition of the assemblage
- possible cultural connections of the assemblage

METHODS

The flaked lithic assemblage was sampled, and different samples were analysed in detail for a range of information using the Extract Catalogue described below. Other material assemblages were examined in their entirety according to the fields of information appropriate to the aims outlined above.

THE EXTRACT CATALOGUE

Before any further analysis of the flaked lithic assemblage was undertaken, a detailed catalogue was drawn up so that all relevant information could be recorded. This covered a total of 50 different fields (mf 1:D1–D7). Information was recorded on to pre-printed forms, and then stored and sorted on computer (Sharp MZ–5600 compatible with the smaller project computers) using a program, known as ROCKS, devised for the project by D Powlesland.

Given the size of the artifact assemblage (c. 140,000 pieces), it was not feasible to examine all pieces individually. Thus, samples relevant to the different areas of interest were selected with reference to the information contained in the on-site catalogue. These pieces alone were subject to detailed examination. By using separate samples for each area of interest a variety of specialists could work on the different aspects of the assemblage at any one time. This both speeded up the analysis and increased the range of expertise in use.

When the sampling involved the splitting of the contents of a context, the pieces were divided with the help of a random numbers table. The two catalogues were designed to link into each other so that the collective object records from the on-site catalogue could be split and an individual record number assigned to each piece. The information from the on-site catalogue was automatically duplicated to link it to the more detailed information contained in the extract file. In this way the only pieces assigned individual extract numbers were those that were used for detailed analysis.

COMMENT

The work carried out upon the flaked lithic assemblage did not include any use-wear analysis. Brief examinations of both the raw materials (Ms J Taffinder, Uppsala University), and of a small sample of blades from the site (Dr C Sussman, University of California), suggested that microwear polishes would develop on some pieces. The analysis of these polishes and of associated wear is extremely time consuming and expensive, however. Although much work has been done upon the formation, survival and interpretation of use-wear, there is great variability in wear traces on the different types of raw material utilised in prehistory and most work has been done on flint. Meaningful use-wear analysis on the Kinloch assemblage would involve extensive experimental work, on both the local flint and the bloodstone, before the technique could be applied to the archaeological artifacts. The constraints of time and money in operation for the project meant that such analysis was not possible, although it would have added to the interpretation of the site.

3 THE EXCAVATION: RESULTS

THE FIRST SEASON: TESTING THE SITE

The first season of excavation was designed to locate and assess the nature of the archaeological site. The excavation of the sample quadrats clarified the distribution of flaked stone in the ploughsoil, and a clear concentration of material in the SE area of the field was identified (Ill 5). Few of the metre squares in the N two-thirds of the field contained over 20 pieces of lithic material, and none had over 50, whilst in the SE corner densities of between 200–1800 pieces per m^2 were recorded. A clear N edge to the scatter, coinciding with the density of 50 pieces per m^2, could be drawn just to the S of the 15m contour. Elsewhere, to the S, E and W, the scatter continued to the field boundary. The field slopes down to the SE corner but the possibility that the accumulation of artifacts might have resulted from natural processes was quickly ruled out by a comparison with the distribution of other artifactual materials (eg fragments of glass and nineteenth century ceramics), as these were evenly distributed across the field. The position of the lithic scatter was therefore closely defined, and it seemed likely that this might indicate the location of the archaeological site. To confirm this hypothesis it was necessary to check the spatial association between the area of the lithic concentration and the locations of any preserved features; in order to do this five quadrats were enlarged and excavated (Trenches AA – AE, Ill 4).

THE EXCAVATED QUADRATS: RESULTS

A key for use with the plans and sections is available on a fold out attached to ILL 12 (facing p 40)

TRENCH AA

Trench AA contained an amorphous, sterile pit, which is probably a large root hole.

TRENCH AB

A dark gravelly feature lay in the NE corner of the original quadrat. The excavation did not recover any artifacts, and the discolorations and textural alterations proved to be largely natural. Marine re-working of the underlying till in the late-glacial period has resulted in a banding and sorting of the general matrix; this was also visible elsewhere on the site. The feature itself had originally formed as a slight hollow in this stony glacial subsoil and it was filled by soil creep. In addition, traces of modern agriculture, in the form of ploughmarks, were evident; agriculture had undoubtedly contributed to the soil differentiations initially observed.

TRENCH AC (Ill 7)

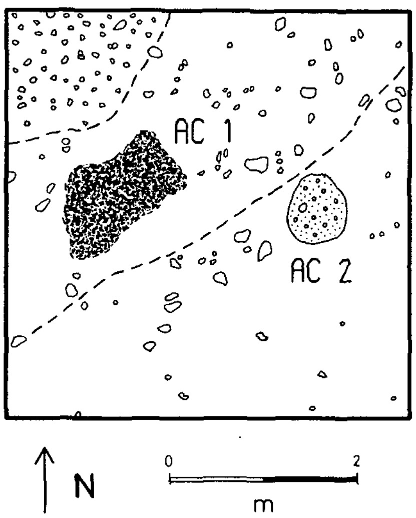
A banded feature appeared to run NE-SW across the original quadrat. Excavation revealed this to be part of a complex of amorphous colour and textural changes within the subsoil matrix. These were natural and related to the reworking of the glacial till. On the surface of the till lay a patch of charcoal (AC 1). This contained carbonised hazel-nut shell, together with a small assemblage of lithics, and it probably represents the base of a truncated pit. To the E a single post hole was recognised (AC 2): it consisted of a clear post pipe surrounded by a packing of small stones, and it contained a number of flaked lithics and pieces of carbonised hazel-nut shell.

TRENCH AD

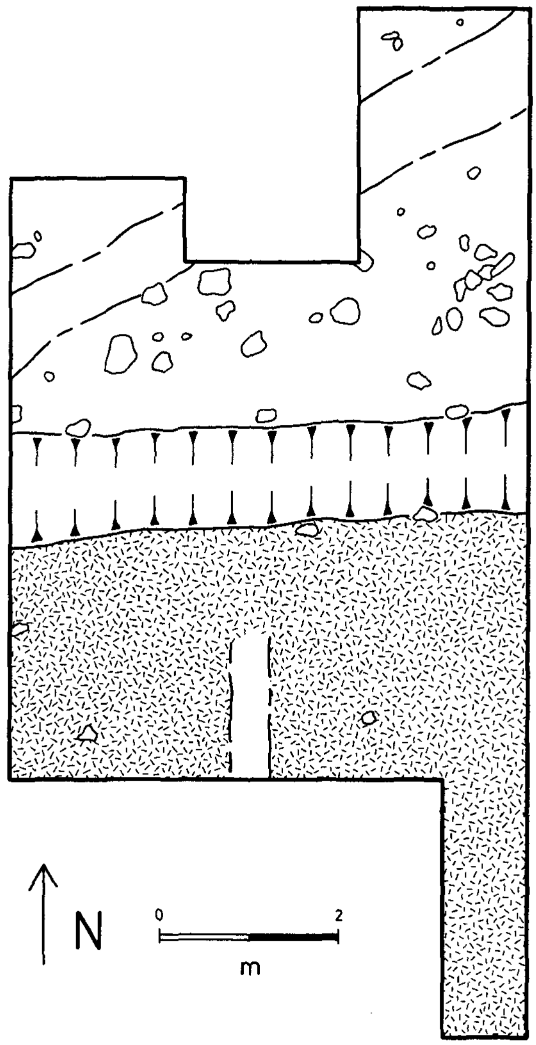
During excavation of the sample quadrat one of the metre squares was overdug to reveal a charcoal rich soil containing a large number of flaked lithics. Excavation revealed this to be part of a complex of intercutting pits and hollows. All contained large amounts of artifactual material, including hammerstones and abraded pumice, and the usual flaked lithics.

Type	Number
PEBBLES	26
CORES	156
BLADES	238
REGULAR FLAKES	1506
DEBRIS	26441
MODIFIED ARTIFACTS	
Microliths	318
Non-Microlithic	153

Table 1: Ploughsoil sample: the lithic assemblage.



ILL 7: Trench AC: excavated features.
For key see ILL 12.



ILL 8: Trench AE: excavated features.
For key see ILL 12.

TRENCH AE (Ill 8)

The subsoil of the original quadrat revealed a clear differentiation in texture between the N and S halves of the trench. This proved to mark the remains of an old, robbed field-dyke running E-W across the field. The dyke is not marked on any known maps of Kinloch, and must have gone out of use before 1877 when the first edition of the Ordnance Survey 6 inch map was prepared. In addition, a rubble field drain, and a later tile drain were uncovered. All were cut into the natural, which in the S half of the trench consisted of a compacted, rotted sandstone gravel possibly related to the 'bank' material uncovered in Trench BA (see below this section). No prehistoric artifacts were recovered from this trench.

SUMMARY

Excavation of the extended quadrats revealed that archaeological features were indeed preserved, and that their location coincided exactly with the area of the lithic scatter. The main archaeological site was, therefore, judged to lie in the S portion of the field; it was bounded to the N by the edge of the scatter and elsewhere by the limits of the field.

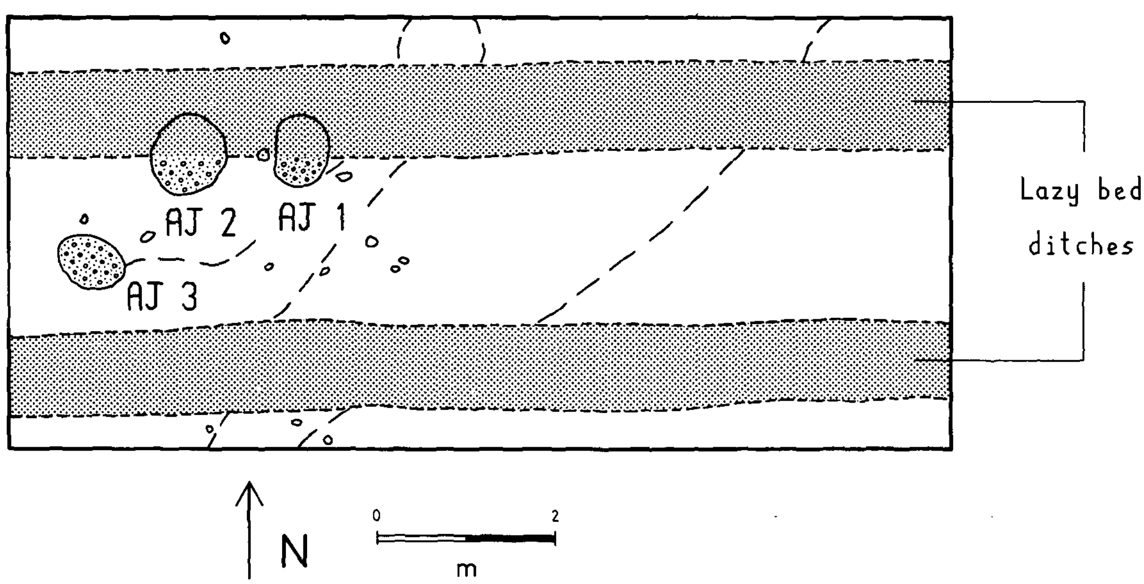
DISCUSSION: THE NATURE OF THE SITE

The nature of the site was assessed by analysis of the types of artifact recovered and of the types of feature preserved.

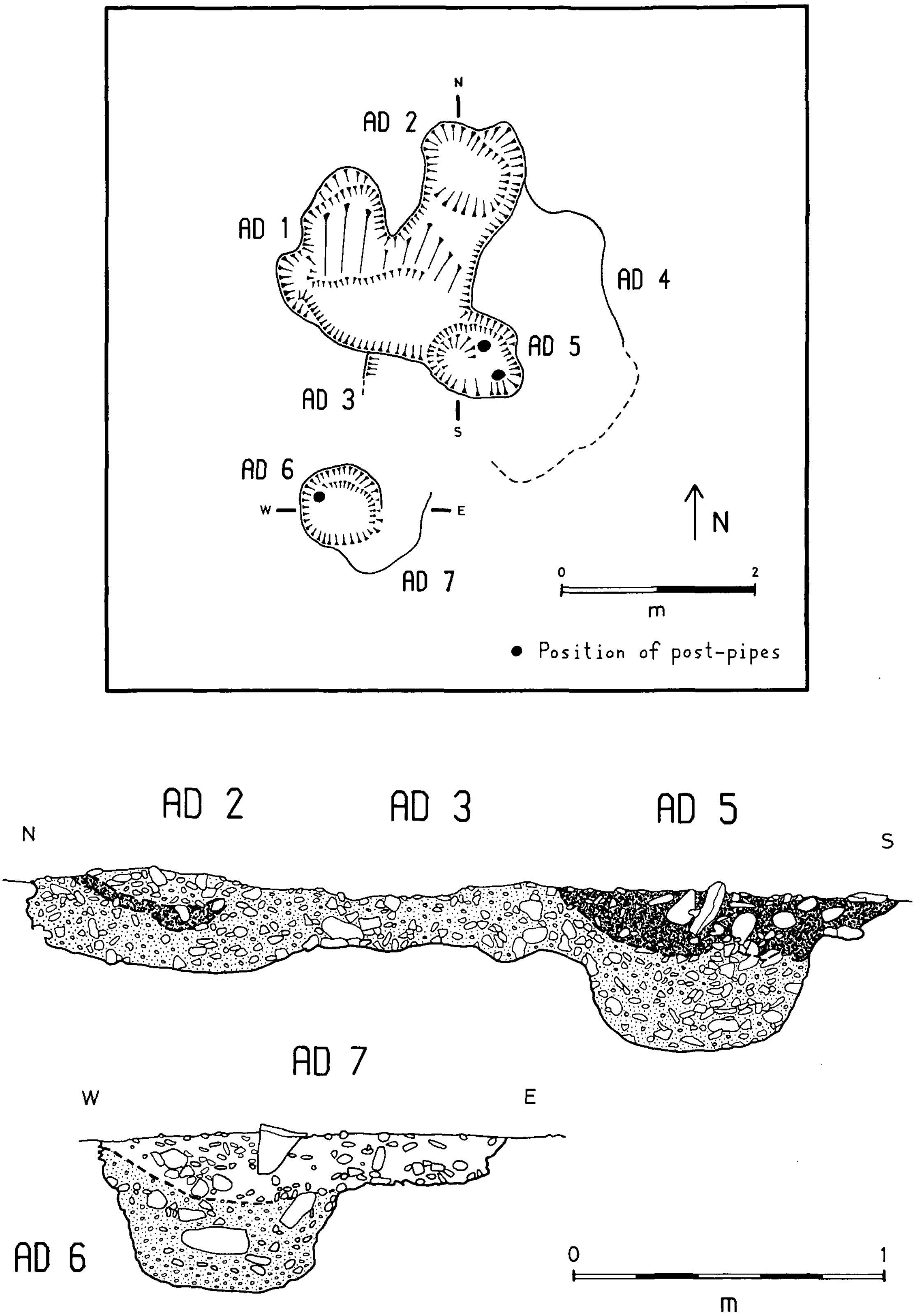
The artifacts consisted primarily of a large assemblage of flaked lithics. From the sampling of the ploughsoil 28,838 pieces were recovered. Much of this was knapping debris, but there were also many regular flakes, together with a significant number of blades, many microliths, and a few other retouched pieces (Tab 1). The retouched pieces included two complete, and eight fragmentary, leaf-shaped points. All the microliths were made on small narrow blades, and the presence of several hammerstones confirmed the impression that knapping had taken place on site. Finally, the existence of two pieces of pumice, both with deep grooves from the abrasion of points of bone or other materials, pointed to the large part of the original artifactual assemblage that had not survived (Ill 88).

The artifacts demonstrated the existence of a late mesolithic site, with some indication from the leaf-shaped points that activity had continued into the neolithic. Excavation of the features supported this. All the prehistoric features examined could be parallelled on mesolithic sites elsewhere (Woodman 1985a, 7–31: McCullagh forthcoming), and all contained artifacts comparable with those from the ploughsoil sample. This mesolithic interpretation was confirmed after excavation by the production of two radiocarbon determinations based on carbonised hazel-nut shell found in one of the pits (AD 5). The dates (8590±95BP, GU–1873 and 8515±190BP, GU–1874; Chapter 10) place the site at the start of the later mesolithic period, and make it the earliest certain evidence, at the time of writing, for the human settlement of Scotland. Dates obtained in the later seasons were to confirm the existence of some neolithic remains on site, though these were separated by a period of several thousand years from the mesolithic occupation.

At the end of the first season the archaeological site had been located and chronological information obtained; subsequent seasons were designed to explore the site in detail, and the results of these seasons are presented below.



ILL 9: Trench AJ: excavated features. For key see ILL 12.



ILL 10: Trench AD: excavated features. For key see ILL 12.

THE MESOLITHIC EVIDENCE

Mesolithic remains were found in five areas of the site: Trenches AC, AD, AG, AJ and BA. Trenches AC and AJ revealed only limited evidence of activity; Trenches AD and BA, an extension of AG, produced more extensive evidence.

RESULTS FROM THE TRENCHES

TRENCH AC

The remains in Trench AC consisted of the base of a pit and an isolated post-hole (see above; Ill 7).

TRENCH AJ (Ill 9)

The bases of three pits (AJ 1, 2 and 3) were recovered in Trench AJ. Each was truncated by the construction of lazybeds, so they add little to an understanding of the site as a whole.

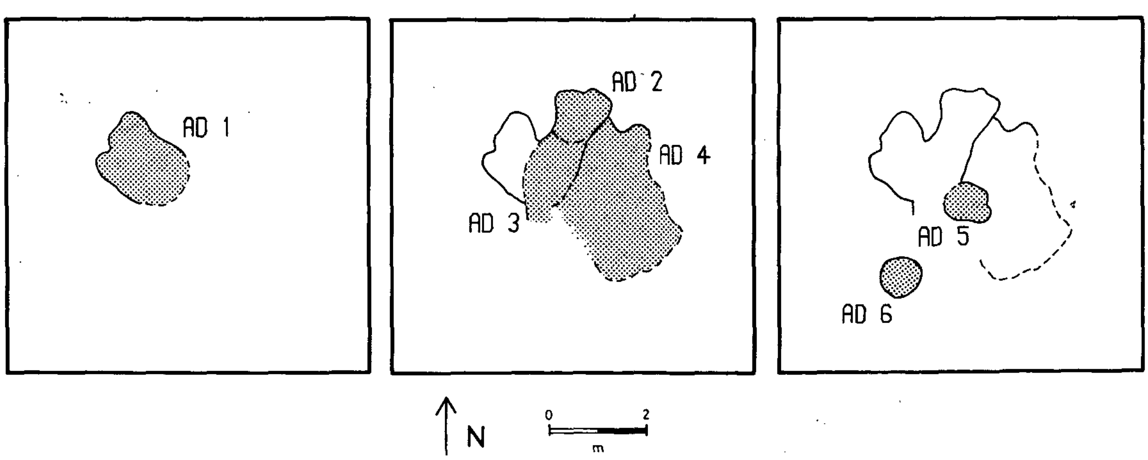
TRENCH AD (Ill 10)

A complex of mesolithic pits and hollows (AD 1–6) survived in Trench AD. The earliest was a deep, irregular hollow (AD 1) which was greatly altered by later activity. The surviving edges were steeply cut in places, but for the most part they followed the natural incline of the subsoil strata. The hollow was slightly modified by, or for, human use, but it seems to have been naturally formed, possibly as a tree root hole. The base was level, and the hollow appeared to have been deliberately infilled; the pebbly fill contained both lithic debris and a quantity of carbonised hazel-nut shell (Ill 99), but much had been removed by the cutting of a later pit (AD 3).

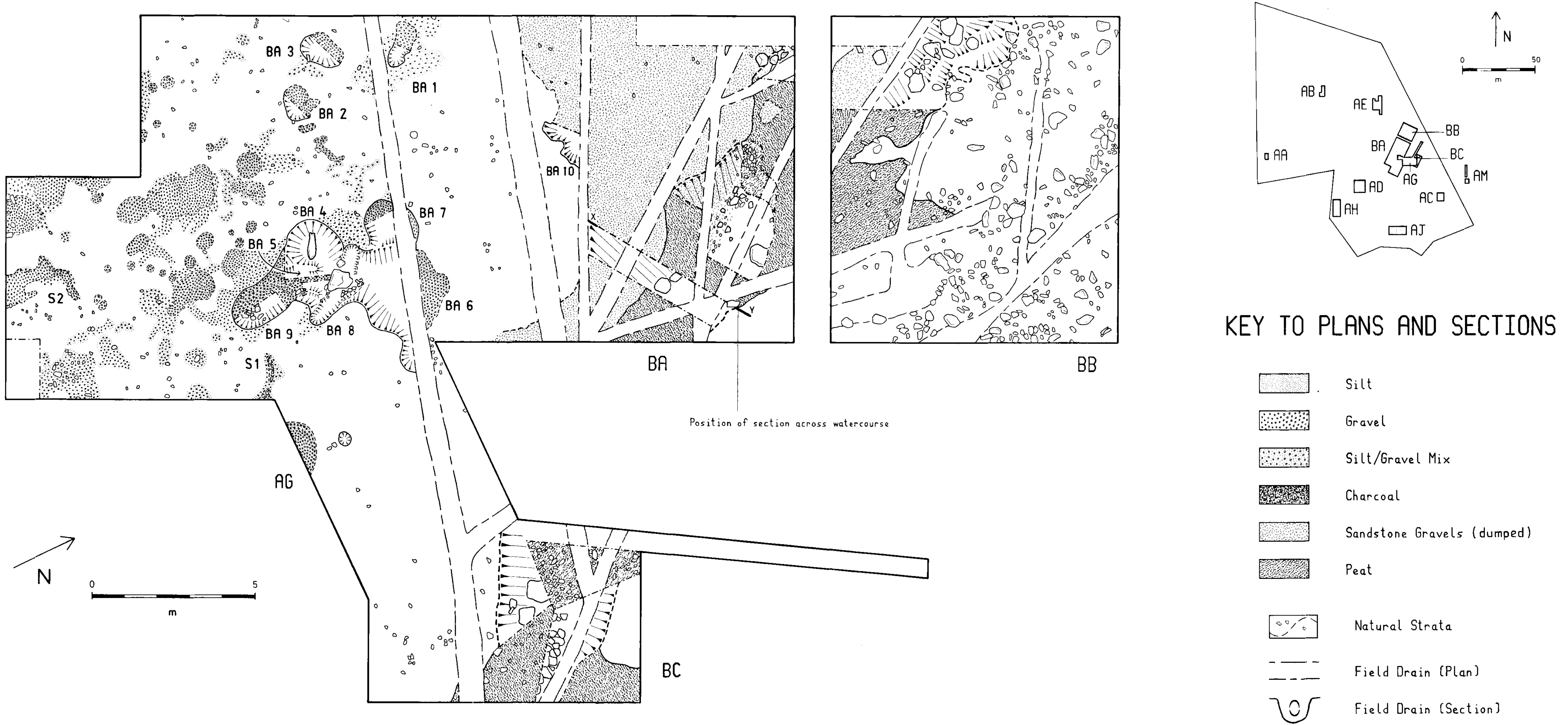
Sometime after the backfilling of AD 1 another shallow hollow (AD 4) was formed together with two small pits (AD 2 and AD 3). AD 4 was largely obliterated by AD 2 and AD 3, but it survived towards the E side of the complex. The relationship between these three features was unclear, but it is likely that the pits AD 2 and AD 3 were cut at the same time. They appear to have been open and then deliberately filled together. Little of AD 4 survived; it had been much altered by the later pits, and both the edges and base were difficult to define in the stony, banded subsoil. The fill comprised pebbles and gravel mixed with a brown soil which had percolated through to the subsoil. Charcoal was also recovered, together with burnt and unburnt lithic material.

Finally, two further pits were dug in the S half of the area (AD 5 and AD 6). Both were similar in size, shape and fill. AD 5 was cut through the earlier fills of AD 3 and AD 4, and it had a less regular shape than AD 6. At the surface AD 5 measured 0.8m × 0.9m; it had steep sides, sloping to a depth of 0.5m and the profile suggested that little surface truncation had taken place. AD 5 had been deliberately backfilled with a charcoal-rich, gravelly soil containing burnt lithic material, and two post pipes were clearly visible within the fill. Towards the top of the pit lay a group of rounded cobbles; some were heavily abraded from use, others were apparently unused (Ills 79, 83, 84). AD 6 was cut through the backfill of AD 4. It was polygonal in plan, measuring 0.8m × 0.9m at the top and 0.5m in depth with almost vertical sides and little sign of surface truncation. AD 6 was also deliberately backfilled, and a single post had been placed into the pit.

Although the sequence in which the features formed was clear (Ill 11), the interpretation of the activities that lead to their formation is difficult. The trench measured only 7m × 7m and it is possible that further remains lie untouched only two or three metres from the excavated features. Certainly, the original hollow (AD 1) appears to have been natural; it may have provided a good working area but at



ILL 11: Trench AD: the phasing of pits AD 1–AD 6.



ILL 12: Trenches AG, BA, BB, & BC: excavated features; key to plans and sections.

some point it was deliberately infilled, and there seems to have been a quantity of rubbish including both lithic and organic material in the fill. Then, after a further hollow and two shallow pits were dug, two distinctive, steep-sided pits were cut and three upright posts set into them. It seems unlikely that these represent part of any substantial structure; the posts may have supported a rack or frame, but it is equally possible that they acted as markers for the pits. Analysis of the pit fills did not shed light on the original contents, apart from the usual burnt hazel-nut shell and an amount of lithic debris.

TRENCH AG (Ill 12)

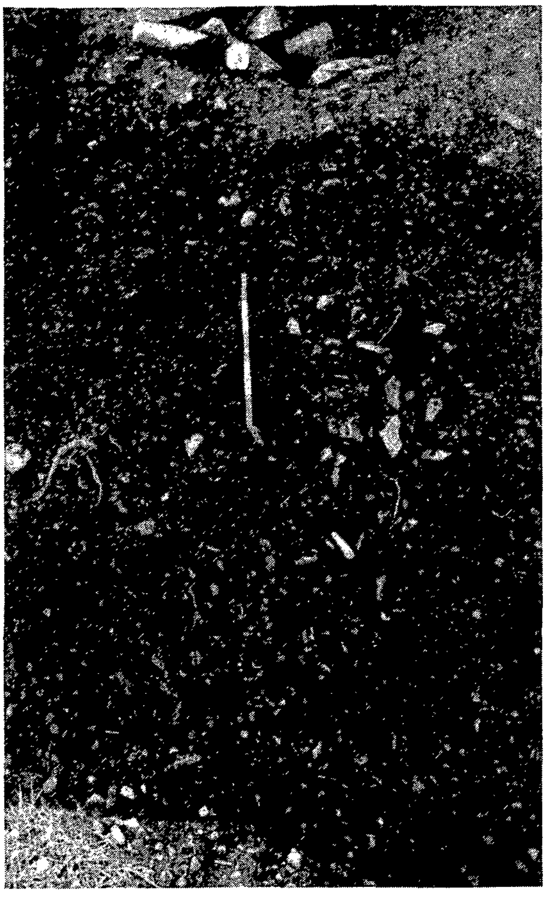
Trench AG was laid out to provide a transect from the central ridge across the boggy hollow of the watercourse at the E edge of the field. Features associated with mesolithic activity were only found at the W edge of this trench where the discovery of two conjoining pits prompted a small extension. Within this extension lay a complex of intercutting pits containing dark, organic, artifact-rich fills. These pits had all been cut by a modern field drain which ran across the trench. The small size of the extension meant that further examination of these features was left until the following season when a larger Trench (BA) could be stripped around the area.

TRENCH BA (Ill 12)

Trench BA contained abundant evidence for activity in the mesolithic period. The features uncovered in the extension to Trench AG proved to be only part of a variety of well-preserved features extending across the trench: pits, hollows, stakeholes and slots. These features were visible after the removal of topsoil as patches of dark organic-rich soil. In general they had a less gravelly matrix than the surrounding subsoil and many could be seen to contain lithic artifacts. Once they were emptied the profiles of these features suggested that little vertical truncation had taken place in this area of the site (see Ill 24), and this was supported by the results of the soil analysis (Jordan mf a & b, 3:C2–D7). Some features were surrounded by a shadow, or ghost, apparently caused by the percolation of material from the original fills and the reworking of the feature edges. These ghosts made the excavation of the features a difficult process.

Towards the W edge of the trench lay a group of features (BA 1, BA 2 and BA 3). Two (BA 1 and BA 2) were shallow hollows containing the usual dark fill with carbonised hazel-nut shell and some lithic material. The larger (BA 1) also contained several fragments of broken stone slabs. These occurred in two clusters and appeared to have broken from one or more larger slabs; the nine fragments of the main cluster could be rejoined into six pieces. Further analysis of these fragments suggested that their overall shape was quite different to that of the natural cobbles occurring across the site and that they may have been affected by heat (Jordan mf c, 3:D8–D14). It seems likely that BA 1 contained the broken remains of one or more hearth slabs. BA 3 was a pit with steeper sides than the adjacent hollows, and it was more akin to the deeper pits AD 5 and AD 6. Like them it was apparently deliberately backfilled, but there was no sign of any upright posts within the fill. As well as the usual lithic artifactual material, the fill contained many pieces of broken stone slab. None of these could be rejoined but, like those in BA 1, later analysis suggested that they may have resulted from the dumping of broken hearth slabs.

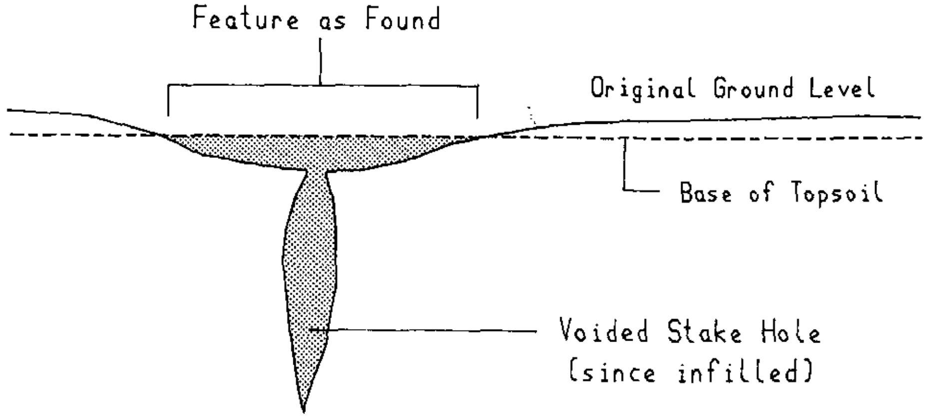
In the E half of Trench BA lay an intricate complex of pits and hollows partially uncovered in the extension to Trench AG. Both the shape and profile suggested that this complex had resulted from a sequence of separate activities, but the reconstruction of this sequence proved difficult because of the uniformity of the fills. Furthermore, it was not possible to finish the excavation of this complex in the time available. The following description is therefore based on the excavated profiles of some of the features, and on the gross visible differences of the fills.



ILL 13: Slot 1: from the E.

The N end of the complex comprised four hollows (BA 4–7) with a deep linear pit (BA 8) which cut through their centres. The N edge of these hollows was destroyed by a field drain which, in combination with the linear pit, made it impossible to determine the inter-relationship of the hollows. The hollows were each roughly circular in plan and gentle in profile with dark organic fills containing quantities of lithic debris and carbonised hazel-nut shell (Ill 99). A large oblong stone lay towards the base of BA 4. The deep linear pit (BA 8) had steep sides and contained large angular stones in its fill. It appeared either to predate the hollows or to have been cut when they were open. No evidence of post pipes was observed, but the association of the pit and hollows does bear a resemblance to the complex of features in Trench AD.

The S end of this complex consisted of a linear hollow (BA 9) which was only partially excavated. It resembled the other hollows of the complex in profile and content except at the S end where a deposit of angular blocks lay up against a steep edge. Excavation suggested that these blocks had formed an early part of the fill of this feature and had protected the original sides, elsewhere subsequent wear or weathering had led to a gentler profile. These



ILL 14: The characteristic profile of a stakehole.

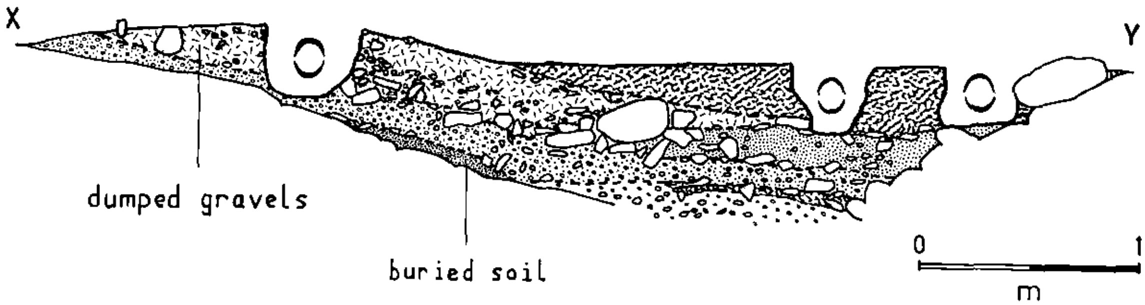
blocks were aligned with the adjoining foundation slot (S1), and it is possible that the two features originally supported part of a timber structure. The relationship of BA 9 with the rest of the complex was not explored.

Further S in the trench a variety of dark fills were recorded, presumably representing similar pits, hollows or other features but they were not excavated. Across this area, however, a number of probable stakeholes and slots were uncovered, and some of these were excavated. The slot (S1) has already been mentioned; it curved to the E of feature BA 9 for a distance of 1.5m. Although shallow, it was clearly visible, marked from the surrounding subsoil by the alignment of flat stones vertically bedded along its length (Ill 13). Its depth never exceeded 0.2m. Slot S2 to the S also appeared to be structural: in this case a rectangular corner formed of conjoining stakeholes. In addition, at least 16 individual stakeholes were uncovered, but the poor weather conditions and coarse subsoil matrix made these particularly difficult to excavate. A number were examined by trowelling off spits 0.3m deep and planning and photographing the features after the removal of each spit. In this way they were found to have a characteristic profile as the collapse of the top of the feature had lead to the formation of a small dished area below which a narrow 'cylinder', usually less than 0.1m in diameter, extended for at least another 0.1m (Ill 14). Thus excavation helped to confirm the interpretation of these features as potential stakeholes but others must undoubtedly lie undiscovered, and it is not possible to reconstruct certain upstanding structures from the evidence examined. Nevertheless, there is a clear indication that structures did exist on site (Chapter 14 below).

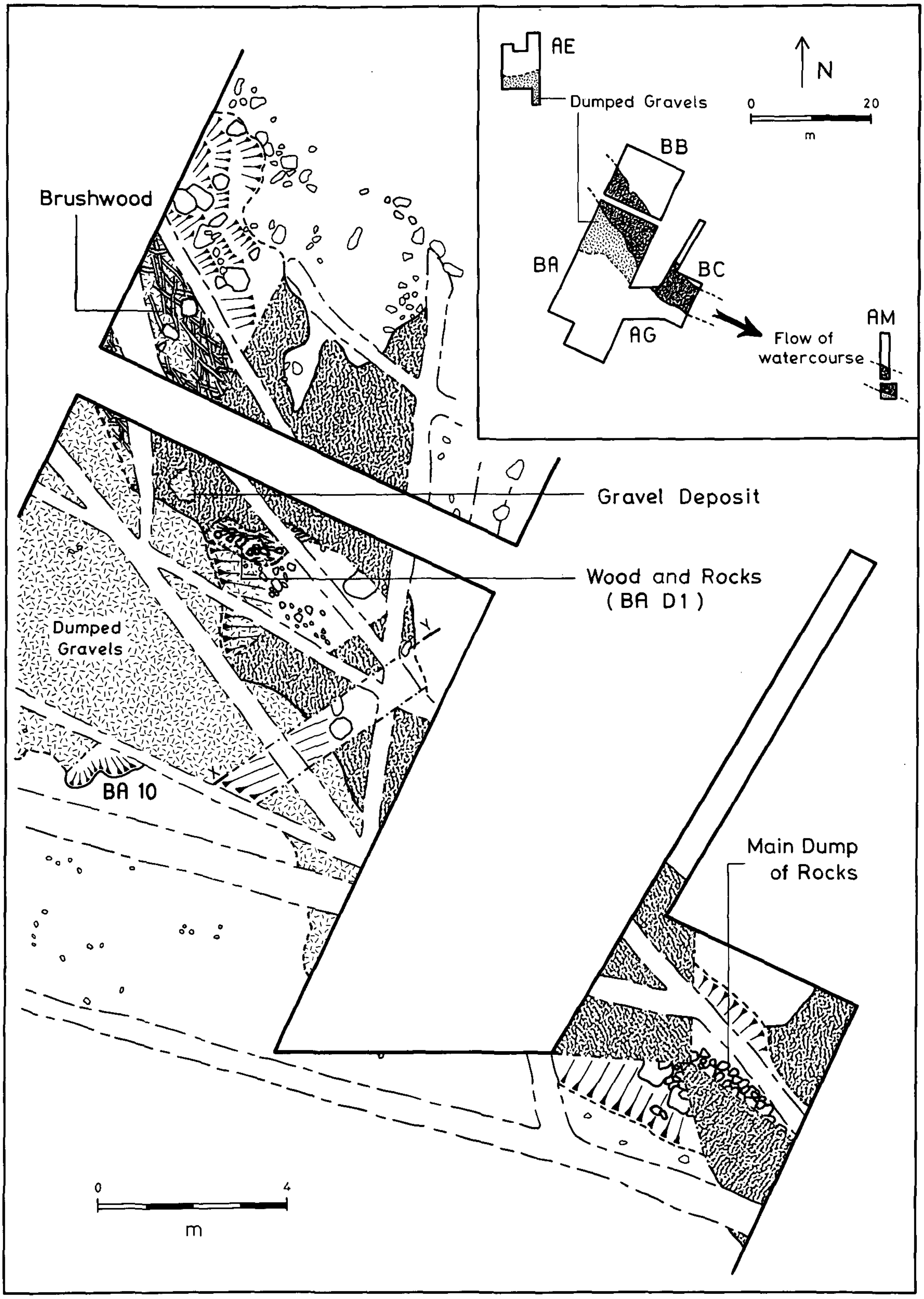
The N end of Trench BA abutted the defunct watercourse which today is a wet flush (Ill 15). One shallow hollow (BA 10) was uncovered immediately to the S of the watercourse and this hollow was subsequently dated to the mesolithic period (7880±70 BP, GU–2147); it contained the usual dark fill with much carbonised hazel-nut shell as well as lithic debris. The hollow was sealed by gravelly material that lay along the S bank of the watercourse and was apparently artificially deposited (Jordan mf a, 3:C2–D2). This dumped material was not completely excavated so that it is possible that other mesolithic features remain undiscovered beneath it.

LATER REMAINS

Evidence for the later remains derived primarily from the area of the watercourse and associated gravel dumps, principally in trenches AG and BA. No clear stratigraphical relationship could be defined between the mesolithic evidence and the remains of later activity in this area. The only demonstrably neolithic feature, dated by charcoal to the mid third millennium BC (4725 + 140BP, GU–2043) was a hollow above a mesolithic pit in Trench AD.



ILL 15: The watercourse: section X–Y. See Ill 16 for the location of the section. For key see Ill 12.



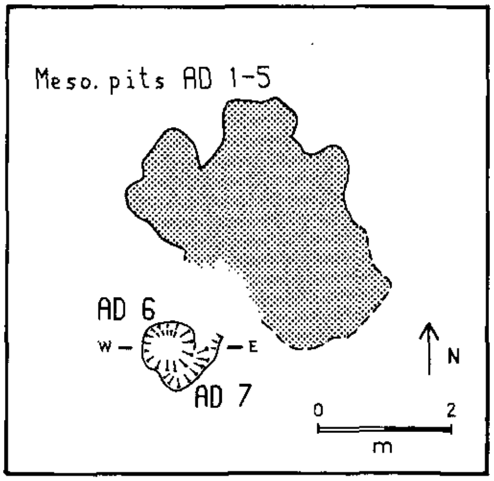
ILL 16: The watercourse: excavated features. For key see Ill 12.

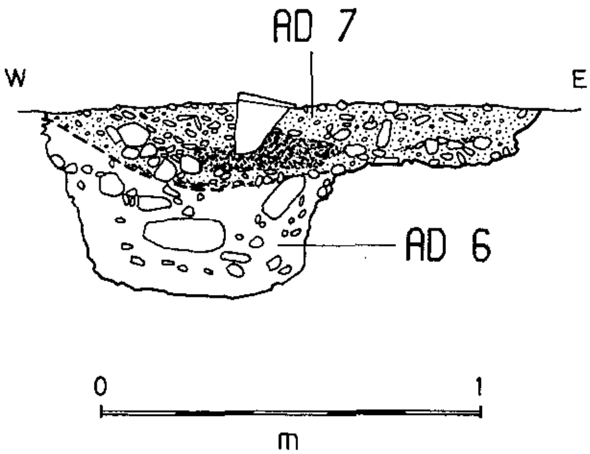
ILL 17: Brushwood deposits in the watercourse: from the N.

THE WATERCOURSE AND THE BANK DUMPS

The bottom of the watercourse was only reached in one small section (Ill 15; Ill 16). At the base lay gravel deposits containing a few lithic artifacts which were presumably derived from the nearby mesolithic remains. Above these basal gravels there were deposits of buried soil that contained a few lithics and this soil was dated from associated carbonised hazel-nut shell to 7140±130 BP, (GU-2211). All the dated mesolithic features were earlier than this, thus it is probable that the inclusion of cultural material into the soil occurred after the mesolithic settlement had been abandoned. The soil had apparently slumped into the watercourse from the S bank, and it was truncated on its downhill side by running water, which suggests that the burn was still flowing when the mesolithic site was in occupation. At the same level in the watercourse, however, a thin layer of peat had formed so that the date of the soil must represent the last possible date at which the burn was active, and it is likely that by this time it was sluggish and intermittent (Chapter 12).

The dumped gravelly materials occurred along the length of the S bank of the watercourse and extended out into it. They consisted of a sandstone gravel containing occasional lithic artifacts. The gravelly materials appeared to be largely derived from the local till and gravels, but analysis suggested that they were not naturally accumulated (Jordan mf a, 3:C2–D2). In the infill of the watercourse both the slumped soil and the lowest thin growth of peat lay below these gravel dumps (Ill 15), indicating that the burn had become sluggish, and that peat had started to form, before the deposition of the gravel.





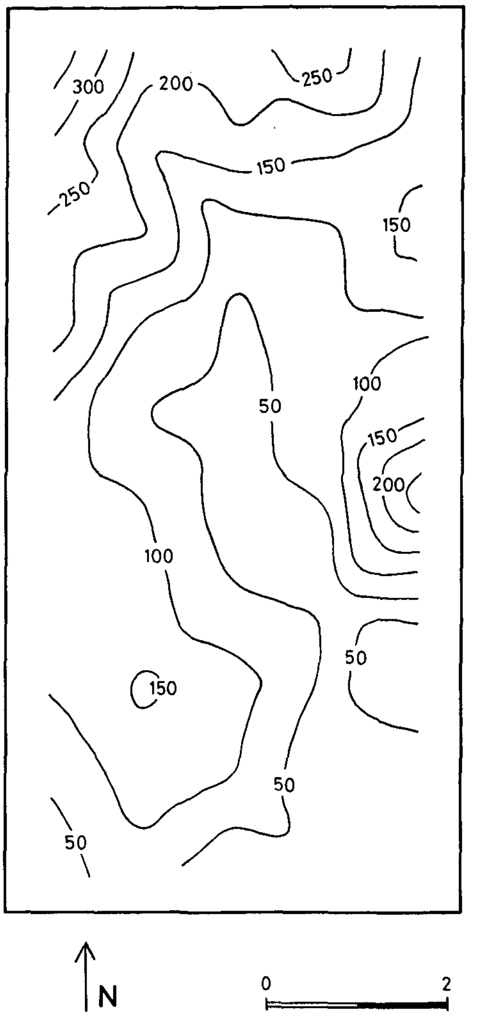
ILL 18: Trench AD: features AD 6–AD 7. For key see Ill 12.

The gravel was presumably derived from the surface of the adjacent site and had apparently been scraped up and spread along the edge of the developing bog. This gravel 'bank' never stood high; there were no great spreads of material that would have resulted from the destruction of a larger feature. On the bank the gravel dumps lay directly below the ploughsoil and sealed at least one mesolithic feature (BA 10); in the watercourse they lay below the main growth of peat.

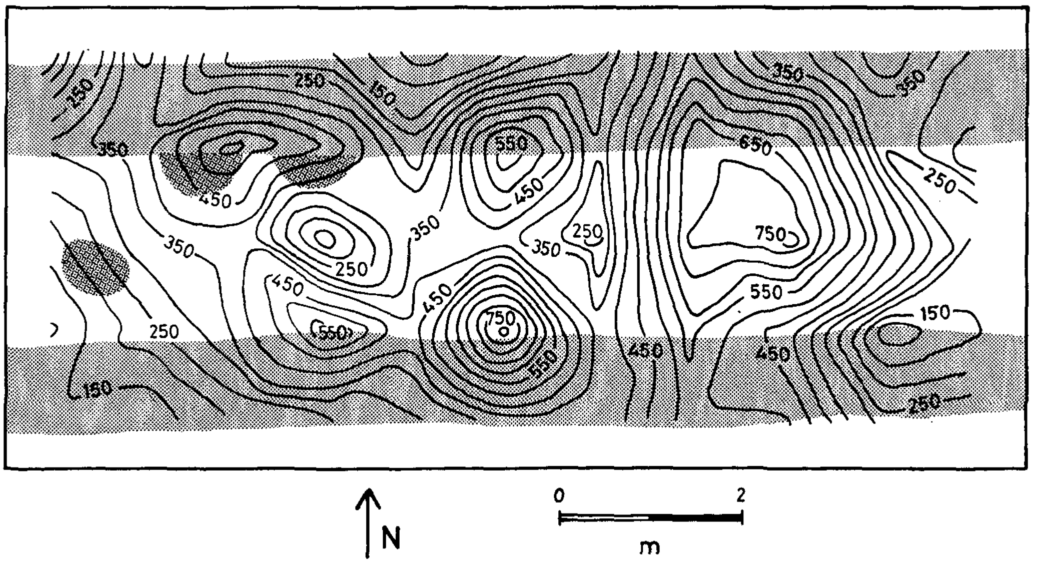
The gravel dumps, therefore, post-date the mesolithic occupation of the site and they seem to pre-date the later activity on site. This later activity is predominantly related to human interference in, and around, the burn in the third millennium BC. Although it is possible that the dumps do relate to this phase, there was no clear stratigraphical relationship between the remains of the two periods. Bearing in mind the environmental indications of human disturbance in the period between the mesolithic and the later activity (Chapter 11), the possibility of the build up of the 'bank' at any time in this period cannot be discounted. This leaves a span of some three thousand years during which it could have been formed.

Isolated gravelly deposits containing some lithic debris were found elsewhere in the peat of the watercourse (Ill 16), and these too may be associated with the scraping up and deposition of gravels from the site. Furthermore, a number of rafts of matted wood lay within the peat throughout the watercourse (Ill 17). Analysis of the wood suggested that these were not natural assemblages but had possibly resulted from scrub clearance (Chapter 11; McCullagh mf. 3:A3–A11). One (D1) was dated to the early third millennium BC (4080±60BP, GU–2148) by which time there is other evidence for activity on site.

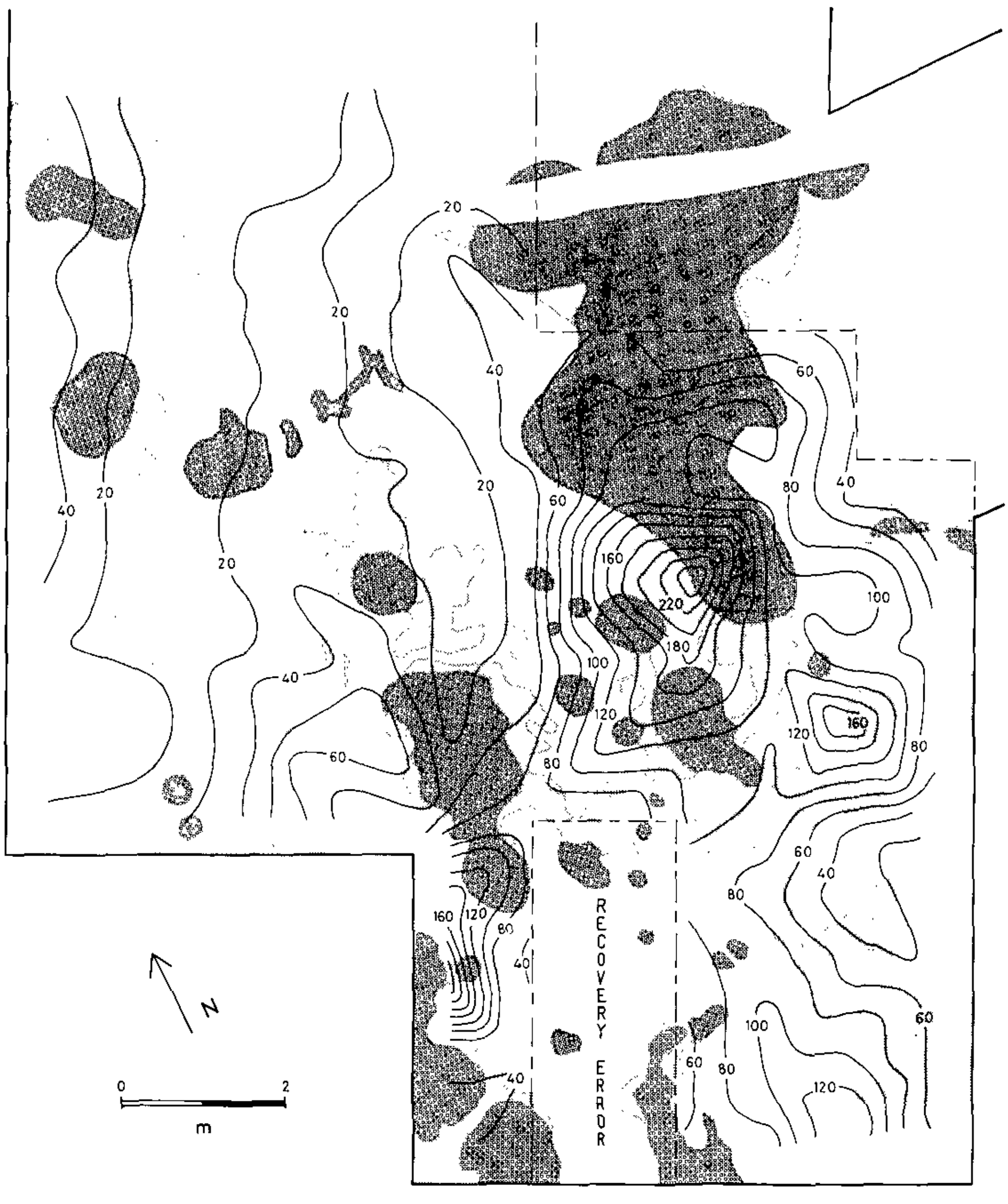
Further gravel deposits were discovered upstream in Trench AE. During excavation it was not possible to interpret these deposits because the trench was too small, but they are similar to the gravel dumps of Trench BA, and they lie clearly along the line of the S bank of the watercourse (Ill 16).



ILL 19: Trench AH: the density of lithic material in the ploughsoil. Contours at intervals of 50 finds per sq m. No stratified contexts survived in this trench.



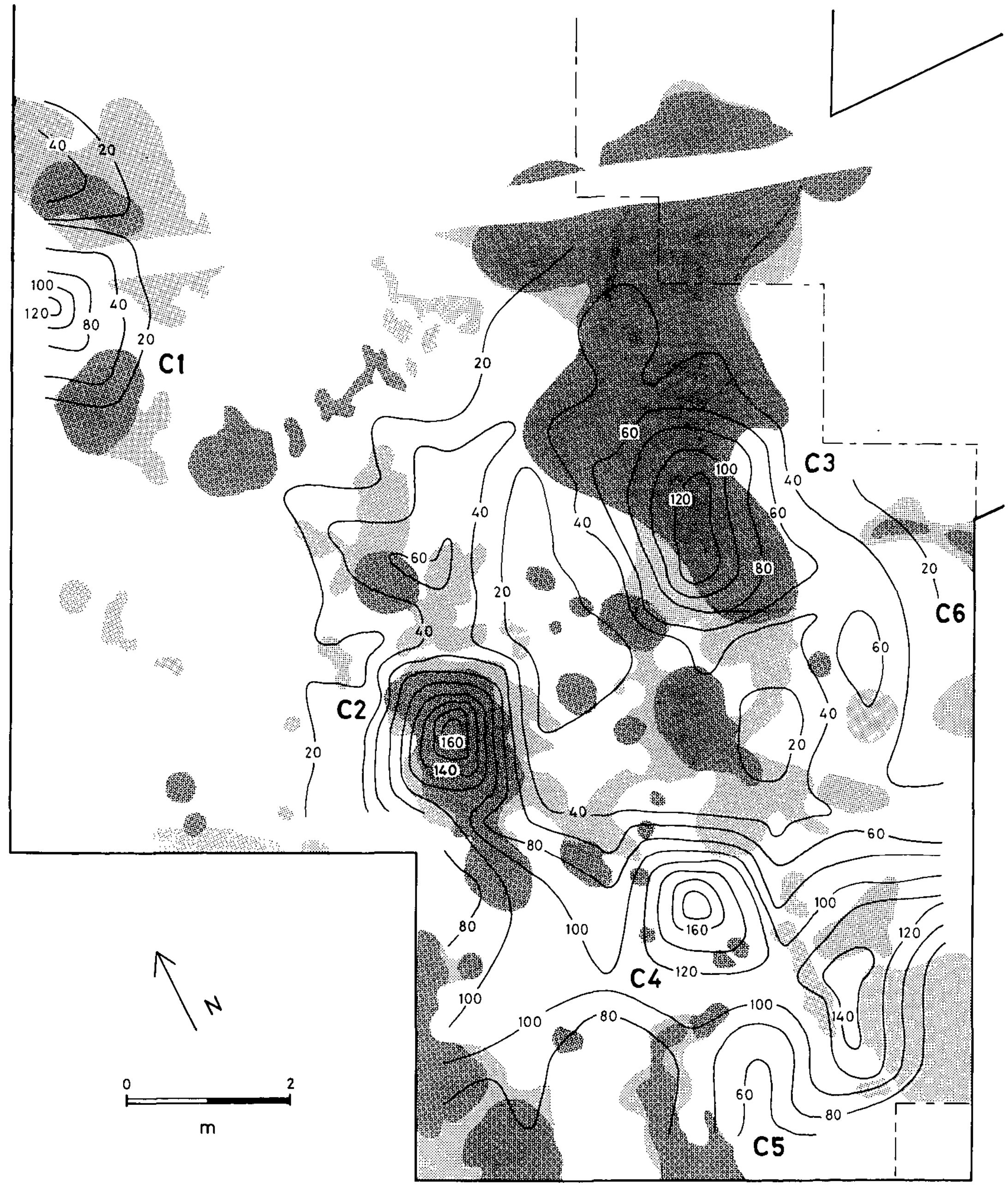
ILL 20: Trench AJ: the density of lithic material in the ploughsoil.
Contours at intervals of 50 finds per sq m. Surviving contexts are stippled.



ILL 21: Trench BA: the density of lithic material in the ploughsoil.
Contours at intervals of 20 finds per sq m. Surviving contexts are stippled.

THE NEOLITHIC REMAINS

No certain evidence for structures relating to the neolithic period were found within the areas investigated. To the N of the watercourse boulder clay lay immediately below the ploughsoil and, with the exception of two stakeholes of uncertain association, no features of archaeological interest were uncovered. To the S, in Trench AD, a small shallow hollow (AD 7) had formed across the top of one of the mesolithic pits (AD 6) (Ill 18). At the base of this hollow lay a thin peaty layer, on top of which a gravelly silt had been deposited containing larger stones as well as both lithic debris and charcoal. This layer was subsequently dated to the mid third millennium BC (4725±140BP, GU-2043). This was the only demonstrably neolithic feature discovered on site. There is, of course, much potential for other areas of neolithic activity amongst the unexcavated features and areas of the site, but so far the only other deposits uncovered relating to this period are those in and around the peat of the watercourse. The



ILL 22: Trench BA: the density of lithic material in the cleaning layer.
Contours at intervals of 20 finds per sq m. Surviving contexts are stippled.

nature and existence of these deposits suggest that further neolithic material must lie somewhere close to the excavated areas.

The main evidence for activity in the neolithic consists of a deposit of rocks, together with organic material, fragmentary pottery (Chapter 9), and lithic debris (Chapters 5 and 6), all lying within the peat of the watercourse towards the E end of the excavated area (Trenches AG and BC; Ill 16). The peat within which the deposit lies apparently started to form before the deposition of the first rocks. A radiocarbon determination based on wood within the deposit produced the date of 3890±65BP (GU–2042); but the date of the deposit is problematical because the deposit also contained pottery of a type thought to be earlier than the radiocarbon determination and pumice that is probably derived from a later Icelandic eruption (c. 2700 BP; Chapter 9). Some of the rocks were substantial; two in particular were of great size and they must have protruded above the surface of the watercourse. Within the deposit the artifactual material was presumably derived from nearby occupation debris, whether of a domestic or other nature. The rocks must have been cleared from the surface of the surrounding land where they may once have played a part in the mesolithic structures (Chapter 14).

INFORMATION FROM THE PLOUGHSOIL

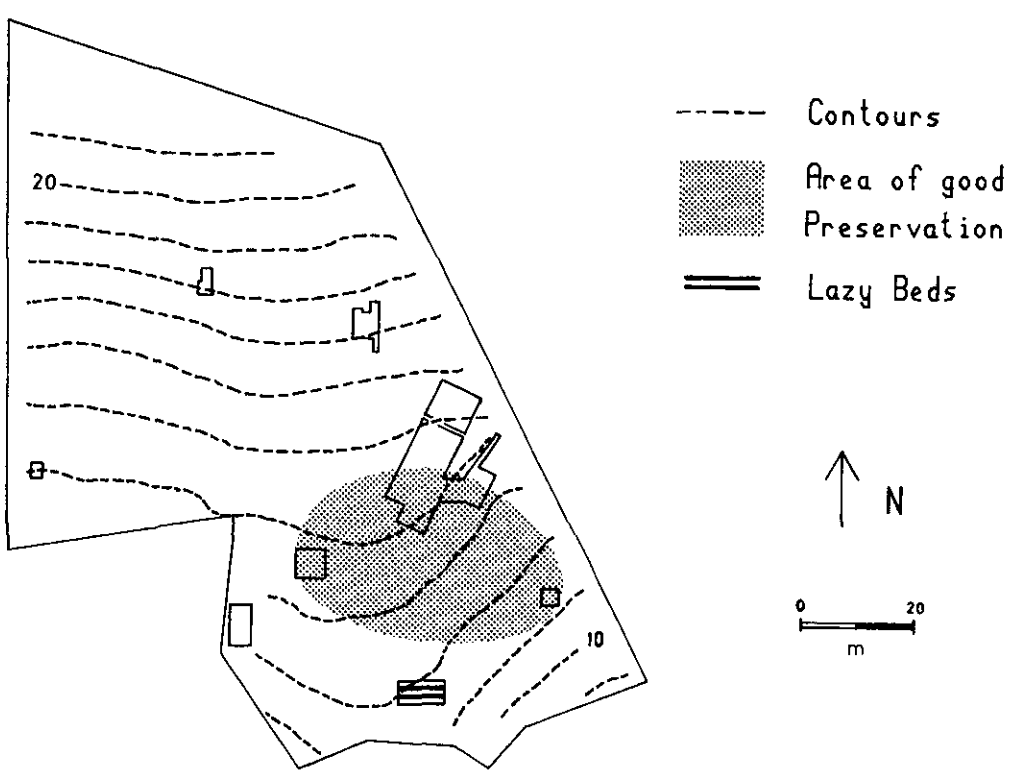
Contour maps of the lithic density per metre square within the ploughsoil of each trench have been drawn up. These show specific concentrations of material surviving within each trench, which could be compared to the positions of the remaining features. In general, the ploughsoil concentrations overlay the features; there were also, however, concentrations with no underlying features. These results are illustrated for the three trenches in which the spatial pattern proved of most interest: Trenches AH; AJ; and BA (Ills 19–22). Trench AD might have been of interest but the trench was laid out so closely around the complex of stratified features that it provided little scope for the recognition of any differential patterning of artifacts within the ploughsoil both over and away from the stratified material. Trench AC was too small for any patterning to be observed.

TRENCHES AH and AJ

The distribution of material across Trenches AH and AJ is shown in Ills 19 and 20. All the material from the ploughsoil has been combined with that from the cleaning layer below, whether recovered manually or by wet sieving. Trench AH (Ill 19) is of interest as here there were no surviving stratified contexts, but the spread of lithic material within the ploughsoil has several clear concentrations which are probably the remains of ploughed out features. Trench AJ (Ill 20) was heavily truncated, but the bases of three pit-like features survived and lithic concentrations were also visible. One of these concentrations coincided with the existing features and three others lay above apparently barren subsoil. Interestingly, there was no obvious relationship between the spread of artifacts over the trench and the two lazy-bed ditches that ran down the length of the trench. This suggests that, although the construction of the lazy-bed ditches must have destroyed any underlying archaeological features, it did not result in the long distance movement of the material from those features.

TRENCH BA

Two contour plans were drawn up for Trench BA. This was in part because of the larger size of the trench and of the more complex spread of underlying features, but it was also because the body of the ploughsoil was not sieved. Illustration 21 demonstrates the general spread of material recovered by hand from the body of the ploughsoil; illustration 22 shows the spread of material recovered (both by wet sieving and manual collection) from the cleaning layer at the base of the ploughsoil. In general, the two plans highlight similar concentrations of artifacts, with



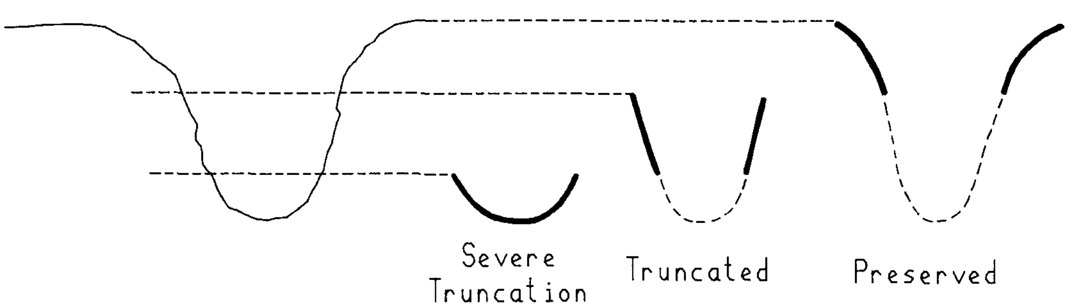
ILL 23: The conditions of preservation across the site.

the difference that the pattern in Ill 21 is less well defined. The three main concentrations of material outlined in Ill 22 (C1–C3) apparently relate to underlying pit complexes and the areas with a particularly low density of artifacts generally correspond to areas of featureless sub-soil. These featureless areas are in sharp contrast to the apparent 'ghost features' of Trenches AH and AJ.

In addition to the pit complexes, Trench BA contained several possible structural features (the arcs of stakeholes and the slots), but these show no uniform relationship with the quantities of material immediately overlying them. One lithic concentration (C 4) lies neatly within one of the stakehole arcs. The area outlined by a slot (S2), however, contains distinctly fewer lithics than its surroundings (C 5), as does area C 6 defined by another slot (S1) (see Ill 12). Given the palimpsest of features in this trench (many of which were never excavated), it is difficult to associate the uneven spread of material with specific feature complexes.

PRESERVATION WITHIN THE FIELD

It was apparent from the start that uneven truncation of the old land surface had taken place across the field, resulting in considerable variation in the preservation of the archaeological remains (Ills 23, 24). The site lies across a slight ridge which runs down towards the sea; to the E of the ridge Trenches AC, AG, and BA all contained well-preserved features below a depth of some 0.25m of ploughsoil.



ILL 24: The relationship between the profile of a pit and the degree of truncation.

ESTIMATING PRESERVATION

In Trench BA it was possible to estimate the truncation by comparing the artifactual content of the surviving pit fills with the quantity of material in the ploughsoil directly above. As the relationship between the two was always in the order of 70% pit fill to 30% ploughsoil material, the observation (made during excavation) that only the surface of the features had been destroyed was supported. To the W of the ridge the formation of the ploughsoil had disturbed the archaeological remains. No features survived in Trench AH, although the spatial patterning of the artifacts in the ploughzone did suggest that features had once been present (see above, this Chapter). To the S. where the ridge broadened out, other agricultural disturbance had taken place and the shadows of two lazybed ditches showed up clearly in Trench AJ, where the only surviving features were the bases of three pits. Across the centre of the ridge less truncation had taken place: Trench AD contained a complex of features that had lost little from their tops.

The archaeological features are well preserved across only a part of the area defined by the lithic scatter, and even within this restricted area there is some variation in their survival. Towards the N end of Trench BA and to the S in Trench AC heavy truncation had removed all but the deepest features. Across the centre of the site the features were better preserved but no prehistoric occupation soil survived and, moreover, a variety of post-depositional processes had taken their toll of the feature fills which were reduced in most cases to a homogeneous dark, silty material. This lack of internal structure was frustrating for excavation, particularly where the features consisted of complexes of intercutting pits and hollows, and in these cases a number of different techniques were used to try to identify the original stratigraphy; none was entirely successful.

The general contour map of lithics within the ploughsoil (Ill 5) shows that the density of material does not drop off towards the present-day field-boundary, and it seems likely that the site originally extended outwith the area enclosed today. To the W and S, modern disturbances have destroyed any archaeological remains; lithics have been collected to the E, although the ground outside the field wall has been churned up in recent times by domestic animals and no archaeological features survive. Stratified features are, therefore, only preserved within the modern field, elsewhere the site has apparently been destroyed by agricultural activity. Cultivation ridges cover the slopes around the site and they continue along the N shore of

Loch Scresort. The results of excavation in Trench AJ indicate that the lazy beds had destroyed any archaeological remains over which they extended. It seems unlikely that the main area of the site was ever subject to this form of cultivation and, indeed, no evidence of lazy beds was found across the main body of the field.

COMMENT

No estate records relating to Kinloch have survived, so the detailed agricultural history of this area must remain unknown, but it appears that the archaeological preservation owes much to the chance agricultural uses of the land.

EXCAVATION OUTSIDE THE FIELD

Four test trenches (AK, AL, AM and AN) were opened outside the immediately threatened area. Three of these (Trenches AK, AL and AM) were quadrats of $4m^2$ dug immediately adjacent to the site (Ill 4). Within this area lithics had been collected from the ground surface, but in Trenches AK and AL any archaeological features had been destroyed. Stratified material only survived within Trench AM, and this appeared to be the downstream continuation of the watercourse.

TRENCH AM

Here the peat contained much stone, together with lithic debris and two sherds of pottery, whilst on the S edge of the peat, and extending out into it, there were gravel deposits similar to those upstream. This trench was too small to examine the remains in detail, but prehistoric material has clearly survived outside the field boundary, and it does appear to be broadly in line with the remains discovered on the main site. In most places, however, the ground outside the field has been severely disturbed for many years and, although the lithic material suggested that the prehistoric remains extended to the SE, no features have survived this disturbance. The excavation of a long narrow extension to the N of Trench AM confirmed that the preservation of prehistoric remains in this area was extremely patchy. Within one metre of the surviving features of Trench AM further modern disturbance was discovered, and to the N of that lay bedrock.

TRENCH AN

Further to the E a trench (AN), of $16m^2$, was opened across an area where disturbance caused by a narrow track had revealed lithic artifacts in the thin peaty soil (Ill 4). An assemblage of some 600 lithics was recovered (Tab 27), but no prehistoric features lay within the area investigated. Much of the trench contained a compacted hillwash that overlay a buried soil.

4 THE LITHIC ASSEMBLAGE: RAW MATERIALS

THE SOURCES OF RAW MATERIAL

Two different materials were exploited for the manufacture of the majority of the flaked lithic artifacts, and these were supplemented by a small quantity of other rocks (Tab 2). All are chalcedonic silicas. The predominant materials are flint and a hydrothermal chalcedony, here called bloodstone. The other materials include agate, quartz, silicified limestone, and volcanic glass. The frontispiece to this volume gives an indication of the nature of the range of raw materials recovered.

FLINT

A few small, rolled, flint nodules were recovered. The flint is characteristically smooth textured and mottled grey/white in colour. It appears to be extremely corticated and a number of pieces contain visible fossils. Many of the flint artifacts retain a weathered cortex suggesting that small rolled pebbles provided the basis of the raw material. Flint such as this was commonly used for prehistoric assemblages throughout the coastal areas of western Scotland. Although nodules are only rarely found throughout the area today, it would seem that the material was not so scarce in the past. It is possible that nodules were brought in from flint-rich areas such as the Antrim coast, but the size, ubiquity, and homogeneous nature of the archaeological material throughout the Western Isles suggests that a more local supply existed. Flint beds extend away from the northern coast of Ireland (Wickham-Jones & Collins 1978, 7), and the transportation of nodules by both seaweed and ice has been recorded (Piggott & Powell 1949, 160; Werner 1974). It seems likely that in early prehistory, at least, flint was washed up on the coasts of the west of Scotland in sufficient quantities to provide some stone tools, and it is likely that this included the beaches of Rhum. The types of flint debitage present at Kinloch demonstrate that whole nodules were reduced on site in the manufacture of tools (Chapters 5 and 6).

BLOODSTONE G DURANT D GRIFFITHS & D SUTHERLAND

Bloodstone is a cryptocrystalline silica which occurs in association with the lavas of Tertiary age that form Fionchra and Bloodstone Hill in the west of Rhum. The silica minerals occupy amygdales (the irregular cavities and fissures that exist within a lava flow) and they were deposited here from hydrothermal solutions as they percolated through the rocks at some stage after the consolidation of the lavas. Several different varieties of silica are present at Bloodstone Hill, but the detailed formation processes are not, as yet, understood.

The different silicas are recognisable by their markedly different colours, from red (jasper and carnelian), through light green (plasma), to a dark green (heliotrope) and a purple chalcedony. In addition, there is great variety in grain size and surface texture within any one colour type. An individual nodule may contain silicas of markedly different colour and quality. There is little agreement as to terminology in the geological literature but technically the term bloodstone should be reserved for the fine textured dark green nodules that are shot through with red. This particular material has long been sought after by jewellers, and in the nineteenth century a small quarry was established at the northern end of Bloodstone Hill to exploit a particularly good seam. In prehistory, however, there was no such selection: all varieties were transported to the site at Kinloch and all varieties were used for tools. Although the individual names are important to a geologist, the prehistoric population apparently made no distinction between the formal varieties, and here they have been grouped together for archaeological purposes under the term *Bloodstone*. This term was retained because of its specific associations with the island of Rhum and with the transport of stone from that island, whether in the 19th century or in prehistory.

The main sources of bloodstone are on Rhum, but outcrops have been recorded elsewhere amongst the Tertiary volcanic systems of the west coast of Scotland, and it was felt necessary to visit all of the possible sources and to analyse more specifically the provenance of the archaeological material (Chapter 13). Although conclusive source analysis was not in the end possible, the preliminary sourcing work, together with both the scarcity and the poor quality of the material at the other geological sites, suggests that bloodstone was obtained in prehistory from Rhum. Examination of the sources on Rhum, at Fionchra and at Bloodstone Hill, showed that the material from Fionchra is quite unlike that exploited at Kinloch, or indeed anywhere else. All the evidence suggests that the predominant source of bloodstone in prehistory was Bloodstone Hill.

Bloodstone Hill (NG 315 007) stands at the southern edge of Guirdil Bay (Ills 1 and 95), on the opposite side of the island to the site at Kinloch. There was no evidence in either till or beach deposits for the natural transportation of nodules across the island, indeed the direction of ice-flow appears to have been from east to west. The prehistoric population of Kinloch must, therefore, have crossed Rhum in order to obtain bloodstone. At Guirdil there are three potential sources of bloodstone: the outcrops at the top of Bloodstone Hill, the talus on the flanks of the hill and the gravels on the beach below. The outcrops are difficult of access, however, and the cortex present on the Kinloch pieces indicates that eroded, slightly abraded nodules were used. These are more likely to have come from a secondary source such as the talus or the beach gravels.

Today the talus slopes of Bloodstone Hill are extensively vegetated, and they are likely to have been so throughout prehistory. This vegetation means that pebble nodules are not easy to obtain from the talus in large quantity. The beach, however, is not vegetated and large numbers of bloodstone nodules of all types, sizes and qualities may still be collected there. Fieldwork at Guirdil suggests that the period of the most abundant 'production' of bloodstone fragments was during the Loch Lomond Stadial, and that the time of greatest transport of material from the talus to the beaches was likely to have been during that Stadial and the very early Flandrian. During most of the Flandrian the fresh release of bloodstone fragments from the outcrops is likely to have been low so that most of the bloodstone in the more recent raised beaches, and in the present beach, is probably reworked earlier material. The present beach is constantly reworked by the sea; this results in the disintegration of those bloodstone fragments with a high vesicle content, while the more coherent and mechanically sound bloodstone will be left behind. In this way the bloodstone on the beaches is not only the most easily located source of bloodstone (both now and in prehistory), but it is also of a naturally selected higher quality than that occurring on the talus. Continued reworking today means that the bloodstone presently available on the beach is likely to be of consistently higher quality, though less abundant, than that in prehistory. With this caveat in mind, material from the beaches was used as the basis for all of the experimental knapping undertaken to test the flaking properties of bloodstone.

Even after beach sorting there is still great variation in quality amongst the nodules available on the beach today. The evidence from Kinloch suggests that in prehistory nodules were tested and primary flakes removed at Guirdil before transportation across the island (Chapter 6). Although the distance involved is not great, a mere 12 km by land, it would clearly have made sense to ensure that waste material was not transported, whether as poor quality nodules or as cortical flakes. However, with the exception of a very few flakes, there is no evidence for the working of stone anywhere at Guirdil (Chapter 13), but if this were carried out on the beach then the waste material would quickly have disappeared and further up the Guirdil Glen the present land cover makes the identification of prehistoric sites difficult.

AGATE, QUARTZ, SILICIFIED LIMESTONE, AND VOLCANIC GLASS

A variety of other siliceous rocks was used to supplement the flint and bloodstone. Agate and quartz outcrop at Bloodstone Hill; they also occur as pebbles on the beaches, and were probably collected together with the bloodstone.

Silicified limestone outcrops on the west coast of the island of Eigg, at Clach Alasdair to the southern end of Laig Bay (NM 455 883), immediately opposite the south east coast of Rhum. It is a glassy, coarse-grained material and, although it has a well developed conchoidal fracture, it was not used in great quantity in prehistory. At the source it may be seen to contain numerous heat fractured nodules of flint, and fragments of these were visible within some of the artifacts on site. Although the journey to Eigg from Rhum is short, the limestone is not present at Kinloch in great enough quantity to suggest any organised collection directly from the source, and this material may well have been washed up on the shores of Loch Scresort alongside the flint. Until this source was inspected, artifacts of this material were classified as quartzite. Although no local quartzite sources have been located, the two materials are macroscopically similar and, as not all of the pieces have been individually tested, it is possible that some genuine quartzite artifacts have now been classified as limestone.

The volcanic glass is a dark green vitreous material. It is homogeneous in texture, and it appears to have a good, if somewhat brittle, conchoidal fracture. Outcrops have been found on Eigg, and it is possible that this is the source of the pieces from Kinloch. If so, these pieces reinforce the view that the prehistoric inhabitants of Kinloch made use of the suitable raw materials that were locally available. The volcanic glass is, however, similar in appearance to Arran Pitchstone, and it is possible that it came from the island of Arran. Pitchstone was transported over long distances, especially in the neolithic and bronze age (Thorpe & Thorpe 1984), but it is worth noting that none of the usual pitchstone artifacts, such as small blades or blade cores, were present at Kinloch.

RAW MATERIAL IDENTIFICATION B FINLAYSON & G DURANT

As a part of the detailed examination of the assemblage it was obviously of interest to be able to assess the relative use made in prehistory of the different raw materials. There were few artifacts of agate, quartz, limestone and volcanic glass, so attention was concentrated on the two main materials, bloodstone and flint. These are both very similar and it was necessary to examine a variety of possible discriminatory techniques in order to distinguish between them.

The first techniques used were the examination of hand specimens and of thin sections from control nodules of known source (Durant mf, 1:E10–F7). From these a number of possible discriminatory features were listed: colour, spherulites of iron calcite, fossils, coarse crystalline quartz and agate banding. It was recognised, however, that there are samples which do not carry any of these distinguishing characteristics. Chemical analysis was tried next in order to develop the identification of the two materials, and both major and trace elements were picked out as being of possible use (Durant mf, 1:E10–F7). The sample size was too small to test the conclusions fully, however, and the situation was further complicated by the large size of the Kinloch assemblage and the considerable variation within each raw material type. A number of other techniques (cathodoluminescence, stable isotope analysis and scanning electron microscopy) were suggested, and X-ray flourescence, electron spin resonance spectroscopy and transmission electron microscopy were also considered. However, all these techniques suffer from expense, lack of speed and the need to build up a large background database of information before the archaeological material could be examined. The problem is made worse by the lack of a precise local flint source to use as a control for the database construction. Furthermore, the variability inherent in the materials collectively termed 'bloodstone' makes the characterisation of this rock more difficult. The features initially noted as being indicative of bloodstone vary both in their frequency and in their visibility. Moreover, the alteration caused by weathering and abrasion on the archaeological artifacts compounded the problems of material identification to the extent that the analysis could not proceed without an examination of that alteration.

THE EXAMINATION OF SURFACE ALTERATION B FINLAYSON

The surface appearance of many of the artifacts shows considerable alteration when compared to the parent rock. In the commonest form of alteration the artifact turns a uniform white or cream colour, and the original hue only survives as a tiny central core. Both bloodstone and flint suffer from this type of alteration, but the change varies in degree throughout the assemblage, from pieces apparently 'mint fresh' to those that have lost surface texture, weight, and colour. In addition, the original variability in the native rock adds to the range of colour and texture present, and makes the separation of the different results of weathering difficult. This problem occurs throughout the spectrum of the bloodstone, as differing colours and textures apparently weather at different rates. It was therefore necessary to seek an explanation for the surface alteration, and to examine its varied nature, in order to be able to approach the task of distinguishing between the artifacts of flint and those of bloodstone.

METHOD

A programme of experiments was devised to look at the surface alteration. These were designed to examine the possible causes of the total alteration of the original surface texture together with the loss of weight that is described here as 'abraded'. The experiments included controlled heating (as in the heat treatment of flint for improved knapping properties; Griffiths *et al* 1987), burning, freezing, exposure to chemical attack by acid and alkaline solutions and mechanical abrasion. These treatments were carried out both in isolation and in combination. The precise methods, together with details of the results, are to be found in microfiche (Finlayson mf, 1:G1–G11). Whilst the tests cannot be regarded as replicating the effects of several thousand years of post depositional action, it was hoped that they might give some broad parameters to possible causes of the archaeologically observed surface alteration, as well as information on the original state and material of an altered piece. Most of the sample was bloodstone, with beach pebble flint from the Solway Firth and English chalk flint used as a control.

RESULTS

The programme of experiments failed to produce a totally abraded piece replicating those from the archaeological sample. The closest copies were made by combining heat, acid and mechanical abrasion, with heat apparently the most important element and abrasion the least. Individual size did not apparently affect variation of weathering. The principal cause of difference appeared to be the original textural variation. Despite its initial appearance, the coarse-grained bloodstone was not so prone to alter under any of the weathering processes as the finer-grained material. In addition, none of the bloodstone weathered as rapidly as the flint. However, against these general trends, some pieces of identical appearance, including some from the same block, did show variation in the rate of weathering, even under the same sequence of experimental events. Differences in the surrounding matrix (eg the depth of the piece in the experimental sand bath) may, in part, account for this, particularly in the case of burning, where fragments may have been located in different parts of the original block.

An interesting result of the experimental work was the light that it shed on the archaeological recognition of burnt pieces. The number of experimentally burnt pieces that showed the classic characteristics of burning, as used during classification on site (ie heat spalling, a colour change to white, and crazing) was surprisingly low. The highest proportion came from shattered pieces that had been heated to 600° C for 100 minutes and cooled rapidly. Even then, only 11% of these burnt pieces would have been identified using the on-site criteria (total sample = 1241). The 'burnt' pieces recognised during excavation must therefore be seen as a minimum quantity.

THE CHARACTERISATION OF THE RAW MATERIALS B FINLAYSON

In view of the technical problems involved in the identification of the raw material, it was decided to examine further the usefulness of hand inspection as a method of distinguishing bloodstone from flint. A list of visual attributes was drawn up which took into account the characteristics of surface alteration.

THE SELECTION OF ATTRIBUTES

After description each piece was assigned to a material, and a degree of certainty was given; pieces that could not be identified were classified as ambiguous. The attributes could then be assigned levels of significance. Some attributes were only associated with clearly identifiable examples of one of the two raw material types. Other attributes were less certainly associated, but in these cases the relative associations of the different attributes were of use. For example, the presence of fossils was taken to indicate flint; frequently associated with these fossils was a particular form of cortex (rounded and battered, typical of beach pebbles), and this cortex was never associated in the sample with any of those attributes distinctive of bloodstone. Pieces without fossils but with this cortex were therefore described as 'probably flint'. This identification was supported by the hypothesis that the bloodstone nodules collected from Guirdil beach were only slightly abraded, whilst the flint cortex was the result of prolonged battering. Out of the reference sample of bloodstone from Guirdil Beach only one piece showed any development of a heavily abraded cortex. Furthermore, these 'probably flint' pieces had a particular colour and texture of weathering which was never noted in conjunction with any evidence of bloodstone. Pieces with this colour alone, but with none of the other 'flint' attributes were therefore classified as 'possibly flint': 'possibly' because of the lack of other discriminating features and because the distinction between the various shades of colour in the assemblage was more difficult than the observation of discrete features.

The attributes selected are presented in tabular form (Finlayson mf, 1:G10): several are those listed by Durant (Durant mf, 1:E10–F7).

THE CLASSIFICATION OF MATERIAL BY ATTRIBUTE

The attribute classification was tested on 64 freshly made pieces and applied to a sub-sample of 1600 of the archaeological pieces. From this a rapid sorting system was developed which, given the constraints of any visual examination of material, was considered to be acceptably accurate (Finlayson mf, 1:G1–G9). The isolation of significant attributes meant that a piece could be classified as soon as any one of these attributes was observed. In this way, three separate samples of the archaeological material were classified:

- the material from the 1984 wet-sieved sample-quadrats
- the material analysed for technological detail
- the modified artifacts.

DISCUSSION

Whilst this method is considered sufficient for the identification of the raw materials at Kinloch, alternative methods that would provide more absolute evidence do exist, but all have problems of expense and speed (see above). Now that a sample of the assemblage has been assigned to material categories it should be possible in future to use small sub-samples to test the accuracy of the groupings. In particular, both the 'probable' and the 'possible' categories are based on analogy with pieces of clearly identified material and it would be preferable if more certain methods could be employed. In addition, the processes of surface alteration and the lack of surface discriminating features have hindered visual identification.

RESULTS

THE PLOUGHSOIL SAMPLE: MATERIAL

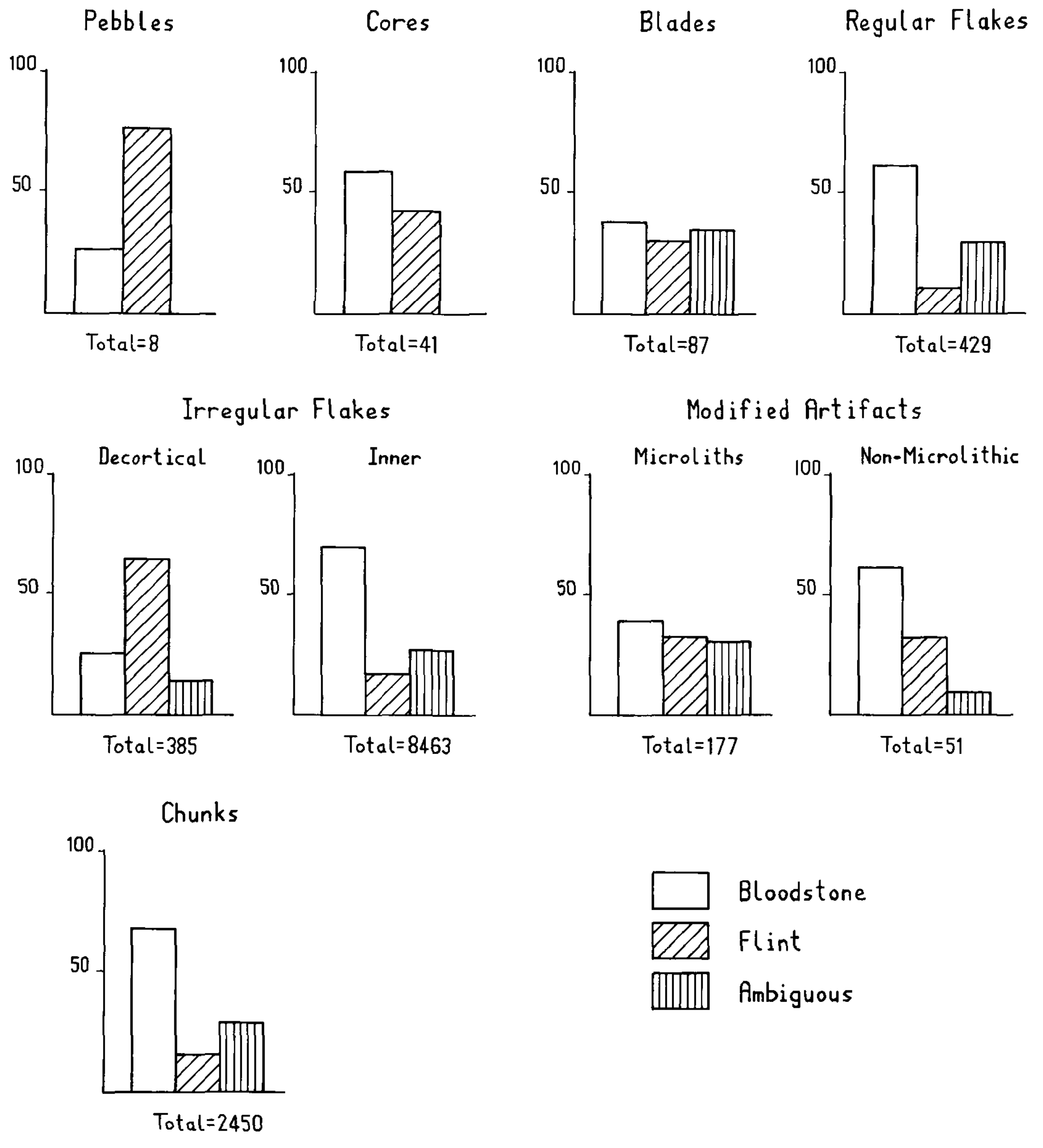
All the material from the 1984 wet-sieved sample-quadrats was classified into raw material categories. This comprised a total of 12,091 pieces of which 137 were neither flint nor bloodstone. Illustration 25 presents a breakdown of this sample by material. From this it is clear that the majority of the assemblage is of bloodstone, in certain categories, however, flint predominates. Amongst the irregular flakes, for example, over half of the inner pieces are of bloodstone, whereas 64% of the decortical pieces are of flint. Both blades and microliths are more often of flint and, although only eight pebbles were recovered, six are of flint. The other retouched artifacts, however, reflect the predominance of bloodstone in the sample. The relative abundance of decortical, irregular flakes of flint may reflect the fact that the presence of cortex aids the recognition of flint, but it is also likely that this reflects the differing reduction strategies used for the two materials (Chapter 6). The relative abundance of flint for blades and microliths is probably also a reflection of the exploitation of the different properties of flint by the prehistoric knappers (Chapter 6).

THE PLOUGHSOIL SAMPLE: BURNING

This analysis suggested that 8% of the sample was burnt, almost twice the number of pieces that were identified as burnt during the on-site classification. As the experimentation showed that many of the pieces subject to intense heat did not develop the classic signs of burning, this must be a minimum figure for the amount of burnt material in the assemblage. There was no evidence for the deliberate heating of material to improve its knapping qualities (Griffiths *et al* 1987). Almost half of the recognisably burnt material consisted of chunks, a strong indication that the fracturing of both bloodstone and flint on heating was a major factor in the formation of irregular material.

THE STRATIFIED SAMPLE: MATERIAL

The second sample studied was that given detailed consideration by the lithic technologist (Chapter 6), namely material from a secure mesolithic context and material from the mixed mesolithic/neolithic deposits. It consisted



ILL 25: The lithic assemblage from the ploughsoil sample, wet sieved quadrats: by type and material.

of 1708 pieces. The detailed results are presented in Chapter 6 with the discussion of the technology to which they relate, but in brief bloodstone was found to dominate, although the apparent superiority of flint for some artifact types (ie blades) was demonstrated. Overall, the highest proportion of flint came from the purely mesolithic assemblage.

THE MODIFIED ARTIFACTS: MATERIAL

All of the modified artifacts were classified by material. The results of this are presented with the discussion of the individual types (Chapter 7). In summary, those based on blade blanks show a dominance of flint, while those based on flake blanks are more likely to be made of bloodstone (Ills 52, 53).

DISCUSSION

It is evident that the two main materials in use for flaked stone tools were selected in different proportions for different purposes, but in no category was this carried out to the extent of excluding either material. At first sight, the use of any flint seems surprising, in view of the free availability of bloodstone on the island, but the flint was generally of better quality than the bloodstone, and thus more suited to the production of some of the artifacts (Chapter 6). The evidence indicates that a pebble source of flint was used (probably beach pebbles), but flint was clearly not as abundant as bloodstone. Both the flint and the bloodstone were locally available, and they were supplemented by a small quantity of other local siliceous rocks. It is clear that the prehistoric knappers made full use of the range of lithic resources of Rhum.

5 THE LITHIC ASSEMBLAGE: DEFINITIONS AND COMPOSITION

INTRODUCTION

The excavations yielded an assemblage of 138,043 pieces of worked stone. This represents only a fraction of the stone debris that littered the site as a result of the manufacture and use of stone tools throughout its prehistoric occupation. The analysis of this material has been complicated by two factors: firstly, two widely separated periods of occupation were revealed; secondly, the site was not fully excavated so that the assemblage is only a sample of the material originally deposited there.

There are three broad stratigraphic categories from which material was derived:

- 'mesolithic': anthropogenic features dating from the mid ninth to the mid eighth millennium BP
- 'neolithic': mixed anthropogenic and natural features dating from the late fifth to the late fourth millennium BP
- 'ploughsoil': a mixed anthropogenic horizon of recent origin.

Much of the assemblage must have been laid down in the earliest period, with the result that material from this phase has contaminated the later deposits, whilst the third horizon contains material from both earlier periods.

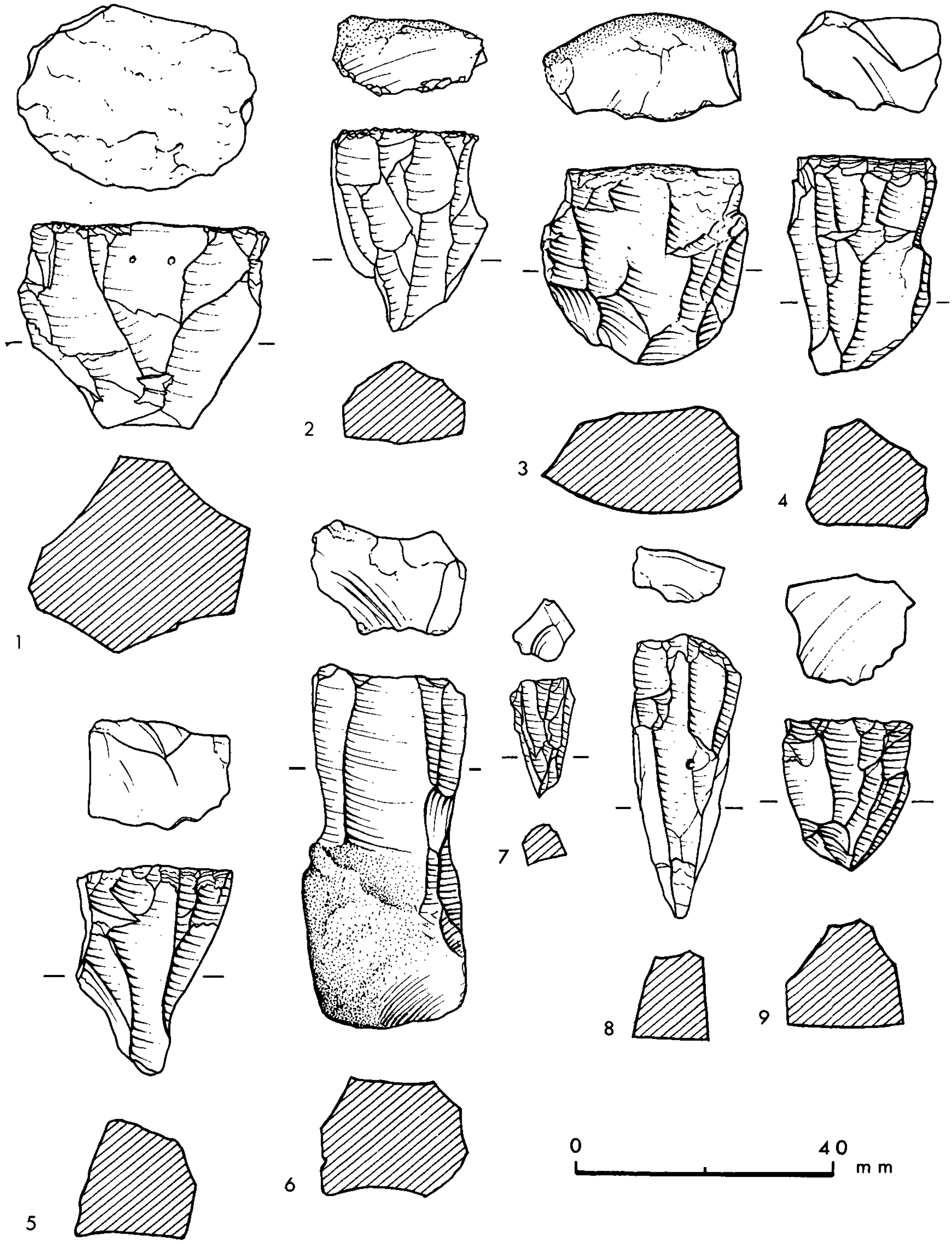
The recovery methods employed for each of these stratigraphic categories have already been described (Chapter 2). In order to prepare the initial, on site, catalogue the whole assemblage was treated alike, and the definitions used for this and for all subsequent analysis are presented below.

The initial catalogue divided the assemblage into basic types (Tab 2) and enabled a general picture to be built up. As the problems of distinguishing bloodstone from flint were not resolved until the detailed post-excavation analysis (Chapters 4 and 6), the two materials were considered as one for the initial catalogue, and they were called chalcedony. Once an adequate method of distinguishing between the two materials had been formulated, then specific samples of the assemblage were sub-divided and so, in the post-excavation analysis, the use of bloodstone could be compared to the use of flint (Chapters 6 and 7).

DEFINITIONS

The following list is intended as a tool to clarify the interpretation of the lithic catalogue, and the sections on specialised lithic analysis. Lithic specialists may sometimes impart specific nuances of meaning to their use of particular terms, and so it is necessary to know the precise meaning of the terminology used to describe any assemblage. The definitions given here are those that were used for the analysis of the lithic material from Kinloch; though they are specific to Kinloch, the list is presented with a view to its potential use in the analysis of material from similar sites. Some terms are not included here, these are terms for which there is less scope for variety in interpretation. Clear definitions of these may be found in Tixier *et al* 1980, and these are the definitions followed by those working on the material from Kinloch.

1 Knapping is the process of flaking stone for the manufacture of tools; it refers to both primary and secondary technology.
2 Primary Technology is the first part of the systematic process of stone tool production: nodules of raw material are prepared into cores and then used for the manufacture of flakes and blades. Many blades and flakes may be used as functional tools in their original form.
3 Secondary Technology is the second part of the tool production process: selected blades and flakes are modified into specific tool types. For the Kinloch analysis these types are defined by attributes relating to both technology and morphology.
4 Reduction Technique is the specific way in which force is applied to the raw material during tool manufacture. This may be through percussion, pressure, or grinding. Percussion may be direct (hammer on to core), or indirect (hammer to punch to core). Hammers may be hard or soft.
5 Reduction Method is the overall process through which knapping is achieved. This may involve the application of several different reduction techniques (Pélegrin 1982, 65).
6 Platform Technique is a reduction technique used in primary technology in which percussion is applied at an angle to the platform of a core. The core may be freely supported or supported on an anvil.
7 Bipolar Technique is a reduction technique used in primary technology in which percussion is applied to the top of the core. The core is always supported on an anvil.
8 *Hard Percussion is a reduction technique in which the* implement used to transfer force to the core is of approximately the same hardness as the worked material. Force is normally direct. Relevant technological attributes include: a large, pronounced bulb of force; clearly visible ripples; radial fissures from the point of impact; bulbar scars.
9 Soft Percussion is a reduction technique in which an implement softer than the worked material is used. It may be direct or indirect. Relevant technological attributes include: a diffuse or flat bulb of force; a platform lip at the edge of the ventral surface.
10 Bulbs of Force have been divided into the following types:
   10.1 Diffuse Bulbs: slightly domed, poorly developed with no ripples or radial fissures.
   10.2 Flat Bulbs: a flat ventral surface with no sign of a bulb and no other identifiable attributes.
   10.3 Pronounced Bulbs: a prominent bulb with readily identifiable ripples.
11 Orientation: during examination artifacts are always held with the dorsal face uppermost and the proximal end towards the observer (and illustrated as such).
12 Dimensions are recorded in millimetres in the order: length: width: thickness.
   12.1 Length is the measurement taken along a line at 90° to the platform of the piece.
   12.2 Width is the measurement taken across the widest part of the piece, at 90° to the length and in the same plane.
   12.3 Thickness is the measurement taken from the ventral surface to the highest point of the dorsal surface along a line perpendicular to both length and width.
13 Primary Material: artifacts with cortex platforms and cortex over the dorsal surface.
14 Secondary Material: artifacts with flake platforms but some cortex over the dorsal surface.
15 Inner Material: artifacts with no surviving cortex surfaces.
16 Decortical Material: primary or secondary removals used to open and shape a nodule.
17 Pebbles are lumps of raw material from which one or two flakes may have been removed at random.
18 Cores are lumps of raw material from which a sequence of removals has been taken. They have been classified into four types:
   18.1 Bipolar Cores: cores from which removals are made by the splitting of the parent nodule by the bipolar technique. At Kinloch the bipolar cores did not develop flat platforms.
   18.2 Platform Cores: cores from which removals are taken from the side of the core by use of the platform technique.
   18.3 Disc Cores: cores from which removals are taken from alternate faces of the core by applying percussion to the core edge. In this way the negative scar of a previous removal becomes the platform for the next removal. These cores are freehand supported.
   18.4 Amorphous Cores: cores from which removals have been made in no regular fashion.
19 Blades are long thin removals with parallel, straight sides and acute edges. They are knapped by a specific reduction method known as blade strategy.
20 Regular Flakes are removals with a minimum of 10mm of regular acute edge. They are wider than blades and do not require the use of a blade strategy. *They are, by definition, always over 10mm in either* length or width.
21 Irregular Flakes are removals with no regular edge. They may be large or small and are frequently chunky in aspect. This category includes all flakes of less than 10mm maximum dimension.
22 Chunks are removals with neither platform nor ventral surface. They are generally the unintentional by-products from knapping. They may be large or small.
23 Modified Pieces are artifacts that have been modified after primary reduction by the use of secondary technology. At Kinloch this was always done by retouching. The individual types of modified piece found at Kinloch are fully described in Chapter 7.
24 Blanks are pieces (generally flakes and blades, but sometimes cores or chunks) that have been selected for modification. No unmodified blanks were identified at Kinloch, but the reconstruction of the predominant types of blank that were selected for the different modified pieces was of interest.
25 Debris is a by-product of knapping: that material which inevitably results from the knapping process but which was not the goal of that process. Some debris may be suitable for use with or without modification.
26 Debitage: is debris that was not suitable for any further purpose, material discarded immediately upon the end of the knapping exercise. It includes much very small material.
27 Tool: the term tool is a subjective term reserved for pieces (whether modified or not) considered to be potentially of use as manipulated artifacts. The term, therefore, includes both unretouched blades and regular flakes, as well as retouched artifacts; in addition a core may become a core tool.



ILL 26: The lithic assemblage, cores: 1–9 platform cores.

COMPOSITION

The total composition of the assemblage may be seen in Table 2; the individual types, their production and the raw material from which they derive are discussed in detail below.

Type	Chalcedony	Quartz	Agate	Silicified Limestone	Volcanic Glass	% Cortex	Total
PEBBLES	91	12	17			100	120
CORES							
Bipolar	267	11	2			12	1252
Platform	929	8	1			34	
Disc	7					28	
Amorphous	26		1			34	
BLADES	2572	3				3	2575
REGULAR FLAKES	13230	150	8	18	2	8	13408
IRREGULAR FLAKES	104944	444	151	50	2	6	105591 (69% <1cm)
CHUNKS	13364	40	82		2	17	13489
MODIFIED ARTIFACTS							
Microliths	1155						1155
Non-Microlithic	452			1			453

Table 2: The total lithic assemblage: composition by type and material.

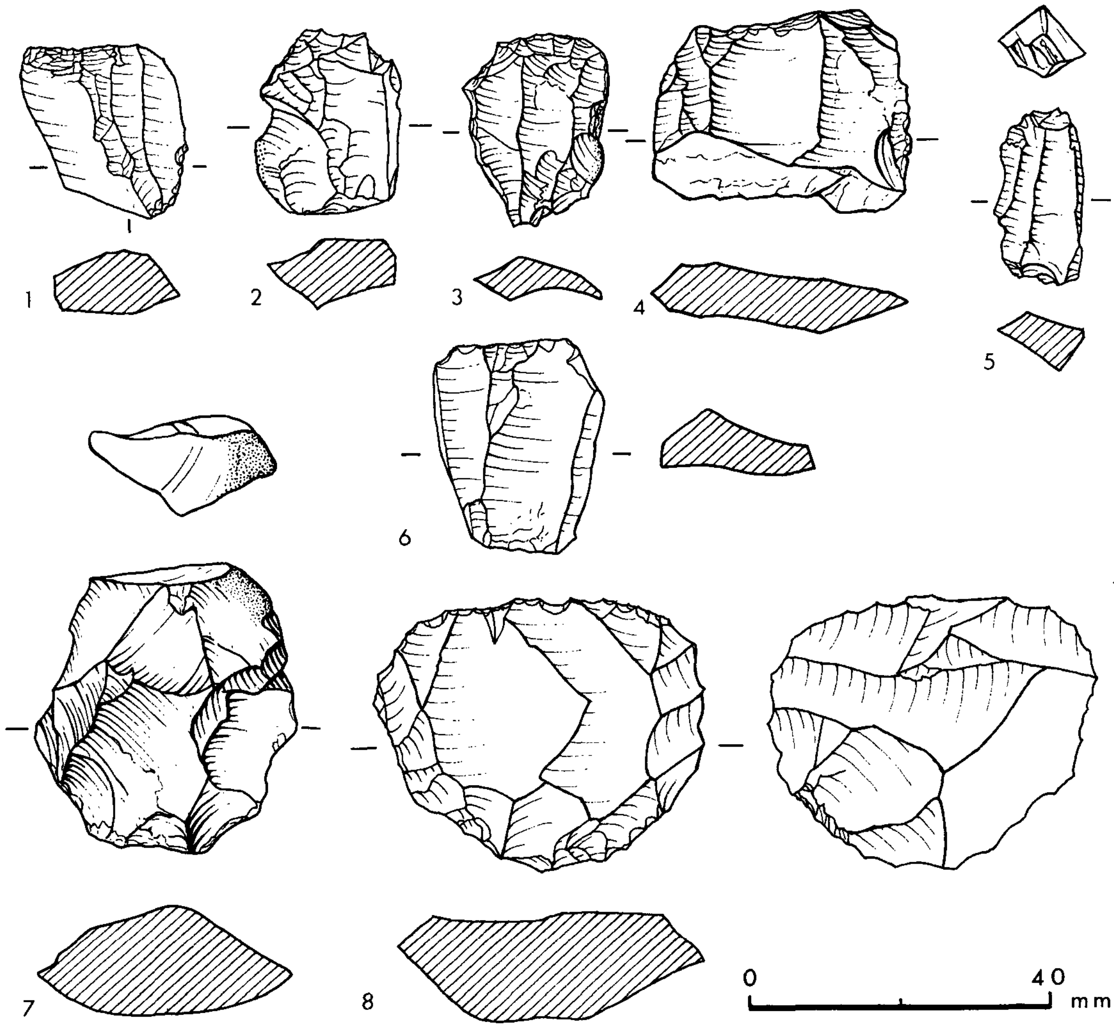
PEBBLES

The 120 pebbles represent less than 1% of the total assemblage. The majority are of chalcedony (82%), while the remainder are of quartz or agate; all are small. In many cases one or two flakes have been removed from the pebbles, and thus they may represent raw material that was never utilised.

CORES (Ills 26, 27, 28)

Cores represent 1% of the assemblage. There are 1252 in all, the majority are platform cores (75%), in addition 22% are bipolar cores, and there are a few disc cores (a total of 7), as well as 27 amorphous cores. Both the bipolar and the platform cores tend to have all of the cortex removed and, although this is clearly a result of the reduction strategy, it may also be related to the small size of the original nodules. A total of 146 (16%) of the platform cores have two platforms, the majority of the rest have single platforms. Some of the cores were large enough to have been further reduced, but analysis done by Oliver (1987) demonstrated that most were worked until they were quite small and that there was little difference in the mean length at discard between the different types of core (Tab 3). This suggests that platform and bipolar cores were both reduced until they were too small to produce useful flakes or blades, and that the bipolar technique was used in its own right and not just as a method for working out exhausted platform cores (Chapters 6 and 14). However, 10% of all cores were apparently discarded because of the develop-

ILL 27: Platform core of agate; scale 2:1 (Photograph – I Larner).



ILL 28: The lithic assemblage, cores: 1–6 bipolar cores: 7–8 disc cores.

ment of step fractures. These can be due to knapper error or to flaws in the raw material, and they usually lead to the premature abandonment of a core.

CORE TYPE	MEAN LENGTH AT DISCARD (mm)
Platform	27
Bipolar	25
Amorphous & Disc	26

Table 3: The lithic assemblage: core lengths at discard.

BLADES (Ill 29)

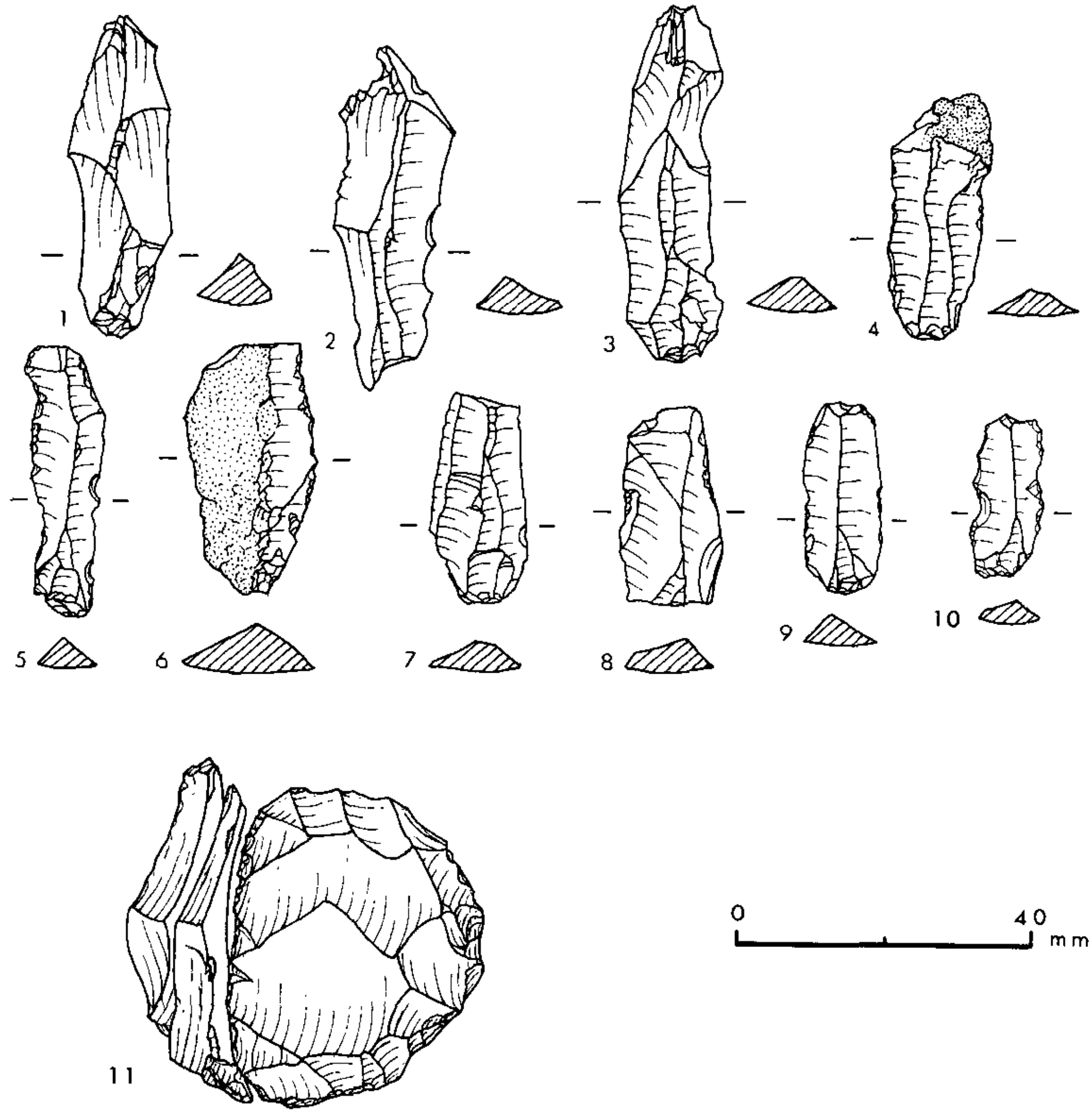
There are 2575 blades, 2% of the assemblage. With the exception of three quartz blades, all are of chalcedony. 96% are inner; there are 88 secondary blades and 3 are primary; only 8 crested blades were recovered. It would seem that the nodules could readily be flaked into blade cores without recourse to the preparation of an artificial crest. The manufacture and alteration of the blades is dealt with in more detail in Chapter 6.

REGULAR FLAKES

Regular flakes make up 10% of the assemblage, there are 13,413. The majority (98%) are of chalcedony; there are also some of quartz and a very few of siliceous limestone, agate, and volcanic glass. There are few primary flakes, and only 7% are secondary, most flakes are inner. Some derive from core trimming (75) or core rejuvenation (15), but these may be under-represented as the rapid count made their recognition difficult.

IRREGULAR FLAKES

There are 105,597 irregular flakes, 76% of the assemblage. The majority (99%) are of chalcedony; others cover the whole range of materials exploited. There are few secondary or primary flakes; 95% are inner.



ILL 29: The lithic assemblage, blades. 11 is a refit of blades 1 and 2 to core 26.8.

Included here are one core rejuvenation flake and 25 core trimming flakes. As this category is defined by small size as well as by irregularity of edge, it incorporates both irregular flakes whether large or small and tiny regular flakes. The category was created in an attempt to cover the by-products of knapping, but because it was not subdivided many different by-products lie within this broad class, eg both tiny retouching flakes and larger trimming flakes. During the more detailed analysis of the assemblage the irregular flakes that were of less than 10mm in maximum dimension were separated out and counted in an attempt to get more information from the variety within this category but, although the presence or absence of such small pieces did prove to be of interest in places, there was not time to examine this small debitage in detail and divide it into constituent types. Work done elsewhere has shown that this could be of great interest (Clarke 1986; Newcomer & Karlin 1987).

CHUNKS

10% of the assemblage are chunks, 13,490 pieces in total. A few are of quartz and agate, and there are two of volcanic glass, but over 99% are chalcedony. This may reflect the difficulties of recognising artifactual debris of quartz and agate some of which is likely to have been discarded as natural. Most of the chunks (83%) are inner pieces.

MODIFIED PIECES

Only 1% of the assemblage is modified, a total of 1,608 artifacts. The modified pieces fall into two categories: microliths and others. This distinction is based both on the size of the artifact and on the nature of the modification. Tables 4 & 5 present a general breakdown of the artifact types involved, and each is described in detail in Chapter 7.

SCRAPERS	
Simple	79
Angled	86
Concave	25
Resharpening Flakes	17
Broken	21
BORERS	56
EDGE RETOUCHED ARTIFACTS	
Simple	26
Complex	33
Broken	38
RETOUCHED BLADE SEGMENTS	7
INVASIVE POINTS	
Complete Leaf Shaped	3
Complete Barbed & Tanged	1
Broken Leaf Shaped	4
Basal Fragments	3
Tips	2
Miscellaneous Fragments	3
BURINS	
Tool	1
Spall	1
MISCELLANEOUS	
Complete	15
Broken	31
GUNFLINT	1

Table 4: The lithic assemblage: modified artifacts, non-microlithic types.

Microburins	33
Lamelles à Cran	6
Obliquely Blunted	16
Backed Bladelets	144
Scalene Triangles	158
Crescents	53
Double Edge Crescents	11
Rods	8
Fine Points	18
Invasive Points	2
Fragments	706

Table 5: The lithic assemblage: microlithic artifact types.

SUMMARY

The initial classification suggested that the site contained evidence for both the manufacture and the use of stone tools. The evidence for manufacture consisted of the quantities of knapping debris: cores; core trimming and rejuvenation flakes; irregular flakes; and chunks. Evidence for use lay in the modified artifacts and in the blades and regular flakes many of which were doubtless used without modification. The modified artifacts included scrapers, borers, bifacial points, and a variety of microliths. A number of factors suggested that some of these, at least, had been used (Chapter 8).

6 THE LITHIC ASSEMBLAGE: PRIMARY TECHNOLOGY

P ZETTERLUND

INTRODUCTION

Examination of the primary technology was concentrated on well-stratified mesolithic material from Trench AD. No unmixed neolithic contexts were discovered, but material from mixed mesolithic/neolithic contexts was examined to establish whether any technological differences could be determined over time. Work on the raw materials (Chapter 4) meant that bloodstone and flint could be differentiated for this analysis, so that the relative use of the two materials could also be assessed.

A technological study is concerned with the analysis of the techniques and methods used to reduce lithic material to blanks and tools (Callahan 1987). Specific definitions pertinent to work on the Kinloch assemblage are presented in Chapter 5. It should be emphasised, however, that exceptions to these definitions will be found in any assemblage: fracture morphology is not rigid in any material, so small assemblages may yield misleading interpretations.

SAMPLING THE MESOLITHIC MATERIAL

The mesolithic features in Trench AD comprised a series of pits (Chapter 4, Ill 10). Although three different phases were distinguished, the material was treated as a single unit for the technological analysis, so that overall patterns could be seen. In fact, the lack of erosion surfaces between fills suggests that there was little time separation between phases and, indeed, a general examination of the lithic contents of the different phases made after completion of the analysis did not reveal any significant differences between them.

THE ARTIFACTS EXAMINED

TYPES

The material included both modified and unmodified tools, as well as debitage. Although this analysis was concerned with the primary technology, the debitage was not considered because of time restrictions. Table 6 presents a breakdown by type of the artifacts used for the analysis. From this it is clear that there were so many regular flakes that not all could be studied. However, there were few primary or secondary flakes and, in order to obtain sufficient for analysis, all of these were included, but only 50% of the inner regular flakes (a 50% random sample from each context). The total sample of regular flakes amounted to 54%. This method of sampling was considered to be appropriate because the overall analysis was dependant on the recognition of general trends of attributes among the different artifact types. Furthermore, subsequent comparison of the sample with the remaining material did not reveal any significant differences, so that the material selected may be considered to be representative of the mesolithic assemblage as a whole.

RAW MATERIALS

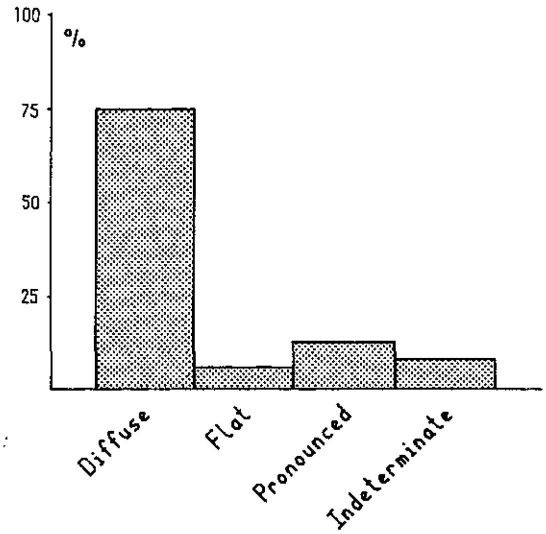
Only the flint and bloodstone artifacts were examined.

THE CONDITION OF THE ASSEMBLAGE

Many of the pieces showed severe surface alteration (mainly abrasion and loss of colour). It was almost impossible to recognise individual morphological and technological attributes on these pieces, and they were excluded

TYPE	TOTAL	% EXAMINED
CORES		
Platform	14	100
Bipolar	6	100
BLADES		
Decortical	6	100
Inner	263	100
REGULAR FLAKES		
Decortical	74	100
Inner	942	50
MODIFIED ARTIFACTS		
Microliths	113	100
Non-Microlithic	14	100

Table 6: Trench AD, mesolithic sample: lithic artifacts used for technological analysis.



ILL 30: The lithic assemblage, mesolithic sample: bulb types.

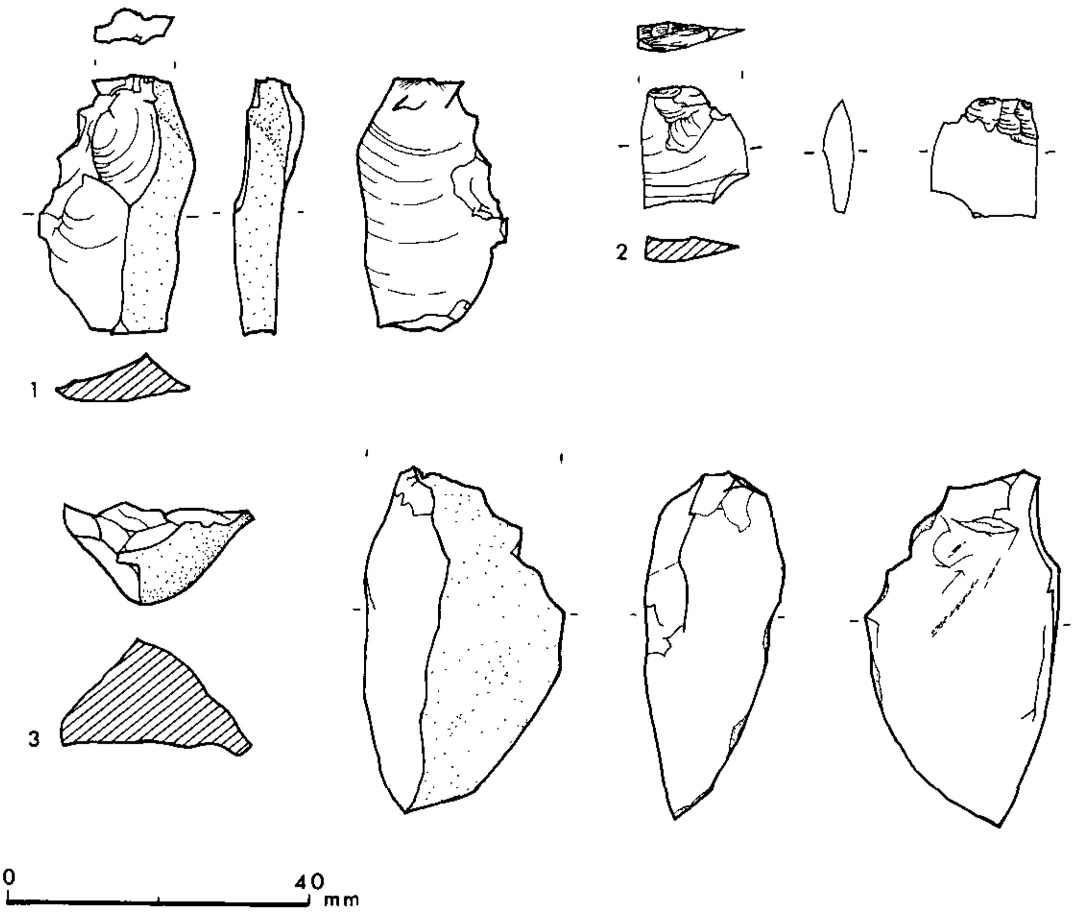
from the analysis. This comprised 27% of the blades; 31% of the sampled regular flakes; 4% of the cores; and 11% of the microliths, and it included all pieces of ambiguous material (Chapter 4). The condition of the retouched artifacts posed a problem as there were only fourteen in total, six of which showed some surface alteration. This group was so small that it could only be used for comparisons of artifact size.

THE ANALYSIS OF REDUCTION TECHNIQUES

There are several features which are commonly held to indicate the reduction technique used in the production of any lithic artifact. Bulb type, in particular, is often cited as distinctive of the way in which force is applied to the core. In the sample under examination, three kinds of positive bulbs were identified, and there were also a number of blades with unclassifiable bulbs in which platform crushing had removed a significant part of the bulb. Amongst the bulb types, diffuse bulbs predominated on both blades and flakes of flint and bloodstone (Ill 30). As both diffuse and flat bulbs generally indicate the use of soft percussion, the abundance of both point to this as the main reduction technique, and this is supported by the presence of a platform lip on a few pieces. Nevertheless, there were a number of pronounced bulbs in the assemblage, and these would usually be associated with the use of a hard technique. However, the relationship between the hard and soft techniques is both complex and varied, and the technological attributes once thought to be characteristic of the hard technique (Knutsson 1981; Madsen 1978) should be re-examined; not only are there always exceptions to the norm, but also bulb type is affected by many factors other than the type of percussor, eg:

- amount of force;
- flaking angle on impact;
- material structure;
- platform preparation on the core edge;
- platform size/mass at the proximal end of the removal.

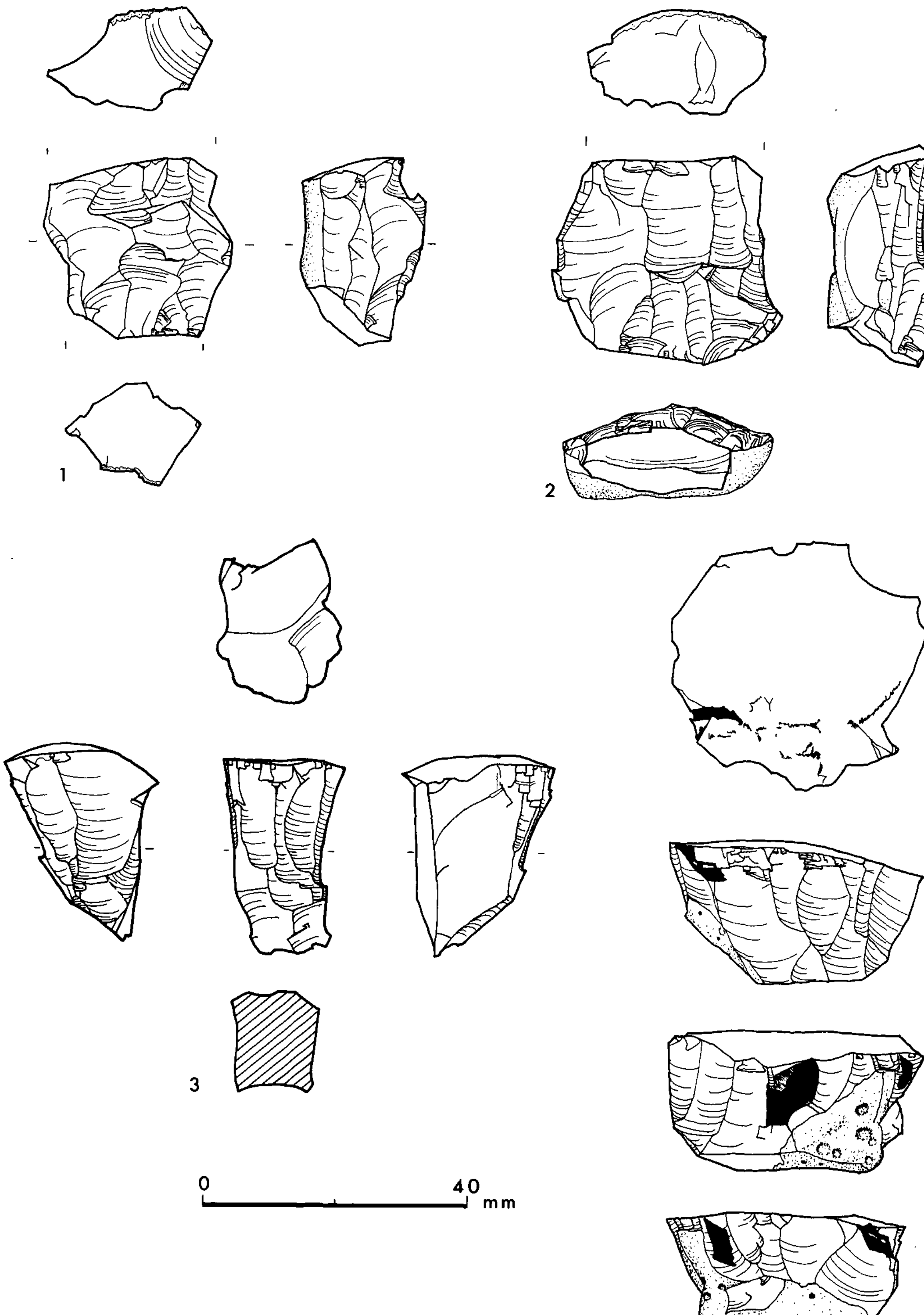
Of these, the first two are more or less impossible to register in any lithic assemblage. The ring cracks to be seen on 13 pieces in the sample may reflect increased force, but they do not correlate with a particular bulb type and so they are hard to interpret. The structure of the material is of more interest at Kinloch as two quite different materials were used, and the flint blades and flakes do show a significantly larger number of pronounced bulbs than do those of bloodstone. This may



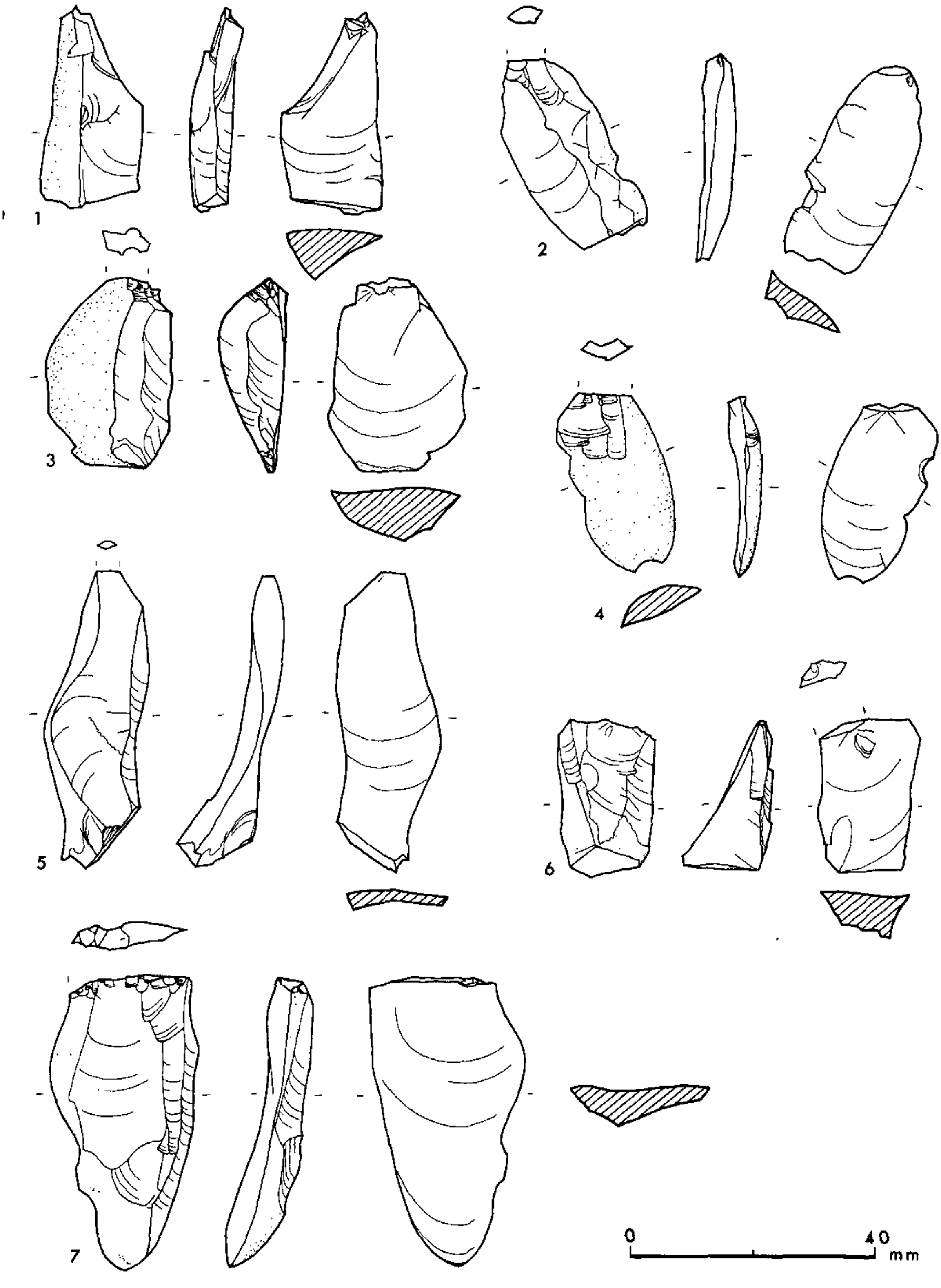
ILL 31: The lithic assemblage, mesolithic sample: flakes. 1 platform edge preparation: 2–3 high speed fractures. 1 & 3 bloodstone: 2 flint.

be due to the different fracture dynamics of bloodstone, but detailed experimental work is needed to clarify this matter and it was not possible within the project. The fourth factor (core edge preparation), is associated with the fifth (platform size/mass). Core edge preparation may result in a relatively thick proximal end (Ill 31.1) because a harder blow is needed to remove a flake from a prepared edge, and the point of impact must lie well back from the face of the core. If the mass of the platform edge is too great, or if the wrong flaking angle is used, then the force of the blow may disappear into the body of the core and split it with a plunging, overshot fracture. Bearing these factors in mind, the conclusion must be that soft percussion was used at Kinloch, and that this produced some attributes normally associated with hard percussion.

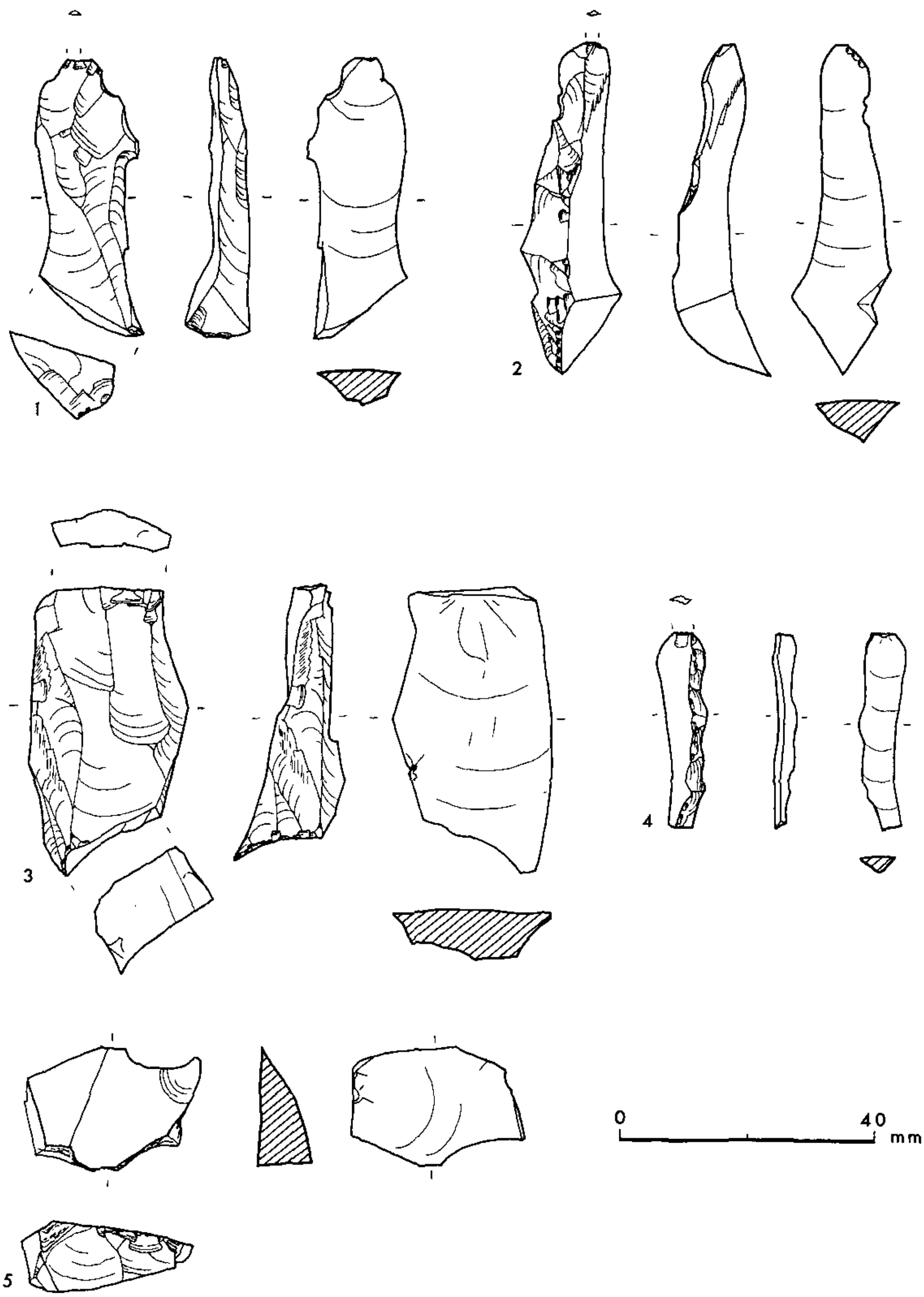
Soft percussion may be direct or indirect (in contrast to hard percussion, which is almost always direct), and it is difficult to determine whether a soft baton was used as a percussor (whether direct, or indirect in combination with a punch), or as a pressure tool. At Kinloch the morphology of the platform cores argued strongly against the use of pressure (Ill 32), and this is supported by the lack of typical pressure blades in the assemblage. As for the use of indirect percussion, there is no definite evidence of the use of punches in the assemblage. Much material is fragmented (c. 60% of both blades and flakes), and this may be caused by indirect percussion, but it could also result from other factors such as intentional breakage, use-wear, or post-depositional pressures. In general, therefore, the evidence suggests that both blades and flakes were produced by direct, soft percussion. This is supported by the small size of the surviving platforms, particularly on the blades. 76% of the blades and 30% of the flakes have platform remnants that are less than 1mm wide (Ill 33. 3–4): evidence that the platform was struck very close to the edge. In some cases the



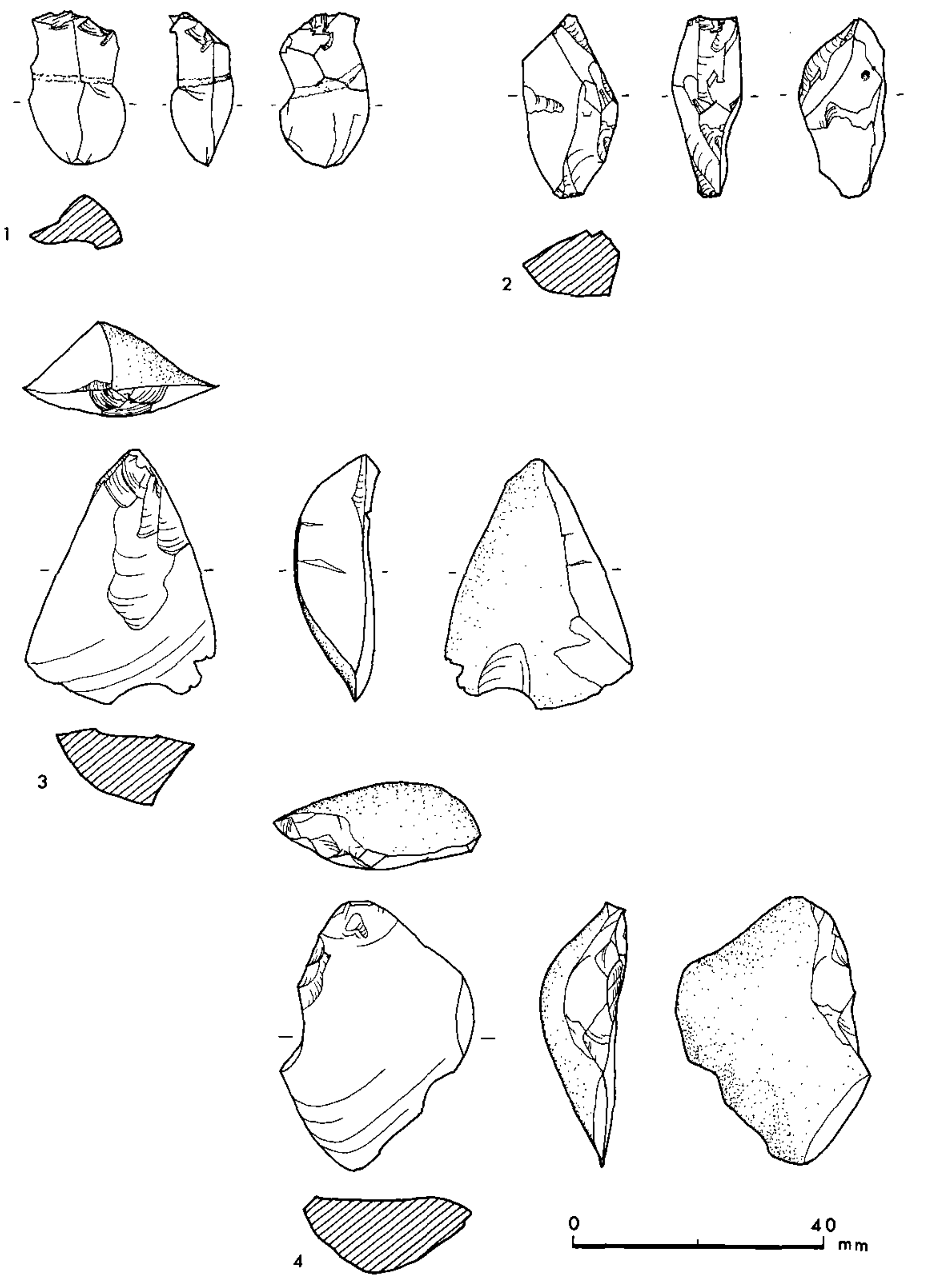
ILL 32: The lithic assemblage, mesolithic sample: platform cores. 1–2 double platformed cores: 3–4 conical platform cores. 4 bloodstone: 1–3 flint.



ILL 33: The lithic assemblage, mesolithic sample: flakes and blades. 1–4 with prepared platform margin: 5–7 overshot blades. 1. 4–5 bloodstone: 2–3, 6–7 flint.



ILL 34: The lithic assemblage, mesolithic sample: flakes and blades. 1 & 3 removals with two platforms: 2 & 4 crested blades: 5 platform rejuvenation flake. 1 & 3 bloodstone: 2, 4–5 flint.



ILL 35: The lithic assemblage, mesolithic sample: cores and flakes. 1–2 bipolar cores; 3–4 flakes with cortex platforms. 1–3 bloodstone; 4 flint.

platform had collapsed altogether, possibly because of deficient preparation as well as the impact of the force being too near to the platform edge. Collapsed platforms are a fairly common phenomenon when direct soft percussion is used.

The type of core preparation also supports the argument for soft percussion. Preparation consisted of the simple removal of the small overhang formed between detachments, and it is best described as a light retouching of the platform margin (Ill 33. 1–4). Furthermore, there are 8 high-speed fractures, where the removal (whether blade or flake) has been split down the flaking axis (Ill 31. 2–3). These are usually considered as indicators of the use of direct percussion. Given the evidence for the use of direct soft percussion, there are sandstone percussors from the site that may have been used (Chapter 9; Ills 79, 80). If so, the use of a medium-hard stone might explain the existence of some technological attributes more commonly considered to be indicative of hard percussion.

REDUCTION METHOD AT KINLOCH: THE MESOLITHIC EVIDENCE

The reduction method employed for the production of any lithic assemblage may combine a number of different reduction techniques. The technological attributes of the individual artifact types in the assemblage may be used as indicators of the various techniques used to make the different tool types.

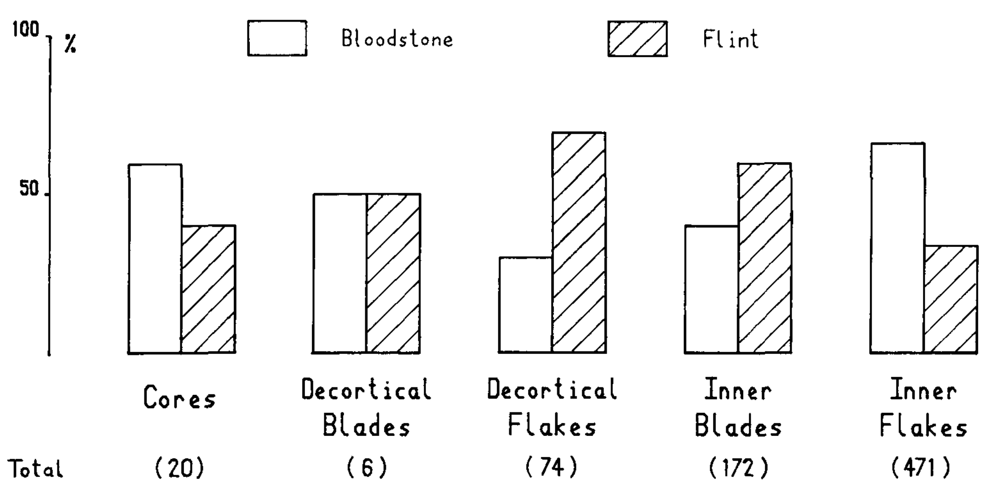
Both bloodstone and flint, were available on Rhum as beach nodules of varying quality (Chapter 4). The relationship between the two materials may be summarised as follows: the quality of flint was high, but the nodules were small; bloodstone was available in larger nodules, but they were generally of inferior quality. In practice this means that the manufacture of any artifacts longer than c.50mm was difficult.

TYPES

CORES

Flint.

There are no certain bipolar cores of flint. Six of the eight flint cores are platform cores. The other two cores are based on flakes; they have few removals, and it is possible that they were intended for further reduction by the bipolar method. Four of the platform cores were double platformed (Ill 32. 1–2), and the other two are conical blade cores (Ill 32.3). The platform cores all have evidence of platform preparation, and the mean flaking angle is 70°. Three were used for blades alone, and the others for a



ILL 36: The lithic assemblage, mesolithic sample: artifact types by material.

mixture of blades and flakes. All were abandoned because of knapping faults (the formation of step and hinge fractures); although, as they were of similar length when discarded (30mm), they may have been knapped to their limit.

Bloodstone.

There are seven platform cores and five bipolar cores of bloodstone. The platform cores are more varied than those of flint, and they have relatively large platforms in relation to their length (Ill 32.4). Although all of them have only one platform, some of the bloodstone flakes and blades indicate that cores with opposed platforms did exist (Ill 34.1–3). Only three platform cores show signs of platform preparation, but the mean flaking angle is still 70°. The majority of these cores were used for both blades and flakes, but some were apparently used to produce flakes alone. Most were abandoned when inclusions made further flaking impossible, and only one was discarded because of flaking fractures.

The five bipolar cores were all made of relatively high quality bloodstone. They are typical of this type of core (Ill 35. 1–2), and one is based on a flake (Ill 35. 2). Two were abandoned because of inclusions, the rest show no obvious flaws and had probably been worked as much as was practical.

DECORTICAL FLAKES AND BLADES

The sample contains a number of decortical flakes and blades. Those with platforms of cortex were detached at the beginning of reduction (Tixier *et al* 1980, 86) and they may be called 'nodule opening flakes' (Ill 35. 3–4). Other flakes with cortex originate from the removal of irregularities on the nodule and from the shaping of cores (Ill 33. 1–3). All tend to be large and thick, of concave profile, and of varying shape with large platforms and little edge trimming. There are many more decortical flakes and blades of flint, than of bloodstone (Ill 36). Decortical blades, of which there are only six, probably represent blades detached in the initial stages of reduction in order to create ridges for blade manufacture proper.

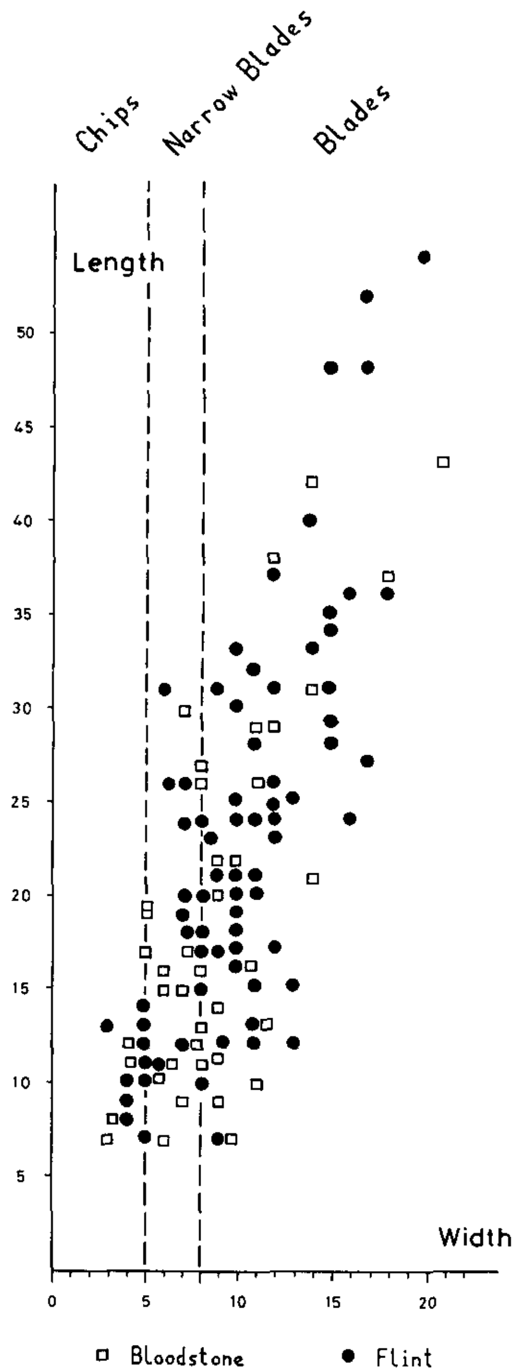
OVERSHOT FLAKES AND BLADES

Overshot flakes and blades may either be a deliberate feature of the core production process (Tixier *et al* 1980, 94) or they may be accidental (usually when the misdirection of the blow results in the removal of the base of an existing core). There are far more overshot blades and flakes of flint than of bloodstone, and most result from core shaping (Ill 33. 7). One removed a fracture to repair a core, and two appear to be knapping mistakes which have removed part of an opposed platform (Ill 33. 5–6).

The overshot blades are amongst the longest blades, and as such they may indicate the maximum length of prepared cores, ie 50mm for flint and 40mm for bloodstone.

CRESTED BLADES

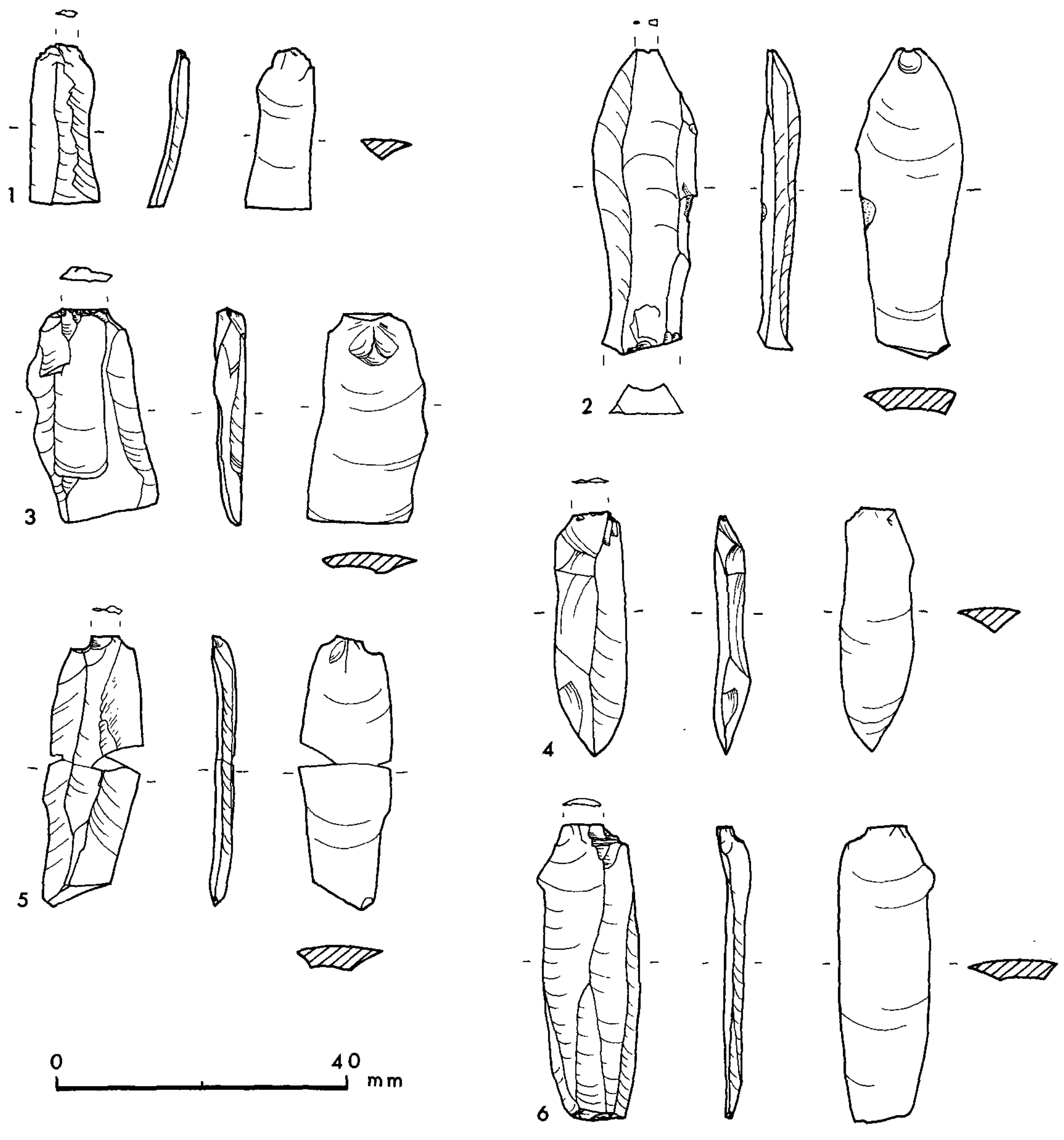
There are two crested blades, both of flint (Ill 34. 2 & 4). They were used to prepare ridges down the side of a core to guide blade production. Neither is a true crested blade (on which the ridge is formed by alternating flakes). Both have been produced to straighten a natural pre-existing ridge. One is overshot and was used to shape the base of the core as well as its sides. Both have platforms isolated by careful edge trimming.



ILL 37: The lithic assemblage, mesolithic sample: blade types. Dimensions in mm.

PLATFORM REJUVENATION FLAKES

There was only one platform rejuvenation flake within the sample (Ill 34.5); it was struck from the side of the core and reduced the core length by 10mm.



ILL 38: The lithic assemblage, mesolithic sample: blades. 2, 4, 5 bloodstone: 1, 3, 6 flint.

BLADES

Blades have been divided into three groups (Ill 37) on the basis of the size of unmodified, as compared to modified, blades:

1 Blades with a width exceeding 8mm: blades
2 Blades of width between 5–8mm: narrow blades
3 Blades below 5mm in width: chips

1 Blades (Ill 38. 1–6):

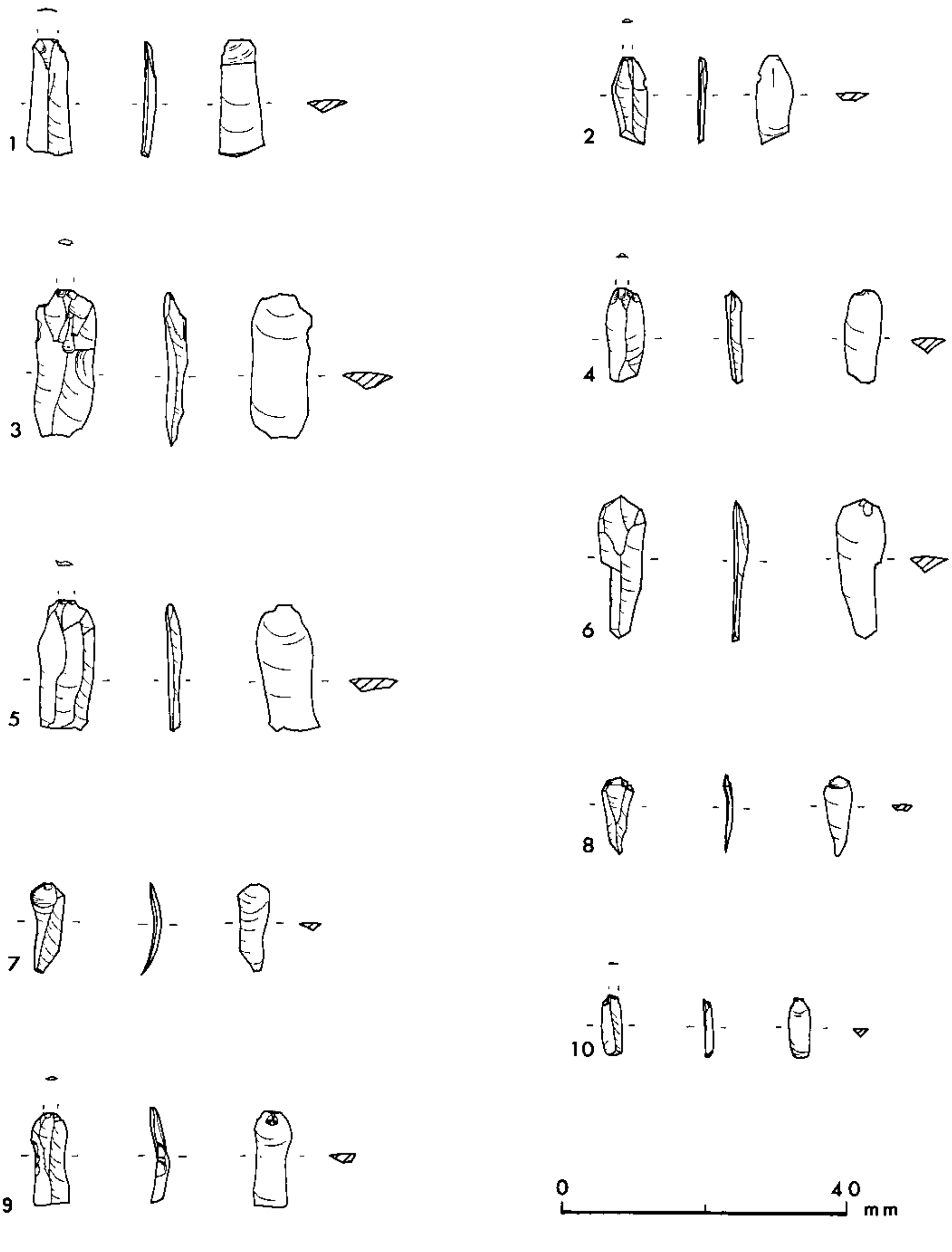
Blades are characterised by small elongated platforms (mean size 3mm × 1mm), careful platform preparation, platform isolation, parallelism, and low dorsal ridges. Most are straight, and the flaking angle varies between 70° and 80°. The size range of complete specimens is presented in Ill 37. There are more blades of flint than of bloodstone; many have resulted from the initial shaping of platform cores.

2 Narrow Blades (Ill 39. 1–6):

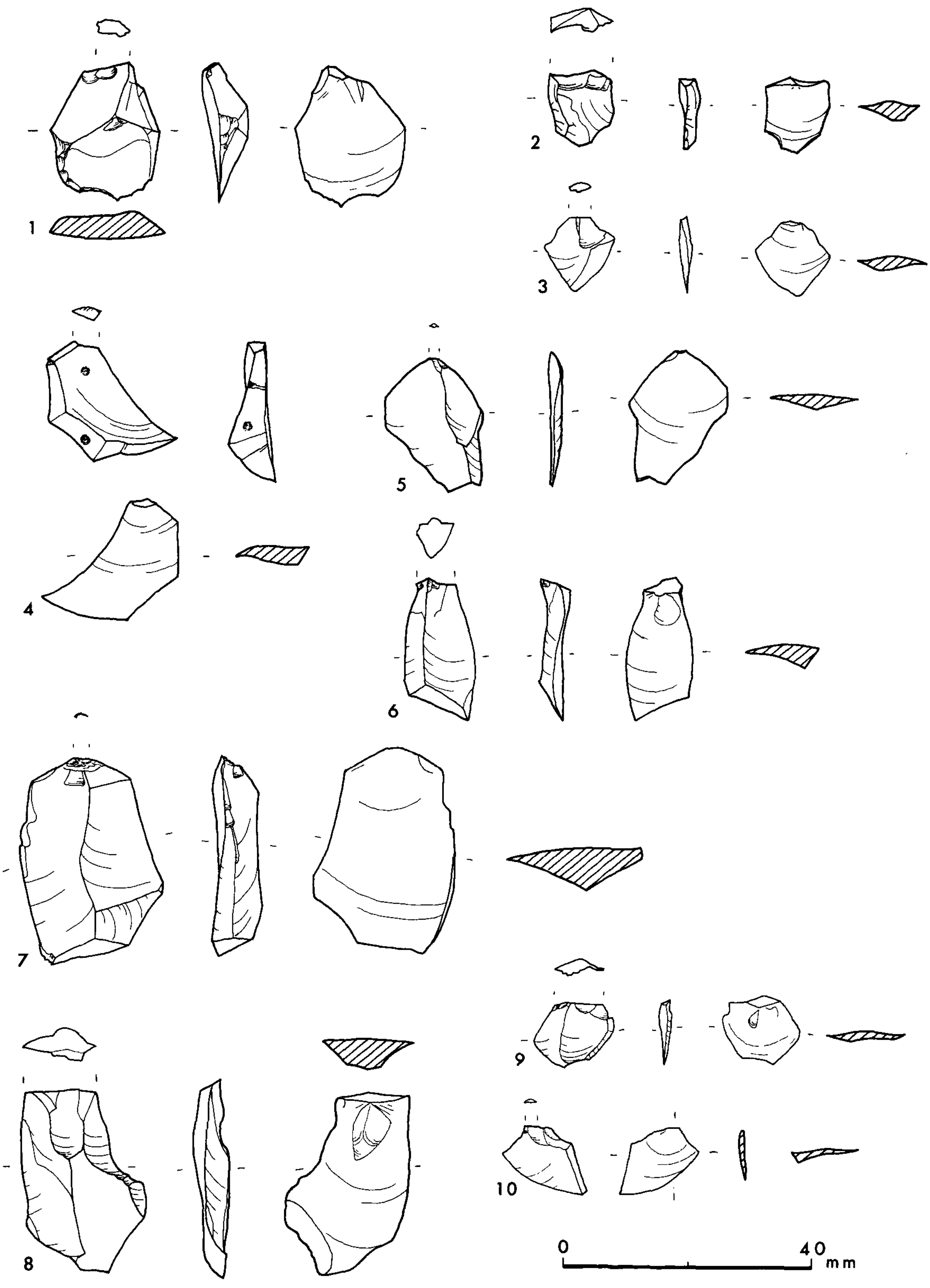
Narrow blades have the same morphological and technological properties as blades, though they tend to have fewer dorsal ridges. The size range is shown in Ill 37. There are more narrow blades of bloodstone than of flint in the sample.

3 Chips (Ill 39. 7–10)

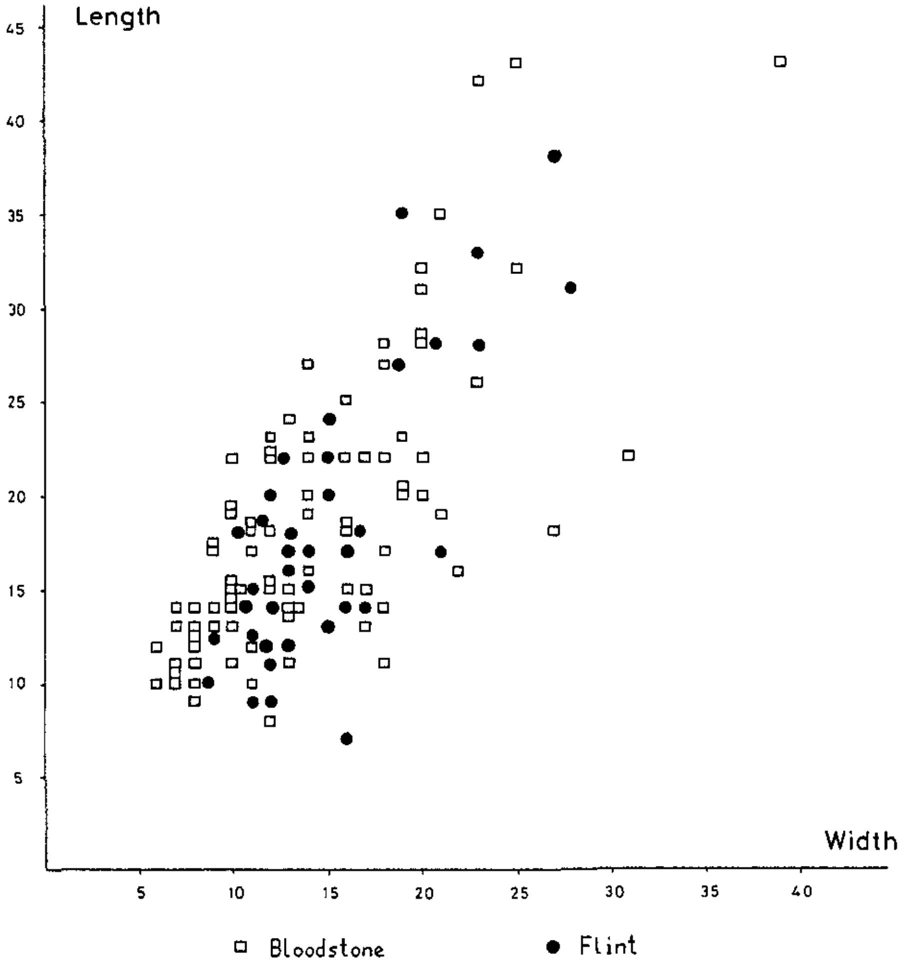
There are few chips. They exhibit the same characteristics as the other two groups, but are much smaller (Ill 37).



ILL 39: The lithic assemblage, mesolithic sample: narrow blades and chips. 1–6 narrow blades: 7–10 chips. 1–3, 9–10 bloodstone: 4–8 flint.



ILL 40: The lithic assemblage, mesolithic sample: flakes. 2–3, 5–6, 8 bloodstone: 1, 4, 7, 9–10 flint.



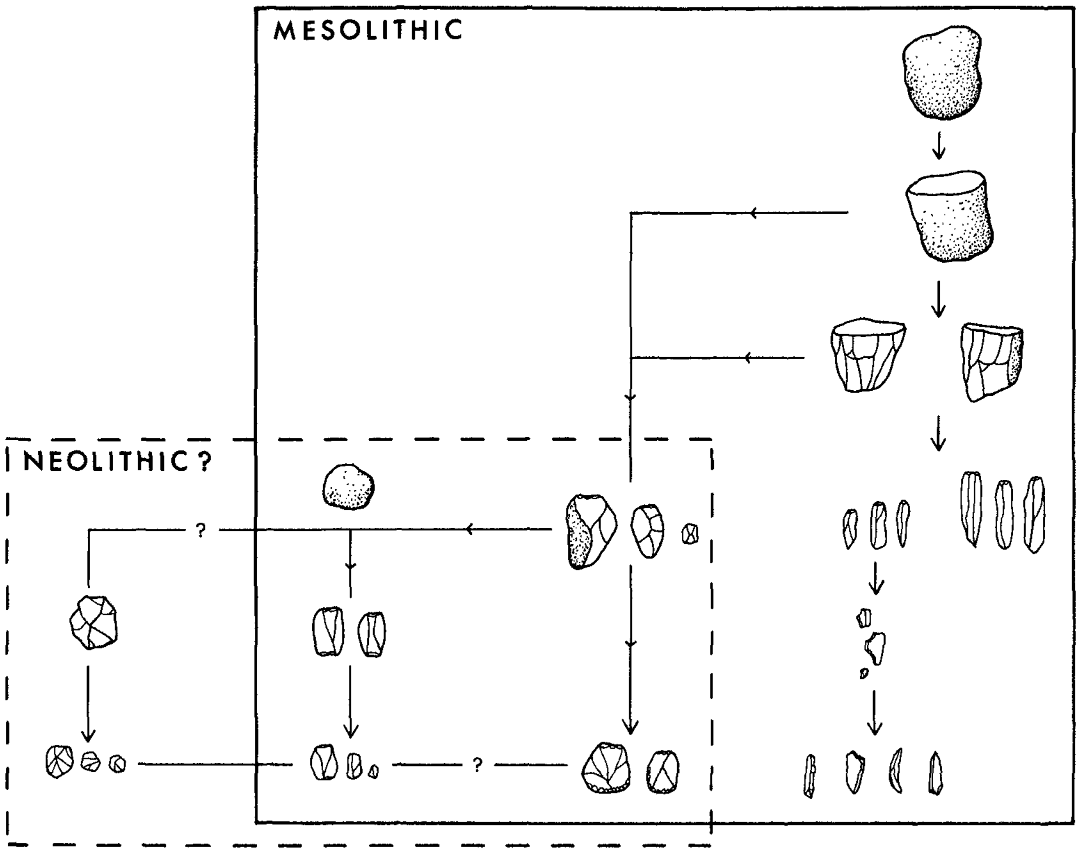
ILL 41: The lithic assemblage, mesolithic sample: complete inner flakes, length/width ratios. Dimensions in mm.

INNER FLAKES

There are more inner flakes of bloodstone than of flint (Ill 36). Most have small, flat, elongated platforms similar to those of the blades, but the flakes have wider terminations than blades and they exhibit no parallelism. In the consideration of any site with blade technology, the flakes are problematical, as it is not possible to determine with certainty whether they were manufactured deliberately or whether they are blade-making debris. At Kinloch, as few have been well prepared and many are small and thin (Ill 40. 1–10, 41), it seems most likely that the manufacture of flakes was related to the manufacture of the blades.

THE AIMS OF THE PRIMARY REDUCTION PROCESS IN THE MESOLITHIC

The mesolithic reduction process at Kinloch was geared to blade manufacture. This being the case it should be reflected in the general make-up of the assemblage, particularly if the site was one which specialised in blade making. By comparing the quantity of blades in the assemblage to that of flakes (the *lamellar index*: Bordes & Gaussen 1970), it is possible to measure the importance of blade manufacture on site. If the site specialised in blade making, then it is accepted that the ratio of blades to flakes must exceed 20%. In the sample under consideration the lamellar index is 24%. Thus, there is some evidence that the knappers at Kinloch were specialising in the manufacture of blades. The flakes in the assemblage constitute the debris from this process, and some were subsequently modified. Many pieces, both modified and unmodified, may have been used.



ILL 42: Comparative lithic reduction strategies.

Having established the presence of blade manufacture on site, it is necessary to examine why blades were made. Many, no doubt, were used without modification, but it would only be possible to detect these with use-wear analysis. However, the assemblage also contains a number of artifact types which are based on the modification of blades. The most numerous are the microliths, but within the sample there was also a borer, a burin and a scraper. Turning first to the wider category of blades, many of these were a by-product of the shaping of the platform cores, but some were used as blanks for modified (formal) tools. It is unlikely that these were blanks for microlith production, as this would have entailed reducing the width of the blade by over half (compare Ill 37 with Ills 61 and 62), but non-microlithic formal tools were made on the wider blades (Ills 54, 57).

In contrast to the wider blades, narrow blades are well suited to the production of microliths. Broadly similar blades seem to have been selected for the different microlith types, though the modification has led to shape differences (Ills 61, 62). The final group of blades were classified as chips; these are preparation chips, produced during the trimming of platforms (called core front chips by Newcomer & Karlin 1987), ie they were produced spontaneously rather than intentionally. As with all small debitage, these pieces may be used to indicate knapping floors, and they are so small that they often remain at the place of production (unless the knapping floor was cleared in some way, in which case debitage may have been dumped elsewhere).

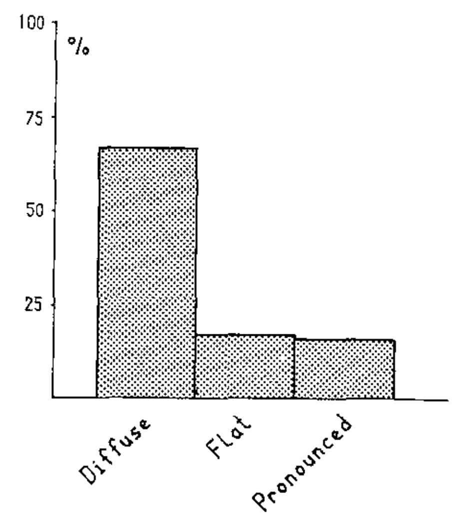
Although making flakes was not the primary goal of the knappers, there are many that would have been useful, and it is unlikely that these went to waste. Without further study it is impossible to identify those that were used unmodified. Some, however, were modified, eg most of the larger modified tools in the sample are on flake blanks. A comparison of the sizes of unmodified flakes with the modified artifacts (Ills 41, 52, 53) suggests that most of the unmodified inner flakes are too thin to have been made into some types (such as scrapers), but the cortical flakes were generally thicker and more suitable for blanks. An examination of the scrapers shows that the majority were made on flakes and many on inner flakes, so it may be that the more suitable inner flakes were removed from the unmodified assemblage in prehistory.

CONCLUSIONS: THE MESOLITHIC REDUCTION STRATEGY AT KINLOCH (Ill 42)

Of the two main materials (flint and bloodstone), the primary reduction of flint certainly took place on site, but this is not so certain for bloodstone. Although there is some waste from the primary reduction of bloodstone, the quantity of decortical flakes and blades is insignificant, and it seems likely that the majority of nodules were opened for testing and roughly shaped elsewhere, probably on the beach where they were collected. Further reduction was then carried out on both materials with direct, soft percussion, probably using medium-hard sandstone cobbles as hammers. In general, platform cores were prepared, though some bipolar cores were also used. Knapping was directed towards the production of blades of two specific types: blades and narrow blades. Blades were predominantly of flint and many were the by-products of the shaping of platform cores, though some were modified into formal tools, and others may well have been used without modification. The narrow blades are predominantly of bloodstone (this may well reflect the poorer knapping quality of the bloodstone), and they were apparently deliberately manufactured as blanks for microliths. In addition, tiny blades, classified as chips, were produced as part of the core preparation process. Flakes were a by-product of this reduction strategy, but they are present in large numbers and many would have been quite suitable for use, with or without modification.

TYPE	TOTAL	% EXAMINED
CORES		
Platform	15	100
Bipolar	16	100
Disc	4	100
BLADES		
Decortical	6	100
Inner	87	100
REGULAR FLAKES		
Decortical	54	100
Inner	628	53
MODIFIED ARTIFACTS		
Microliths	21	100
Non-Microlithic	8	100

Table 7: Trench AD, mesolithic/neolithic sample: lithic artifacts used for technological analysis.

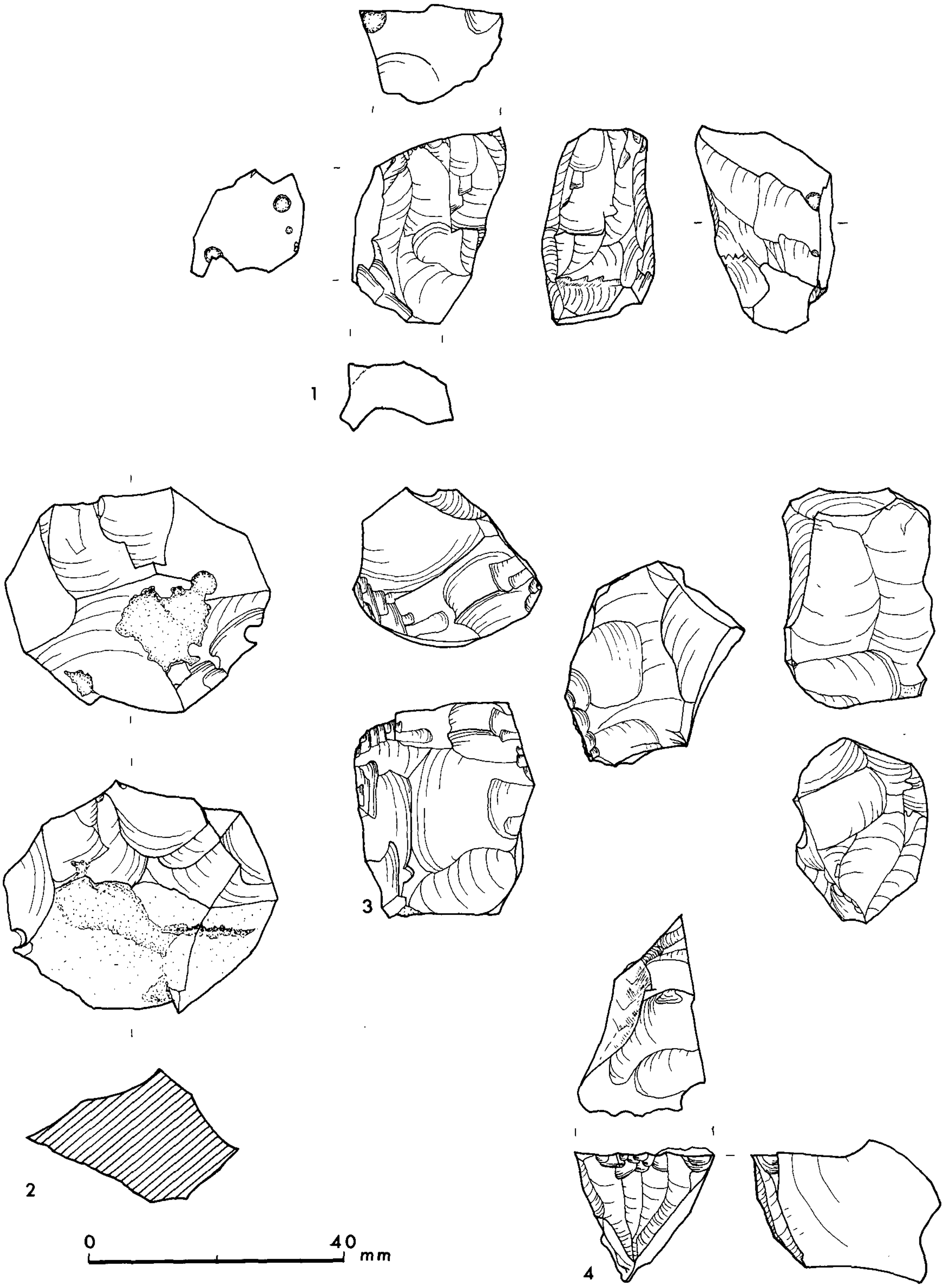


ILL 43: The lithic assemblage, mesolithic/neolithic sample: bulb types.

SAMPLING THE MIXED MESOLITHIC/NEOLITHIC CONTEXTS

In the fourth millennium BC the site was littered with debris from earlier occupation, and mesolithic material was incorporated into the fills of all the later features. Nevertheless, four of these mixed deposits were selected for comparison with the pure mesolithic material studied above. These areas comprised:

1 Peat: the peat that formed in the watercourse on the northern edge of the site.
2 Rocks and debris: a deposit of rocks together with organic material, pottery and lithics lying towards the eastern end of the peaty fill of the watercourse.



ILL 44: The lithic assemblage, mesolithic/neolithic sample: cores. 1–3 disc cores: 4 handle core. All of bloodstone.

3 Small dumps: a series of matted rafts of wood and other material from the surface of the peat in the watercourse.
4 Basal peat: the peat below the deposit of rocks (Area 2 above).

Of these four deposits, 2 and 3 are associated with radiocarbon determinations (Area 2: 3890±65 BP, GU–2042; Area 3: 4080±60 BP, GU–2148). Area 4 contained so little lithic material that it was not included in the study after the initial classification of artifacts.

The aims of this analysis were twofold: to ascertain whether the primary technology differed in any way from that deduced from the uncontaminated mesolithic material; and to establish whether there were any differences between the four areas. At this point it should be stressed that none of the material under consideration lies in a primary context: at best 2 and 3 are rubbish dumps; at worst 1 and 4 comprise material that has accumulated within the growing peat beds. It should be remembered, however, that even the mesolithic material from Trench AD derives from a pit complex and as such has been deposited from unknown use-areas.

THE ARTIFACTS EXAMINED

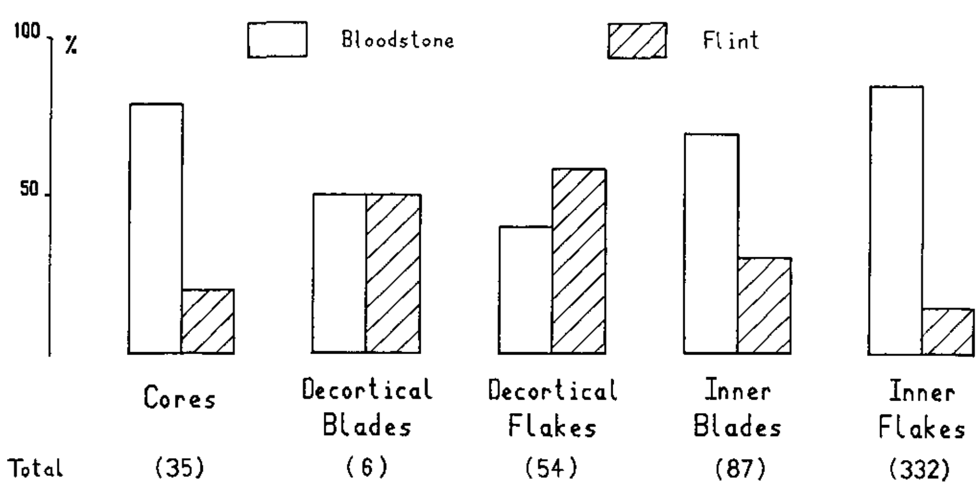
Types, Raw Material and Condition.

The sample for this analysis was derived in the same way as that for the analysis of the mesolithic contexts. It included flint and bloodstone cores, blades, regular flakes, microliths and retouched artifacts (Tab 7).

In contrast to the mesolithic sample, few pieces showed signs of surface alteration.

THE ANALYSIS OF REDUCTION TECHNIQUES (see definitions, Chapter 5)

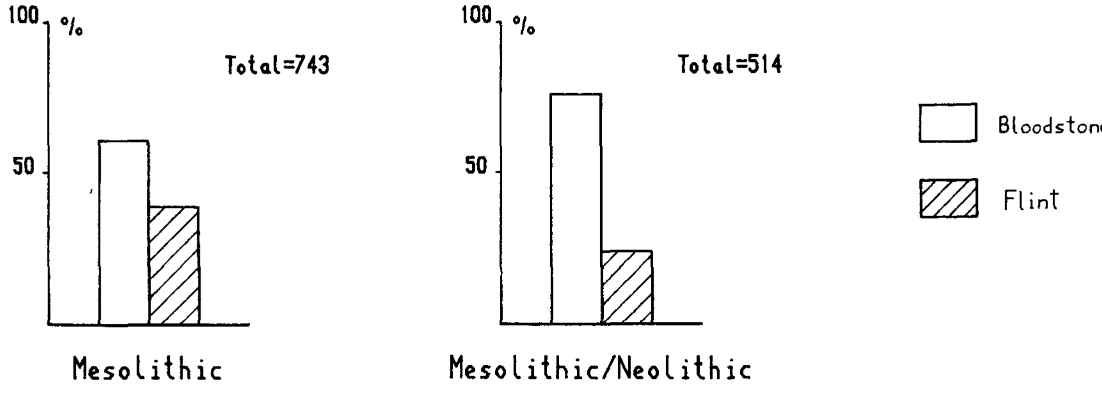
The features indicative of the methods used to apply force for the manufacture of flakes and blades were catalogued and analysed. As in the mesolithic sample, diffuse and flat bulbs were predominant (Ill 43), suggesting the use of soft percussion. This is supported by the other technological attributes. The presence of some attributes normally associated with hard percussion is best explained by the use of medium hard sandstone cobbles as hammers. The similarity of the technological attributes with those of the mesolithic assemblage suggests the use of direct percussion. One core may have been flaked with pressure (Ill 44. 4), but no generalisations can be drawn from a single artifact.



ILL 45: The lithic assemblage, mesolithic/neolithic sample: artifact types by material.

REDUCTION METHOD AT KINLOCH: THE LATER EVIDENCE

Both flint and bloodstone were present in the sample (Ill 45), but there is less flint amongst the later contexts than there was in the mesolithic material (Ill 46).



ILL 46: The lithic assemblage, samples used for technological analysis, by material.

TYPES

CORES (Ill 47)

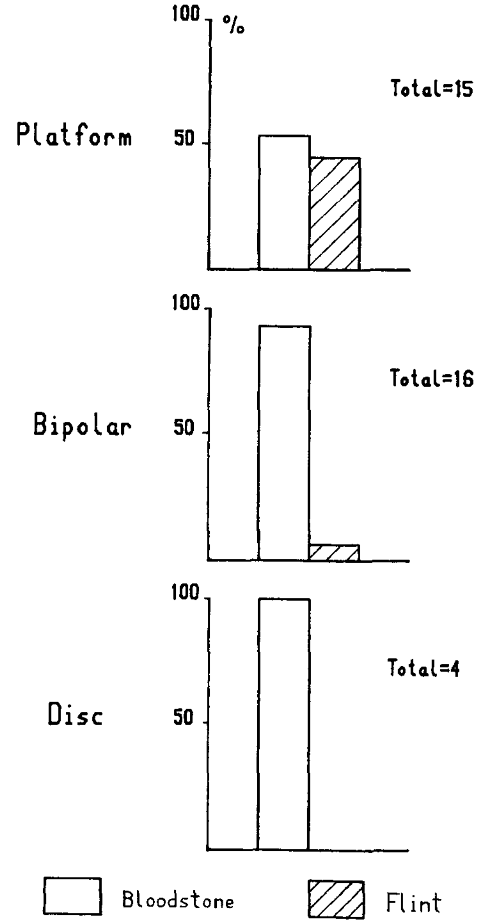
Flint.

There are seven flint cores in the sample, all but one of which are platform cores with a typical conical shape. Although these are all single platformed, there are blades and flakes that indicate the use of cores with opposed platforms. Most of the cores are unifacial, ie they have been flaked around one side only. They are similar to those used in the mesolithic contexts, and, like them, many were abandoned as a result of flaking fractures: the mean length at discard was 32mm. In addition, there is one bipolar core, from Area 2, made from a cortical flake but with few detachments.

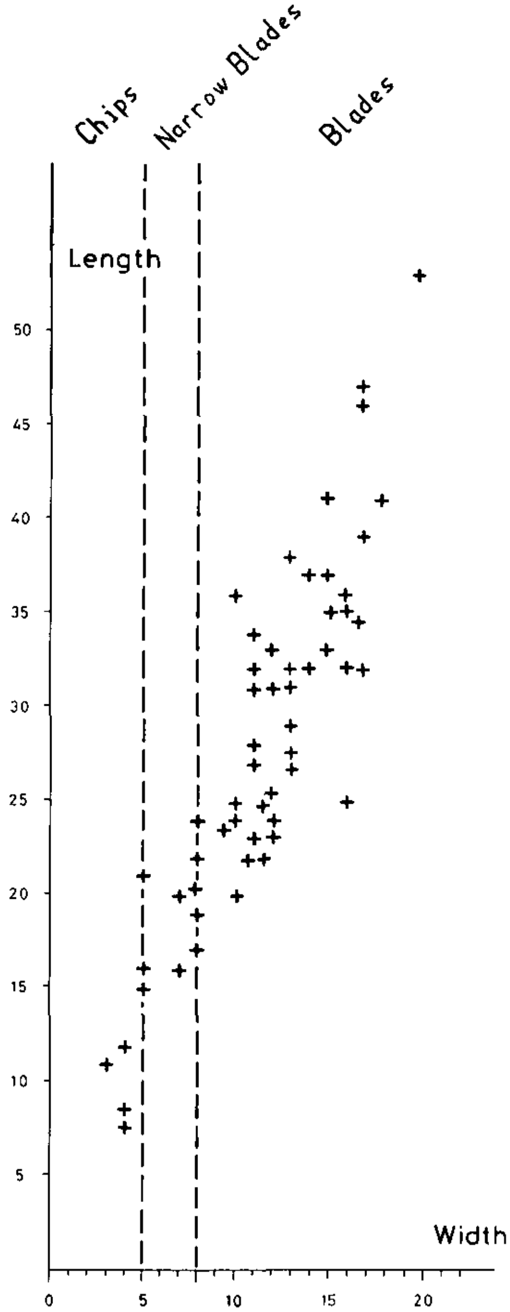
Bloodstone.

There are nine conical platform cores of bloodstone. They are relatively short and wide, and have removals all the way round. A few are wider than they are long. They were used for both blades and flakes, but flakes predominate. In contrast to those from Trench AD, there is less evidence of discard as a result of impurities in the stone, and more were apparently worked to exhaustion. One bloodstone platform core (from Area 2) is quite different from the others as it has clear evidence of microblade removal, possibly by pressure (Ill 44. 4), but so far this piece stands alone. Areas 2 and 3 are dominated by bipolar cores, all but one of which are of high quality bloodstone. All are typical bipolar cores, similar to those from Trench AD, but of more variable length.

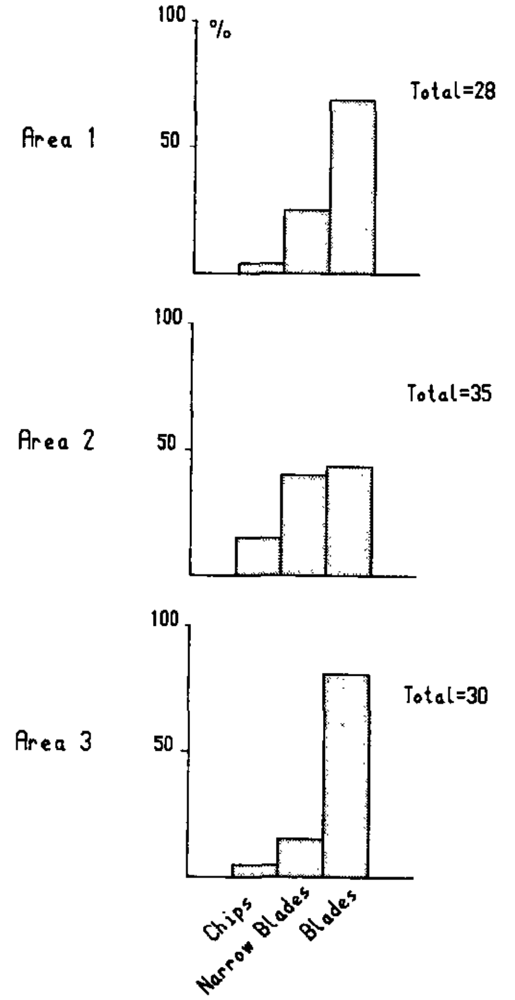
Four bloodstone disc cores, a type not found in the mesolithic contexts, were also identified (Ill 44. 1–3). They were used in the production of flakes by a quasi-bifacial method, each removal utilising the negative scar from the previous flake as a platform. This is a complex way to make flakes and requires well planned work. It is reminiscent of levallois flaking as it relies on previous removals to control the size of the flakes produced. These cores may have been flaked to exhaustion as neither defects of raw material, nor



ILL 47: The lithic assemblage, mesolithic/neolithic sample: cores by material.



ILL 48: The lithic assemblage, mesolithic/neolithic sample: blade types. Dimensions in mm.



ILL 49: The lithic assemblage, mesolithic/neolithic sample: blade types by area.

flaking fractures, led to their abandonment. In addition, there is one bloodstone core from Area 3 that seems to be a cross between a platform core and a disc core.

DECORTICAL FLAKES AND BLADES

There are a number of decortical flakes and blades in the sample: all represent the same reduction processes as those of the mesolithic sample and, like them, they are predominantly of flint (Ill 45).

OVERSHOT FLAKES AND BLADES

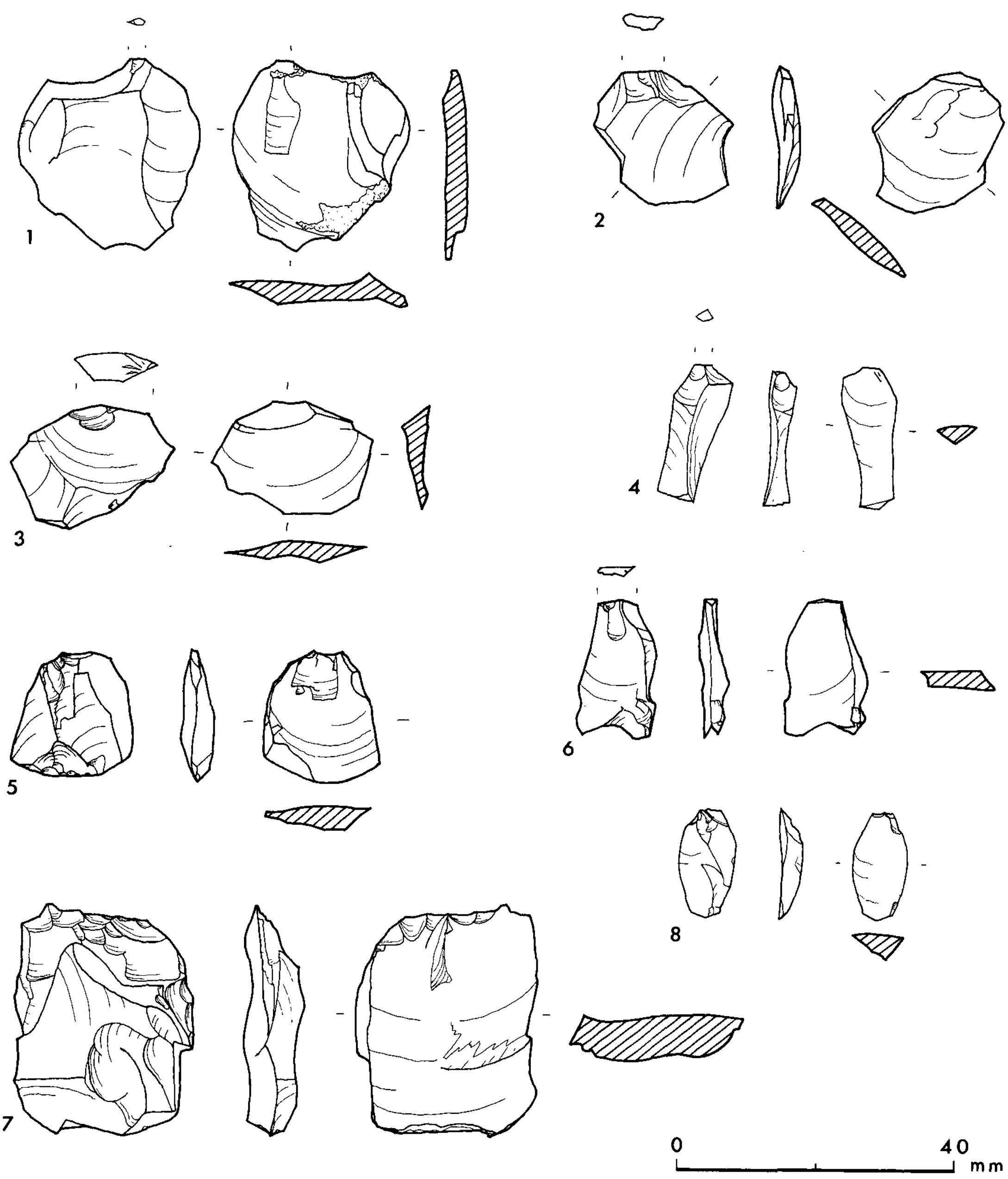
There are a few overshot flakes and blades; all present the same picture as those from Trench AD.

CRESTED BLADES

There are two crested blades, both of bloodstone. Like those from the mesolithic sample, the crests were formed from the accentuation of a pre-existing natural ridge. In contrast, however, neither had a prepared platform, and it should also be remembered that those from the AD sample are of flint.

BLADES

The blades from this sample are similar to those from the mesolithic sample (Ill 37); all three types are present (Ill 48). The wider blades are found predominantly in Areas 1 and 3 (Ill 49), whereas in Area 2 there are more narrow blades (and the majority of the microliths were found in Area 2). Area 2 also contained more chips. Although there



ILL 50: The lithic assemblage, mesolithic/neolithic sample: Flakes. 1–3 disc core flakes: 4–8 bipolar flakes. 1–4, 6–8 bloodstone: 5 flint.

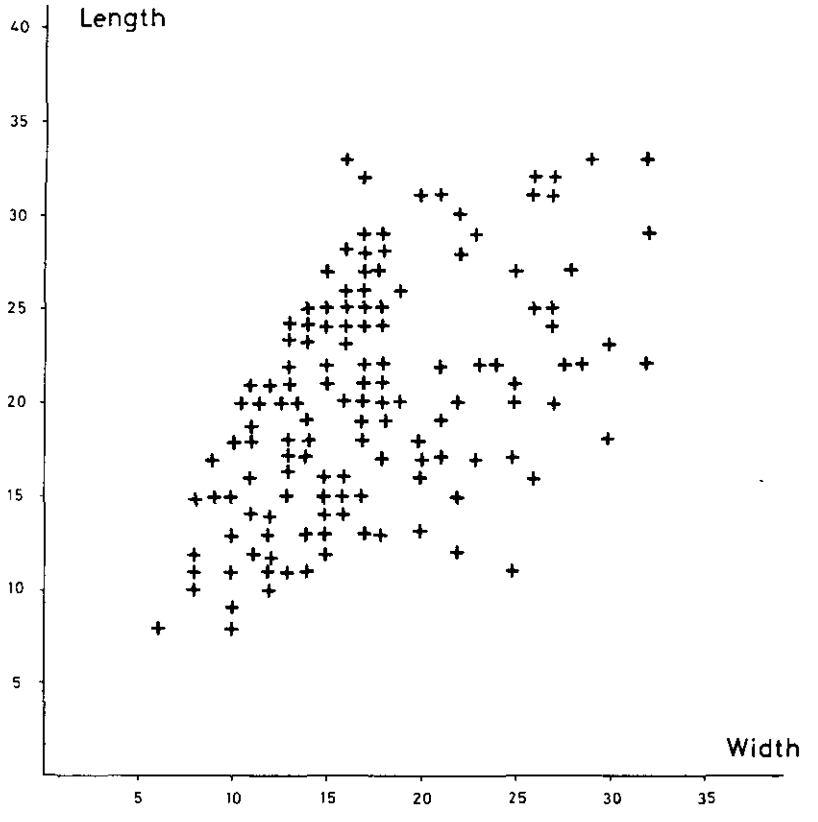
are no certain bipolar blades amongst this assemblage, a number of blades (bloodstone and flint) have crushed platforms, and these may well have resulted from the use of the bipolar method in the manufacture of blades.

FLAKES (Ill 50, 51)

As in the mesolithic sample there are more flakes of bloodstone than of flint (Ill 45). In contrast to the mesolithic sample, however, the dimensions and the detachment characteristics of the later flakes suggest that they were deliberately produced (although this is less certain in Area 2). This suggestion is strengthened by the evidence from the cores, all of which had apparently been used for flake production. Flakes were removed from both disc and platform cores as well as bipolar cores (Ill 50. 1–8), but the most regular flakes were produced from platform cores.

SCRAPER RESHARPENING FLAKES

Three small flakes (two flint, one bloodstone) appear to have resulted from the resharpening of scrapers (see Chapter 7). All retain truncated retouch scars from a scraper face, two come from Area 2 and one from Area 3.



ILL 51: The lithic assemblage, mesolithic/neolithic sample: complete flakes, length/width ratios. Dimensions in mm.

THE AIMS OF THE PRIMARY REDUCTION PROCESS IN THE LATER PERIOD

The assemblage comprised both flakes and blades, but the technological evidence suggested that the flakes were an end product in themselves (though the lamellar index is the same as that for the mesolithic sample: 24%). A number of formal tools were made on flake blanks: as in the mesolithic sample these blanks were selected by size and shape. There were also some modified tools based on blade blanks, notably the microliths, most of which were found in Area 2 (and may indicate contamination from earlier material).

CONCLUSION: THE REDUCTION STRATEGY IN THE LATER PERIOD AT KINLOCH (Ill 42)

The reduction strategy reconstructed for the later material is similar to that suggested for the mesolithic material, but there are important differences. Both bloodstone and flint were used, still from the same sources and still prepared in the same way, but (in contrast to the earlier assemblage), there is much less use of flint. Direct, soft percussion was still used to reduce the cores, and both platform and bipolar cores were prepared, but the knappers were now making use of a third type of core (the disc core), and their production was geared more to the manufacture of flakes. There were few modified tools in the later samples.

DISCUSSION

Although the basic reduction techniques were similar, there are a number of differences between the mesolithic assemblage and the later material. The later assemblage contains less flint; it includes disc cores, which do not occur in any mesolithic context on site; and, though both flakes and blades were present in both assemblages, the flakes in the later contexts are somewhat different. The characteristics of the 'later' flakes suggest that they were deliberately produced, unlike those from the mesolithic sample which were apparently a by-product of blade manufacture. The later material contains very few modified artifacts, but the same basic types are present in both samples. Both assemblages contain a range of microlithic and non-microlithic tools.

TYPE	AREA 1	AREA 2	AREA 3
CORES			
Platform	7	4	4
Bipolar	2	9	5
Disc	2		2
BLADES	28	35	30
FLAKES	101	501	80
MODIFIED ARTIFACTS			
Microliths	3	16	2
Non-Microlithic	4	3	1

Table 8: Trench AD, mesolithic/neolithic sample: lithic artifact types by area.

Within the later sample, material was derived from three distinct areas (1–3), and one objective of the analysis was to look for possible differentiation between these areas. Although there was evidence for all of the reduction methods in each area, Area 1 was dominated by platform cores, while Areas 2 and 3 contained more evidence of bipolar working. The majority of both narrow blades and microliths came from Area 2 (Ill 49). There are other mesolithic elements present in Area 2, and together they may indicate greater mesolithic contamination (there are no disc cores, and the flakes are more like those from the mesolithic sample). As all three areas were apparently re-deposited it is difficult to take analysis further and interpret the observed differences.

Finally, it is important to consider whether the differences between the mesolithic and the later material could represent any technological change through time. Studies elsewhere have observed a shift from blade to flake industries between the mesolithic and the neolithic periods (Pitts & Jacobi 1979) and so it is interesting to note that, though both blades and flakes are present in both assemblages, the evidence from the earlier period was geared to blades alone, while in the later period flakes were more important. However, the lamellar index was the same for both groups of material; perhaps the value of the index as a straightforward indicator of the presence of blade production should be questioned. At Kinloch it is likely that the later samples were contaminated with some mesolithic material and this will undoubtedly have affected the index for Areas 1–3, but it is clear that the index alone is not sufficient to indicate the importance of blade making.

In a consideration of technological change through time it is important to note that the individual reduction techniques used at Kinloch change hardly at all. The one exception is the introduction of reduction from disc cores in the later period. The disc core may be linked both to the increased importance of flakes as an end product in themselves, and to the decline in the amount of flint worked. The change in raw material is harder to explain. It may be the result of a drop in the quantity of available flint (certainly there are few pebbles of flint to be found around the coasts of Rhum today), or it may be linked to the lessening of the need to make blades. The whole reduction strategy is a complex system and it is impossible to pinpoint the reasons behind any change, or the stages at which stress entered to generate that change. Certainly, by the later period at Kinloch there was less emphasis on blade production and this is manifest in several ways: the different characteristics of the flakes present, the new type of cores and the decline in the use of flint. Why this change in emphasis took place it is impossible to say. As all of the later contexts still contained some blades (even if only by contamination), it is not possible to isolate blade technology as an exclusively mesolithic trait at Kinloch.

7 THE LITHIC ASSEMBLAGE: SECONDARY TECHNOLOGY WITH S McCARTAN

INTRODUCTION

A total of 1608 pieces were modified after primary flaking. The strategy for modification was always retouching (ie the removal of small flakes from the original blank), and the most common technique was the application of pressure to the edge of the blank, probably through an antler tine. In addition, some light percussion was used to modify flakes, particularly when a steeper edge angle was required, as on many of the scrapers.

The modification of a blank, although related to the intended function of that blank, does not necessarily indicate its working edge. Modification may be used to alter either an edge in a particular way or the whole shape of the blank. In the first case the edge in question may either be the working edge of the tool, or it may be a secondary edge altered for some other purpose, eg to fit into a haft. If the whole blank is to be modified then modification of all edges is obviously involved, and general thinning of the surfaces of the piece may also be required. Therefore, although the modification of an artifact is related to its function, it is impossible to identify the working edges of a tool without further study. As the analysis of the Kinloch material did not involve work on the use-wear patterns, the examination of the modified pieces was concentrated on the nature of the modification (i.e. the type and the location of alteration), and artifact types were constructed from this. In general, these types coincide with conventional tool types, so they have been assigned conventional names where appropriate. It must be stressed, however, that these types are based upon technological and morphological information only.

THE MODIFIED TOOL TYPES (Ills 52; 53)

SCRAPERS

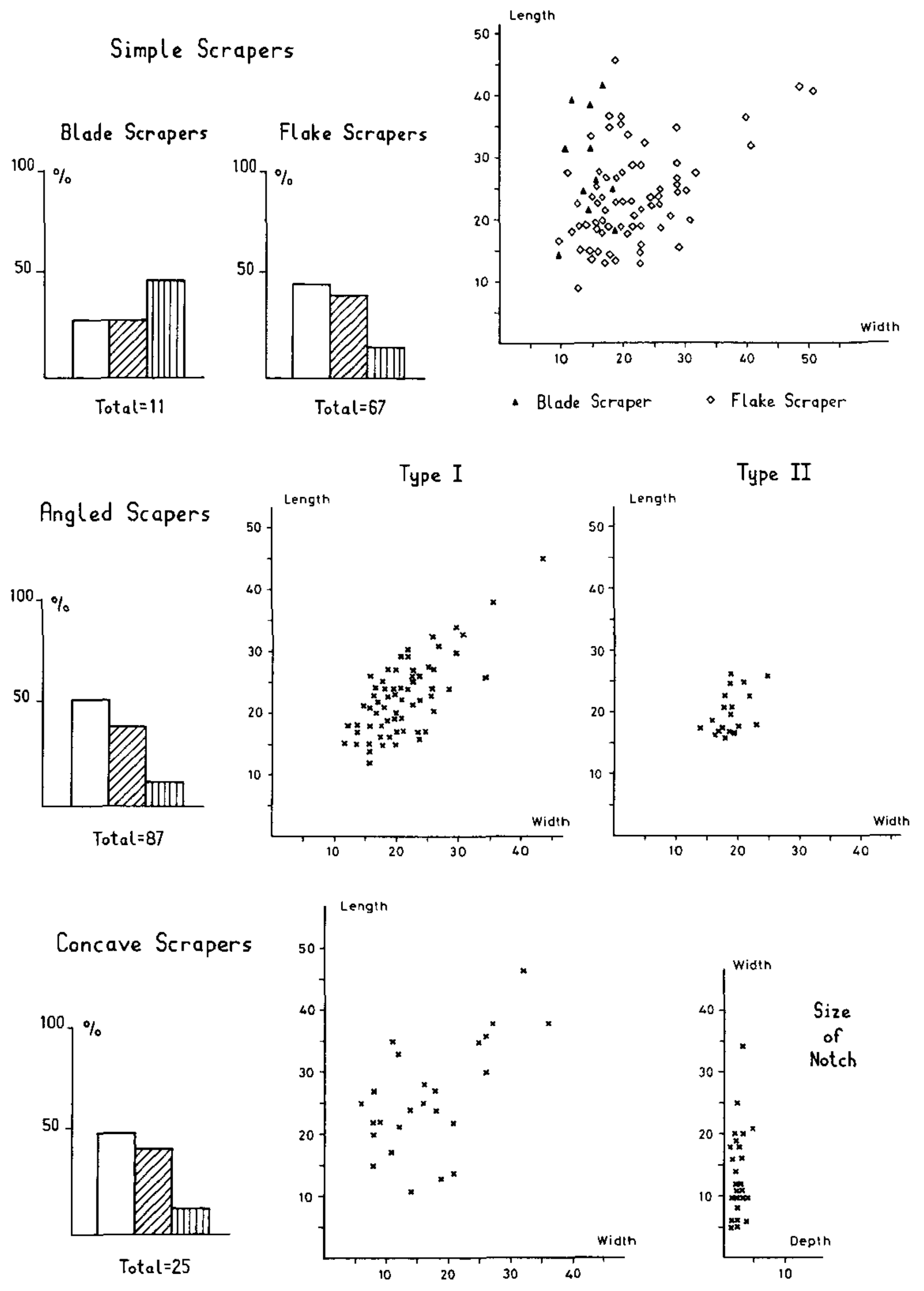
Scrapers have modification to produce a 'scraping edge'. A 'scraping edge' is unifacial; the retouch is shallow, regular and short, and runs steeply up from the edge of the piece at an angle of between 55°–95°. Various sub-types exist.

SIMPLE SCRAPERS

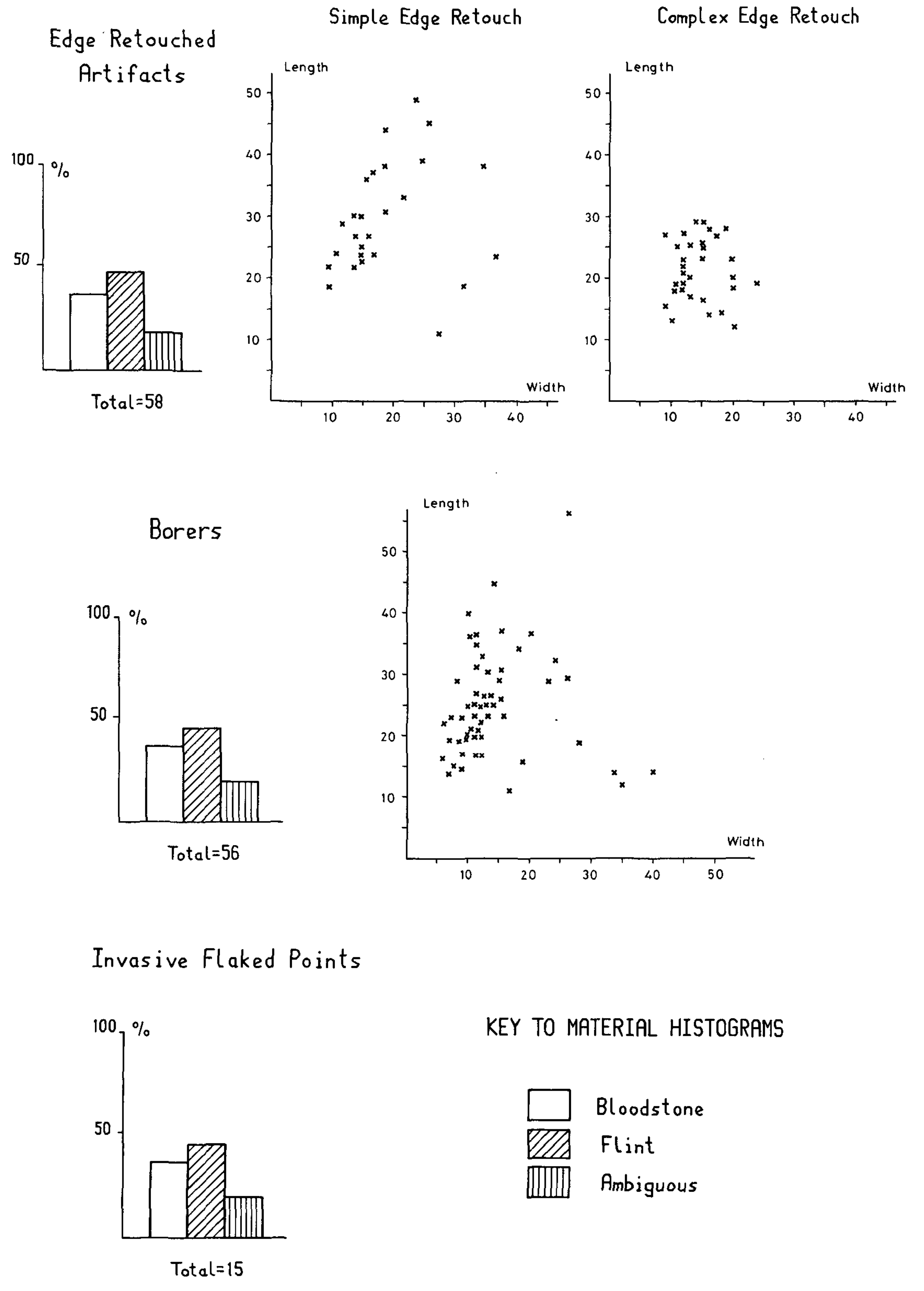
Simple scrapers have a single 'scraping edge'.

There are 78 simple scrapers; they were made on both blades (11) and flakes (67), of both bloodstone and flint, and there is one of silicified limestone. There was a preference for the selection of inner pieces as blanks (80% are on inner blanks). The flake-blanks may be divided into blade-like flakes (i.e. parallel sided) (17), regular flakes (43), and irregular flakes (8). The shape of the finished artifact was dependent on the original blank; regular blanks were preferred which needed little modification away from the scraping edge. The size of the simple scrapers varies greatly, a comparison of Ill 52 with 37 and 41 shows that although the flake blanks were selected from the larger end of the size range, the blade blanks which were chosen reflect the complete size range of unmodified blades. The majority of simple scrapers were modified on one end only, usually the distal, but some (on flakes), were modified along a side. Where necessary, inverse retouch was used to create the scraping edge on the ventral surface of the flake; this occurs on only a few examples. Wherever the retouch, the scraping edge was always prepared on the shortest side of the piece. Most scraping edges are convex in plan, but a few are straight.

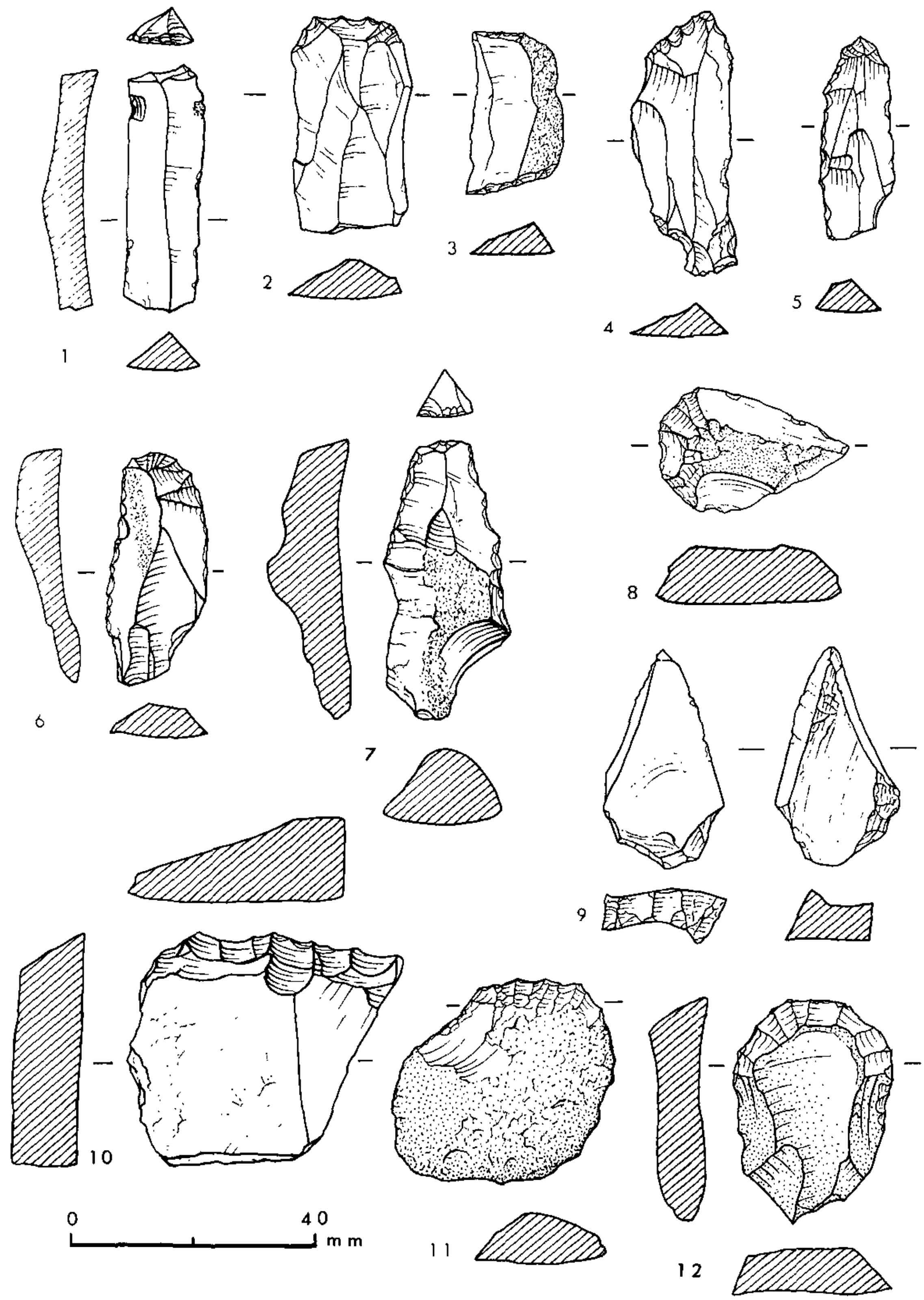
Simple scrapers may be sub-divided by the type of blank into blade scrapers and flake scrapers.



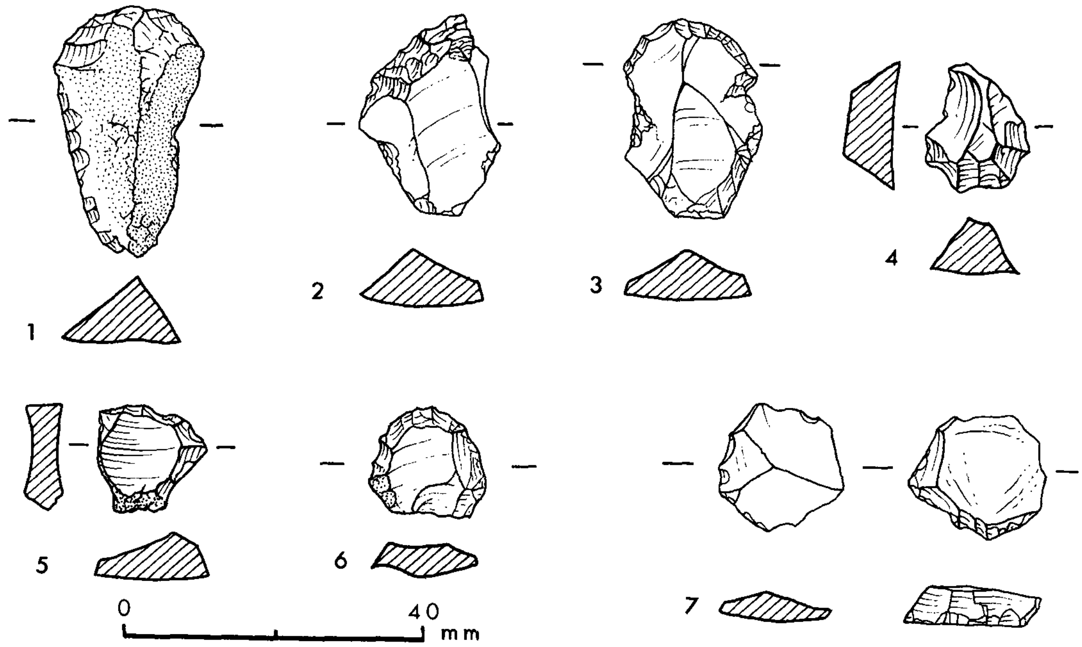
ILL 52: The lithic assemblage, modified artifacts by type, material and dimensions (mm).



ILL 53: The lithic assemblage, modified artifacts by type, material and dimensions (mm).



ILL 54: The lithic assemblage, modified artifacts: simple scrapers. 1–6 blade scrapers: 7–12 flake scrapers. 4–7 with tangs. 4, 6, 9 bloodstone: 8 & 11 flint: 10 silicified limestone: 1–3, 5, 7, 12 abraded.



ILL 55: The lithic assemblage, modified artifacts: simple (flake) scrapers (4–7 horizontally truncated).
2, 4, 7 bloodstone: 1 & 5 flint: 3 & 6 abraded.

Blade Scrapers (Ill 54. 1–6)

Blade scrapers always retain the shape of the blank; the scraping edge is always located at the distal end, and it is abrupt and short. One has a second scraping edge at the proximal end (Ill 54. 3). Three blade scrapers have tanged bases on the proximal end (Ill 54. 4–6). There is one simple scraper on a blade-like flake which has a similar basal tang (Ill 54. 7); it has been retouched along the right side to enhance its regular shape. Few blade scrapers are of bloodstone (Ill 52), and this presumably reflects the advantages of flint for blade production.

Flake Scrapers (Ills 54. 7–12; 55. 1–7)

Flake scrapers are more irregular in shape than blade scrapers; they are more round in outline and thus the scraping edge is often wider. Eight may be singled out, all are small and of a round outline, and each has been thinned by a horizontal blow which has removed the dorsal surface and truncated the scraping edge (Ill 55. 4–7). They resemble scraper resharpening flakes, but are more regular in shape and the truncated scraping edge is very uniform. The truncation was apparently deliberate, perhaps to facilitate hafting.

All these scrapers are either intact, or have only a small fragment missing. Broken scraper fragments cannot be assigned to a particular type of scraper (see below), but it is worthy of note that seven of the eleven blade-scrapers have been laterally snapped. This may be due to the particular pressures of use or it could be deliberate, but it also reflects the weak point of any blade.

ANGLED SCRAPERS

Angled Scrapers have two or more adjoining 'scraping edges'.

Angled scrapers are usually on flakes and there are more of bloodstone than of flint (Ill 52); there are 87 in all. There was no apparent selection by type or size of blank: primary, secondary and inner flakes are all present, both regular and irregular. On many angled scrapers the junction of the scraping edges forms a pronounced angle, but others have a more rounded outline. There are two sub-types:

I - those with two adjoining scraping edges.
II - those with three or more adjoining scraping edges.

Angled Scrapers I (Ills 52; 56. 1–3)

There are 68 of these angled scrapers in total; they are retouched round the distal end and one of the sides; a few are modified on the proximal end. If necessary, inverse retouch was used so that one of the scraping edges is on the ventral surface of the blank. Although all pieces are of similar proportions, there is a great range of size within this sub-group.

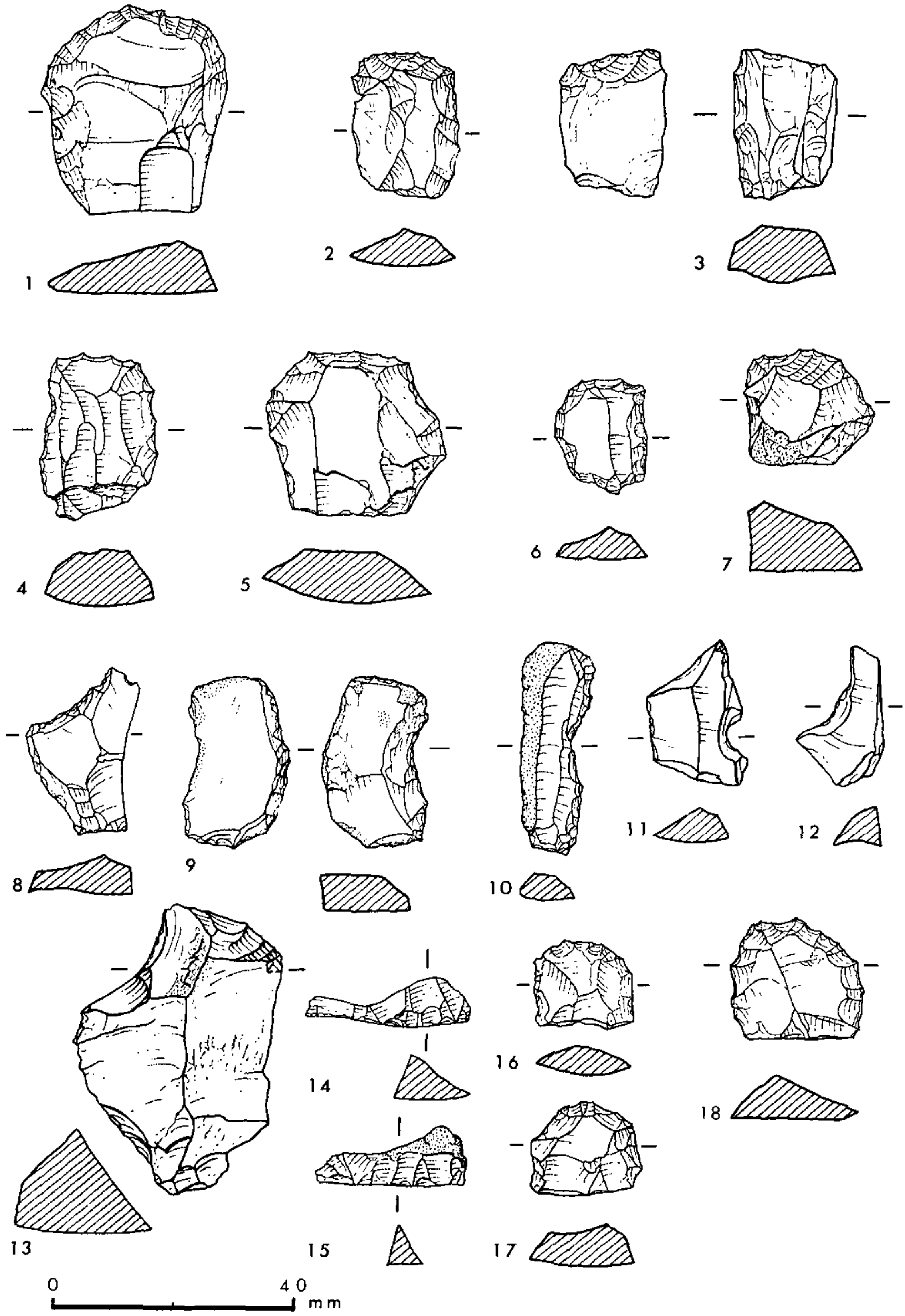
Angled Scrapers II (Ills 52; 56. 4–7)

There are 19 of these; many are modified round the entire perimeter of the flake, but the steep scraper edge and the characteristic angled outline remain. There are no examples of inverse retouch in this sub-type. These pieces tend to be smaller than those of Type I and they are less varied in size.

CONCAVE SCRAPERS (Ills 52; 56. 8–13)

Concave Scrapers have an inwardly curving 'scraping edge'.

There are 25 concave scrapers; they comprise a varied type with little uniformity of size or shape. A range of both bloodstone and flint blanks were used. The outline of the scraping edge ranges from a short, deep notch to a broad shallow curve, but no clear groupings were identified. The modification is most often along one of the sides of the artifact, and inverse retouch is frequently present.



ILL 56: The lithic assemblage, *modified artifacts*: 1–3 *angled scrapers I*: 4–7 *angled scrapers II*: 8–13 concave scrapers: 14–15 scraper resharpening flakes: 16–18 broken scrapers.
1–3, 5–7, 12, 16–18 bloodstone: 8–11, 14 flint: 4, 13, 15 abraded.

SCRAPER RESHARPENING FLAKES (Ill 56. 14–5)

Scraper resharpening flakes are identified by the possession of a length of 'scraping edge'. In contrast to other scrapers, this edge is usually truncated both in width and in height.

There are a total of 17 scraper resharpening flakes; most are long and thin. They were removed by a blow to the side of the original scraper, just behind the scraper face, so that the remnant edge runs along the length of the resharpening flake. The flake removed varied from a narrow spall along the redundant edge, to a wider, flatter tablet that took away much of the base of the original scraper: eleven spalls and six tablets were found. Five of the scraper resharpening flakes were removed from angled scrapers, the others may all have come from simple scrapers, but the lateral truncation of the scraper edge has made the original type harder to identify.

Scraper resharpening flakes have resulted from the removal of a worn scraping face so that a new scraper edge could be prepared by further modification. No flakes from such re-working were identified, but they must lie undetected within the 'less than 1cm' fraction of the irregular flakes.

BROKEN SCRAPERS (Ill 56. 16–8).

Broken Scrapers have a length of 'scraping edge' on a broken blank.

The assemblage contained 21 broken scrapers. The breakage pattern is remarkably consistent: the majority are laterally broken behind the scraping edge, and over half were originally retouched on the distal end. There are several possible explanations for this pattern: it could either reflect the natural weak point of any flake or blade; or the deliberate truncation of scrapers; or the particular pressures of use. Experimental analysis of breakage patterns on both used and unused pieces would be necessary to throw light on this problem. Broken scrapers are too fragmentary to be allocated to a particular scraper type.

EDGE RETOUCHED ARTIFACTS

Edge retouched artifacts have an edge modified by a length of shallow, acute retouch.

59 edge retouched artifacts were identified. They were made on both regular and irregular flakes, and a few blades were also used. There was some preference for inner blanks. Both bloodstone and flint were used, but there was more use of flint (Ill 53) suggesting selection by material also. This is not surprising when the shape of these pieces is considered. Two sub-types have been identified:

Simple Edge Retouched Artifacts: those with modification on a single edge.
Complex Edge Retouched Artifacts: those with modification on two or more edges.

SIMPLE EDGE RETOUCHED ARTIFACTS (Ill 57. 1–8).

There are 26 simple edge retouched artifacts; they are more blade-like in shape than the complex pieces, and the retouch is predominantly along the side of each piece. The retouch scars are usually short and they only alter the very edge of the piece. Three have invasive retouch across the dorsal surface (Ill 57. 1, 4, 6), and inverse retouch was also occasionally used to create an appropriate edge. The retouched edges are either straight or slightly convex in plan. There is a great range of size within this type, and there are no obvious sub-groups (Ill 53), but it is likely that a variety of 'prehistoric tool types' have been subsumed under this classification.

COMPLEX EDGE RETOUCHED ARTIFACTS (Ill 57. 9–16)

There are 33 complex edge retouched artifacts, the majority of which were modified around the entire artifact; several were modified to provide one broad end and one narrow end (Ill 57. 9, 11). The retouch is always short and only on the edge of the blank; there was little use of inverse retouch and no invasive retouch. Although many of the retouched edges are straight or slightly convex, a number are irregular. Complex edge retouched artifacts differ in shape to the simple edge retouched pieces: they are smaller and more irregular in outline, with less variation in size (Ill 53), but it is likely that several different 'prehistoric tool types' are included.

BROKEN EDGE RETOUCHED ARTIFACTS

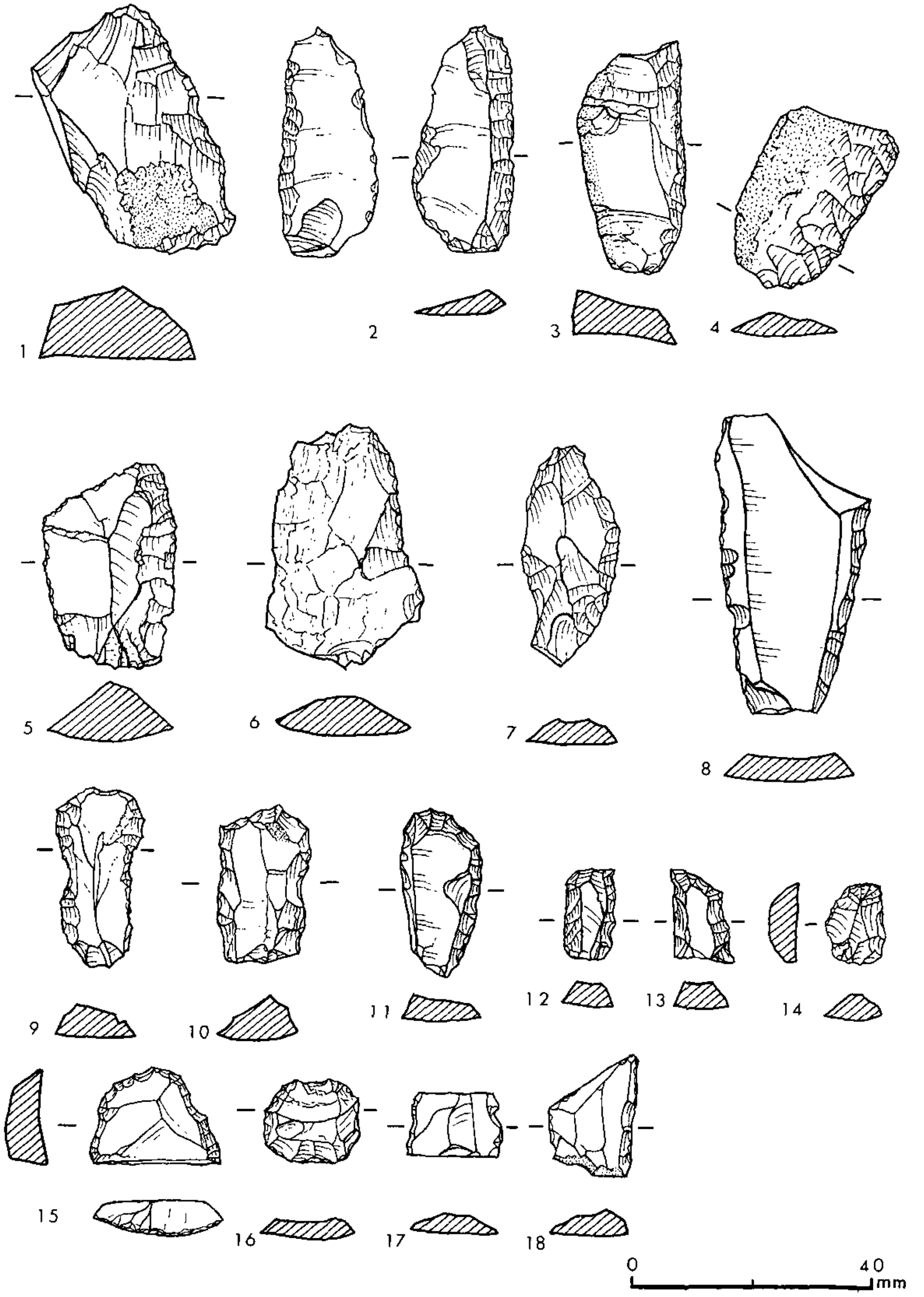
Broken edge retouched artifacts have a length of edge modified as above, but the artifact has been broken so that the original morphology can be longer be ascertained.

The assemblage contained 38 broken edge retouched artifacts, none of which could be assigned to either subtype. Like the broken scraper fragments, the majority are broken laterally, but unlike the scrapers the modified edge is truncated.

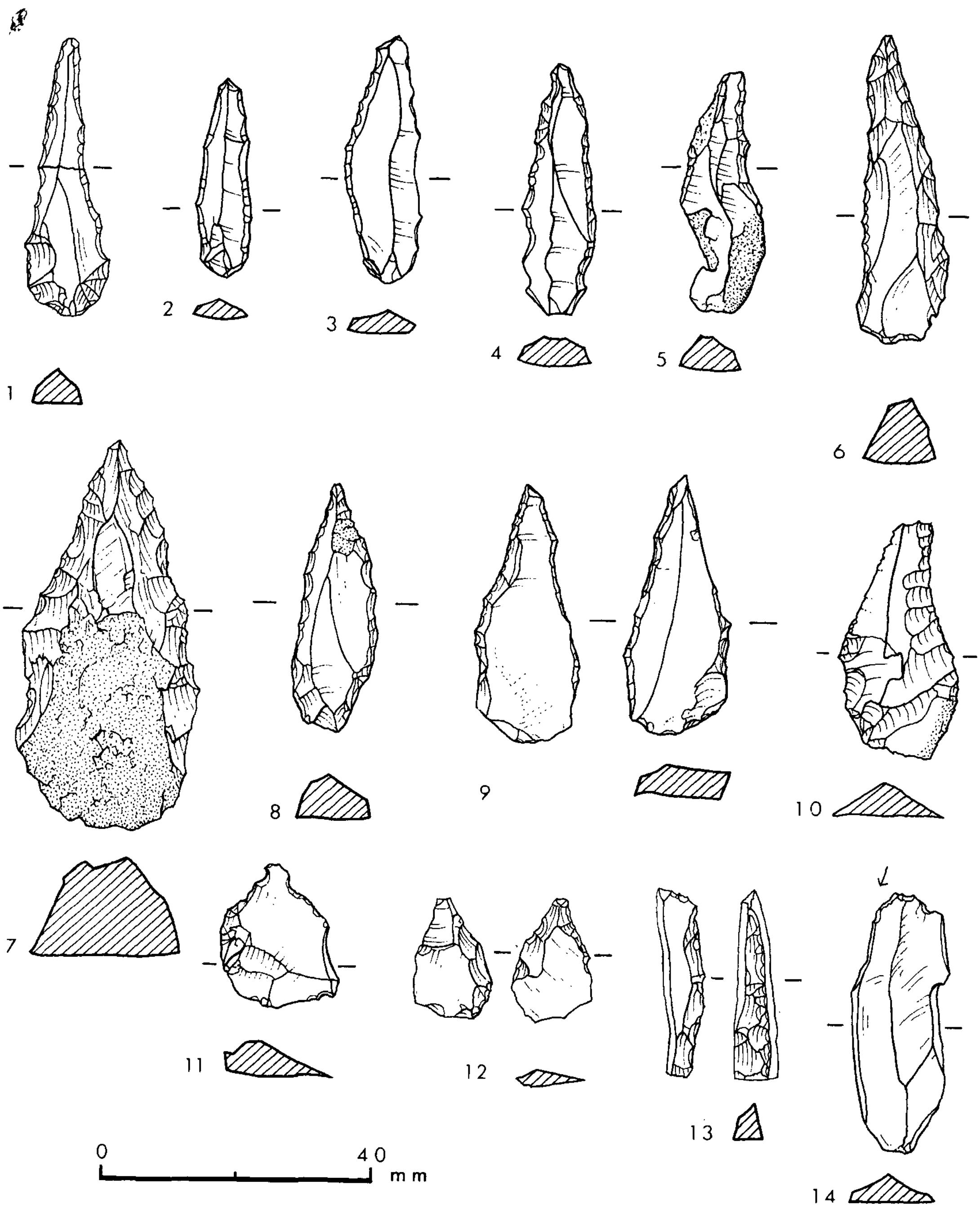
RETOUCHED BLADE SEGMENTS (Ill 57. 17–18)

Retouched blade segments are deliberately segmented blades that have been modified along one or more edges.

There are 7 retouched blade segments, none of which retain either the distal or the proximal end. The majority are retouched on one side only, and the non-retouched edge is often damaged. Two pieces are retouched on both sides and two have been retouched across the break.



ILL 57: The lithic assemblage, modified artifacts: 1–8 simple edge retouched artifacts: 9–16 complex edge retouched artifacts: 17–18 retouched blade segments.
5–6, 9, 12–14, 16 bloodstone: 1–4, 7–8, 10–11, 15, 18 flint: 17 abraded.

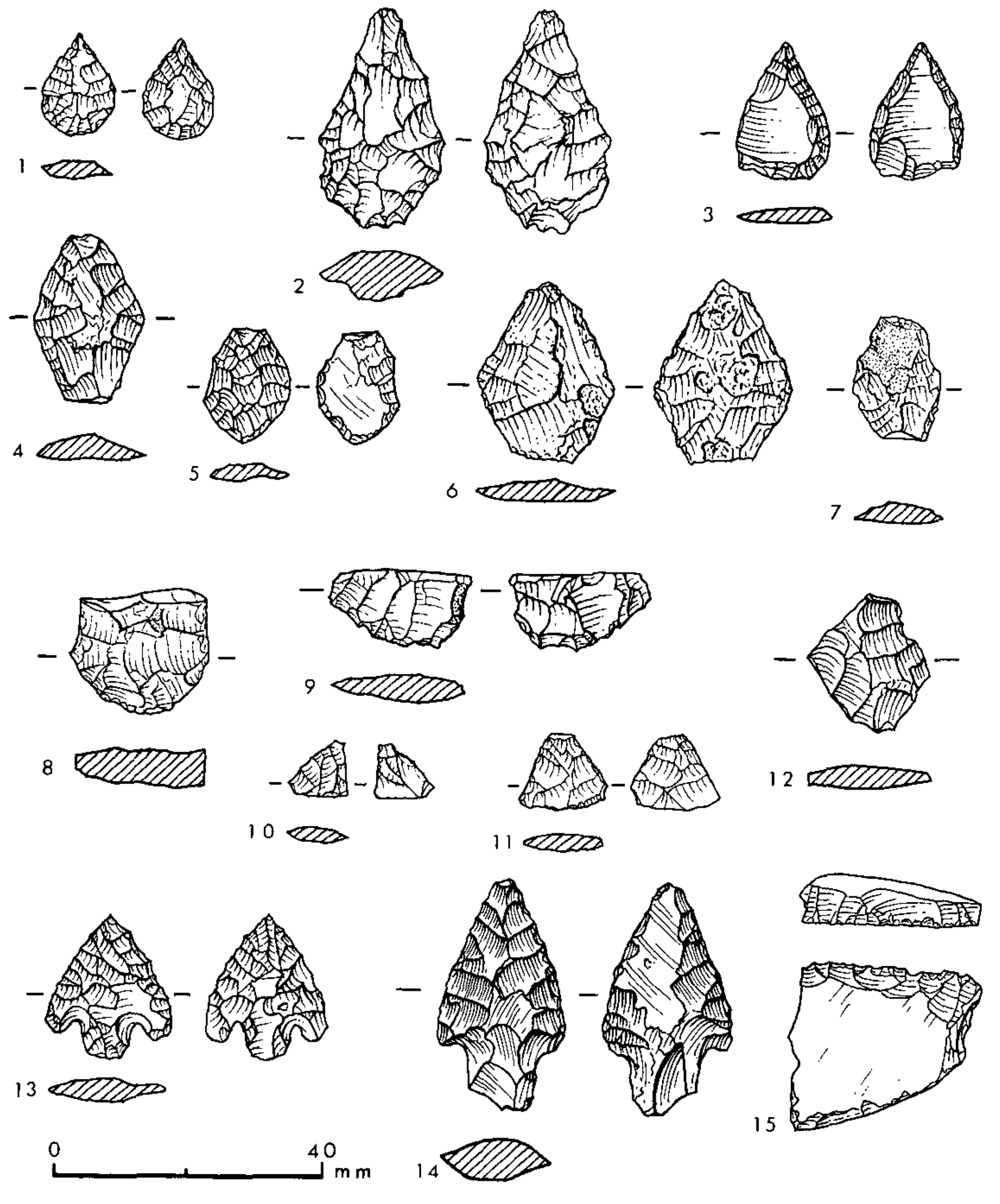


ILL 58: The lithic assemblage, modified artifacts: 1–12 borers: 13 burin spall: 14 burin:
6, 8, 10–14 bloodstone: 1–3, 7, 9, flint: 4–5 abraded.

BORERS (Ill 58. 1–12)

Borers have a point created by the modification of one or more edges.

56 borers were identified. The majority are of blade-like proportions (Ill 53) and this is reflected in the selection of blanks. Inner blades and inner regular flakes were preferred, and flint was the usual raw material. The majority of the points are long and fine (Ill 58. 1–5), they are enhanced by microlithic retouch on at least one side and they often have inverse retouch on the other. The retouch frequently extends the length of the blank, serving both to form the point and to modify the overall shape of the artifact. A few borers, on chunky blanks, have thicker points (Ill 58. 6–8). Many of the points are blunt and, on a number, the extreme tips have sheared off, possibly as a result of use. Others have snapped further away from the tip, and for one snapped borer the two halves could be



ILL 59: The lithic assemblage, modified artifacts: 1–14 invasive flaked points: 15 gunflint.
5, 8, 11. 13 bloodstone: 1–4, 7, 9–10, 15 flint: 6 & 12 abraded.
NB 14 recovered from near to the summit of Hallival in 1982.

joined (Ill 58. 1; both halves came from the same grid square in the ploughsoil). Six borers stand out from the rest: each is made on a wide, short flake blank, and the points are small and insubstantial, isolated by short indentations of tiny retouch (Ill 58. 11–12).

BURINS (Ill 58. 13–14)

One possible burin and one burin spall were identified. The burin is on a blade of bloodstone, and has a long facet running the length of the left side. The spall is also of bloodstone.

INVASIVE FLAKED POINTS (Ill 59. 1–13)

Invasive flaked points have modification to the original shape of the blank to form a pointed or 'arrowhead' shape.

The assemblage contained a total of 19 invasive flaked points. There are four complete invasive flaked points: three leaf-shaped points (Ill 59. 1–3) and one barbed-and-tanged point (Ill 59. 13). In addition, there are four leaf-shaped points with the tips and bases missing (Ill 59. 4–7), and six fragments apparently from similar points (three rounded bases, Ill 59. 8–9; two tips, Ill 59. 10–11; and one side, Ill 59. 12). Also included within this classification are two tiny fragments, each with invasive flaking over one face.

Both bloodstone and flint were used for the invasive flaked points, although more are of flint (Ill 53). There is great variation in size and shape amongst the more complete pieces, which range from a tiny, slightly ogival point to a large kite-shaped point. The retouch was used to thin the blanks as well as to shape them, and it is fine and regular, although on one point an area of dense, intractable material was left as a bad irregularity (Ill 59. 2). One of the leaf-shaped points was formed on a suitably thin flake with the use of edge retouch only (Ill 59. 3). This piece is idiosyncratic in shape, and it might be related to the small borers on flakes; it has, however, been considered as a point as none of the borers have retouch right around the periphery of the blank and all are smaller in size. The barbed-and-tanged point (Ill 59. 13) is of bloodstone; it is finely flaked. There has been no attempt to fit the points in to the classification devised by Green (1980) as his work did not examine Scottish points in detail. Metrical analysis of the type proposed by Green would be difficult as so few of the Kinloch points are complete.

MISCELLANEOUS

Miscellaneous pieces are those with some edge modification, but this modification does not allow the artifact to be placed into any of the previously defined categories. 15 artifacts fell into this category. A wide range of sizes and blanks of both bloodstone and flint are represented but the modification on each is usually minimal.

BROKEN MISCELLANEOUS PIECES

Broken miscellaneous pieces have some modification to an edge, but the artifact is broken to the extent that no formal artifact type may be assigned; there are a total of 31.

GUNFLINT (Ill 59. 15)

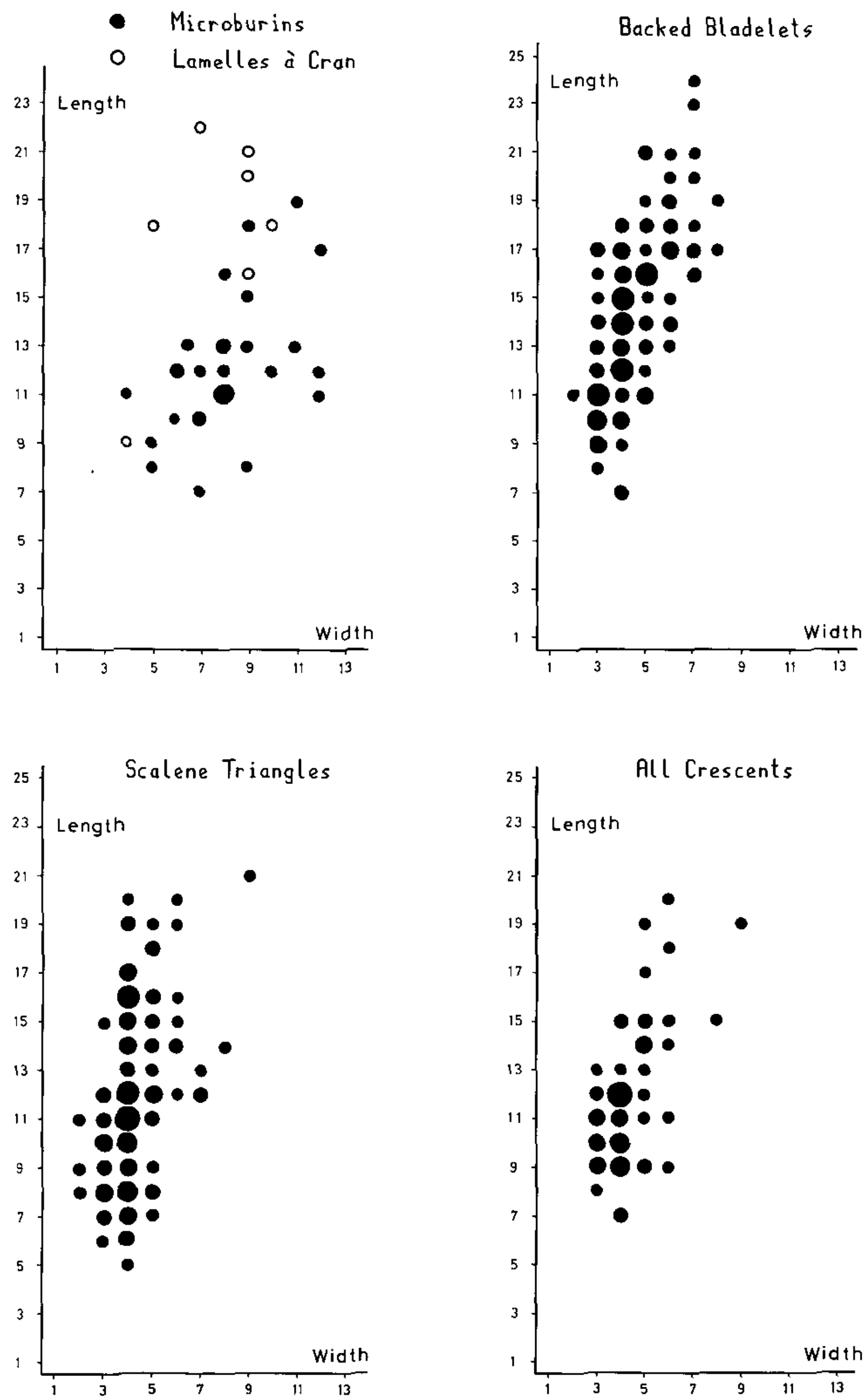
One gunflint was recovered, from the ploughsoil. It is made of a dark brown flint quite unlike that used for the rest of the assemblage, and it was presumably imported. The gunflint is broken, but it was not of the double backed varieties more common in recent times (Skertchly 1879, 46–64). The retouch, which is very abrupt, deep and irregular, is quite unlike that on the prehistoric artifacts.

MICROLITHS (Ills. 60–64)

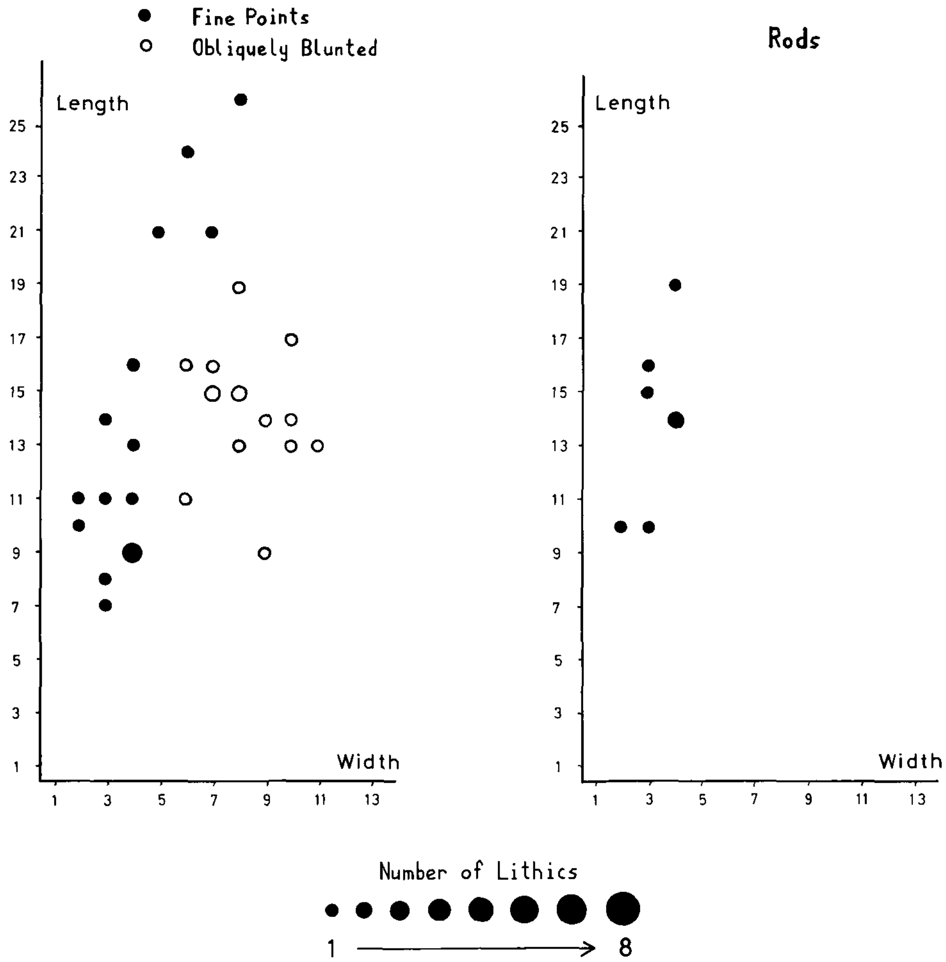
Microliths are blades that have been modified by short, abrupt retouch in order to alter the shape of the original blank and to blunt the edges.

The assemblage contained 1,155 microliths. They were

ILL 60: The lithic assemblage; microliths; scale 2:1 (Photograph – I Larner).



ILL 61: The lithic assemblage, microlith types: dimensions (mm).



ILL 62: The lithic assemblage, microlith types: dimensions (mm).

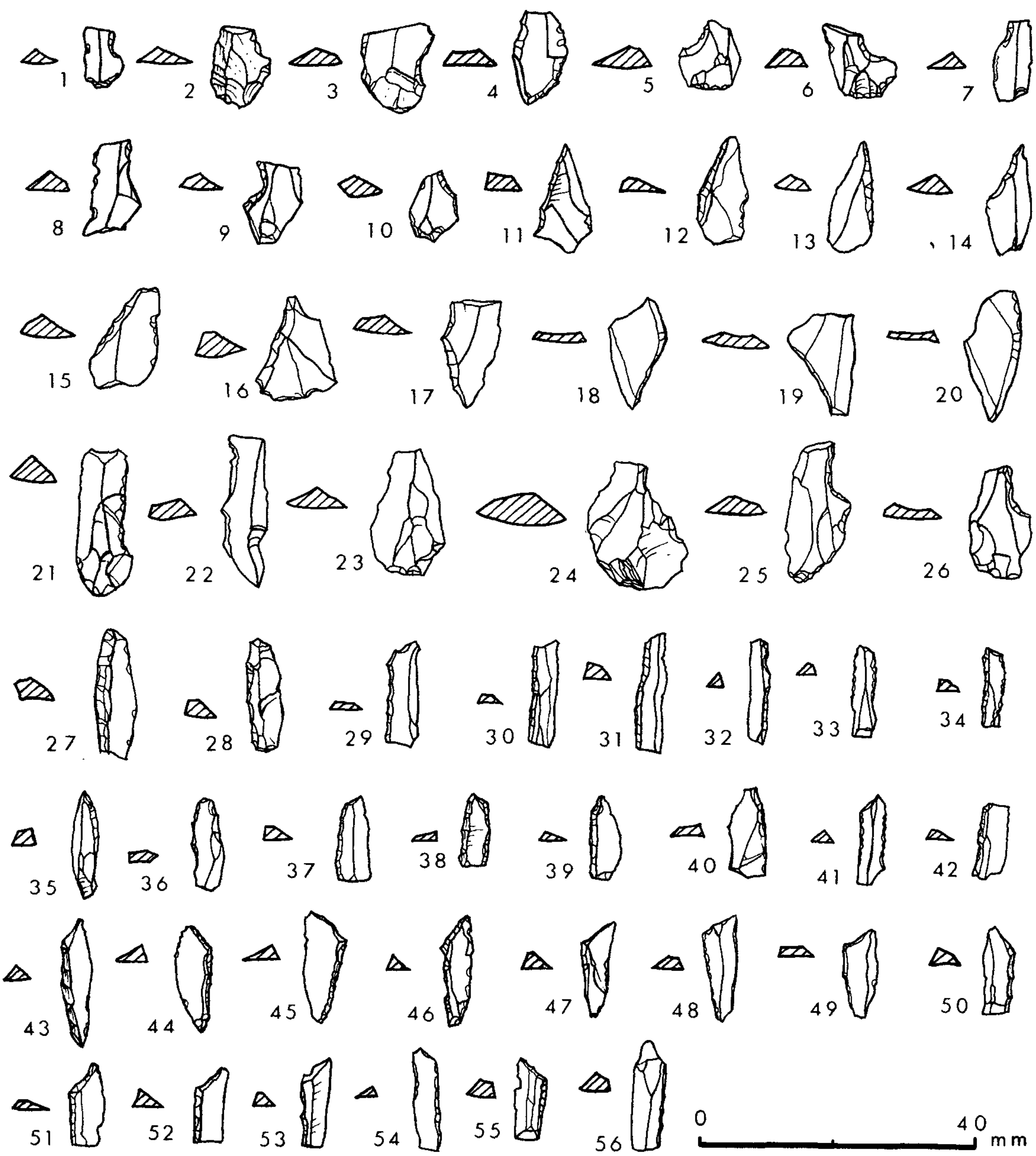
manufactured on blades of distinctive size (narrow blades; Chapter 6) in both bloodstone and flint. Many were abraded and their surfaces were altered to the extent that it was difficult to distinguish the material of which they were made, but flint was apparently preferred (as with all artifacts based on blades). Both the tips (distal) and the butts (proximal) of the blades were removed for the majority of microliths. This truncation is often associated with the manufacture of microburin waste (Bordaz 1970), but there are few microburins from Kinloch and it is likely that truncation was also accomplished by straightforward retouching (although it is possible that deposits containing microburins were not excavated). The retouch used for microlith modification is quite different to that used for the other modified pieces (except for the tips of the borers), and it is termed 'microlithic retouch'. With the exception of two artifacts (the invasive points, Ill 64. 24–5), the retouch scars are extremely short and abrupt, and they are confined to the very edge of each blade. The microlithic retouch has produced very blunt edges, from 75°–90°; the easiest way to achieve this abrupt modification on such small blanks is to rest the blank on an anvil and apply light percussion. Although this technique may well have been used at Kinloch, it has not always resulted in the characteristic *enclume* retouch that is often associated with work on an anvil, when scars are detached simultaneously from both faces of the blank. Some examples of *enclume* retouch do exist at Kinloch, but it seems likely that the formation of *enclume* scars depends on the shape of the blank: a blank with pronounced central ridges will rest on the anvil in such a way that the dorsal face of the blade is not in contact with the anvil.

There are eleven sub-types of microlith, in general each corresponds to a traditional microlith type, but detailed definitions are given below.

1 Microburins
2 Lamelles à Cran
3 Obliquely Blunted Blades
4 Backed Bladelets
5 Scalene Triangles
6 Crescents
7 Double Edged Crescents
8 Rods
9 Fine Points
10 Invasive Points
11 Fragments

MICROBURINS (Ills 61; 63. 1–10)

Microburins are the snapped ends of blades, and are characterised by a notch produced by microlithic retouch



ILL 63: The lithic assemblage, modified artifacts: microliths. 1–10 microburins: 11–20 obliquely blunted blades: 21–26 lamelles à cran; 27–42 backed bladelets: 43–56 scalene triangles.

on one side of the blade in order to generate the snap. The notch is usually truncated by the snap.

There are 33 microburins. Microburins are recognised to be waste material from the manufacture of microliths, in particular from scalene triangles (Brinch-Petersen 1966). The majority at Kinloch are proximal ends, most of which have been notched on the right-hand side; there are also a few distal ends (all but one with a left-hand side notch), as well as a few segments of uncertain orientation.

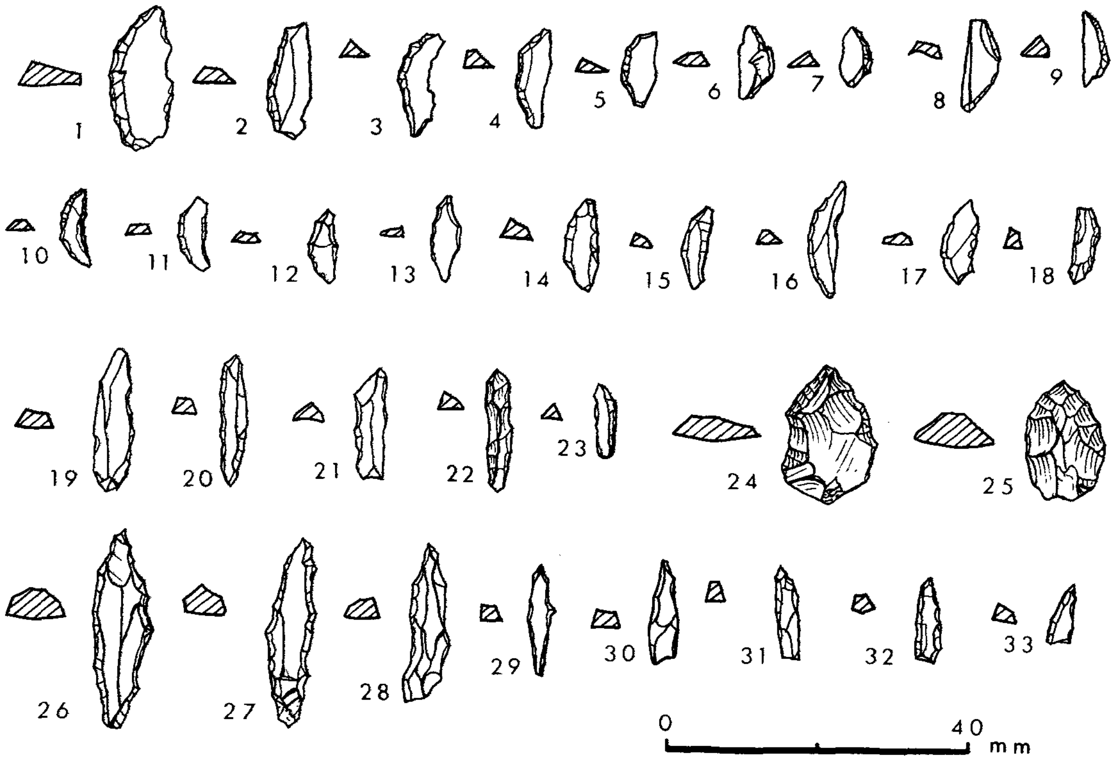
LAMELLES À CRAN (Ills 61; 63. 21–26)

Lamelles à cran are the proximal ends of blades with microlithic retouch along one side (sometimes both sides). Like microburins, Lamelles à cran have a characteristic notch, presumed to be associated with the snapping process.

Lamelles à cran may be a long form of microburin, but they are apparently deliberately shaped by microlithic retouch, there were a total of 6 in the assemblage. Like microburins, they have been associated elsewhere with the production of scalene triangles (Brinch-Petersen 1966).

OBLIQUELY BLUNTED BLADES (Ills 62; 63. 11–20)

Obliquely blunted blades are snapped blades with microlithic retouch across the snap, which runs obliquely across the piece.



ILL 64: The lithic assemblage, modified artifacts: microliths. 1–9 crescents: 10–18 double edged crescents: 19–23 rods: 24–25 invasive points: 26–33 fine points.

There are 16 obliquely blunted blades; unlike the other microliths, they preserve a short length of both of the original sides. Some have fresh and acute edges, others have blunt edges, and a few have been deliberately blunted by microlithic retouch. Although they are of a standard length (c.14mm), the obliquely blunted blades are wider than the other microlith types, and it is possible that they represent a type of distal microburin.

BACKED BLADELETS (Ills 61; 63. 27–42)

Backed bladelets have been blunted by microlithic retouch down one side, and all have a triangular cross-section and they are rectangular in plan.

There are 144 backed bladelets; a few have retouch along both sides, but even these still have the characteristic triangular cross section which differentiates them from rods.

SCALENE TRIANGLES (Ills 61; 63. 43–56)

Scalene triangles are blades that are both backed and obliquely blunted by microlithic retouch. They are triangular in plan and in cross-section.

There are 158 scalene triangles, with a great variety of both size and shape, but in general they are shorter than the other microlith forms, and they are always of a distinctive triangular shape with a short oblique edge. The majority of the scalene triangles have a straight oblique edge but a few have a concave oblique edge.

CRESCENTS (Ills 61; 64. 1–9)

Crescents are blades that have been blunted by microlithic retouch down one side. The retouched side is convex in outline, so that the piece is crescentic in plan with a triangular cross-section.

There are 53 crescents.

DOUBLE EDGED CRESCENTS (Ills 61; 64. 10–18)

Double edged crescents are blades that have been retouched by microlithic retouch on all sides to produce a crescentic shape. These pieces lack the acute, unmodified edge of the crescents and they have a more rectangular cross-section.

There are 11 double edged crescents; the similarities of shape with the crescents would suggest that they may be related to the crescents, but they lack the sharp edge of the latter so that this may be a false assumption. Double edged crescents tend to be smaller than crescents, and they are the shortest of the microlith types, doubtless because of the greater amount of modification involved in their manufacture.

RODS (Ills 62; 64. 19–23)

Rods are blades with microlithic retouch down one or both sides, and they have a rectangular cross-section.

There are 8 rods; they differ from the backed bladelets in that they do not have the acute edge of the backed bladelet. Although of a similar length to the backed bladelets, rods tend to be narrower, no doubt as a result of modification on both sides.

FINE POINTS (Ills 62; 64. 26–33)

Fine points are blades with modification by microlithic retouch along one or both sides to form a narrow single point at one end.

There are 18 fine points; all are long and thin, and many have a very sharp point. The blunt end is formed by a lateral snap across the piece. They are shorter and finer than the borers, but of a similar pointed morphology, and it is possible that they are merely the snapped tips of freshly made borers.

INVASIVE POINTS (Ill 64. 24–25)

Invasive points are small flakes or blades modified into the shape of a point by invasive retouch over the dorsal face.

Two invasive points were recovered, both from the same spot within the ploughsoil. They differ from the bifacial points in that they are unifacial, and they are much smaller than all but one of these points (the mesolithic piece Ill 59. 1).

FRAGMENTS

Fragments are broken pieces with microlithic retouch.

706 pieces were identified as fragments; all are so broken that the original microlith type cannot be identified. With the exception of eight pieces, all the fragments are laterally broken, as might be expected for artifacts of this shape; 35% are proximal fragments, 17% are distal fragments, and 48% are segments.

DISCUSSION

With the exception of the two anomalous invasive points, the microlith assemblage is based on the modification of narrow blades. Evidence for the manufacture of these blades was noted during the technological examination of the assemblage (Chapter 6). Broadly similar blades were selected for the different microlith types, even though there is some differentiation in size between the different types of finished piece (Ills 61, 62). This is presumably related to the different amounts of modification necessary. Although the microburin technique was used, there are so few microburins of any type that microburin technique cannot have been essential to the production of any microliths, whether scalene triangles or others.

It is generally accepted that microliths are the lithic components of composite tools which used several lithic elements set into a haft, usually surmised to be of wood. At Kinloch a number of specifically different morphological types were recovered, but the relationship of these different types one to another must be questioned. In the past, different functions have been ascribed to the different microlith types but, as Woodman notes, composite tools combine different microlith types when they are preserved (Woodman 1985a, 47). An examination of the locations of the different microlith groups at Kinloch revealed neither recurrent combinations nor mutually exclusive distributions that might have shed light on the associations of the original tools.

CONCLUSIONS: SECONDARY TECHNOLOGY AND THE MODIFICATION OF ARTIFACTS

Only a small proportion of the blades and flakes that were manufactured were modified. Although it is likely that modified artifacts were removed from the immediate areas of manufacture, there is evidence for both the use, as well as, manufacture of stone tools amongst the assemblage, so that the proportions of the different types of material recovered are likely to be representative of the original assemblage. Once modified, the finished tools fall into a number of distinct morphological types, and it would seem that the prehistoric knappers had a variety of templates to which they manufactured pieces. There is certainly evidence for the careful selection of different blanks according to the requirements of the different artifact types: in some cases inner blades or regular flakes were preferred (eg for the borers); in others a more chunky irregular flake was suitable (eg for the angled scrapers); or a narrow blade (eg for the microliths). Although both main raw materials were used for all modified artifact types, those reliant upon a more regular blank were made more frequently on flint. This may reflect the deliberate selection of flint, but it may also reflect the fact that regular blanks were less easily made of bloodstone.

Finally, the classifications presented here do not necessarily equate with any prehistoric tool types. Research has shown that the relationships between archaeological tool types, actual tool functions, and indigenous tool types are extremely complex (Knutsson 1988a; and see Wright 1977, especially the papers by Clegg; Crosby; Hayden; and White *et al*). Not only may a tool be used for more than one purpose, but it may also be altered in shape throughout its life to suit various functions; moreover, the ways in which tool users classify their tools do not always correspond to the uses to which they are put. Compare the modern classifications of a fountain pen, ball point, felt tip, and roller ball, all of which serve the same function, while a penknife may serve many functions but is rarely associated with writing.

8 THE LITHIC ASSEMBLAGE: USE AND DEPOSITION

INTRODUCTION

The lithic artifacts recovered from Kinloch are the products of a series of human activities (Bonnichsen 1977; Knutsson 1988a, 11–18). The first of these have already been considered: the selection and procurement of raw materials and their reduction into specific tool types. After manufacture, however, artifacts still have some way to go before they enter the archaeological record. The next stage would usually be use, followed perhaps by maintenance or curation, and finally deposition. The stages of manufacture, use, and deposition have been termed the 'Formative Processes' (Madsen 1986, 5; Knutsson 1988a, 22–3), and they are to be differentiated from the subsequent post-depositional 'Formation Processes' (Schiffer 1976). Formation processes are discussed in Chapter 12; the present section is concerned with the period of time between the manufacture of the assemblage and its incorporation into the archaeological deposits. It includes analysis of both the function and the deposition of the assemblage, but first it is necessary to question the relationship between the recovered assemblage and the assemblage that was originally deposited.

Lithics were collected by both manual collection and by wet sieving, to ensure that the archaeological assemblage might be representative of the original composition of the prehistoric assemblage (Chapter 2). The most obvious impact of the wet sieving was that it greatly increased the size of the recovered assemblage (Tab 9), but in addition certain types of artifact were apparently more likely to be recovered through visual inspection than were others. Table 10 was constructed in order to illustrate the biases operating in the material recovered by hand. In this figure the composition of a hypothetical sample of 1000 artifacts recovered by wet sieving in combination with manual collection is predicted, then compared with the composition of the assemblage that would be expected from hand collection only. From this a bias factor for each artifact type may be calculated. Some types are seen to be over-represented in the manual collection, while other types are under-represented, but it must be stressed that these particular bias factors apply only to Kinloch. The excavators at Kinloch were clearly more likely to recover larger artifacts of known type on site (eg cores or scrapers), but their interest in hunter-gatherer

Recovery Technique	Pebbles	Cores	Blades	Regular Flakes	Irregular >1cm Flakes	Irregular <1cm Flakes	Chunks	Microliths	Non-Microlithic ret. pieces	Total
Manual	10	76	232	1253	1568	1145	350	46	26	4706
%	50%	63%	39%	39%	34%	8%	14%	17%	59%	18%
Wet Sieve	10	44	357	1994	3034	12916	2215	224	18	20812
%	50%	37%	61%	61%	66%	92%	86%	83%	41%	82%
Total	20	120	589	3247	4602	14061	2565	270	44	25518

Table 9: Recovery techniques: a comparison of the different recovery rates by lithic artifact type.

sites may be reflected in the high manual recovery rate for microliths, despite their small size. Even with a 3mm mesh sieve, much lithic material will still be lost (Bang-Andersen 1985, 21; Payne 1972, 52–3; Fladmark 1982), but with sieving the biases inherent in manual collection are reduced, so that the archaeological sample may be considered with more confidence to represent that buried in prehistory.

Sample of 1000 pieces Expected composition	Pebbles	Cores	Blades	Regular Flakes	Irregular >1cm Flakes	Irregular <1cm Flakes	Chunks	Microliths	Non-Microlithic ret. pieces
by hand + sieve	1	4	23	127	180	551	101	11	2
by hand alone	2	16	49	266	333	243	75	10	6
Bias of hand collection at Kinloch	× 2	× 4	× 2	× 2	× 2	÷2	÷1.5	-	×3

Table 10: The bias factors for hand collection at Kinloch.

THE FORMATIVE PROCESS

Manufacture has already been considered, and here evidence relating to use and deposition is examined; this encompasses five fields:

- the existence of a range of modified artifacts;
- the existence of macroscopic edge damage on many artifacts;
- the existence of specific breakage patterns amongst the modified artifacts;
- the existence of resharpening flakes and other indications of tool maintenance;
- the spatial patterning and associations of the lithic artifact types across the site.

THE RANGE OF MODIFIED ARTIFACTS

Amongst the assemblage there are a number of types of modified tools, all of which would be suitable for a variety of functions (Knutsson 1988a, 142–6; 1988b, 9–20). These pieces may have been used on site, but they may be freshly made tools awaiting removal for use elsewhere (particularly if the site were used for specialised production, cf Torrence 1986), or they could be failed tools, ie artifacts that did not conform to the prescribed type and so were discarded before use. As they generally conform to clear patterns of modification, the artifacts at Kinloch are unlikely to be failed tools, and a close examination of the pieces reveals that many bear macroscopic edge damage, and still more are broken.

MACROSCOPIC EDGE DAMAGE

Macroscopic edge damage occurs on many of the modified tools from Kinloch and it is seen on both retouched edges and unmodified edges. Although not systematically recorded, it was also observed on the regular flakes and on the blades, as well as on much of the debitage. Macroscopic edge damage may be caused by manufacture, use, or post-depositional pressures, eg plough damage or trampling (Betts 1978; Knudson 1979). Without microscopic examination, however, it is usually impossible to distinguish between damage that has resulted from use and post-depositional damage. The most obvious example of edge damage caused by use occurs amongst the borers, where many of the tips are noticeably rounded and blunted.

BREAKAGE

Breakage may result from use and from post-depositional pressures. When due to post-depositional pressure it generally occurs in a random fashion exploiting the structural weaknesses of the pieces. Breakage due to use generally occurs in more consistent patterns, as certain tool shapes are repeatedly subject to particular pressures. For this reason, the examination of any patterns of breakage amongst different tool types may shed light on tool use. At Kinloch certain tool types showed particular breakage patterns: many of the borers had lost their tips, and both the borers and the simple scrapers were frequently laterally broken. There were many broken scraper edges that had snapped just behind the scraper face; in these cases the face was usually made on the distal end of the blank, and they appeared to have broken from simple scrapers (Ill 56. 16–18). In contrast with the scrapers, the fragments of broken edge retouched pieces were varied. The particular patterns of breakage on scrapers have been noted on other sites, and it has been suggested that breakage was a deliberate part of tool manufacture (Broadbent 1979, 56–8). Finally, almost all the microlith fragments were a result of lateral breakage, but it is impossible to say whether this was a result of pressures imposed during use, or whether it was a feature of the natural weak point of the narrow blade blanks. The two causes may be linked, as breakage due to use will normally exploit the natural weak point of a tool.

INDICATIONS OF RESHARPENING

The existence of a number of scraper resharpening flakes (Ill 56. 14–15) is clearly indicative of use: some of the scrapers, at least, became blunt enough to require the manufacture of a new edge. These pieces are easily recognised, while flakes resulting from the resharpening of other tools are not, though a careful sort of the tiny irregular flakes would certainly reveal others with the characteristic truncated scars of previous edges. It is also notable that the tool types with the most complex retouch tend to be smaller than their simpler counterparts (Ills 52, 53); this is not just a result of a more complex manufacturing process bcause larger blanks were available and were used where necessary. An alternative explanation may be that the more complex modification is a result of resharpening and using new edges: as simple tools were repeatedly resharpened they became smaller and more complex.

SPATIAL PATTERNING AND ARTIFACT ASSOCIATIONS

The relationship between activity, activity area, and material deposits on hunter-gatherer sites has been much discussed (Binford 1983, 144–92; Forsberg 1985, 189–261; Schiffer 1976; Yellen 1977). At Kinloch the deposits containing stone tools might result from a variety of activities that may be divided into: tool manufacture and maintenance; tool use; tool discard. The analysis had to take account of the fact that the site was in use over a long period of time, and it was based on three areas of assumption:

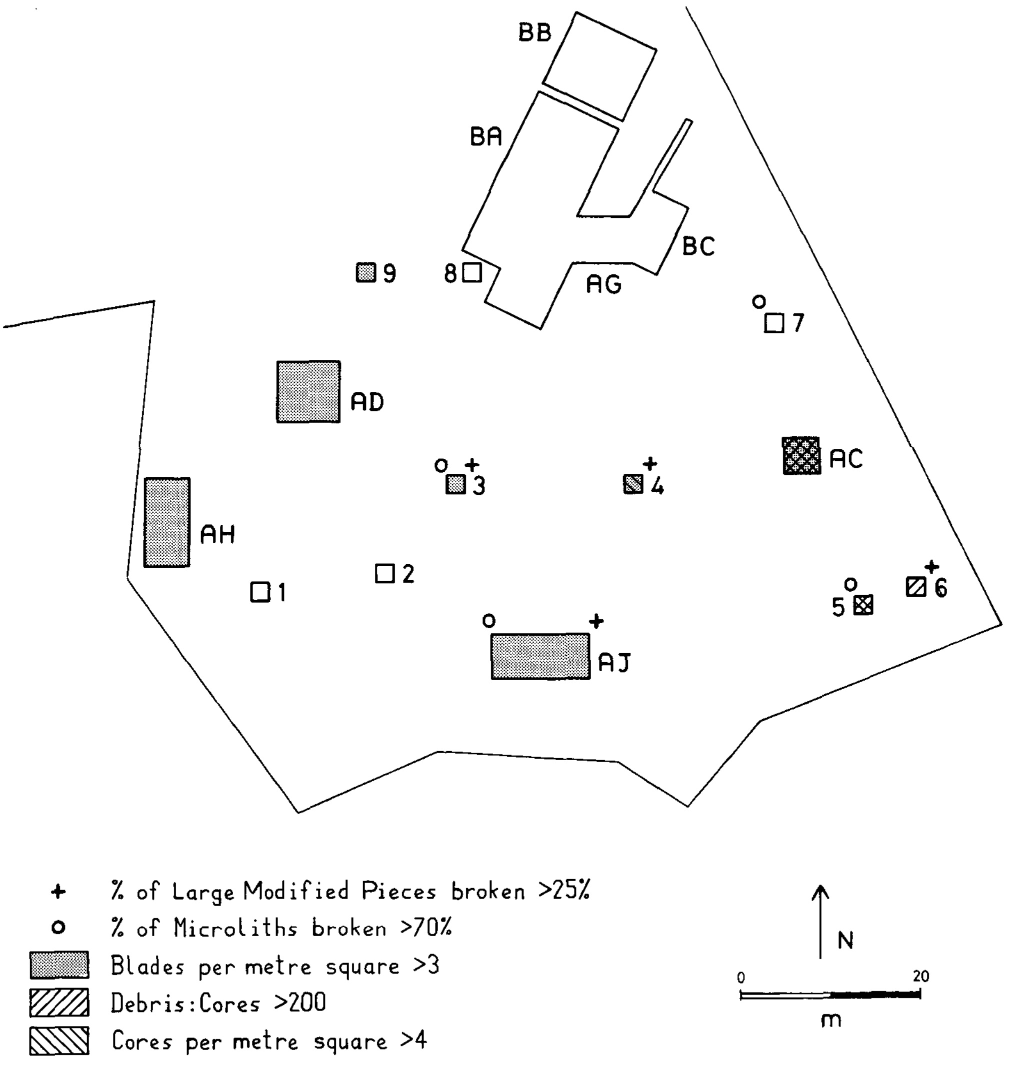
Deposits resulting from tool manufacture.
These should contain high quantities of debitage, as well as many cores and large numbers of regular flakes (it is likely that regular flakes were a by-product of the manufacture of blades at Kinloch, Chapter 6). If the knapping was *in situ*, or if the waste was specifically dumped, then a large proportion of the debitage should consist of tiny pieces (Behm 1983; Newcomer & Karlin 1987). Blades and modified pieces should be relatively rare.

Deposits resulting from tool maintenance.
These should contain both resharpening flakes and broken tools (the latter recognisable as broken blades and modified pieces). There may be some unused tools (probably unrecognisable to the present study), as well as flake and blade blanks. If the activity took place close by, or if the material was deposited soon after re-tooling finished, then very small resharpening and modification flakes may be present in large numbers.

Deposits resulting from tool use.
These should contain little knapping debris, and higher proportions of blades and modified pieces. If the morphological tools are broken, then they may have been deliberately discarded, and the location of the deposit may not be the place of use. If the morphological tools

	Debris/Cores	Microliths/m²	Cores/m²	Blades/m²
Sample Sq.				
1	148	<1	<1	1
2	122	2	1	1
3	145	12	3	5
4	180	12	7	8
5	241	6	4	<1
6	214	3	2	<1
7	170	3	1	4
8	130	10	4	11
9	44	2	2	3
Trench				
AC	214	5	4	4
AD	177	2	<1	3
AG	73	1	<1	2
AH	139	2	<1	5
AJ	194	3	2	5
BA	21	<1	2	2
BB	33	<1	<1	<1
BC	50	<1	1	2

Table 11: The distribution of lithic artifacts across the site.



ILL 65: The distribution of lithic artifacts across the site. Sample quadrats are numbered 1–9.

are complete, then the deposit may result from an interrupted activity. Although this use might have taken place close by, the tools may have been cached after use elsewhere. If the morphological types are all of a specific type or association of types, it may be possible to suggest that different areas were used for different tasks.

METHODS OF SPATIAL ANALYSIS

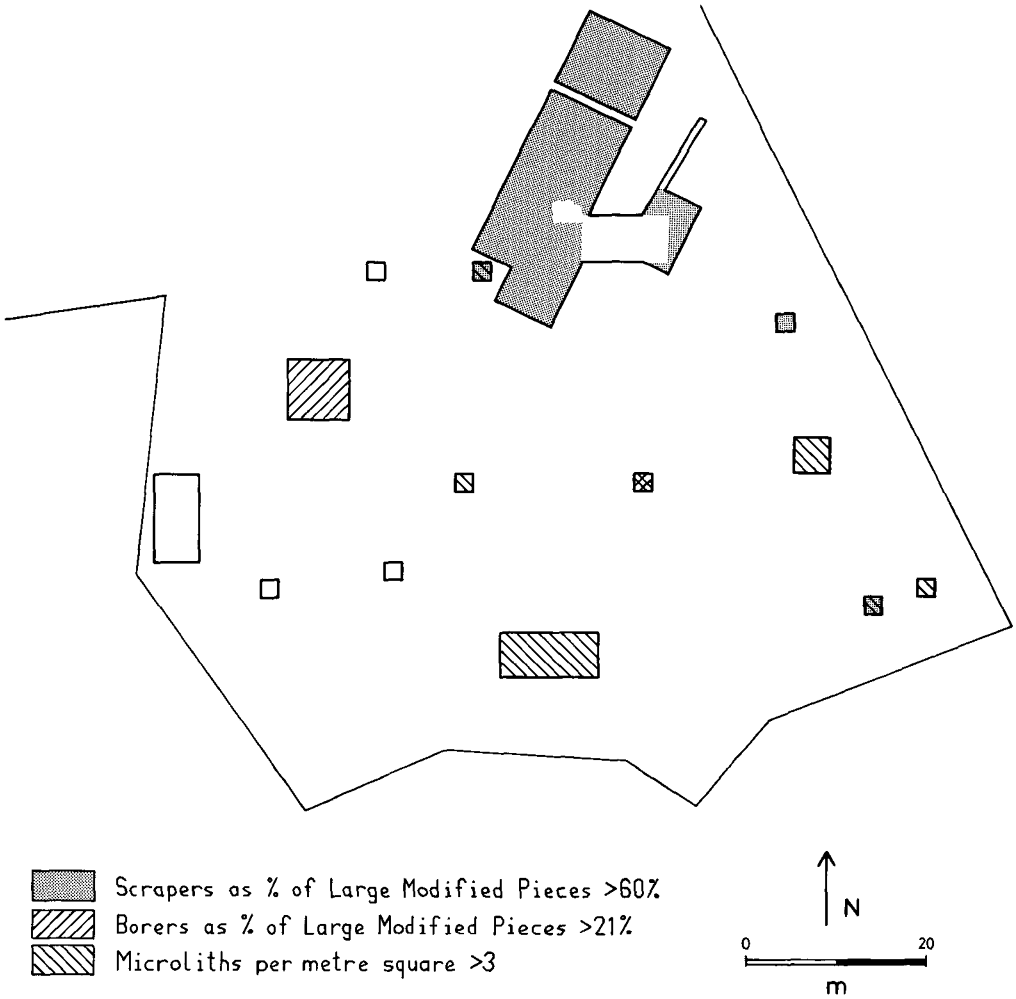
The spatial analysis was based on visual observation, the nature of the site and excavation was such that statistical analysis could not be applied (Whallon Jr 1978). Initially, the absolute quantities of the different artifact types in separate trenches were examined. This revealed some differentiation, but, as both the area and the assemblage size varied greatly, it was necessary to evaluate whether or not the differences revealed were true reflections of the variation of the prehistoric assemblages. Next, the importance of each lithic type was assessed for each context (as a percentage of the total assemblage from that context). Then, the absolute numbers of artifacts per metre square for the different contexts were calculated. Finally, it was predicted that specific associations of certain artifact types might be of interest (bearing in mind the assumptions outlined above), and indices were constructed to illustrate the ways in which these associations vary across the site:

debitage: cores,
debitage: regular flakes,
blades: cores,
regular flakes: cores.

THE RESULTS OF SPATIAL ANALYSIS

The contexts from which material was recovered are considered under two general headings, ie Ploughsoil and Stratified Features.

Initially, all the pits, hollows and other stratified features were examined, but in only two of the trenches (BA & AD) were features preserved to the extent that detailed analysis was worthwhile. There were, however, concentrations of material within the ploughsoil, and these were related to the features where they survived, while in areas of greater truncation they suggested the locations of 'ghost'



ILL 66: The distribution of modified artifacts across the site.

features. The general composition of the ploughsoil assemblage was therefore examined across the whole site, and the distributions of the different artifact types were plotted in detail across Trench BA. This trench was large enough both to identify spatial patterning in the size of the assemblage and its contents within the ploughsoil, and to relate the patterning to the complexes of stratified features.

The Ploughsoil Assemblage

The lithic assemblage was concentrated towards the S end of the site (Chapter 3; Ill 5), but it must be remembered that the 'original' S edge of the site had been disturbed in recent times. The absolute distributions of the individual artifact types reflect this concentration, but when the relationships between the types are examined some differentiation across the site may be discerned.

In general, the deposits of all areas were dominated by debitage; however, the indicators of manufacture were concentrated towards the SE corner of the site, whereas higher concentrations of blades were found to the S and W (Ill 65; Tab 11). Modified artifacts were evenly spread across the site and, although all types do appear in all areas, there is differentiation between the distribution of the various types (Ill 66; Tab 12). The N area of the site is dominated by scrapers, while microliths dominate in the S. Scrapers were particularly abundant in Trench BA (most of the concave scrapers were in Trench BA, though the morphological variation between the different concave scrapers means that several different prehistoric tool types may be represented, Chapter 7), and it is notable that only two of the scraper resharpening flakes occurred within scraper dominated areas. Borers were concentrated across the central and N parts of the site; they dominated the modified artifacts in Trench AD and in one sample quadrat (no 4), both of which are areas with low percentages of scrapers. Broken modified artifacts were concentrated across the central area of the site. Microliths were relatively rare towards the N edge, but where they occurred in the N they were dominated by backed bladelets, usually in association with scalene triangles. Towards the S and W scalene triangles predominated, while more of the crescentic types came from Trench BA (Ill 67; Tab 13), here there were also many backed bladelets but scalene triangles were rare.

Looking at trench BA in detail there is a general trend for material to be found towards the S, with the edge of another possible concentration to the W (Ills 68, 69). The distribution of individual types follows the same pattern

	Scraper %	Borers %	Retouched Edge %	Miscellaneous %	Invasive %	Retouched Blade Segments %	Scraper Resharpening %	% Broken Retouched	Total no. of artifacts
Sample Sq.									
1			100						1
2	20		20	40			20		5
3	41	11	29	11		6		35	17
4	32	21	18	7			18	28	28
5	70	10	10	10					10
6	25		25	12	12		25	25	8
7	60	20	20					20	5
8	70		10	10			10	10	10
9									
Trench									
AC	32		22	23	9	4	9	23	22
AD	21	25	39	11		3		18	28
AG	48	8	30	4		4	4	17	23
AH	50	10	20	10		10		10	10
AJ	38	8	15	28	6	2	2	30	47
BA	62	11	18	6	1			22	104
BB	100								2
BC	75		25					25	4

Table 12: The modified lithic assemblage: composition of non-microlithic artifact types by area.

(Ills 71–74), and the composition of the assemblage within each grid square is similar. Each square across the trench is dominated by knapping debris (Ill 70), but there is some patterning, eg blades were relatively more abundant towards the W (Ills 73, 76). Four of the grid squares with particularly high concentrations of debitage had surprisingly few cores (Ill 75); these areas included a high proportion of regular flakes, as well as a great percentage of tiny pieces (less than 10mm). There were more cores in some of the other debitage-rich areas, but none of the deposits characterised by debitage had large numbers of blades (Ills 75, 76).

Mesolithic Deposits

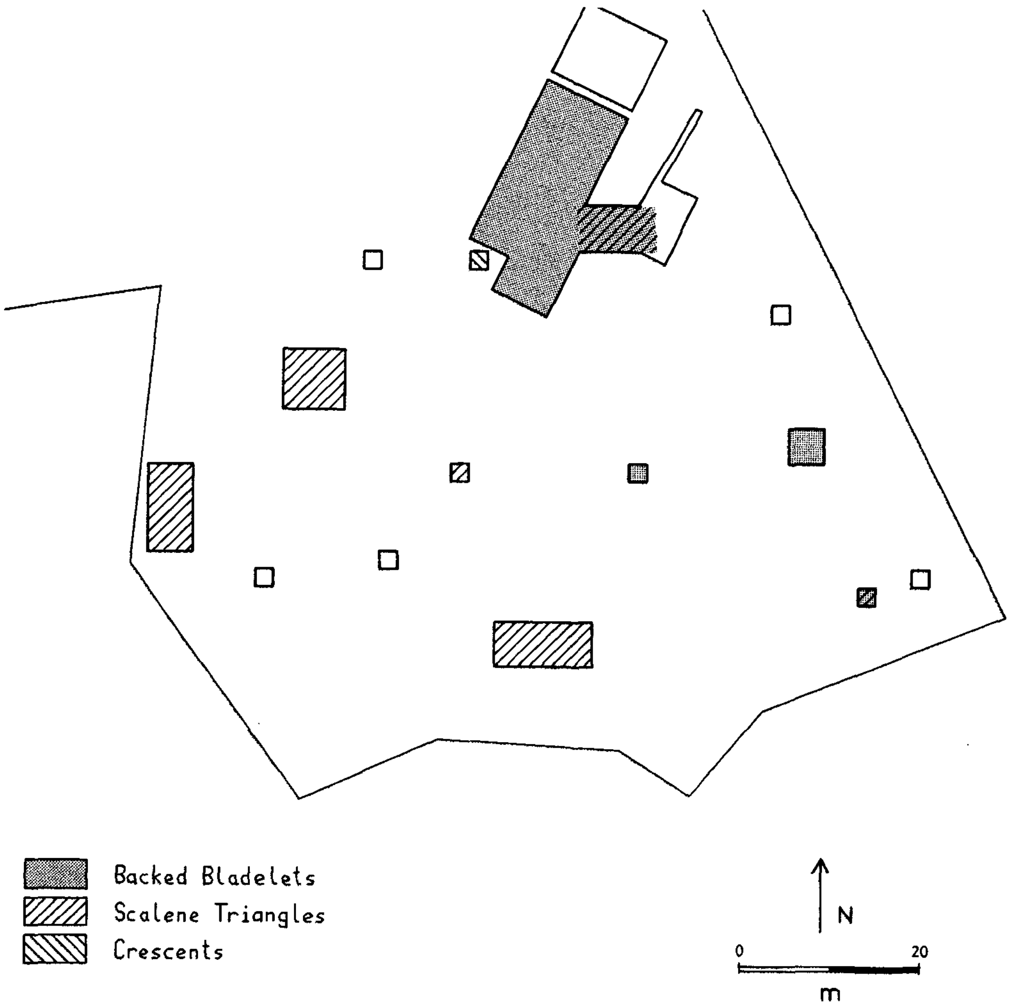
Trench AD (Tab 14) The mesolithic pits within the AD complex cut into each other, and they had probably filled relatively rapidly, consequently it was difficult to separate the contents of the individual pits. As might be expected, the larger and most recent pits had larger assemblages, whilst Pits AD 3 and 4 (of both of which little had survived) had the smallest assemblages. Examination of the artifact types within each pit revealed no discernable differences. The bulk of each fill consisted of knapping debris and similar types of modified artifacts, the bigger the fill the greater the range of types. With the exception of the ubiquitous fragments, the microliths were dominated by backed blades and scalene triangles, together with a few microburins and one or two of the other types. Larger modified artifacts comprised eight scrapers, two borers, a burin, one edge retouched piece, and a small leaf point.

Trench BA (Tab 14) As in Trench AD many of the pits in Trench BA were part of an intercutting complex (Pits BA 4–9), and there were no major differences between their artifactual contents. Knapping debris dominated all the fills. Modified artifacts included a limited range of microliths: fragments; backed bladelets; crescents and double edged crescents. The larger modified artifacts included mainly scrapers and borers which, interestingly, did not occur together within the same pits. There were also two edge retouched artifacts.

Mesolithic/Neolithic Deposits

Trench AD Only one small neolithic pit (AD 7) was identified and it contained few lithics (predominantly knapping debris, with three microliths: two fragments and a backed bladelet).

Trenches BA/BB/BC No pits of neolithic origin were identified in these trenches, but there were mixed deposits in, and around, the peat-filled watercourse (Chapter 3). There was little difference between the artifactual content



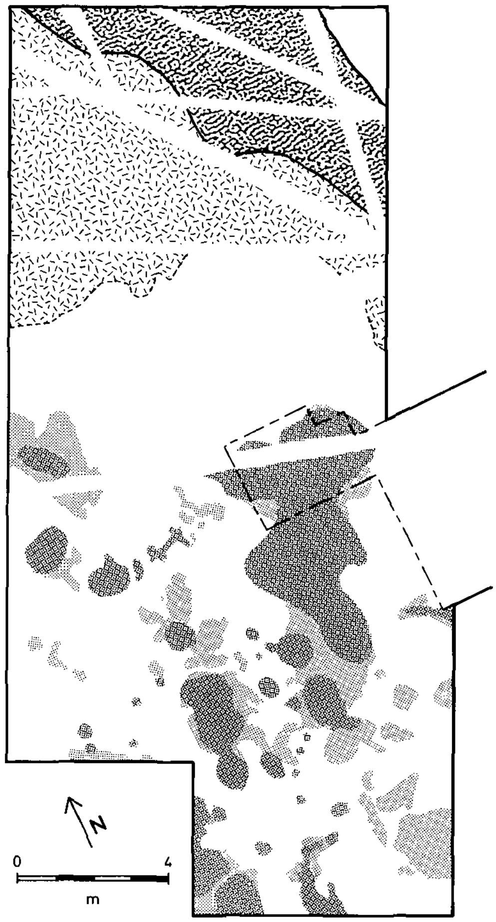
ILL 67: Artifact distribution across the site: dominant microliths.

of these individual deposits (the peat itself, the dumped bank materials, and the rocks and debris within the peat). All contained knapping debris, including a high percentage of cores and pebbles, and there were few modified artifacts. The latter comprised a few microliths and some other types (mainly broken or miscellaneous pieces, but there were two borers, a scraper resharpening flake, and two leaf points).

DISCUSSION

The archaeological evidence suggests that the spatial patterning of artifacts across the site resulted from differing activities in the various areas. Although evidence for the manufacture of tools existed everywhere, a closer examination of the range of artifact types indicates that manufacture predominated towards the S corner, and that the different areas of the site were dominated by specific modified types.

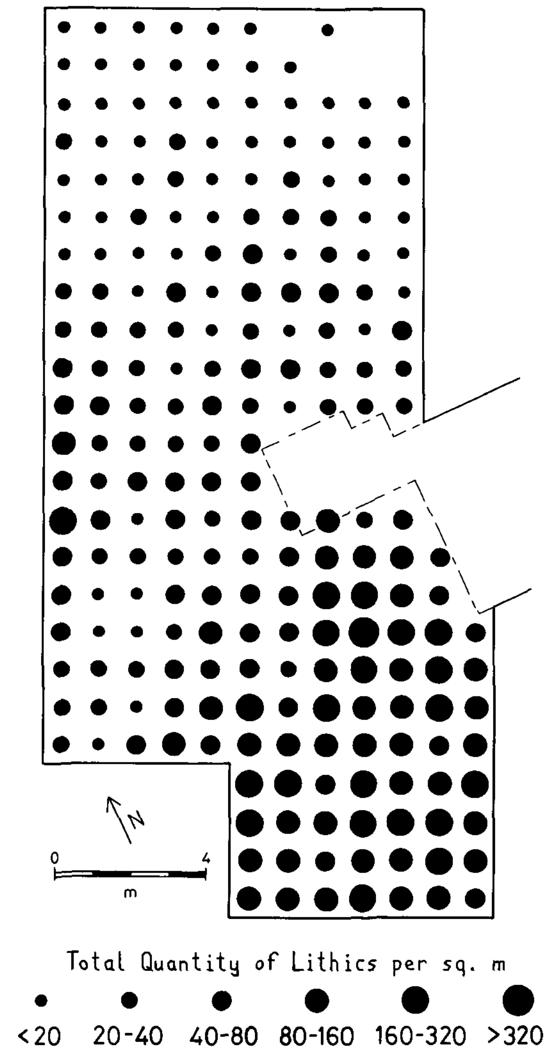
The knapping debris was concentrated in the S, but it still dominated the assemblage from Trench BA, and in this trench discrete concentrations could be highlighted. In some cases, the absence of cores associated with concentrations of knapping debris is cause for surprise, but work done elsewhere has suggested that the use of cores as an indicator of knapping debris may be misplaced (Welinder 1971, 181), and these particular deposits are probably the result of tool manufacture. Indeed, the presence of much tiny debitage would suggest that knapping occurred close by, if not on the spot. These deposits stand out from others where less tiny debris was



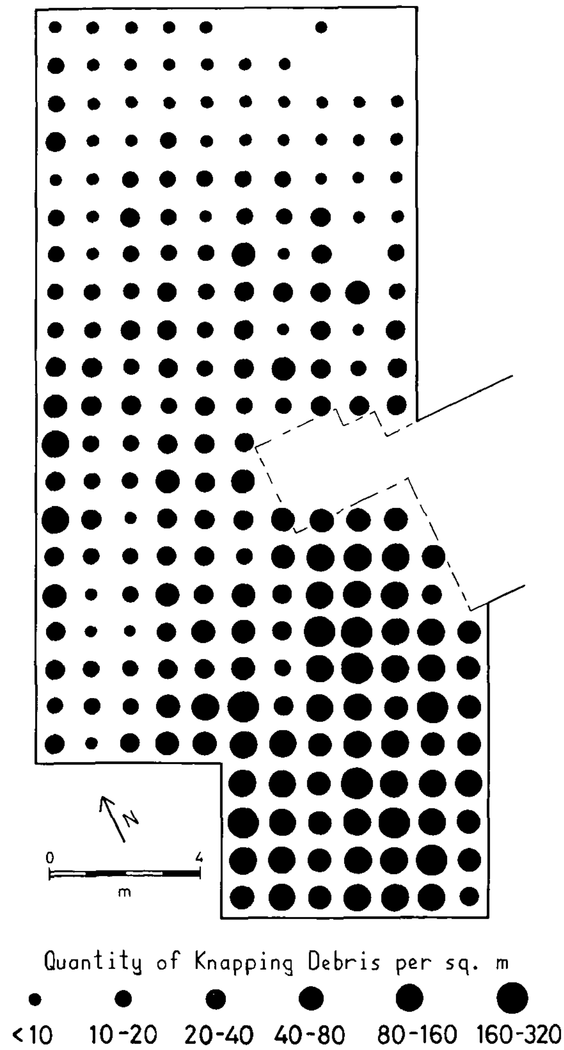
ILL 68: Trench BA: features.

recovered. The deposits in Trench BA seem fresher, or less re-worked, than material from elsewhere.

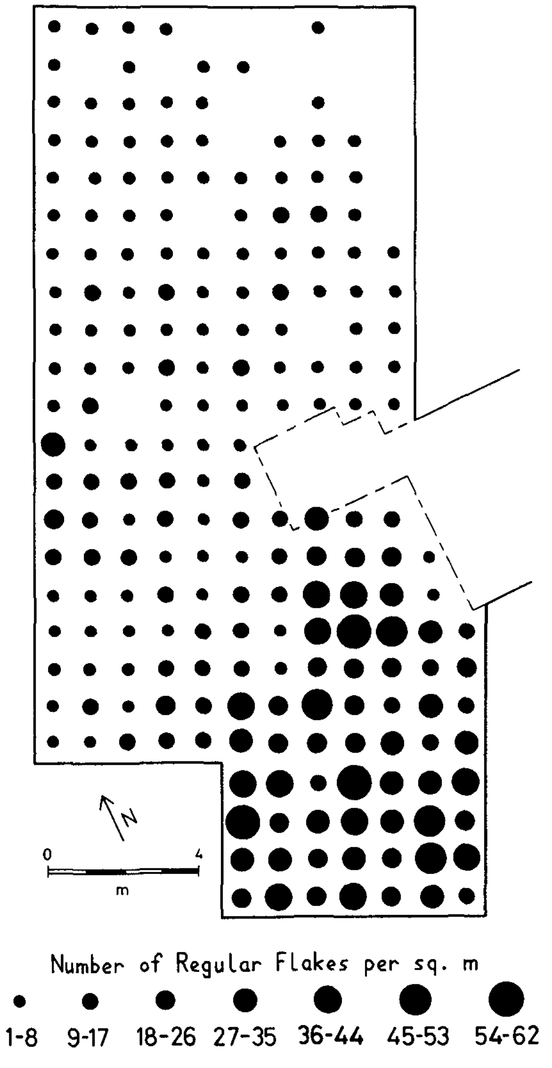
Trench BA yielded few modified artifacts, and there was little spatial variation across the trench. Microliths were not common at all, in either the features or the ploughsoil (though it is notable that the majority of the crescents from the site came from this trench); they were most abundant in the mesolithic pits. The mesolithic/neolithic deposits contained predominantly knapping debris with a few broken artifacts. In Trench AD the pits contained a different assemblage of modified tools to those in Trench BA and this difference was also reflected in the material from the ploughsoil. Although scrapers dominated the assemblage of larger modified tools, there were a few borers, but the two types did not occur together. Across the site the modified tools were always found in association with knapping debris, so that it seems likely that whilst the deposits were dominated by waste from tool manufacture, they also contained material from other activities. The different areas were dominated by particular tool types, some of which appear to be associated: eg microburins and scalene triangles occur in similar locations to the borers (S and centre); whilst elsewhere scrapers (particularly concave scrapers) were associated with crescentic microliths (to the N).



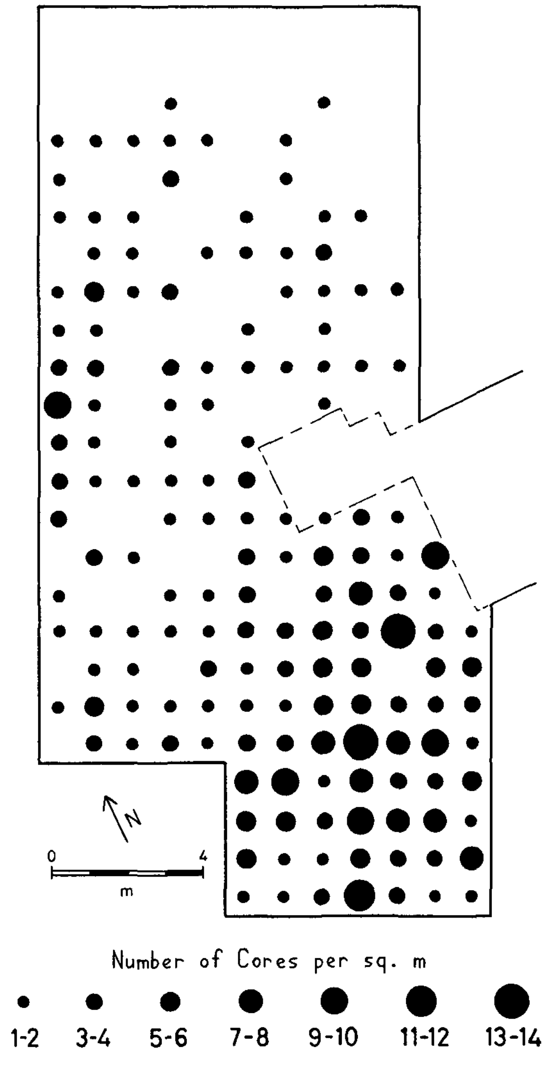
ILL 69: Trench BA: distribution of the total lithic assemblage.



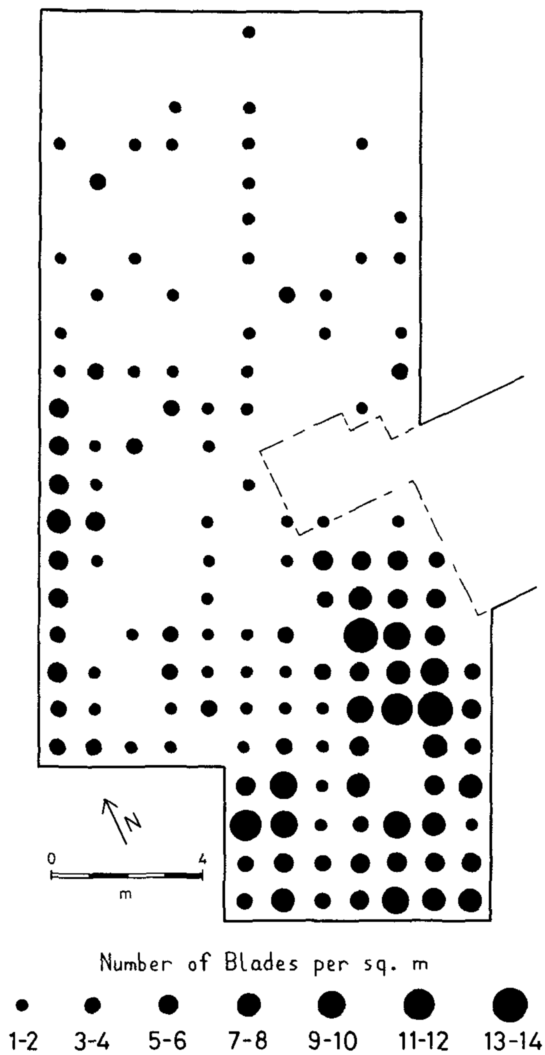
ILL 70: Trench BA: the distribution of knapping debris.



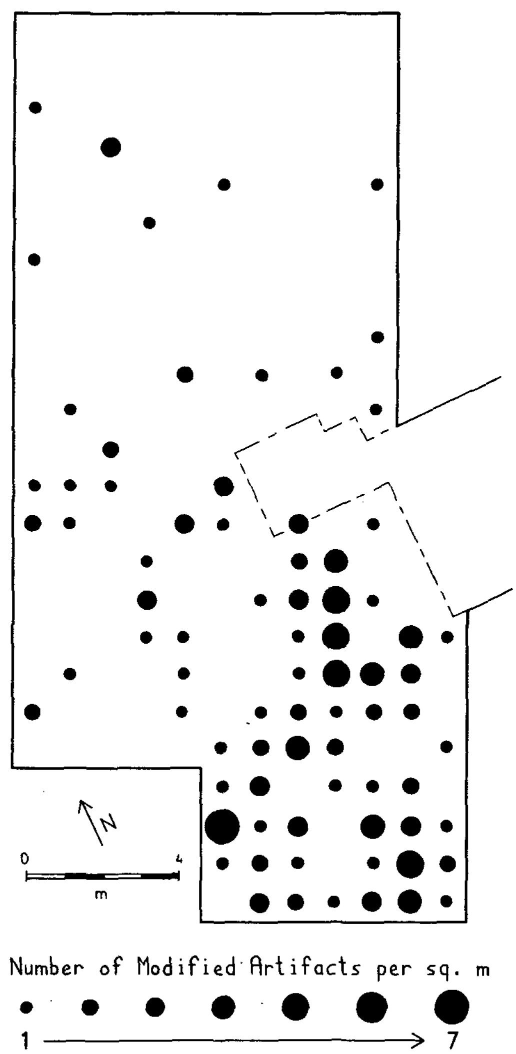
ILL 71: Trench BA: the distribution of regular flakes.



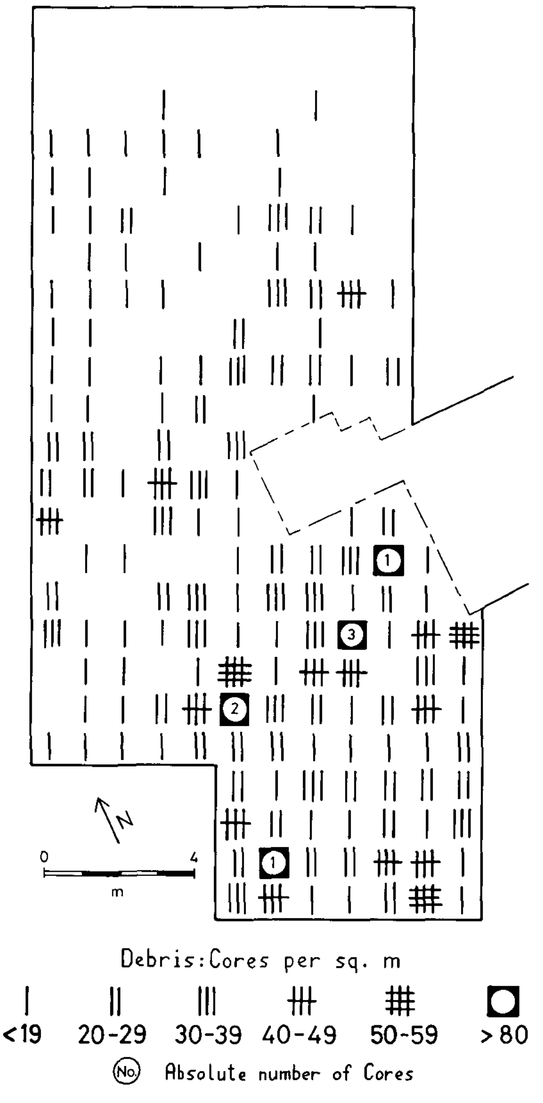
ILL 72: Trench BA: the distribution of cores.



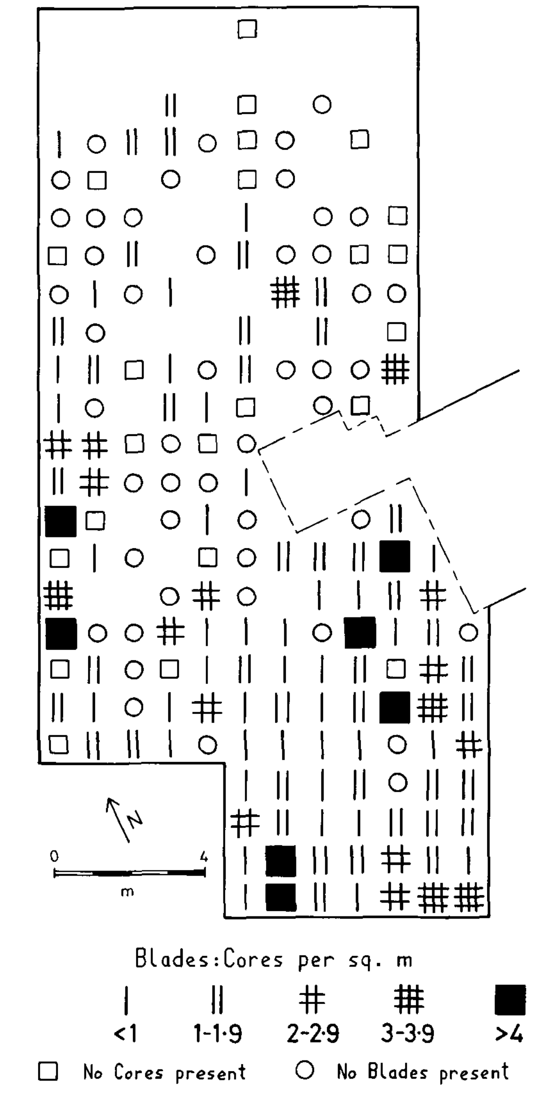
ILL 73: Trench BA: the distribution of blades.



ILL 74: Trench BA: the distribution of modified artifacts.



ILL 75: Trench BA: the distribution of debris/cores.



ILL 76: Trench BA: the distribution of blades/cores.

	Microburin %	Rods %	Backed Bladelets %	Scalene Triangles %	Crescents %	Fine Points %	Obliquely Blunted %	Lamelles a' Gran %	Invasive Fine Points %	Double Edge Crescent %	Broken %	Total no. of artifacts
Sample Sq.												
1				33	33						33	3
2	17						17				66	6
3			8	14	4						73	49
4	2		10	8			4				67	48
5			8	8	4	4				4	72	25
6	8		17	8			8				58	12
7		10		10			10				70	10
8	2		10	5	15	2			5		61	41
9	11				11	22		11			44	9
Trench												
AC	5	1	17	10	2	7		1			56	82
AD	5	1	10	21	1	1	1	2			58	109
AG	2		11	10	3	2	3			3	65	60
AH	5		4	17	2		4	1			67	98
AJ	1		8	12	3	1	1			1	72	165
BA	2		19	16	6		2				54	48
BB				50							50	2
BC				33			33				33	3

Table 13: The microlithic assemblage: composition of the assemblage by area.

PIT	PEBBLES	CORES	BLADES	DEBITAGE	Fragments	Backed Blades	Scalene Triangles	Double Edge Crescents	Crescents	Rods	Microburins	Fine Points	Obliquely Blunted	Scrapers	Borers	Edge Retouched	Invasive Points	Burins	TOTAL
AD 1	1	1	40	453	9	2	2							2		1		1	512
AD 2	1	12	104	3096	21	9	14		3	1	1	1	1	3	2				3269
AD 3			4	56															60
AD 4				7			1												8
AD 5	1	11	117	2151	30	4	5				3			3			1		2326
AD 6		2	13	305	3	3	1												327
BA 4/5	1	20	34	3055	6	2		3	1	1				3		1			3127
BA 6				59															59
BA 7	1	1	38	1627	6	3			2						2				1680
BA 8		8	35	3285	4				1	1									3344
BA 9		4	18	1353	4	2								1		1			1383
					Microliths									Non-Microlithic					

Table 14: Pits AD 1–6 & BA 4–9: lithic contents.

CONCLUSIONS

Although the artifactual deposits were composed primarily of knapping debris, the evidence does not suggest that Kinloch was simply a production site. Production was geared towards the manufacture of blades and modified tools based on blades, and a number of other morphological tool types were made. There is evidence that at least some of these tools were used for a range of tasks, and the different patterns of the tools across the site suggest that particular activities were concentrated in separate areas. The interpretation of these patterns is problematical as, although a variety of features was examined (particularly in Trench BA), the level of truncation and the long period of use of the site make the detailed association of the artifact patterns with stratified features difficult. Furthermore, the present analysis cannot suggest whether the activities carried out on site involved the maintenance, use, or curation of tools.

9 OTHER SMALL FINDS: COARSE STONE TOOLS POTTERY PUMICE AND BONE

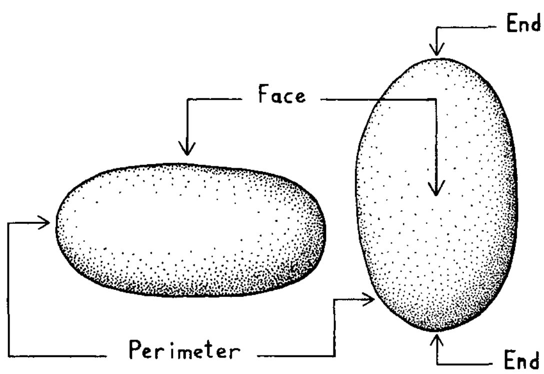
9.1 COARSE STONE TOOLS A CLARKE

Sixty-one artifacts were recovered, and most are based on rounded cobbles. In addition, there are twenty-nine rounded, but unused, cobbles; all contrast markedly with the angular cobbles of the natural gravel matrix of the site, and it is likely that they were deliberately selected for use. All the pieces were classified according to the type and location of wear and of modification if present (Ill 77). The types are defined in Table 15.

RAW MATERIALS (Tab 16)

With one exception, all of the pieces were made on water-worn pebbles or cobbles; the exception was made on a flake (Ill 78.4). The materials are predominantly of sedimentary origin including feldspathic grit, arkose (derived from the disintegration of granite), sandstone and siltstone. There are also some igneous and pyroclastic rocks, represented by microgabbros and tuffs. One artifact is made on a large quartz pebble (Clarke mf, 1:E1–E5). All of the materials occur on Rhum, and the unused cobbles were probably taken from the island beaches. The beach at Guirdil Bay has many similar cobbles today, and it is possible that coarse stone cobbles were collected at the same time as the nodules of bloodstone. There is evidence for the on-site storage of cobble tools (see below this section), and this suggests that cobbles were collected at some distance from the site.

The raw material was identified using a hand lens. Although accurate geological definition requires the use of thin sectioning, in this case it was the general properties of the raw material that were of interest and the sedimentary rocks were visually divided according to grain size.



ILL 77: Coarse stone tools: terminology.

MODIFICATION BEFORE USE

Modification before use occurs on five pieces. One (a tabular inner flake of microgabbro), has been ground at the distal end, on both the faces, as well as the sides, to produce an acute curved end with a fine edge angle (Ill 78.4). There is no visible macroscopic edge wear on this tool.

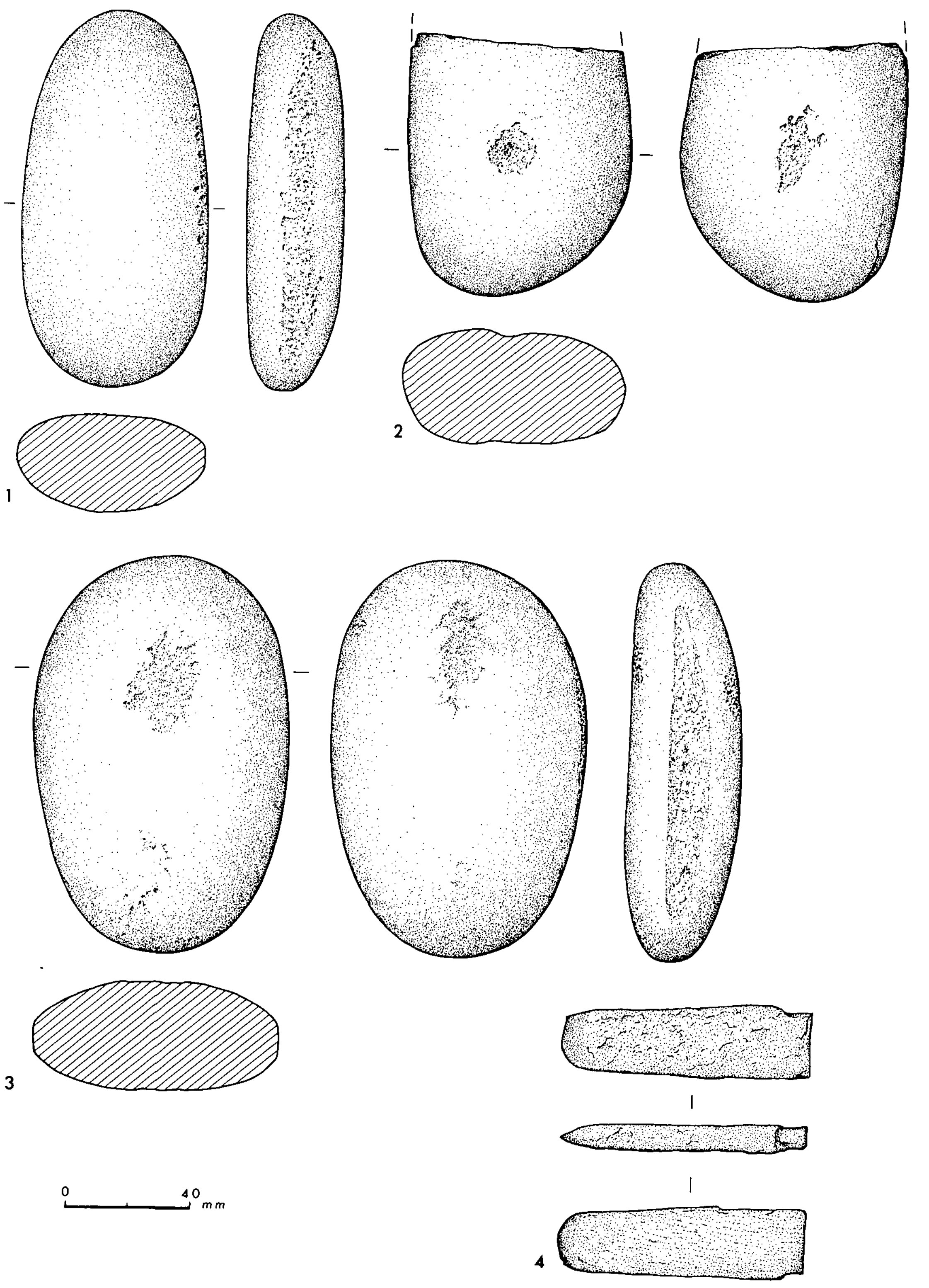
The other four modified artifacts are all oval sandstone cobbles. They vary in grain size from a coarse grit to a fine grain; all are of similar size and shape, and all have a flat cross-section. The two long sides of each cobble have been pecked flat, and possibly finished with grinding (Ill 78. 1–3). Although the modification was clearly intended to alter the shape of these cobbles, the squaring-off of the sides did not necessarily straighten them, and the natural shallow curve of the cobble edge has been retained on most. After modification the flattened edges remained undamaged. Two of the artifacts were also used as anvils, but they are the only two to bear any use-wear (Ill 78. 2–3). Thus, the function of the flattened edges must remain obscure; the flattening may have facilitated hafting but, if so, the haft has left no trace.

Tool Type	Qty.	Blank	Modification	Wear
Plain Hammerstones	16	Rounded Cobble	None	Random pecking and/or flaking over parts of the surface.
Faceted Hammerstones	9	Rounded Cobble	None	Localised pecking forming facets. Generally only one or two facets per artifact, two are faceted around perimeter. The facets may be rough or smooth.
Rounded Hammerstones	7	Round Cobble	None	Heavy pecking on one or both faces and around perimeter. Wear on faces may also include linear indentations.
Bevelled Pebbles	18	Narrow, Elongated Cobble	None	Bevelling on one or both ends the result of pecking and grinding. There may also be some flakes from the worked surface.
Anvils	7	Flat Oval Cobble	Two have been modified on the sides (see below)	Pecking, this may include both round and linear indentations on one or both faces.
Flat Sided Cobbles	4	Flat Oval Cobble	Both sides flattened through pecking and/or grinding	Two have been used as anvils.
Ground Edge Flake	1	Tabular Flake	Bifacially ground distal end forming fine edge angle	None
Polisher ?	1	Flat Rectangular Pebble	None	Highly polished edges. Natural ?
Manuports	29	Rounded Cobble	None	None

Table 15: Coarse stone tools: the definition of types.

	Sedimentary Rock						
	Coarse	Medium	Fine	Tuff	Microgabbro	Quartz	UId.
Plain Hammerstones	11	4	1				
Faceted Hammerstones	3	4	1				1
Rounded Hammerstones	4	2				1	
Bevelled Pebbles	1	10	4	1	2		
Anvils	2	2	1	1	1		
Flat Sided Cobbles	1	1					
Ground Edge Flake					1		
Polisher ?			1				
	22	23	8	2	4	1	1

Table 16: Coarse stone tool types: materials.



ILL 78: Coarse stone tools: modified artifacts. 1–3 flat sided cobbles (2 & 3 used as anvils): 4 ground-edge flake.

USE-WEAR

Fifty-eight of the artifacts bear possible use-wear traces (Tab 15). The wear patterns are often well developed, and they fall into five specific categories.

PLAIN HAMMERSTONES (Ill 80. 4)

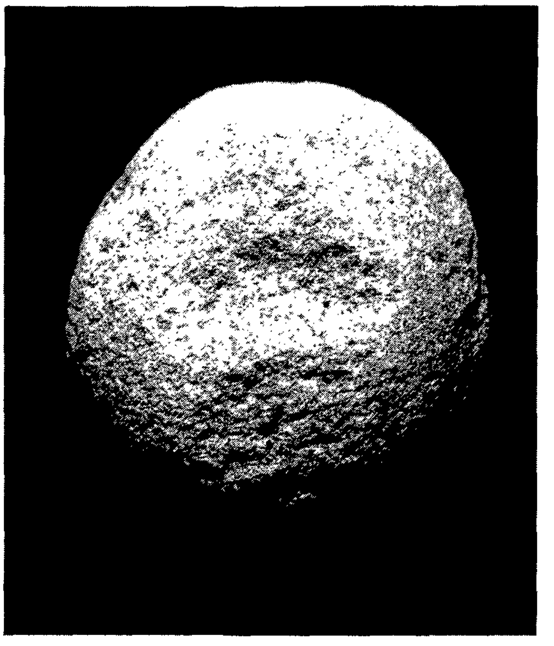
There are 16 plain hammerstones; they have minimal wear, often just a random light pecking. They are the most diverse in size and shape of the coarse stone tools, and they include the largest artifacts in the coarse stone assemblage (Ill 82). The plain hammerstones may represent undeveloped forms of any of the other categories.

FACETED HAMMERSTONES (Ill 80. 5–7)

There are 9 faceted hammerstones; all have small facets formed by highly localised pecked areas. The pecking is usually heavy, but on some artifacts it is light. Many have other areas of pecking which have not developed into facets. Faceted hammerstones are diverse in size and shape (Ill 82).

ROUNDED HAMMERSTONES (Ill 80. 1–3)

There are 7 rounded hammerstones; they have heavily pecked scars on the opposed faces and they are blunted by pecking around the perimeter. Long score-marks run across the faces of some of the artifacts. The rounded hammerstones are all of similar shape and size (Ill 82) and all would fit comfortably into the palm of a hand.



ILL 79: Hammerstone: close up of use wear; scale 1:1 (Photograph – I Larner).

BEVELLED PEBBLES (Ill 81. 1–9)

There are 18 bevelled pebbles; these have the most specific wear traces of any of the coarse stone tools. These traces occur at one or both ends of the tool, and they comprise the bevelling of the end, apparently by grinding, sometimes with pecking. Most of the bevelled pebbles are 2–3 times longer than they are wide: Ill 82 illustrates the size range of these tools. The differences in the wear patterns between tools are generally due to the state of development of the wear; on some pieces the bevel has only just started to form, and only five of the bevelled pebbles have bevels at both ends. On most tools the bevelled end presents a relatively sharp angle, but on two it is very obtuse (Ill 81. 7–8); the thicker angle may result from overworking, or from the original choice of a thicker pebble, or from a different angle of use.

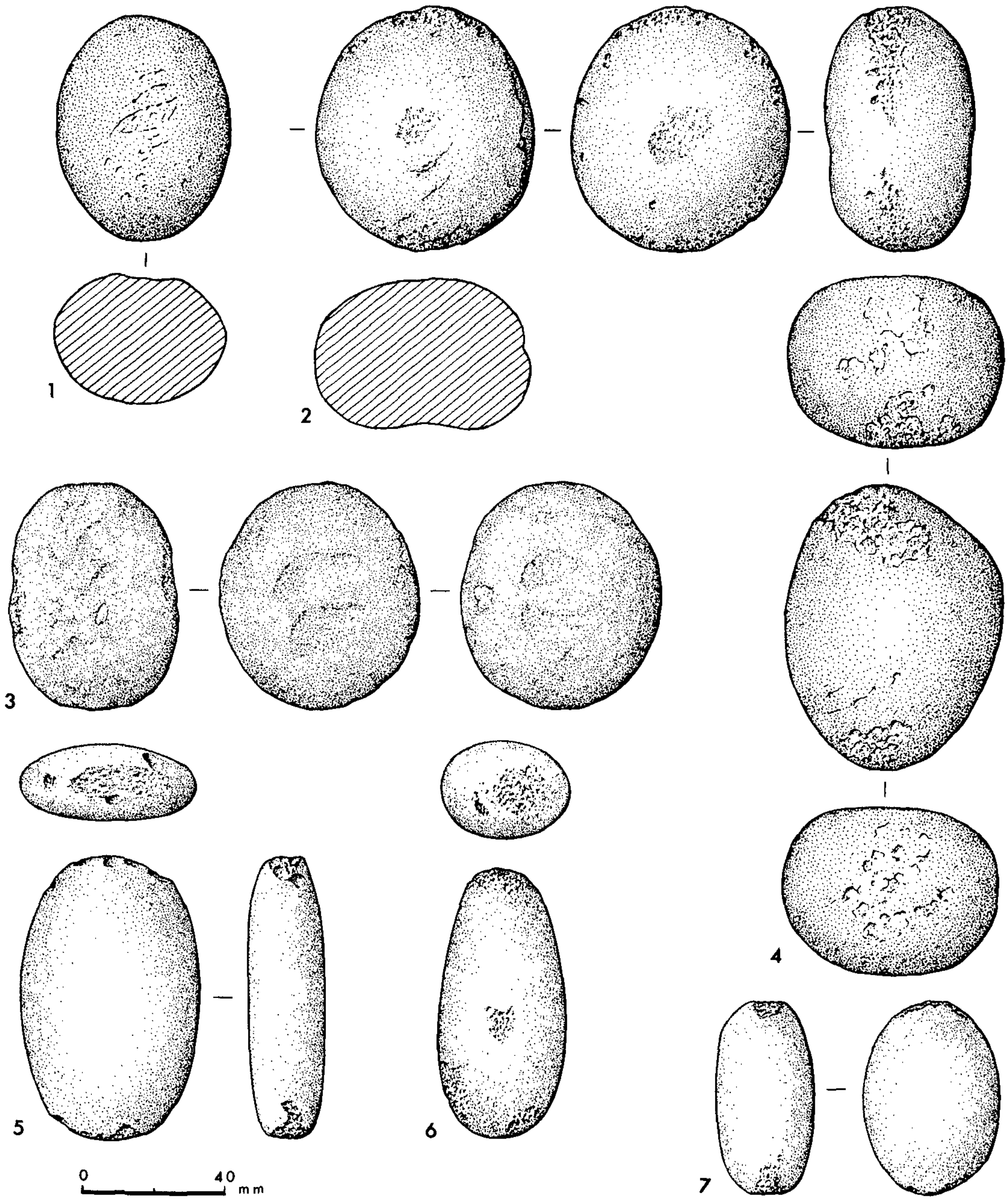
ANVILS (Ill 78. 2–3)

There are 7 anvils; all have distinctive wear in the form of localised indentations on one or both surfaces. Some indentations are circular, while others are linear in plan. Linear indentations have been shown experimentally to be associated with bipolar working (Broadbent 1974, 111–2). Three of the anvils are laterally broken but, even so, all are large (Ill 82).

INTERPRETATION

Cobble Selection

The different shapes of cobble and the grades of raw material correlate with the various use-wear categories. Thus, if the different wear patterns reflect the different tool functions, it is clear that specific material types and cobble shapes were selected for specific uses. Hammerstones are predominantly of coarse- to medium-grained sedimentary rocks. Bevelled pebbles, in contrast, are mainly of medium- to fine-grained rocks. The selection of shape may be seen in the choice of flat oval cobbles for both the anvils and the flat sided pieces; long narrow pebbles, which provided a short working edge and a comfortable grip, were chosen for the bevelled pebbles. Rounded cobbles of similar weight, which give an easily manipulated grip, were chosen for the rounded

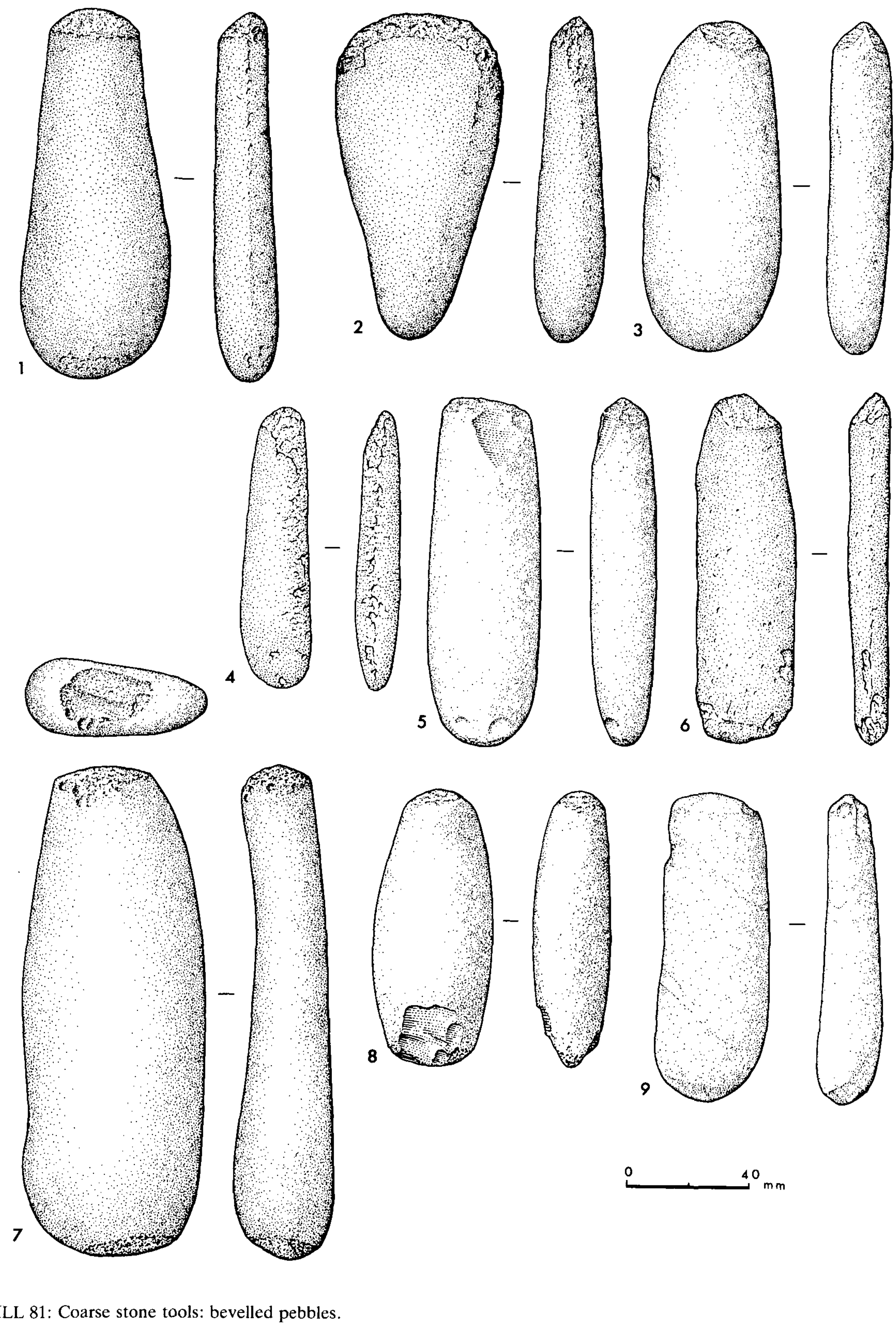


ILL 80: Coarse stone tools: hammerstones. 1–3 rounded hammerstones: 4 plain hammerstone: 5–7 faceted hammerstones.

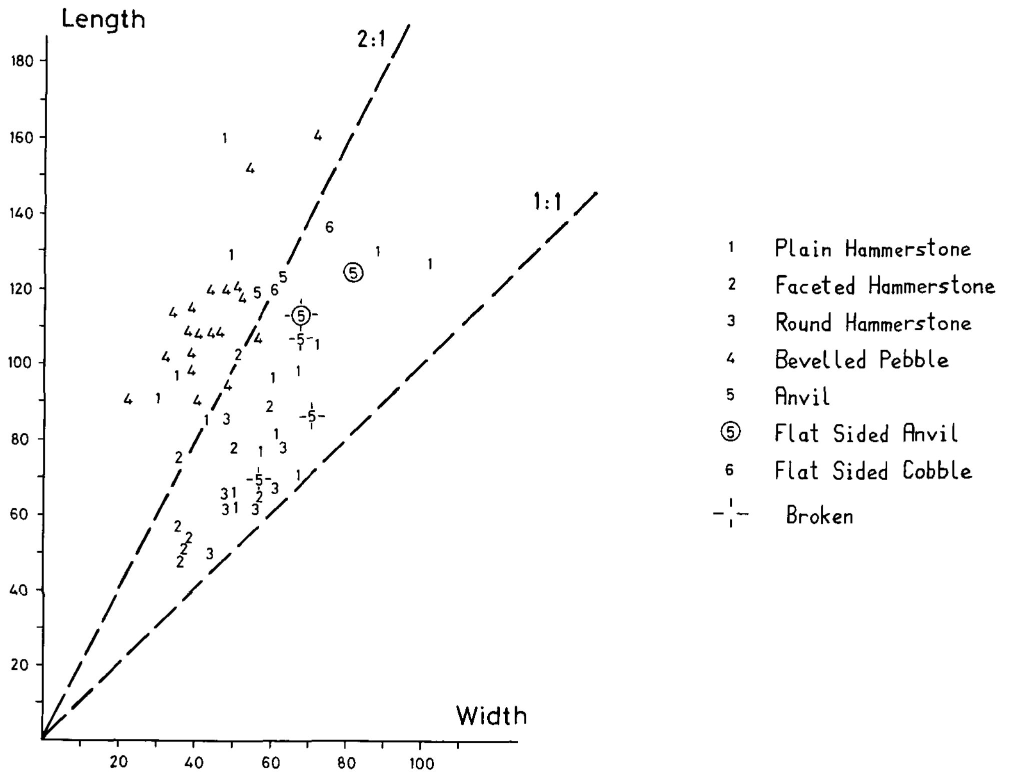
hammerstones. The blanks for the faceted hammerstones were generally smaller than those used for the other tools, but they were also more diverse in shape. Plain hammerstones were based on cobble blanks of diverse size and shape and, as noted above, many may simply be little used artifacts from the other categories (one in particular may be an undeveloped rounded hammerstone, Ill 80. 4).

Function

There are many uses for hammerstones, such as these, but few have been tested experimentally. Recent experimental work elsewhere has, however, shown that some of the artifact types from



ILL 81: Coarse stone tools: bevelled pebbles.



ILL 82: Coarse stone tools: dimensions (mm).

Kinloch may be associated with knapping (Callahan 1987), in particular with bipolar working (as both hammers and anvils). The wear on 'bipolar' hammers is heavy, and deep linear indentations may form during the core reduction process. Linear indentations are also produced on the surfaces of anvils used for bipolar reduction where they indicate the position of the core. Other forms of percussion for stone tool manufacture also involved stone hammers, and indeed two of the faceted hammerstones from Kinloch are similar to those used for freehand percussion in some experimental knapping (eg Ill 80. 5; Callahan 1987). In support of this interpretation, it may be noted that the technological analysis of the flaked lithic artifact assemblage concluded that medium-hard stone percussors of a material such as sandstone may have been used in the manufacture of the tools (Chapter 6). The single quartz rounded hammerstone contrasts with the sandstone hammers in that it would provide a hard percussor, but it is not out of place in the assemblage as there were some indications of hard percussion amongst the flaked assemblage from Kinloch.

The function of the bevelled pebbles is more problematical. They too may have been used for knapping but they are rather elongated for this. Previous research has postulated that they were used for processing shellfish (as 'limpet hammers'; Lacaille 1954; Roberts 1987, 135). They are often found in association with shell middens, but this interpretation is dubious. Bevelling may be produced by grinding, rubbing, and smoothing, as well as by pecking, and as they are of fine grained stone, these tools could have been used on soft materials to give similar wear. Whatever their function, it clearly required a short working edge. Likely tasks will remain obscure until further experimental work can be undertaken.

The other coarse tools, such as the plain hammerstones, have minimal wear, and they may provide evidence of expedient cobble use. Alternatively, many may be in the early stages of tool use. The presence of a variety of unused manuports at Kinloch suggests that rounded cobbles were selected and brought to the site, and it seems that they were then sorted for size before being used accordingly.

ILL 83: Pit AD 5: cache of coarse stone tools and unused cobbles, from the W.

DISTRIBUTION

Coarse stone tools mainly occurred in Trenches AD, AG, and BA, around the perimeter of the artifact scatter. There was one concentration of note: at the top of Pit AD 5 lay a cache of fourteen pieces comprising six bevelled pebbles, four plain hammerstones, and four unworn manuports (Ills 83, 84). This group supports the interpretation of the manuports as unused tools, and it points to the storage of both tools and cobbles. Elsewhere across the site the pieces are randomly spread, with the exception of the faceted hammerstones and the anvils in the ploughsoil of Trench BA where they appear to have more discrete concentrations (Ill 85).

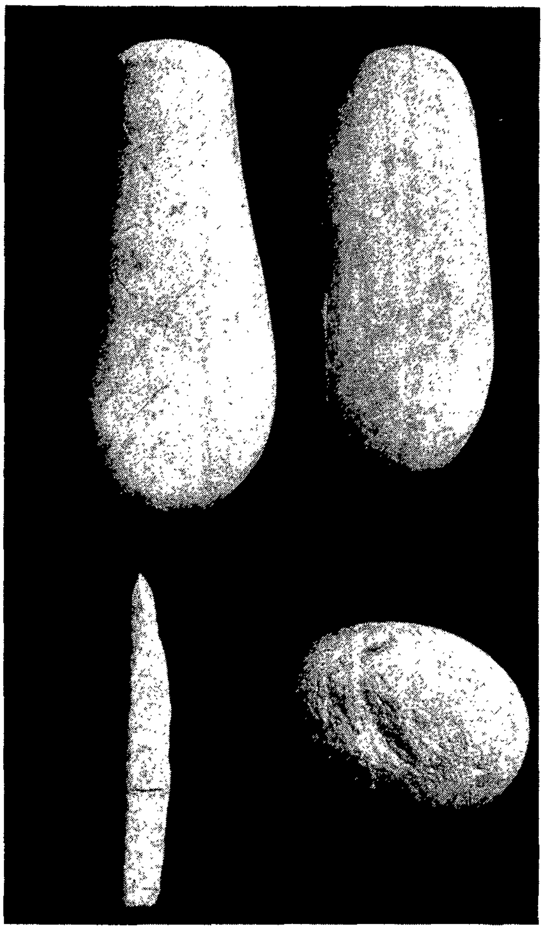
There are no clear associations between the different types of coarse stone tools. Despite their possible mutual use in the process of bipolar reduction, anvils and rounded hammerstones do not occur together. The single associated group (in the top of Pit AD 5) comprises predominantly one tool type (bevelled pebbles). Two of the plain hammerstones in this cache may be undeveloped bevelled pebbles, whilst the unused pieces are mostly of suitable size and shape to be bevelled pebbles.

CHRONOLOGICAL AND CULTURAL AFFINITIES

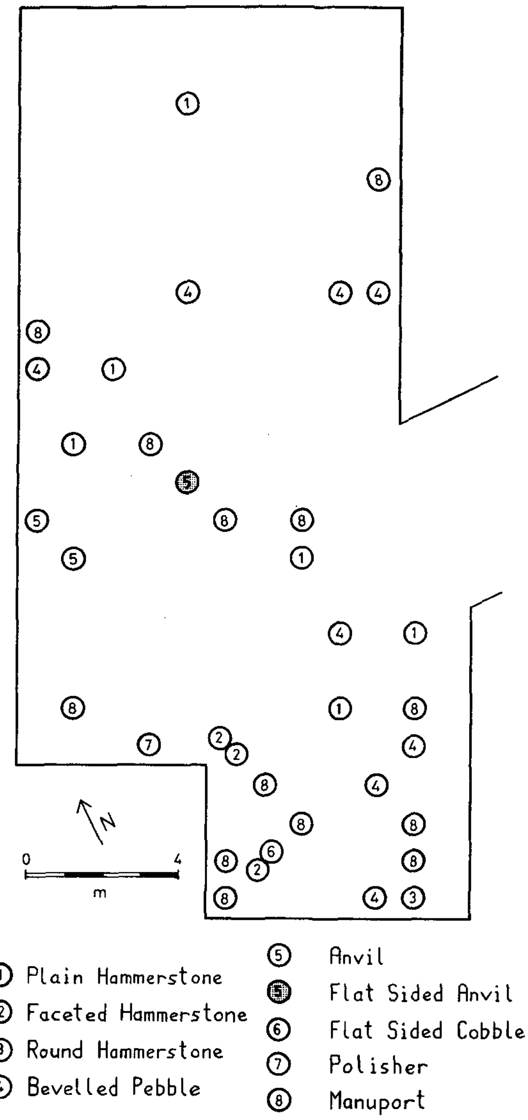
Hammerstones are difficult to date as their functions, and the wear produced, are not usually period specific. At Kinloch hammerstones occur in both mesolithic and later contexts.

Bevelled pebbles have frequently been associated with the mesolithic, and they do occur on many mesolithic sites around Britain, including the Oronsay middens, Oban rock shelters, and on the Isle of Man (Morrison 1980; Woodman 1987). At Kinloch bevelled pebbles are only found in mesolithic pits or in the ploughsoil; they do not occur in any of the 'later' deposits.

The ground-edge flake is also associated at Kinloch with a mesolithic context, and this is of interest as it is rare to see this type of working during the mesolithic in Scotland. The grinding of stone occurred during the mesolithic elsewhere along the western seabord of Europe, eg Newferry, Ireland (Woodman 1978), but elsewhere the grinding is often over the whole artifact



ILL 84: Coarse stone tools including flat sided cobble, rounded hammerstone, ground edge flake and bevelled pebble; scale 1:2 (Photograph – I Larner).



ILL 85: Trench BA: the distribution of coarse stone tools in the ploughsoil.

rather than just on one edge. The flat-sided pieces are previously unknown in Scotland, and they are rare in Europe (a similar piece, made on a cylindrical cobble, occurs on a mesolithic site in Belgium; Lauwers and Vermeersch 1982). At Kinloch, one of these pieces (also used as an anvil), occurs in a mesolithic pit (BA 3). Together with the ground-edge flake, these tools may provide evidence for the more controlled and varied working of coarse stone in the mesolithic than has been previously acknowledged.

CONCLUSIONS

Coarse stone tools were an important part of the tool kit for any site. Those from Kinloch show the careful selection of blanks, and the specific wear patterns that occur suggest that particular types of tool served specific functions. One of these functions is likely to have been knapping, but there were many other possible uses, and it is of interest that the only cache of tools did not contain types likely to have been used for knapping.

It is difficult to compare the coarse stone tools from Kinloch with those from other sites as so few other assemblages are recorded in detail. If a fuller picture of the role of these tools in prehistory is to be produced, then it will be necessary to identify and collect coarse stone tools wherever they occur. Furthermore, a programme of experimental work is needed to clarify the functional problems.

9.2 POTTERY M KEMP

The pottery assemblage comprises 299 sherds, weighing a total of 2 kg. Table 17 illustrates the distribution of the assemblage which was concentrated within the main artificial dump of the infilled watercourse (22%), and in the associated ploughsoil and drains (75%); in one case a sherd from the watercourse could be fitted to one from the ploughsoil directly above. The eight remaining sherds were recovered from the ploughsoil across the site.

	1A	1B	1C	1D	2	3	4A	4B	4C	5A	5B
Watercourse and Associated Deposits	4*	14	4	25	2	1	13		1	1	1
Overlying Disturbed Deposits	26*	52	31	29	24		15	7	3	21	18
Other			2	1						3	2

Table 17: The location of the pottery by fabric type.
* indicates the location of the two sherds that joined between contexts.

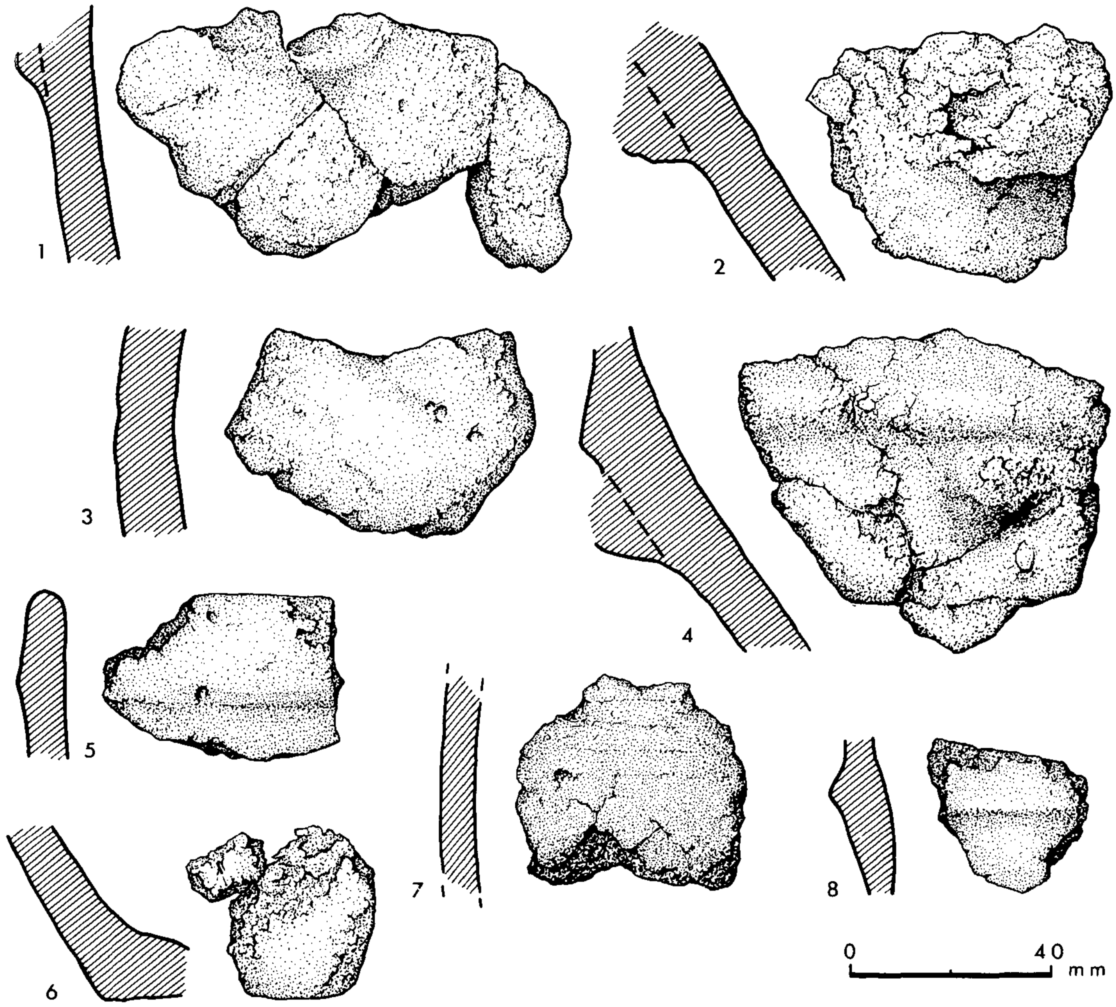
FORM AND FABRIC

The sherds are all small in size and over half of them are so abraded that any attempt at physical description and typological identification is limited. For the catalogue the assemblage has been grouped according to fabric. Five broad groups of fabric, with some subdivisions, have been identified; the groups range from coarse thick pottery with a crumbly sand-tempered core to fine burnished pottery with a black core (Kemp mf, 1:D8–D13).

The assemblage is predominantly derived from round-based vessels, but there is one sherd from a flat-based vessel (Ill 86. 6) and another may be a flat-base sherd. All the sherds come from prehistoric coil-built pots, and this method of manufacture may be clearly seen in some pieces (Ill 87. 13). The majority of the sherds are featureless. Plain carinated pots with shoulders are present, but one sherd bears a fine plain cordon (Ill 86. 5), and three sherds have lugs. Two of the lugs have been pulled from the body of the pot while the clay was still plastic (Ill 86. 2 & 4), and the third lug appears to have been made by applying a shaped piece to a prepared surface when the clay was leather hard (Ill 86. 1). One of the lugs is situated just below a carination (Ill 86. 4). Most of the rims are simple, undeveloped forms (Ill 87. 1, 3–4), but two sherds have expanded and externally bevelled rims (Ill 87. 2 & 5). There is no correlation between pot forms and fabric types (Tab 18).

POTTERY RESIDUES B MOFFAT

During the course of the excavation dark fibrous accretions were noticed adhering to the surface of a few of the pottery sherds. In order to try to identify these accretions, the sherds were examined by a palaeobotanist prior to the routine artifact analysis. In addition, samples were taken of the surrounding soil matrix for background environmental information. Finally, all other sherds were visually inspected for similar accretions as an initial part of the post-excavation analysis (Moffat mf, 2:F1–G12).



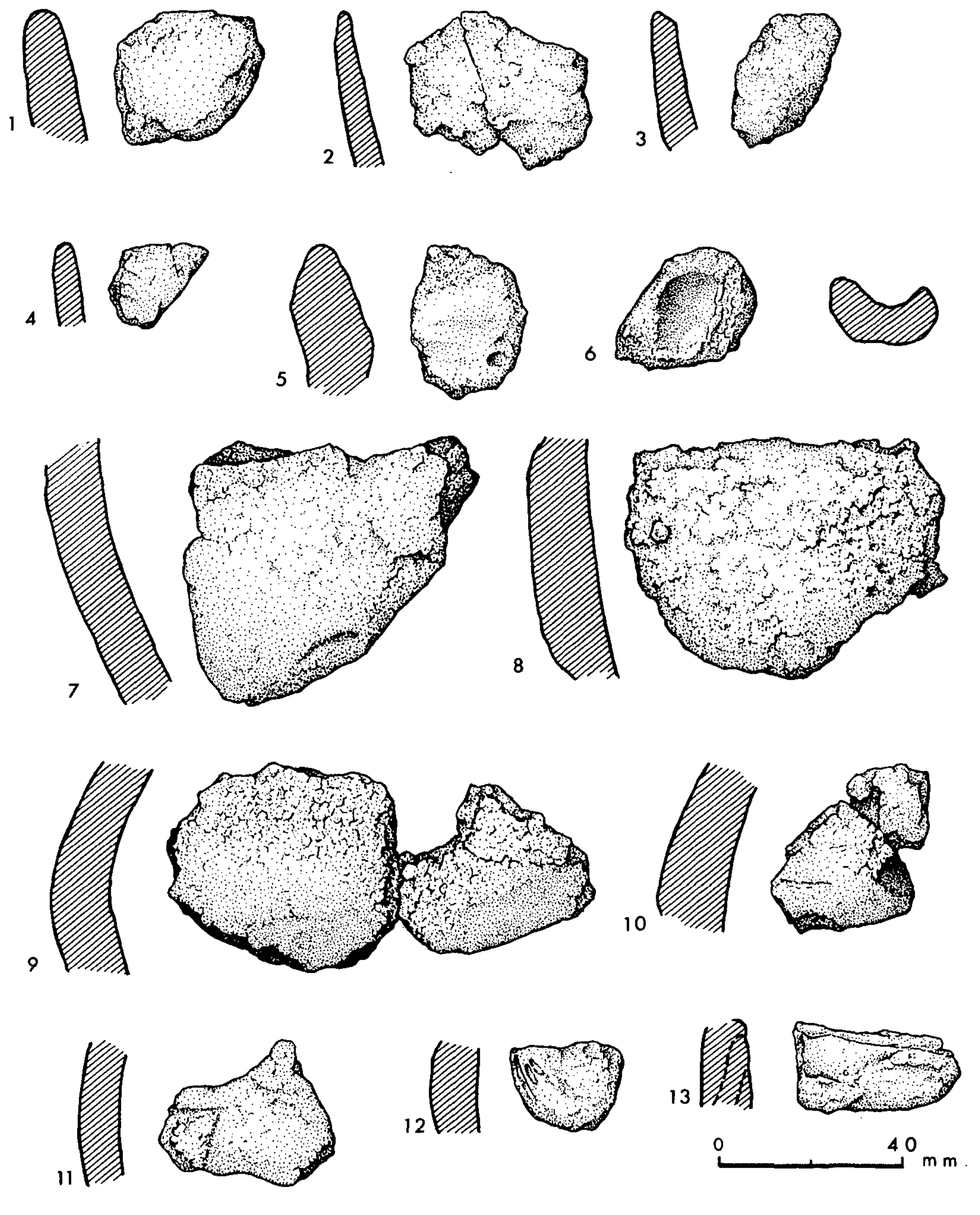
ILL 86: Pottery: 1 prepared edge for lug; 2 broken base of lug; 3 shoulder; 4 carinated shoulder above a broken lug; 5 rim with cordon; 6 base sherd; 7 burnished sherd; 8 sherd with carination.

THE ACCRETIONS

The accretions were removed from the pot surface with a sterile swab and they were microscopically examined for preserved pollen and macrobotanical remains. In the event, close identification of the fibrous material was not possible. It appeared to be organic, and was probably mashed cereal straw. Three of the sherds held a pollen assemblage that was distinctive and quite different from that of the background samples. This assemblage included low counts of cereal-type pollen (not found elsewhere on the site), and exceptionally high values of ling and other heathers, together with meadowsweet and royal fern (Tab 19; Moffat mf, 2: F1–G12). These species do not occur in similar proportions elsewhere in the environmental record, and it is highly unlikely that they would have been combined in this way in a purely natural assemblage. It is feasible that they have been deliberately combined and that they may relate to the original contents of the pot.

INTERPRETATION

Documentary search of the historical uses of such plants suggest a number of ways in which they might have been used: as a dyestuff; for medicinal purposes; or as a fermented drink (Macdonnel 1910; Fraser 1983). It is clearly impossible at this remove to favour with certainty one recipe over another, but similar assemblages found elsewhere in association with prehistoric pottery have generally been interpreted to be the result of prehistoric fermentation (Bohncke 1983; Dickson 1978), in the author's opinion this is the most likely interpretation here. For the interpretation of the Kinloch residues the possibility of a brew was taken further by the modern production of a drink based on the fermentation of heather honey. The brew was made under modern conditions in the Girvan laboratory of William Grant and Sons, the Glenfiddich distillers: it used only the ingredients identified from the pollen analysis. The results were non-toxic and quite palatable, at 8% proof.



ILL 87: Pottery: 1–5 rim sherds; 6 possible fragment of lug; 7–10 shoulders; 13 coil break.

CONTEXT C WICKHAM-JONES

It is important to consider the processes by which the pottery arrived in the watercourse and the surrounding ploughsoil. Several elements combine to suggest that the assemblage is redeposited. Most obvious of these must be the context itself, for it is highly unlikely that the watercourse (or associated drains and ploughsoil), represents the primary location of the pots. It is impossible to tell whether the pots were deposited in the watercourse as a result of human action or by a natural agency. In favour of human action the specific association of the pottery with other artifactual material and dumped stones may be cited. Nevertheless, the high percentage of abraded sherds might indicate a natural agency; if this were the case, a more general spread of pottery throughout the entire length of the watercourse might have been expected.

Abrasion also suggests that the assemblage is rede-

Fabric Type	Featureless Sherds	Flat Base	Shoulder	Cordon	Carination	Carination With Lug	Lug	Rim	Incised
1A	23	1	3	1		1			
1B	60		2				2*		2
1C	33	1	1					2	
1D	52				1			1	1
2	22							4	
3	1								
4A	27						1		
4B	6							1	
4C	4								
5A	23			1					1
5B	30								1

* One possible lug fragment and one sherd with prepared edge for lug

Table 18: The Pottery: sherd form by fabric type.

Plant Type	Pollen Count
Cereal Type undifferentiated	19
Heathers	270
Meadowsweet	37 + 2 *
Royal Fern	25 + 2 *
Other Herbs	97
Trees and Shrubs	106
Grasses and Sedges	185

* Clumps of immature pollen

Table 19: The pollen count from pot residues.

posited, and it may have several causes. Abrasion could be due to the movement of water within the boggy surroundings of the pottery, or it could be due to the exposure and erosion of the sherds prior to their final deposition. It might also result from the recovery of some of the sherds by wet sieving, but this does not account for all cases of abrasion, as some manually recovered sherds were also abraded. Abraded sherds did not only occur in the watercourse; there were similar proportions of abraded material in the ploughsoil and, as the location of the pottery within the ploughsoil directly reflects the position of the watercourse below, the ploughsoil material is presumably derived from the destruction of the upper levels of the watercourse. In support of this theory, one of the ploughsoil sherds was found to join to one of those from the watercourse. Also, the analysis of the distributions of the lithic artifacts within the ploughsoil suggested that the ploughsoil had not been subject to great disturbance so that the artifactual material was still closely associated with the locations of disturbed prehistoric features. It is therefore likely that the abraded sherds within the ploughsoil were originally abraded when in an earlier watercourse location. Finally, the radiocarbon determination associated with the pottery (3890±65 BP, GU–2042) also suggests redeposition. This determination is surprisingly late for pottery of this type and it is possible that the pottery may have lain elsewhere for some time before it was incorporated into the watercourse deposits.

To conclude, it seem likely that the pottery was deposited into the watercourse dumps by a human agency, but it was probably not in a fresh condition at the time.

CULTURAL AFFINITIES

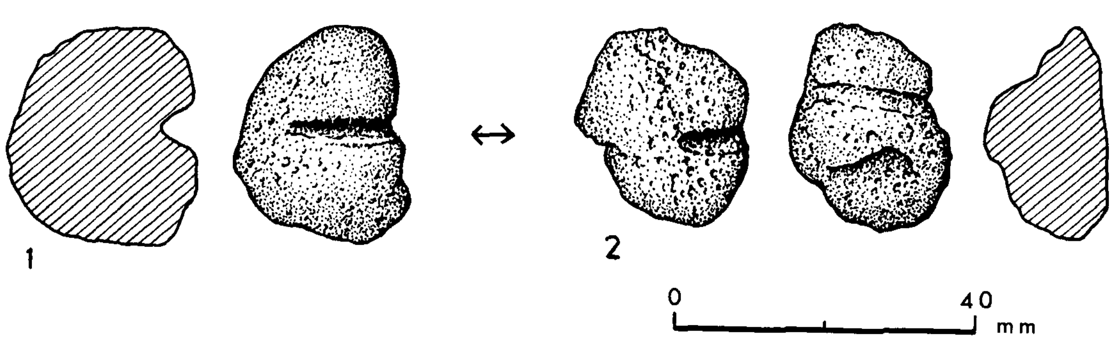
Exact parallels for the assemblage are difficult to cite. The few individual traits and forms which can be identified fit most comfortably into a middle neolithic context. The fabrics are like those of other Hebridean wares (Henshall 1972, 152–4), in the case of the 'corky ware' (fabric 4b), parallels are to be found in Orkney (Henshall 1963, 107 & pl 14b). The combination of a lug just below a carination is unusual, but when taken individually the features are all common in Scottish neolithic pottery (Kinnes 1985, 21–3). Little is known about the development of the prehistoric pottery of the Western Isles, but the date associated with the main deposit of pottery (3890±65 BP, GU–2042) is surprisingly late for this type of pottery (but see also the discussion of the pumice below). However, given both the context of the assemblage (within one of the dumps of material in the watercourse), and the abraded state of many of the sherds, it seems likely that the pottery, as stated above, had been redeposited by some agency either natural or, more possibly, human.

9.3 PUMICE A CLARKE & A DUGMORE

Eleven finds were identified as pumice on the basis of their highly vesicular morphology. Most are dark brown-grey in colour with millimetre scale vesicules; the remainder are light grey and appear superficially weathered. Recent work on pumice has drawn attention to the possibility of using geochemical analysis to relate finds to the source areas (Binns 1972a; 1972b; 1972c), and the occurrence of pumice in coastal areas may be used to define isochronous marker horizons that may be of use in dating archaeological sites (Dugmore *et al* in prep). Consequently, the pumice was visually examined and three samples were selected for geochemical analysis (one, typical of the homogeneous collection of brown-grey pumice, from the main watercourse deposits; and two light coloured pieces from mesolithic pits, AD 2 and BA 10; Dugmore, mf, 3:G7–G10).

GEOCHEMICAL ANALYSES

Geochemical analyses indicate that the two mesolithic samples are most unlikely to be volcanic in origin. These pumaceous pieces may have been formed by the intense heating of the local Torridonian sandstones, perhaps by natural processes. There is, however, abundant burnt material amongst the flaked lithic assemblage and there were, no doubt, numerous domestic hearths on site throughout the period/s of occupation. Anthropogenic processes may, unintentionally, have led to the creation of these pieces. The geochemistry of the later sample (from the watercourse; Chapter 3) indicates a volcanic origin, probably in Iceland. Geochemically the sample is similar to other pieces of pumice found on the Outer Hebrides and Shetland. The major and trace element abundances of the



ILL 88: Grooved pumice, showing refit.

Rhum sample lie within the very narrow ranges produced by simultaneous analyses of other Scottish material; it is therefore likely to represent a single eruption, perhaps a particular event c. 2700 radiocarbon years BP. It is of interest that the same context provided a radiocarbon determination of 3890±65 BP (GU–2042; Chapter 10), and yet the analysis of the associated pottery suggested that the radiocarbon determination was surprisingly late (see above, this section).

USE

Five pieces have evidence of use. On two pieces this comprises smoothed surface areas; on the other pieces it consists of indentations. One indentation has a wide, shallow asymmetrical cross-section, and two are fine narrow grooves. The two grooved pieces join across the groove (Ill 88), both were re-used after breakage and on one a second groove was formed.

LOCATION

	Worked	Unworked
Mesolithic Pits		
AD 2		1
AD 5		1
BA 4/5		1
BA 8		1
BA 10		1
Watercourse	1	1
Ploughsoil AD	3	
Ploughsoil AG	1	

Table 20: The location of the pieces of pumice.

Table 20 illustrates the location of the pumice. Five pieces were from mesolithic locations, all were unworked. One of the worked pieces came from the deposits within the watercourse, and the other four were recovered from the ploughsoil; the two joining pieces came from the same metre square in the ploughsoil of Trench AD.

9.4 BONE A CLARKE

There was almost no preservation of organic material on the site, only 8.16g of calcined bone and two small fragments of shell were recovered, mainly from mesolithic contexts (Tab 21). The bone consisted of crumbs and fragments, and close identification was impossible, but it could have come from a sheep-sized animal (Armour-Chelu *pers comm*). There is one probable piece of coprolite and one fish bone, probably the pharyngeal toothplate of a wrasse (*labridae*) (Wheeler *pers comm*).

	Bone	Coprolite ?	Fishtooth	Shell
Mesolithic Pits				
Fill AG00121	0.59 g			
AJ 2	0.20 g			
BA 4-9	2.91 g	3.05 g	x	
Buried Soil	0.42 g			
Watercourse	0.99 g			x

Table 21: The location of preserved bone.

10 THE RADIOCARBON DETERMINATIONS

G COOK & E SCOTT

INTRODUCTION

Radiocarbon dating was carried out at the Glasgow University Radiocarbon Dating Laboratory (now based at the Scottish Universities Research and Reactor Centre), during the period 1984–87. One date, relating to the Kinloch Glen pollen core (Chapter 11) was obtained from the Harwell laboratory (HAR–6608). A procedural resumé is included in the microfiche (Cook & Scott mf, 3:G11–G14).

RESULTS

THE FIRST COUNT

Table 22 presents all of the samples dated for Kinloch. All dates are quoted in conventional years BP (before 1950 AD) and are uncalibrated with respect to dendrochronological age. The errors are expressed at the ± one sigma level of confidence.

THE RECOUNT

One dilemma which faces those involved with radiocarbon dating is the relative reliability of any large series of dates, as dating may be carried out over several years and within more than one laboratory. In this study it was decided to recount the samples of mesolithic origin as a single batch, so that the long term reproduceability of the counting process could be determined. In this respect the use of glass sealable ampoules has a significant advantage in that the samples can be stored virtually indefinitely, without any loss through evaporation. Ideally, it would be preferable to re-synthesise the sample benzene from replicate sample material, but in the absence of this option the best alternative was employed. Results from the recent intercalibration study, which is in part organised by this laboratory, have shown that the major contributory factor to interlaboratory variation probably derives from the counting process (Scott *et al* in press).

Table 23 presents the results obtained from the recount of the Rhum dates. These indicate that there are no significant differences at the 2 δ level between the ages calculated from 1984 to 1987 and the ages dated as a single batch in 1988. Furthermore, there is no trend to suggest a shift to either older or younger ages within the 2 δ error band. In approximately 50% of the results the central ages from the 1988 calculation are older than those of the first count, and the other 50% are younger, thus inferring that there is no bias in the results from the first count. Because of the lack of both significant difference and bias between the two counts, the original radiocarbon dates are used throughout the text and for calibration.

CALIBRATION

Table 24 presents the calibration of the radiocarbon ages using the 20 year atmospheric record from the University of Washington, Quaternary Isotope Laboratory radiocarbon calibration programme. The earliest dates are beyond the present calibration limits. For this reason dates are presented uncalibrated within the text.

DISCUSSION WITH E SCOTT G COOK & K HIRONS

Four of the radiocarbon determinations (GU–1873, GU–2040, GU–1874, and GU–2150) all date features that provide the earliest excavated evidence, so far, for the human settlement of Scotland. A further five dates (GU–2146, GU–2039, GU–2147, GU–2145, and GU–2149) come from similar features and suggest mesolithic occupation over a period of time. The first three dates are the earliest; they come from Trenches AD and AJ, and they are relatively close in age, with a mean

Lab. No.	Date	C13	Material	Site Ref.	Feature	Comment
HAR-6608	8770 ± 90		Peat	KR84 K	.	Kinloch Glen Core base
GU-1873	8590 ± 95	-24.9	Carbonised hazel-nut shell	KR84AD0028	AD 5	Pit fill
GU-2040	8560 ± 75	-25.1	Carbonised hazel-nut shell	KR85AJ0175	AJ 2	Lower fill of a truncated pit
GU-1874	8515 ± 190	-23.8	Carbonised hazel-nut shell	KR84AD0028	AD 5	as GU-1873
GU-2150	8310 ± 150	-25.7	Carbonised hazel-nut shell	KR86BA0100	BA S2	Only date associated with a structural feature
GU-2146	8080 ± 50	-25.0	Carbonised hazel-nut shell	KR86BA0023	BA 1	Pit fill
GU-2039	7925 ± 65	-25.3	Carbonised hazel-nut shell	KR85AG0121		Part of pit complex further investigated in trench BA, see also GU-2149
GU-2147	7880 ± 70	-25.1	Carbonised hazel-nut shell	KR86BA0052	BA 10	Hollow sealed by dumps on edge of burn, TPQ for the dumps.
GU-2145	7850 ± 50	-25.0	Carbonised hazel-nut shell	KR86BA0021	BA 3	Pit fill
GU-2062	7800 ± 75	-28.5	Peat	KR85 RH 1 base		Base of organic deposit in transitional sandy peat, TAQ for local marine transgression, post-dates start of *Corylus*-type pollen rise and relates to establishment of open scrub. See also GU-2107, GU-2108, GU-2109, GU-2110.
GU-2149	7570 ± 50	-25.3	Charcoal	KR86BA0090	BA 4/5	Fill of pit complex, see also GU-2039
GU-2211	7140 ± 130	-25.8	Charcoal & hazel-nut shell	KR86BA0085		Buried soil at edge of burn, TPQ for peat in burn

Table 22: The radiocarbon determinations: Kinloch. Rhum series in chronological order.
These dates are quoted in conventional years BP (before 1950 AD) and they are uncalibrated with respect to dendrochronological age. The errors are expressed at the ± one sigma level of confidence.

Lab. No.	Date	C13	Material	Site Ref.	Feature	Comment
GU-2108	6430 ± 90	-28.0	Brown woody peat	KR85 RH 1 1.39-1.41 m		Start of initial rise in *Alnus* pollen. See also GU-2062, GU-2107, GU-2109, GU-2110.
GU-2107	5300 ± 60	-26.8	Brown woody peat	KR85 RH 1 1.19-1.21 m		Major *Alnus* maximum prior to phase of reduced tree pollen. See also GU-2062, GU-2108, GU-2109, GU-2110.
GU-2043	4725 ± 140	-27.3	Charcoal	KR85AD0153	AD 7	Fill of hollow. See also GU-2106, GU-2042, GU-2148.
GU-2110	4660 ± 70	-29.2	Brown woody peat	KR85 RH 1 0.89-0.91 m		Transition from fen-wood peat to monocot peat. Initial pollen evidence for major local impact of man. See also GU-2062, GU-2107, GU-2108, GU-2109.
GU-2106	4260 ± 70	-25.9	Humified amorphous peat with charcoal	KR85AM 0.50-0.58 m		Peaty material below slopewash, TPQ for onset of slopewash See also GU-2042.
GU-2148	4080 ± 60	-26.5	Charcoal	KR86BA0077	BA D1	'Midden'-type dump in peat of burn. TAQ for peat and for gravel dumps on edge of burn. See also GU-2042, GU-2106.
GU-2041	3945 ± 50	-28.5	Wood	KR85AG0245		Base of slopewash to N. of burn. Matches interpolated date for start of major *Alnus* pollen decline in monolith. See also GU-2106.
GU-2042	3890 ± 65	-28.5	Wood	KR85AG0128		Deposit of rock and debris within peat of burn. See also GU-2106, GU-2148.
GU-2109	3340 ± 80	-29.2	Dark brown-black humified peat	KR85 RH 1 0.59-0.62 m		Start of major rise in *Potentilla* pollen and end of decline in arboreal pollen. See also GU-2107, GU-2108, GU-2110.

Table 22: continued

Laboratory Number	1984-87 Ages	1988 Ages
GU-1873	8590 ± 95	8360 ± 70
GU-2040	8560 ± 75	8490 ± 50
GU-1874	8515 ± 190	8060 ± 150
GU-2146	8080 ± 50	8180 ± 50
GU-2039	7925 ± 65	7860 ± 50
GU-2147	7880 ± 70	7950 ± 50
GU-2145	7850 ± 50	7900 ± 50
GU-2062	7800 ± 75	7800 ± 50
GU-2149	7570 ± 50	7600 ± 50
GU-2211	7140 ± 130	7220 ± 100

Table 23: The radiocarbon determinations: samples of mesolithic origin with ages as calculated from several batches during the period 1984–7 and re-counted as a single batch in 1988.

Laboratory Number	1984-87 Ages	* Calibrated Ages (cal. BC)
GU-1873	8590 ± 95	B.C.L.
GU-2040	8560 ± 75	B.C.L.
GU-1874	8515 ± 190	B.C.L.
GU-2150	8310 ± 150	B.C.L.
GU-2146	8080 ± 50	B.C.L.
GU-2039	7925 ± 65	6569-7060
GU-2147	7880 ± 70	6493-7050
GU-2145	7850 ± 50	6495-7026
GU-2062	7800 ± 75	6450-7022
GU-2149	7570 ± 50	6230-6554
GU-2211	7140 ± 130	5730-6222
GU-2108	6430 ± 90	5230-5540
GU-2107	5300 ± 60	3990-4330
GU-2043	4725 ± 140	3046-3790
GU-2110	4660 ± 70	3140-3632
GU-2106	4260 ± 70	2625-3040
GU-2148	4080 ± 60	2470-2881
GU-2041	3945 ± 50	2320-2580
GU-2042	3890 ± 65	2146-2573
GU-2109	3340 ± 80	1440-1878

Table 24: The radiocarbon determinations: calibration of ages using the 20 year atmospheric record from the University of Washington, Quaternary Isotope Laboratory Radiocarbon Calibration Program, 1987.
B. C. L. = Beyond Calibration Limits.
* Calibrated age ranges are ± 2.

determination of 8555 years BP. The six later dates come from Trench BA (with the exception of one from Trench AG), and although they appear to follow a time trend in themselves, they are all more recent than those from Trenches AD/AJ. They have a mean age of 7936 years BP, but the standard error is large. Bearing in mind this difference in the mean age of the samples from the two areas, it was thought possible that the different parts of the site might have been in use at different times. In order to test this possibility, a two sample t-test was carried out to examine the hypothesis that: 'the mean age of the AD/AJ samples equalled the mean age of the BA samples'. The results of this test were highly significant and indicated that the hypothesis could be rejected. It is therefore possible that the features of Trenches AD and AJ represent a slightly earlier occupation than those of Trench BA, but the apparent time trend in the BA determinations does cast some doubt on this interpretation.

Four dates (GU–2043; GU–2106; GU–2148; GU–2042), relate to neolithic activity on site. Of these GU–2043 appears to be earlier than the others, but it has a large standard error and does lie within the mean age of the other three dates (calculated at 95% confidence interval), so that none of the determinations can be separated. It should be stressed that interpretation of the neolithic activity has been difficult. No traces of occupation structures were uncovered, but it is likely that dwelling structures were not far away (Chapters 3 and 14).

Between the mesolithic and neolithic activity the site was apparently abandoned, but the environmental record does show signs of human influence, suggesting the presence of people within the area (Chapter 11). At some point gravel was scraped up and spread as a low bank along the S edge of the watercourse. There are no dates directly associated with this activity, but the gravel seals mesolithic material (GU–2211), and stratigraphically it underlies the midden-like dumps within the peat (GU–2148). It is likely, therefore, that people did frequent the area of Kinloch, if only intermittently, during the time when the site itself was abandoned.

The remaining dates relate to the environmental history of the area (Chapter 11). The date suggested for the initial rise in alder (*Alnus*) pollen (GU–2108), does accord well with other radiocarbon datings of this pollen stratigraphic marker from west Inverness, south Skye, Wester Ross and Sutherland (Birks 1977). The dates are later than those from further south, and possibly much later than the actual arrival of alder (Rymer 1974). GU–2110 provides a date for the earliest major local human influence marked by a reduction in tree and hazel (*Coryloid*) pollen, and an increase in grass pollen, together with that of open habitat taxa. The interpolated date for the start of a major alder pollen decline (GU–2041) coincides with the first evidence of cereal-type pollen and the start of major local clearances, which are indicated by declining tree pollen and increased frequencies of grasses and weedy pollen taxa. At the end of the arboreal pollen decline (GU–2109), the data suggest the replacement of hazel (*Corylus*) on the drier slopes above the site by heath, and a decline in local alder fen woodland with a rise of acid grassland.

11 THE POSTGLACIAL ENVIRONMENT K HIRONS

INTRODUCTION

In the early postglacial period a highly dynamic environment was produced in the Hebrides by a combination of exposure, climatic change, fluctuations in sea level, and rapidly changing vegetation. This changing environment must have imposed various stresses on the resource base of the early inhabitants of Kinloch and thus on their survival strategies. To examine it an integrated series of palaeoecological and palaeoenvironmental studies were carried out in conjunction with the archaeological investigations. Plant fossils were not abundant on the excavation site itself, but a series of pollen studies was undertaken to help characterise the sediments on site (Moffat mf, 2:F1–G12; Edwards and Hirons mf a, 2:C4–D13), and wood was analysed where it had survived (McCullagh mf, 3:A3–A11). Off-site, pollen analysis was carried out on monoliths taken from a bog that had developed to the W of the excavation on part of the Farm Fields (Farm Fields sites RH 1; RH 2, Hirons & Edwards mf a, 2:C4– D13), on a core from the Kinloch Glen (Kinloch Glen site K, Parish mf, 2:A3–B8), and on sediments collected from the bed of Loch Scresort (Chapter 3), (Ill 89). Botanical and English nomenclature follows Clapham *et al*, 1962.

BACKGROUND

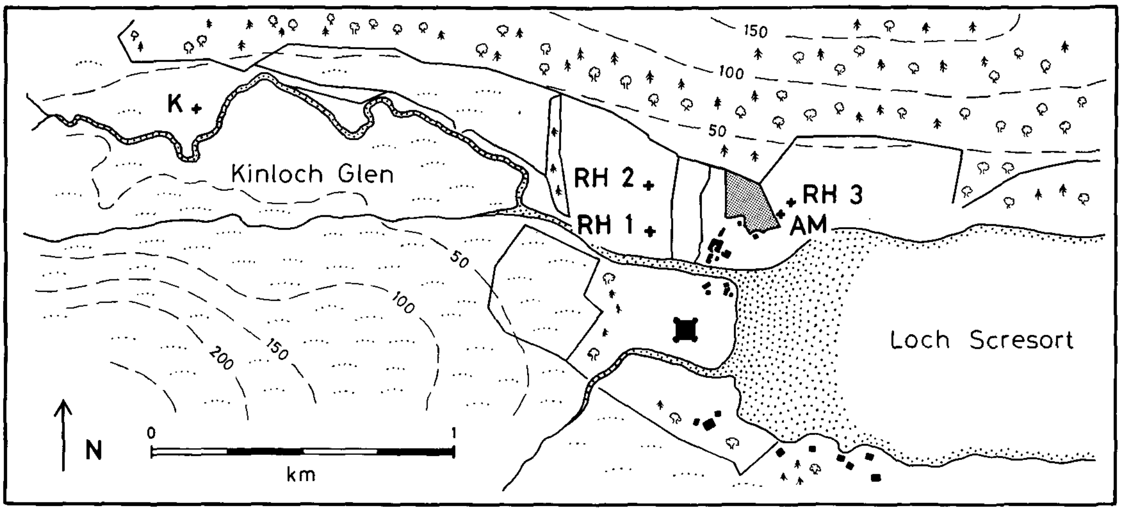
VEGETATION

Reconstructions of the past vegetation of other Hebridean islands have shown the importance of the geographical location of Rhum. Closed woodland was probably never able to develop on the flatter and more exposed islands such as Tiree and Canna (Flenley & Pearson 1967; Pilcher 1974; Birks & Williams 1983). On the larger and more topographically diverse islands of Skye, Mull, and Lewis, woodland was of limited extent in the early postglacial period, and it was restricted to sheltered localities (Birks & Williams 1983; Bohncke 1988; Lowe & Walker 1986; Walker & Lowe 1985). Limited woodland cover, with frequent tall-shrub, heath, and grassland communities is also indicated in the pollen evidence from the north west of mainland Scotland (Birks 1980).

The geographical limits of both pine (*Pinus sylvestris*) and oak (*Quercus* spp.) are thought to have lain in the Inner Hebrides. Pine has always been infrequent, or absent, on west and central Skye, the Fort William area, and Kintyre, but pine forest with birch (*Betula* spp) was able to develop in eastern Skye, Wester Ross and the central Grampians (Birks 1977; Birks & Williams 1983). On south east Skye and on Rhum, occasional stumps of pine have been recorded (Steven & Carlisle 1959; Birks 1975). The northern limit of oak may have lain near to southern Skye (Birks & Williams 1983); certainly oak woodland was able to develop on Mull to the south (Walker & Lowe 1985; Lowe & Walker 1986). Thus, Rhum lies close to the presumed northern limit of oak woodland and close to the western limit of pine.

The present vegetation of Rhum has been mapped by the NCC (1970) and discussed by Ball (Ball 1983 & 1987). The principle plant communities identified by Ferreira (1967) fall into four general classes: base-poor heath; fen; blanket bog; and richer grasslands (Ball 1987). The latter only occur on the lower slopes of the western glens. Natural scrub only survives as very small fragments in inaccessible sites, where it gains some protection from grazing. Hazel (*Corylus avellana*), birch (*Betula pubescens*), oak, rowan (*Sorbus aucuparia*), holly (*Ilex aquifolium*), aspen (*Populus tremula*), hawthorn (*Crataegus monogyna*), and sallows (*Salix atrocinerea* and *S. aurita*) are the only tree species thought to remain naturally; there is a record of the removal of the last copse of wood in 1796 (Ball 1987).

On Eigg, however, small but significant woodlands do survive, and they are dominated by hazel with ash (*Fraxinus excelsior*), wych elm (*Ulmus glabra*), rowan, hawthorn, blackthorn (*Prunus spinosa*), and aspen. Colonsay also supports two mixed woodlands (oak, birch, hazel, rowan, sallow, ash) in sheltered eastern sites, and in the centre of Soay there are soils that are derived from Torridonian sandstone (and are more akin to those to the



ILL 89: Location map of environmental sampling sites. RH1–3: AM: K.

north of Loch Scresort on Rhum); these soils support birch-rowan and sallow-birch in sheltered areas. On Skye, oak is virtually confined to Sleat, where it occurs as pure oak or birch-oak stands on the Torridonian sandstones; stands of ash-hazel and birch-hazel also survive on the better soils derived from this bedrock.

These woodland remnants on nearby islands suggest that Rhum is within the range of occurrence of many tree species and that its soils could have supported some woodland in the past. The success of the recent tree planting schemes on Rhum has also confirmed the suitability of the island for tree growth, albeit of selected species and in selected situations (Wormell 1968).

CLIMATE

The climate of Kinloch is oceanic, dominated by strong westerly airflows from the Atlantic, and characterised by low summer temperatures and high winter temperatures (Green & Harding 1983). The seasonal temperature range is limited, and frosts are relatively rare at low elevations (mean 116.3 days with ground frost, and 20.4 days with snow). The average rainfall is high (2373 mm per year), and it is coupled with a low evaporation demand thus leading to soil moisture excesses even in the summer. Wind speeds are moderate, but the salt content of the wind aggravates damage, especially to trees, and using the criterion of wind effect on lone growing broad leaved trees Kinloch has been categorised as "moderately exposed with extremely mild winters", and the northern slopes of the Kinloch Glen have been categorised as "exposed with extremely mild winters" (Birse & Robertson 1970). Anticyclones can persist for a month or more over the area, bringing interludes of dry conditions in the summer and cold conditions in the winter, and it has been suggested that these episodes might create dry conditions favourable to natural fires in the summer and to possible frost damage in the winter (McVean 1964).

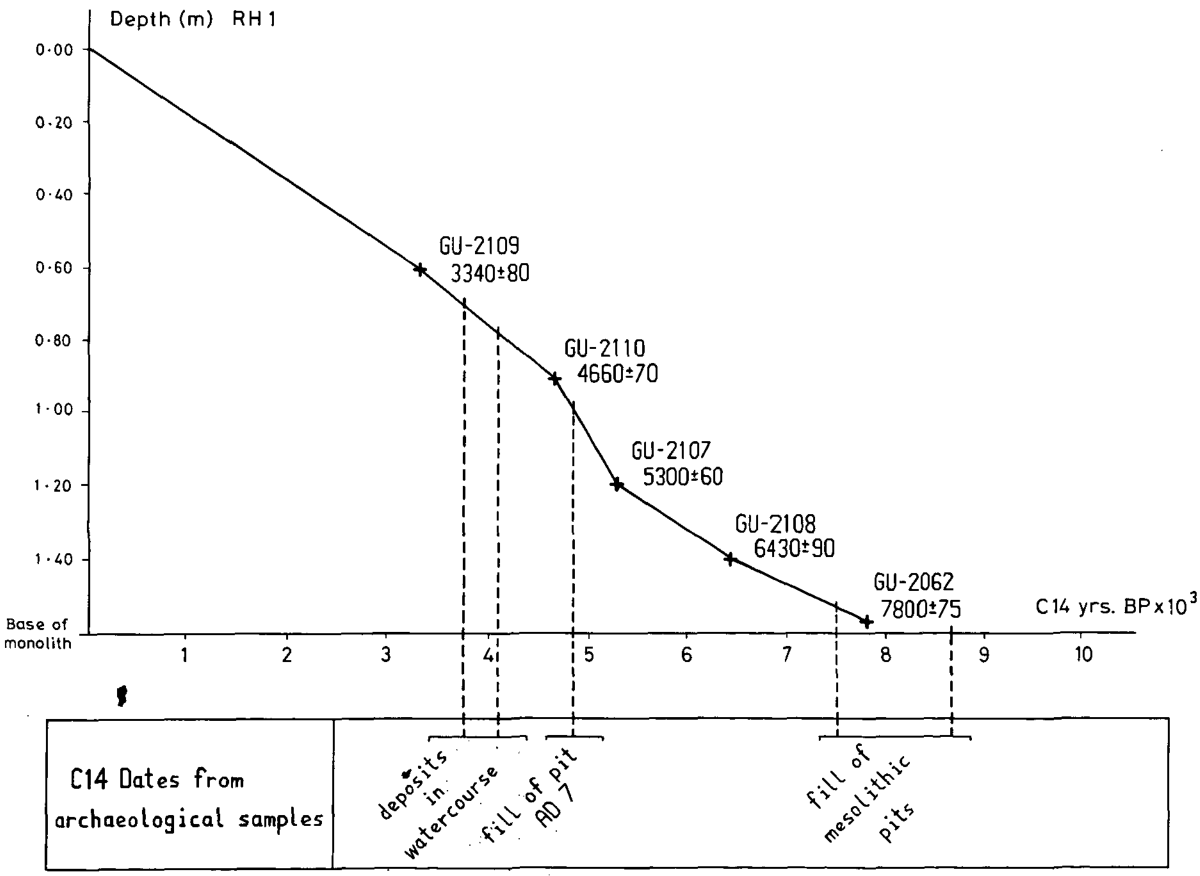
SOILS

In general, the soil parent materials of Rhum are poor and readily acidified, leading to the general development of peat. The soils local to Kinloch are peaty gleys on both the Torridonian sandstones to the north and on the igneous complexes to the south. Around the head of Loch Scresort, on the cultivated land, humus-rich iron podsols have developed. There has been no specific work on the blanket peats of Rhum, but it is now suspected that wide variations in timing, and probably in causation, may be expected (eg Edwards & Hirons 1982). Wider inferences may be drawn from studies of basin peats, both on Rhum and on other islands of the Inner Hebrides (Skye, Islay and Colonsay), and these suggest that a major environmental change took place between 4000–5000 BP. This change is manifest in a shift from woodland to an open environment (probably similar to that observed over much of the Western Isles today), as areas receiving run-off from the surrounding slopes developed into base-poor grasslands, whilst water-shedding areas became gradually covered with heath and shallow blanket peats.

THE VEGETATIONAL AND RELATED ENVIRONMENTAL HISTORY OF RHUM

INTRODUCTION

There are major difficulties in the reconstruction of the past vegetation of islands, such as Rhum, using pollen analysis. The Hebrides are exposed to frequent westerly gales, and it has been suggested that in such circumstances the pollen of wind pollinated taxa might be blown away from the islands, so that it would be under-represented in the fossil pollen record (Walker & Lowe 1985, 605). In addition, the anthropogenic factor within any pollen record is difficult to identify, particularly where predominantly open environments are concerned. The criteria used for the recognition of anthropogenic changes in wooded landscapes cannot be applied to open or partly open landscapes without qualification (Vorren 1986; Vuorela 1986). Many species which might suggest human impact when encountered in pollen diagrams from woodland environments can readily colonise sites where open environments are maintained by other agencies. Stress caused by proximity to marine conditions or exposure to climatic extremes (both physiographic norms for much of the Hebrides), may provide ready niches for the particular plants that favour these conditions. Changes in maritime influence caused by sea-level fluctuations, as well as exposure, and anthropogenic activity may all have similar expressions in the pollen diagrams (eg Birks & Madsen 1979), and this has caused problems in the interpretation of the spread of heath and grasslands in the fifth and sixth millennia BP elsewhere, eg on St Kilda, Lewis, Skye and Mull



ILL 90: RH 1: peat growth in relation to dated deposits on site. (Assuming a date of 0 years BP for the bog surface).

(Birks & Madsen 1979; Birks & Williams 1983; Walker 1984; Walker & Lowe 1985; Lowe & Walker 1986; Bohncke 1988). All of these problems are relevant to the site at Kinloch.

The postglacial vegetation of Kinloch may be divided into three time-zones which broadly equate with those defined in the pollen diagrams from the Farm Fields site (Ills 90, 91, 92).

ZONE I: 10000–6500 BP.

Zone I precedes the rise in alder (*Alnus glutinosa*) pollen; it includes zone RHI at the Farm Fields site (RH 1) and local assemblage zone K1 at the Kinloch Glen site (K). This is a period of dynamic environmental change, oscillating sea levels (Chapter 12), and developing and stabilising soils, combined with rapid climatic change and an almost constantly changing vegetation.

The deposits collected for this study did not include material from the earliest postglacial period. However, using a core from the Long Loch bog on Rhum, Ford shows a classical late glacial sequence of two solifluction deposits indicating frost heave of soils, interrupted by an organic deposit (possibly representing a warmer period), and more stable soils (Ford 1976; and see Godwin 1975). At the beginning of the postglacial period (around 10000 BP) temperatures increased rapidly and birch, pine and juniper (*Juniperus communis*) invaded the countryside. Pollen from the Kinloch Glen site (K) at around 8800 BP shows that, even in this sheltered part of the island, conditions were very open; a few copses of birch, and possibly some hazel or bog myrtle, were present, along with taxa characteristic of open non-bog habitats, such as juniper, mugwort (*Artemisia*), and plantain (*Plantago* spp.) (Parish mf, 2:A3–B8). The predominance of grass (*Gramineae*) and heather (*Ericaceae*) pollen suggest the early establishment of grass and heathlands in the area.

At Farm Fields, estuarine saltmarsh with reeds (*Phragmites communis*) had developed before the start of peat growth at 7800 BP. The archaeological site lies at about the maximum altitude of the postglacial high sea levels (Chapter 12). The early part of Zone I is characterised by a great variety of herb pollen, some of which reflects the salt water influence, eg various pinks (*Caryophyllaceae*), sea plantain (*Plantago maritima*), and composites (*Compositae*), while other herbs are more characteristic of late or early postglacial open environments, eg mugwort, Iceland purslane (*Koenigia islandica*), rue (*Thalictrum*). crowberry (*Empetrum nigrum*), and fir clubmoss (*Lycopodium selago*). After the sea level receded around 7800 BP, open hazel scrub became established with an understorey of horsetails (*Equisetum*), ferns, and sedges, together with tall-herb communities, including meadowsweet (*Filipendula ulmaria*), sorrel (*Rumex acetosa*), and umbellifers (*Umbelliferae*). Low pollen frequencies of birch and pine indicate that they may have been present on the island at this time, but they were probably not local to the site. The establishment of dwarf-shrub heaths on the drier sandstone soils near to the site is suggested by the increased frequencies of cinquefoil or silverweed-type (*Potentilla*-type) and scabious (*Succisa pratensis*), in combination with the appearance of ling (*Calluna*) pollen and the continued presence of other ericaceous pollen. Finally, the closing of the hazel canopy appears to have suppressed the flowering of composites, rue, fir clubmoss, and crowberry.

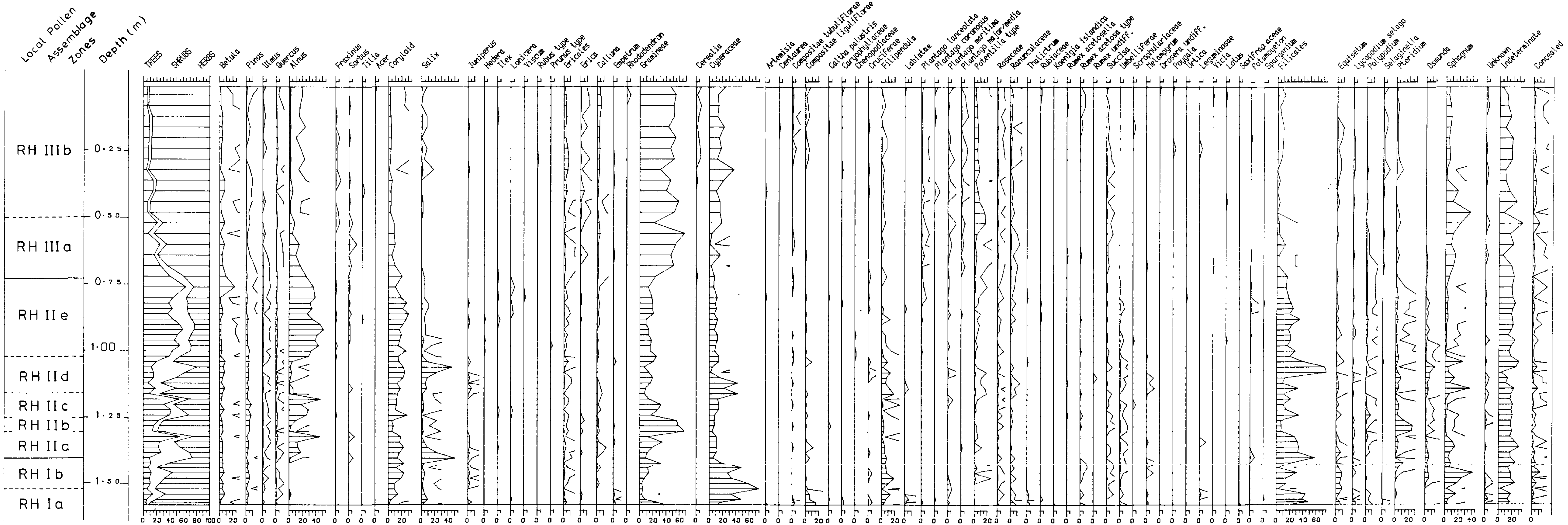
A combination of evidence suggests that the vegetation of the mire surface at the Farm Fields site was disturbed by fire at times throughout this zone (*cf* Bohncke 1988), and this disturbance could have contributed to the establishment of alder in the next zone (McVean 1956a). It is not possible, on the available data, to attribute this disturbance to either anthropogenic or natural fires, but, even if the inhabitants of Kinloch were not directly responsible, then they would certainly have benefitted from the changes that fire promoted (Mellars 1976b). At Long Loch, a decline in tree pollen at a time of increasing bracken (*Pteridium aquilinum*), umbellifers, and composites, (but before the rise in alder), has been interpreted as evidence for clearance activities (Ford 1976). There was apparently more extensive tree cover in the vicinity of Long Loch, mainly comprising birch (up to 25% of total pollen) and alder.

ZONE II: 6500–4000 BP.

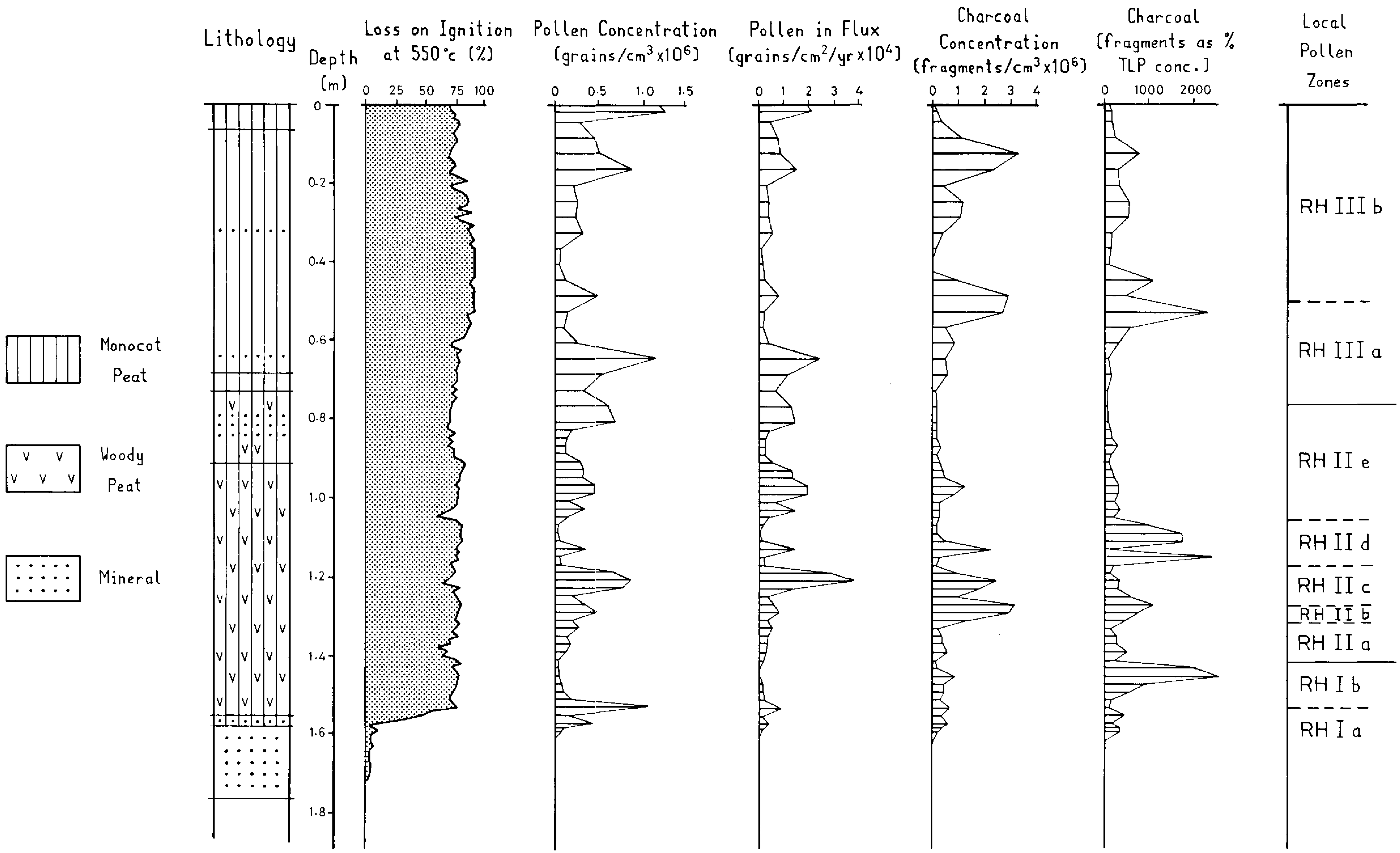
Zone II starts at the rise in alder pollen (6500 BP) and ends just after the beginning of the major decline of both alder and hazel/myrtle (pollen of hazel and bog myrtle is difficult to distinguish and is given the composite name Coryloid), pollen at the Farm Fields site. It encompasses zone RHII at Farm Fields and much of zone K2 at Kinloch Glen. Heather heath was widespread, and birch, pine and oak were also present on better drained areas. Higher frequencies of hazel and alder pollen at Farm Fields suggest that the scrub cover there was more closed than further up the Kinloch Glen.

At the Farm Fields site there are two periods which have reduced alder pollen and increased herb frequencies. These indicate a decline in tree cover, both on the damp alder-fern woodland of the mire and on the drier surrounding slopes, which may have supported hazel. Continued drying of the mire surfaces is demonstrated by a change to grasses and bracken, together with reductions in sphagnum moss and horsetails. These pollen changes and the increased frequency of charcoal at the time (eg in subzone K2b) suggest that the decline of the woodland may be associated with an increased incidence of fire. Alder is thought to be fairly resistant to fire (McVean 1956b), however, so it may be that these periods (which lasted an estimated 250 years) were the result of direct and repeated clearance, in which case the inhabitants of Kinloch would be the primary agency. If this were so, then it is difficult to see what long-term advantages such clearance provided for the population at Kinloch. The promotion of nutritious grazing after burning is a short-term effect (Mellars 1976b), and the driving of game is likely to be a one-off activity. Fire might promote the flowering and productivity of local hazel-nut crops (Smith 1970), but this is unlikely to be the case at Kinloch because hazel was reduced. The hazel reduction suggests that a more widespread impact was taking place on the drier slopes above the mire as well as on the bog itself.

The charcoal concentrations decline after 5300 BP (apart



ILL 91: RH 1: pollen percentage diagram.
Pollen sum = total land plant pollen, types outside this sum are calculated as pollen sum + taxon.
Exaggeration of the open curve is ×10.



ILL. 92: RH 1: loss on ignition; microscopic charcoal concentration and percentage data; pollen concentration and accumulation data.

from brief peaks in RHIId and RHIIe), and this decline suggests a reduction in the incidence of fires similar to that found on the North York Moors (Simmons & Innes 1981 & 1987), the Isle of Arran, and the Kintyre Peninsula (McIntosh 1986). The start of subzone RHIId (c. 5200 BP) dates to around the time of the elm decline, at which time climatic shifts have been suggested elsewhere in NW Scotland (Pennington *et al* 1972; Williams 1976), and these shifts possibly involve increased precipitation resulting from the southward displacement of the polar front (Magny 1982).

The first major local impact of the inhabitants of Kinloch is visible towards the end of zone II, in mid-RHIIe (c.4600 BP). There is an increase in mineral matter, and ribwort plantain (*Plantago lanceolata*) and cinquefoil pollen start a slow increase, while meadowsweet and royal fern (*Osmunda regalis*) values begin to decline. Grass pollen frequencies also start to rise, honeysuckle (*Lonicera periclymenum*) is present, and the tree pollen assemblage begins to include such open habitat taxa as holly, ash, and rowan. At the end of the subzone birch expands to its maximum value in the profile (23%).

In this subzone cultivated flax (*Linum usitatissimum*) occurs as five pollen grains at 0.30m depth in the on-site monolith (Moffat, mf 2:F1–G12). Flax pollen is large, and it is not carried far by the wind (Gennard 1985), so that its occurrence either indicates that it was cultivated nearby or that it was artificially deposited, eg with collected flax in a retting pond. The radiocarbon date from this monolith suggests that the dump of mineral material that overlay the findspot of the flax pollen is dated to slightly before 4000 BP (GU–2042). Although this date may be influenced by the redeposition of derived organic sediments, the secure dating of the slopewash deposits nearby (GU–2041) suggest that the cultivation of flax occurred at the start of the second millennium BC. In Scotland, flax has been recorded from bronze age deposits in Fife (Jessen & Helbaek 1944, 55), and it has recently been reported from likely neolithic deposits in Kincardine and Deeside (Bond & Hunter 1987, 175).

ZONE III: 4000 BP – THE PRESENT DAY

Zone III starts as alder begins to decline at the Farm Fields core site. Changes at this time suggest a decline in the alder woodland and in the tall-herb communities that dominated the mire surface, as well as in the hazel on the surrounding drier soils; this is reflected by a decline in the wood content of the peat. Both ling and scabious expand, suggesting that the hazel was replaced with the spread of heath vegetation. Birch and rowan are present in high frequencies, both possibly expanding as pioneer taxa on the drier cleared areas left open by the decline in hazel. One cereal-type pollen grain was found at the start of RHIIIa; in combination with the increase in plantains (*Plantago lanceolata*, and *P. media*), as well as increased charcoal, this suggests clearance of the land for agriculture. The start of this subzone also coincides with a decline in pine. This decline is approximately coeval with the regional pine decline (c. 4000 BP) which has often been interpreted as the result of human activity and/or climatic change (eg Birks & Madsen 1979; Bennett 1984; Bradshaw & Brown 1987; Bohncke 1981; Birks 1987).

The sediments collected from the infilled watercourse on the excavation site relate to this period (Moffat mf, 2:F1–G12): they are composed of a woody *Molina* peat 0.3m deep (the remains of purple moor grass), and this is overlain by a more woody peat (0.3m in depth). Between the two peat layers there was a band of stony-silts (0.25m deep), and this was barren of pollen; stony-silts also occur within the top 0.1m of the profile. There was a quantity of brushwood within the watercourse; this was mostly alder, but it included oak, birch, hazel, together with rowan, crab apple (*Malus sylvestris*) and hawthorn. The small size of these macroscopic wood fragments suggested that they may have been deliberately collected or, if natural windfall, that they had come from managed scrub (McCullagh mf 3:A3–A11); woodland coppicing may have been taking place (*cf* Goransson 1987).

Three events are closely related at around 4000 BP. Firstly, this is a time of major local impact by the inhabitants of the archaeological site: tree cover was reduced, and acid grassland spread around the site, whilst heaths increased to dominate the drier sandstone slopes (this change dates to after 4660±70 BP, GU–2110). Secondly, there was a build-up of slopewash, visible as extensive spreads of sandstone materials across much of the archaeological site and to the E (Edwards & Hirons mf, 2:B9–C3). Thirdly, there was the deliberate deposition of a layer of stony-silt into the water course (dated to 3890±65 BP, GU–2042), as well as the deposition of midden-type deposits and gravel dumps (TAQ 4080±60 BP, GU–2148). This combination of events suggests that this was a time when local anthropogenic impact was greatly increased.

In contrast, the changes in the pollen assemblages from the Kinloch Glen are much less striking than those visible on site, but they do still confirm the widespread development of agricultural activity. The amount of birch and alder pollen are slightly increased throughout much of zones 3 and 4, indicating that the sparse tree cover in this part of the Glen is little changed, and hazel/bog myrtle (Coryloid) is also better represented. There are, however, increased frequencies of certain weed taxa: cinquefoil; several composites including thistles (*Centaurea*); and ribwort plantain (*Plantago lanceolata*), and these do indicate an increase in open and disturbed habitats. A decline in tree pollen recorded further afield (at Glen Shellesder and Long Loch, both on Rhum; Graham 1986; Ford 1976) must indicate the widespread decline of trees and their replacement with heath, acid grassland, or blanket bog, but it is not possible to correlate these sites precisely with the Kinloch data.

At the Farm Fields core site after 2800 BP, hazel and ferns were replaced by heaths, grasses, sedges and cinquefoil; all suggesting the development of base-poor grassland (perhaps similar to that on the site at present). The reduced mineral content of the peat in the first half of the subzone shows that the local soils had reached an equilibrium after the decline of alder and hazel. In the latter half of this zone, cereal-type pollen is present in the record as a continuous curve, and the presence of pollen of weedy taxa, eg composites, mugwort, buttercups (*Ranunculaceae*), and sorrel (*Rumex acetosa*), suggests that this was the period of the most intensive cultivation on site. This period starts at a depth of around 0.28m in the Farm Fields core (c. 1500 BP), and it coincides with increased mineral input to the peat of the watercourse. The washing of mineral material onto the bog suggests soil instability, and it probably resulted from agricultural activity directly upslope of the pollen site (possibly in the same area where the remains of recent cultivation may be seen; Hirons & Edwards, mf a 2:C4–D13).

ON-SITE POLLEN SAMPLES

Pollen analysis from the fill of the watercourse shows a succession of pollen spectra (Moffat mf, 2:F1–G12). The samples from the top of the fill reflect the heather communities which now dominate the site; higher tree pollen frequencies (in the midden-type material) perhaps reflect conditions around the site prior to the full development of heath and acid grassland. Elsewhere on site, the mesolithic samples tended to have low tree pollen counts, as did the samples from the dump of rock and debris within the watercourse and the samples associated with pot sherds in the ploughsoil. Samples with high tree pollen frequencies include those from the midden-like dumps; these are neolithic or later. The relative chronology of tree cover implied by these samples is confirmed by the interpretation of the off-site pollen analysis, namely that the period when tree and shrub vegetation was most prominent was after the time of mesolithic settlement.

Analysis of the monolith from the watercourse also produced the remains of the ova of the sheep liverfluke (*Fascicola hepatica*), and liverfluke ova were also present in three samples of wood peat from the midden-like deposit (BA D1) and in one sample of wood peat found by the edge of the watercourse. Although it is known as the sheep liver fluke, this parasite has been recorded in most orders of animal, and it is closely associated with livestock. It is particularly prevalent amongst animals kept in large numbers and in enclosed conditions, as repeated feeding on infested grasslands leads to severe infestation. The swampy edge of the watercourse is an appropriate habitat for the wetland snail which is necessary to complete the life cycle of the fluke, and it may have originated in the red deer of Rhum, or in any livestock watering and excreting there.

THE CHANGING RESOURCE BASE OF RHUM

ZONE I

In zone I the first settlers would have been presented with the initial development of stable vegetation under conditions of relatively rapid climatic change and oscillating sea level. The climate warmed rapidly at the onset of the postglacial period (eg Lamb 1982) and, as the soils became stabilised, a time lag developed between the temperature and the vegetation. It seems that open conditions persisted on Rhum rather longer than on parts of the nearby mainland; there is little evidence for the rapid expansion of birch woodland as found in most areas of mainland Scotland (or even in south Skye, eg Birks 1977), and open heathy grasslands survived both in exposed places and in more sheltered areas such as the Kinloch Glen. After 8000 BP soils improved, and hazel thickets developed around the archaeological site, while on the higher, drier slopes, away from the saltmarsh of the estuary, birch-oak woodland developed. Although hazel may have been widespread at this time (Graham *pers comm*), the higher altitude site at Long Loch produced more evidence of birch than of hazel (Ford 1976), so that the distribution of hazel-nut resources may have been patchy.

Rising water tables have been suggested on a continental scale at about the time of the rise in alder pollen, and the expansion of alder to the west of Scotland does appear to have taken place fairly rapidly at around 6500 BP, suggesting that some environmental threshold was overcome rather than that alder arrived by immigration. This would require the presence of small pre-existing local alder colonies and, indeed, pollen of alder was recorded on Rhum in low quantities in the earlier period, perhaps indicating the presence of just such foci (Parish mf, 2:A3–B8; Graham 1986). The subsequent expansion of alder at the time of maximum marine transgression, and a shift towards the dominance of westerly anticyclonic weather conditions (mid 6th millennium BP), indicates both wetter soil conditions and a higher water table.

ZONE II

At Kinloch, alder replaced hazel in the areas of wetter flushes, and it presumably expanded to cover wider areas as the sea later stabilised at a lower level. Throughout this time the tree cover on the soligenous bog at Farm Fields fluctuated, and the area was clearly an ecotone of peaty soils supporting a carr of first hazel and then alder. The soils were often very wet, fed by water flushing downhill from the sandstone slopes above, and at times the slopes became unstable (several episodes of mineral deposition are indicated, Hirons & Edwards mf a, 2:C4–D13). It is notable that there are no remains directly associated with activity on site at this time, but such littoral scrub areas are highly productive today, and they probably attracted both game and fowl for the hunt, as well as vegetable resources. Evidence for generalised human impact does suggest that people were not far away, particularly towards the end of this period.

ZONE III

After c. 4000 BP there was a rapid decline in the tree cover around the site, and this signals a radical change in the resource base. On higher ground the environment became dominated by open, windswept moorland and blanket bogs, and game would undoubtedly have been reduced in density. This was a transition to essentially present-day vegetation-types, and it occurs in similar fashion on many Hebridean islands, though it varies in date (eg Birks & Williams 1983; Birks & Madsen 1979; Walker & Lowe 1985; Lowe & Walker 1986; Bohncke 1988). At Kinloch the short-lived expansion of birch, just before the decline of alder and hazel in K2e, together with the sporadic record of plantain, suggests anthropogenic activity, possibly agriculture, on the slopes above the Farm Fields. This activity gained impetus around 4700 BP and seems to have resulted in the flushing of eroded material on to the mire below. By *c* 4000 BP there is renewed evidence for anthropogenic activity on and around the archaeological site itself. At this time a period of climatic change has been suggested, based on evidence elsewhere (Birks 1987; Andrews *et al* 1985; Walker 1984). This change involved increased stormyness and oceanicity, and it may have resulted in the expansion of exposed open land; it was presumably felt most severely on the Atlantic seabord and must have had an effect on the inhabitants of Rhum, though Kinloch itself would still have been relatively sheltered.

12 SITE FORMATION PROCESSES D SUTHERLAND

INTRODUCTION

An understanding of the origin and developmental history of the deposits underlying the site at Kinloch provides information on four counts. Firstly, the nature of the ground was probably a determining factor in the choice of that locality for settlement. Secondly, during the excavation of this type of mesolithic site it is necessary to be able to recognise the natural material in order to define the margins of any archaeological features. Thirdly, natural processes continuing after occupation may have resulted in the alteration or erosion of structures or features. Finally, and in contrast to the third point, observations on the deposits may show that little disturbance has occurred, and therefore, that much of the original evidence for human activity remains in place.

Accordingly, a number of separate studies were carried out to define the processes responsible for the formation of the site, and possible subsequent modification: the geomorphology and history of sea-level change of the area (Sutherland mf, 3:E11–G6); the sediments immediately underlying the site (Davidson mf, 3:B3–C1, Sutherland mf, 3:E11–G6, and Jordan mf a, 3:C2–D2) and the soil development in the area of the site (Davidson mf, 3:B3–C1, and Jordan mf a, 3:C2–D2). The ability of various procedures to differentiate features from naturally occurring sediments was examined by techniques such as soil micromorphology (Jordan mf b, 3:D3– D7), clast form analysis (Jordan mf c, 3:D8–D14), phosphate analysis (Hirons & Edwards mf b, 2:E1–E14; Lee mf, 3:E1–E10), and geophysical measurements (Maher & Watson mf, 3:A12–B2). The present chapter is a synthesis of these studies.

THE DEPOSITION OF SEDIMENTS UNDERLYING THE SITE

During the last major glacial phase the whole of Rhum was probably covered by ice flowing westwards from the Scottish mainland (Sutherland 1984). The ice flow was deflected to both the north and the south of the main mountain mass of the south of Rhum, such that in the Kinloch area the direction of ice movement was north of west. Glacial deposition deriving from this period is not abundant on Rhum, but along the north side of the Kinloch Glen, from near the head of Loch Scresort for approximately 1 km, the Torridonian Sandstone bedrock is masked by a variable thickness of drift, which thins out against the slope below 50m Rhum L.D. The archaeological site is located close to the eastern margin of this drift cover. Within the drift covered area there are only occasional rock outcrops, and the ground surface is generally smooth with low gradient slopes. An exception is immediately seaward of the site, where there is a small (1.5–2m) cliff cut into the drift by the sea. Beyond the drift margins, bedrock crops out extensively as marked benches and ridges, with a thin cover of peat and some drift in the intervening hollows. This latter type of terrain is typical of much of northern Rhum.

That glaciation was responsible for the emplacement of the drift in this area has been confirmed by analyses of the included clast form and the variations in lithology of those clasts. Thus, Sutherland (mf, 3:E11–G6) found that 12.5% of the clasts greater than 40mm length were of either schist (derived from the Scottish mainland) or of Mesozoic sediments (probably from the neighbouring sea bed). The upslope part of the drift cover is a very compact, poorly sorted, stony material, which has been interpreted as a till (Jordan mf a, 3:C2–D2; Sutherland mf, 3:E11–G6). Downslope in the area of the excavations, however, the upper layers of the drift have been modified by natural processes subsequent to deglaciation (as discussed below).

As the last ice sheet melted, the sea around Rhum became clear of ice earlier than the island itself because of rapid ice wastage resulting from calving of the ice sheet margins in the sea. Sea level at deglaciation was much higher than at present as a consequence of the isostatic depression of the earth's crust by the weight of the ice sheet. At the head of Loch Scresort, sea level at this time was approximately 35m Rhum L.D. (Sutherland mf, 3:E11–G6). During this period of high sea level, thin horizons of clay may have been deposited in hollows on the slopes; such sediments have been encountered at the base of the monolith pit (RH 1) in the Farm Fields area (Chapter 11, and below) and below peat in a bedrock hollow to the east of the excavations. There is no direct dated evidence on Rhum for the subsequent fall in sea level, but comparison with other areas along the west coast of Scotland implies that as the ice melted the sea fell rapidly, perhaps to below its present level (Dawson 1984; Sutherland 1984). These events most probably took place prior to 13,000 BP.

The downslope part of the drift cover in the area of the excavations is immediately underlain by sediments that differ from the till upslope. These sediments consist of a very compact, stony material which differs from the till in being better sorted with less fine material, the matrix is a coarse sand. Analysis of the clast form and roundness (Davidson mf, 3:B3–C1; Sutherland mf, 3:E11–G6) indicates that the sediment has been subjected to processes which have produced rounding and flattening, whilst the clasts have a preferred orientation of their long axes along-slope (Davidson mf, 3:B3–C1). These characteristics have been interpreted as indicating that the upper layers of the till have been subjected to reworking by marine processes. The thickness of the reworked layer is reported by Jordan (mf, 3:C2–D2) to increase as the slope is descended, with the maximum thickness of reworked sediment (1.8m) at the base of the slope.

Other modifications to the deposits in this area have been found in the form of an indurated horizon overlain by a gravel layer 0.5–0.1m thick, these gravels having silt cappings (Jordan mf a, 3:C2–D2). The indurated horizon is at a depth that increases from about 0.4m to 0.8m downslope. The induration and silt cappings are typical of periglacial modification (Fitzpatrick 1956). They can only have formed once sea level had fallen below the altitude of the deposits (ie below c.10m Rhum L.D.), and they may therefore be inferred to date from the Loch Lomond Stadial (11,000–10,000 yr BP), the last period when periglacial conditions were experienced at low altitudes in Scotland. Their presence at shallow depth in the deposits in the area of the excavation implies little erosion of the area of the site during the Flandrian ie the last 10,000 years.

A small shallow infilled channel (the watercourse) cuts across the eastern margin of the drift deposits. Excavated sections of this channel reveal the infill to consist of beds of organic and clastic sediments of Flandrian age. There seems little evidence for persistent streamflow during the Flandrian, and the initial formation of the channel may date to the Loch Lomond Stadial, for it has been demonstrated elsewhere in Scotland that many minor gullies and channels were eroded in unconsolidated sediments during the periglacial conditions of that period (Sissons 1976).

The deposition of, and modification to, the deposits underlying the site may therefore be summarised as follows. During the Late Devensian ice-sheet, glacial till was deposited in an irregular block along the north side of Kinloch Glen stretching about 1km inland from the head of Loch Scresort and reaching a maximum altitude of about 50m Rhum L.D. At the time of deglaciation sea level was relatively high, but a rapid fall occurred during which the downslope portions of the till were reworked by the sea, producing a poorly-sorted upper horizon. This is the material that directly underlies the area excavated. When sea level was low, periglacial conditions affected the deposits producing an indurated horizon at 0.4–0.8m depth and, possibly at this same period, a small channel was cut across the eastern margin of the deposits. The periglacial episode may be assigned to the Loch Lomond Stadial. Thus at the beginning of the Flandrian the essential features of the area around the Kinloch site had been established.

SITE MODIFICATIONS DURING THE FLANDRIAN

The principle natural changes to the area around the site during the Flandrian have been the infilling of hollows by peat, and the development of soil profiles on those areas not covered by peat. An additional factor to consider was whether the sea during the Flandrian ever encroached on the area of the site.

There is considerable minor local variation in the soils developed in the sediments underlying the site, resulting principally from variations in drainage (Davidson mf, 3:B3–C1; Jordan mf a, 3:C2–D2). Overlying the till a non-calcareous gley has developed, similar to the peaty gleys of the 'Kinloch' soil locality name (Ragg & Boggie 1958). The lower part of the site has revealed shallow gleys, gleyed podsols, podsols and iron-humus podsols. It is the last type that is found over the major part of the site, and a typical profile is given in Table 25 (from Jordan mf a, 3:C2–D2). The Mor-type humus found in the H horizon of the soils has infiltrated the gravels, declining in concentration with depth. This humus coats stones in the upper gravels, and it acts to obscure boundaries of texture and colour. The humus is relatively easily dispersed by water, and it may therefore be presumed to be mobile in the soil at present.

The small channel that crosses the site is infilled with sequences of organic, peaty material, together with poorly sorted sands, gravels and cobbles. The earliest dated material in the channel is mixed charcoal and hazel-nut shell from a soil horizon in the base with a radiocarbon age of 7140±130 BP (GU–2211). A peaty horizon overlain by slopewash elsewhere in the channel has been dated to 4260±70 BP (GU–2106). The dates indicate the long period during which the fill accumulated. The minerogenic horizons in the channel occur in discrete lenses with little down-channel continuity; they are poorly sorted, generally non-stratified and contain occasional groups of large clasts. They are apparently not due to normal sedimentation in such a small channel, and so are considered to be the result of the artificial infilling of the channel. It seems likely, therefore, that during the Flandrian the natural sedimentation in the channel has been a build-up of organic sediments, principally peat.

The evidence for sea level change during the Flandrian is sparse around the shores of Loch Scresort. On the south side of the loch there is a gravel terrace at an altitude of c. 11m Rhum L.D. Elsewhere around the Rhum coast the highest altitude to which presumed Flandrian marine deposits have been deposited is 8m Rhum L.D. at Harris, and 9.5m Rhum L.D. at Guirdil (Sutherland mf, 3:E11–G6). It was therefore thought probable that the maximum altitude for marine processes by the Flandrian sea in the area of Loch Scresort was 10–11m Rhum L.D. As the marine features surveyed are gravel ridges and terraces, the mean sea-level at the head of the sheltered Loch Scresort may have been 1–2m below those figures (*cf* Sutherland 1981).

Initially, it was thought (Sutherland mf, 3:E11–G6) that the base of the peat of the Farm Fields represented a seral contact from marine to freshwater conditions, but pollen analyses (Chapter 11) revealed no clear evidence of marine influence, and the basal radiocarbon date of 7800±75 BP (GU–2062) implies that peat formation started prior to the time when the Flandrian sea is likely to have reached its maximum altitude (ie after 7,000 BP, Sutherland 1984). The altitude of the base of the Farm Fields site (9.9m Rhum L.D.) may therefore be considered a maximum figure for quiet water sedimentation at the head of Loch Scresort by the Flandrian sea.

During the Flandrian, the natural processes acting in the area of the site have not resulted in any major disruption. Peat has infilled hollows, and soils have developed on the higher areas of drift. There is little evidence at breaks in slope of any significant downslope washing of material, and

Horizon	Thickness (m)	Description
		Grasses
H	0.02	Greasy, black well-humified (Von Post grade 7) peat. Abundant grass roots. Massive, soft.
B1	0.13	Very coarse sandy clay loam with abundant stones, rounded to sub-angular. Abundant roots. 10YR3/1 very dark grey-brown.
B2s	0.65	Loamy coarse sand with dominant stones rounded to subangular. 2.5YR3/2, dusty red. Moister and less organic than B1.
C	+	Slightly indurated gravels and cobbles with silt cappings in situ.

Table 25: A typical soil profile.

the preservation throughout the Flandrian of the periglacial features in the soils implies little site disturbance. The Flandrian sea did not rise to such an elevation that it transgressed the area that has subsequently been excavated, but the near coincidence in altitude of the lowest level to which artifacts have been traced and the uppermost level to which the sea may have risen (approximately 10±1m Rhum L.D.) suggests that a lower part of the site may have been truncated by the sea.

THE DIFFERENTIATION OF THE FEATURES FROM THE NATURAL SEDIMENT

A variety of artificial features were found during excavation: pits; scoops; possible stake holes. These were generally recognised from their fills of dark organic-rich material, but when examined in detail their margins were not clear due, in part, to the staining of the surrounding gravels by humic material during soil formation. Attempts were therefore made to characterise the feature fills and to compare them with the surrounding material in order to define the features more precisely.

Jordan (mf b, 3:D3–D7; mf c, 3:D8–D14) examined the differences between the fills and the surrounding sediments in most detail. He classified the stones within the features, as well as those in natural sediments, according to their form, roundness and mass. In addition, in a trial study, he examined the micromorphology of three fills. The clast analyses showed very considerable overlap between the characteristics of the fills and the natural sediments, both showing a large range of values for the parameters measured (axial measurements, roundness estimation, mass). However, they could be differentiated on the basis of sphericity and mean maximum length. In general, it could be concluded that the fills were not directly derived from the surrounding material but contained an additional angular component.

In contrast to the clast analyses, the examination of the micromorphology of the fills concentrated on their matrix. One section examined crossed the lower boundary of a feature and showed a much greater frequency of mineral matter outside the feature, with a transition over a distance of about 20mm. The matrix of the features was dominated by organic matter some of which may have been introduced after formation by the activities of worms. There were no notable structures in the matrix, although rare oriented and sorted coatings, domains and plugs suggest that some of the fine organic matter has been mobile in the features, and hence may have been introduced at a later date.

Attempts were also made to identify the features on the basis of geochemical or geophysical signatures. Phosphate surveys were carried out by Hirons and Edwards (mf b, 2:E1–E14) and Lee (mf, 3:E1–E10). These surveys covered only small parts of the site, and it was possible to define areas that clearly had higher concentrations of phosphates than the background for the area. However, the limited number of points sampled did not permit the identification of clear patterns which would assist in the interpretation of any correlations between feature occurrence and phosphate concentration. It was therefore not possible to address the problems as to what activities would give rise to phosphate concentrations, and what relationship such concentrations might be expected to have with particular features.

Geomagnetic surveys of the surface susceptibility, as well as the magnetic field (using both fluxgate and proton magnetometers), were carried out over both excavated and unexcavated parts of the site. Unfortunately, interpretation of the surveys over partially excavated ground was difficult due to the removal of a varying thickness of topsoil. The susceptibility pattern (Maher & Watson mf, 3:A12–B2) showed distinct areas of high susceptibility superimposed on a fairly low background. Individual highs were interpreted as arising from the presence of stones at the surface, but clusters of high points in the unexcavated areas were considered to represent true subsurface features (Maher & Watson mf, 3:A12–B2). The observations with the fluxgate and proton magnetometers produced results which were difficult to interpret and which had little correspondance with the susceptibility survey.

The attempts to develop techniques to characterise the observed features and differentiate them from the natural deposits have only been partially successful. All techniques were applied on an experimental basis, and further work would be necessary to assess their utility.

CONCLUSIONS

A number of factors relating to the location and formation of the site may be considered to have played a positive role in its selection as an occupation area. The presence of the underlying glacial drift has produced a relatively well drained area when compared to the extensive areas of irregular rock outcrop and intervening wet hollows on much of Rhum. The glacial deposits could also be excavated, and hence provide a more stable foundation for even simple structures. Loch Scresort is by far the most sheltered part of the Rhum coast, most of which is rocky and inhospitable with the few beaches being open to storm waves. An exception to this would have been the lower Kilmory Glen during the middle Flandrian where a relatively sheltered marine inlet would have existed. No detailed archaeological survey has been carried out in this area to date.

The site is unlikely to have ever been any further from the coast than it is at present, and for much of the middle Flandrian the sea would have been very close. It seems most probable that this, too, was a factor in the selection of the locality.

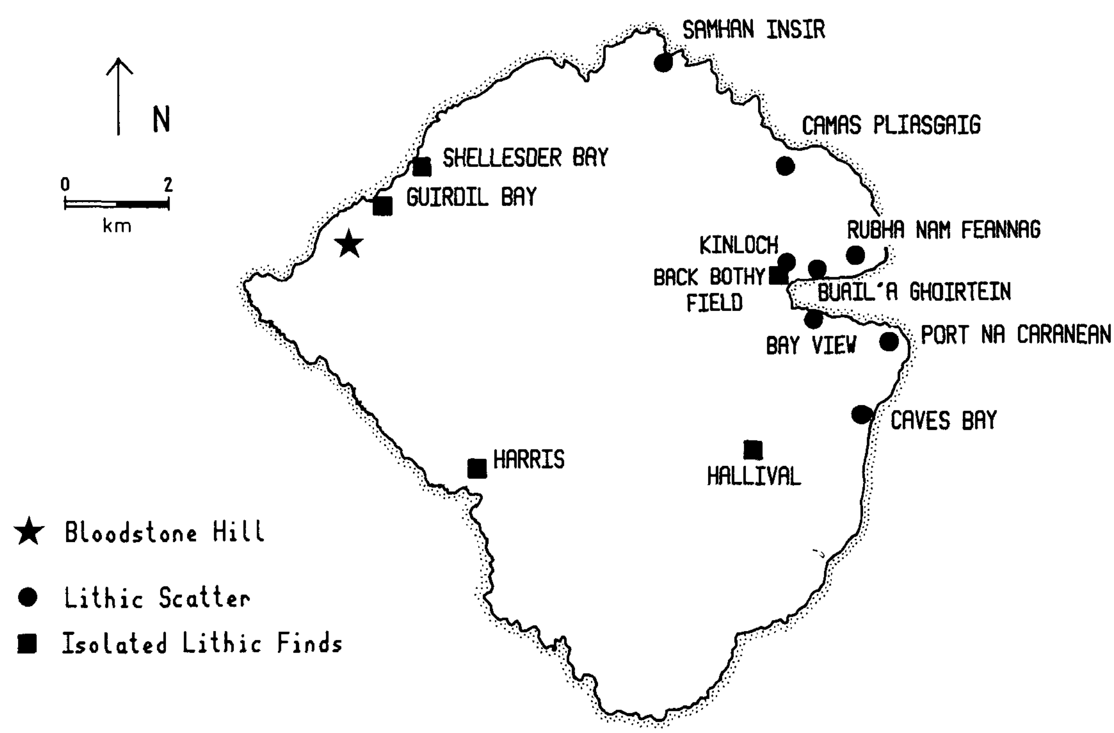
The evidence suggests that there has been little modification, due to natural processes, to the area of the site since occupation. The soil profiles preserve relict periglacial features, suggesting little total erosion, while at breaks of slope there is little build-up of slope-washed material. Thus the majority of the evidence that has not been susceptible to biological decay will have been preserved on site. Unfortunately, the slight positive nature of the relief of much of the area excavated has meant that there has been no development of a stratigraphic sequence corresponding to the various periods of occupation. An exception is the infilled channel (the watercourse), the full potential of which has still to be realised.

13 THE USE OF BLOODSTONE AS A RAW MATERIAL FOR FLAKED STONE TOOLS IN THE WEST OF SCOTLAND

A CLARKE & D GRIFFITHS

OTHER LITHIC SCATTERS ON RHUM A CLARKE

In addition to the excavated site at Kinloch there are twelve other lithic scatters on Rhum (Ill 93). Four were known when excavations commenced (RCAHMS 1983; Love 1983), the rest were located during fieldwork in 1984 (Clarke mf, 1:E6–E9).



ILL 93: Rhum: location of Bloodstone Hill and other lithic scatters.

THE ASSEMBLAGES

Although flint is present, bloodstone is the major lithic component on all of these sites (Tab 26). Knapping debris dominates the assemblages, but cores are only present at Buail a' Ghoirtein. Retouched artifacts are scarce (six artifacts only), and only three barbed-and-tanged arrowheads (two from Samhan Insir; one from Hallival), give any indication of period (bronze age).

SITE	TOTAL	BLOODSTONE	FLINT	INDETERMINATE	OTHER	RETOUCHED
Camas Pliasgaig	17	11		5	1	
Rubha nam Feannag	47	47				
Samhan Insir	34	28		6		Retouched Blade 2x b & t Arrowhead
Bay View	25	19	4		2	
Port na Caranean	264	131	5	116	12	
Caves Bay	43	15	10	17	1	Scraper
Buail'a Ghoirtein	632	403	28	195	6	Scraper
Guirdil Bay	20	17	2		1	
Harris	4	4				
Shellesder Bay	3	3				
Back Bothy Field	6	6				
Hallival	1	1				b & t Arrowhead

Table 26: Rhum, lithic scatters: materials composition of the lithic assemblages across the island.

DISTRIBUTION

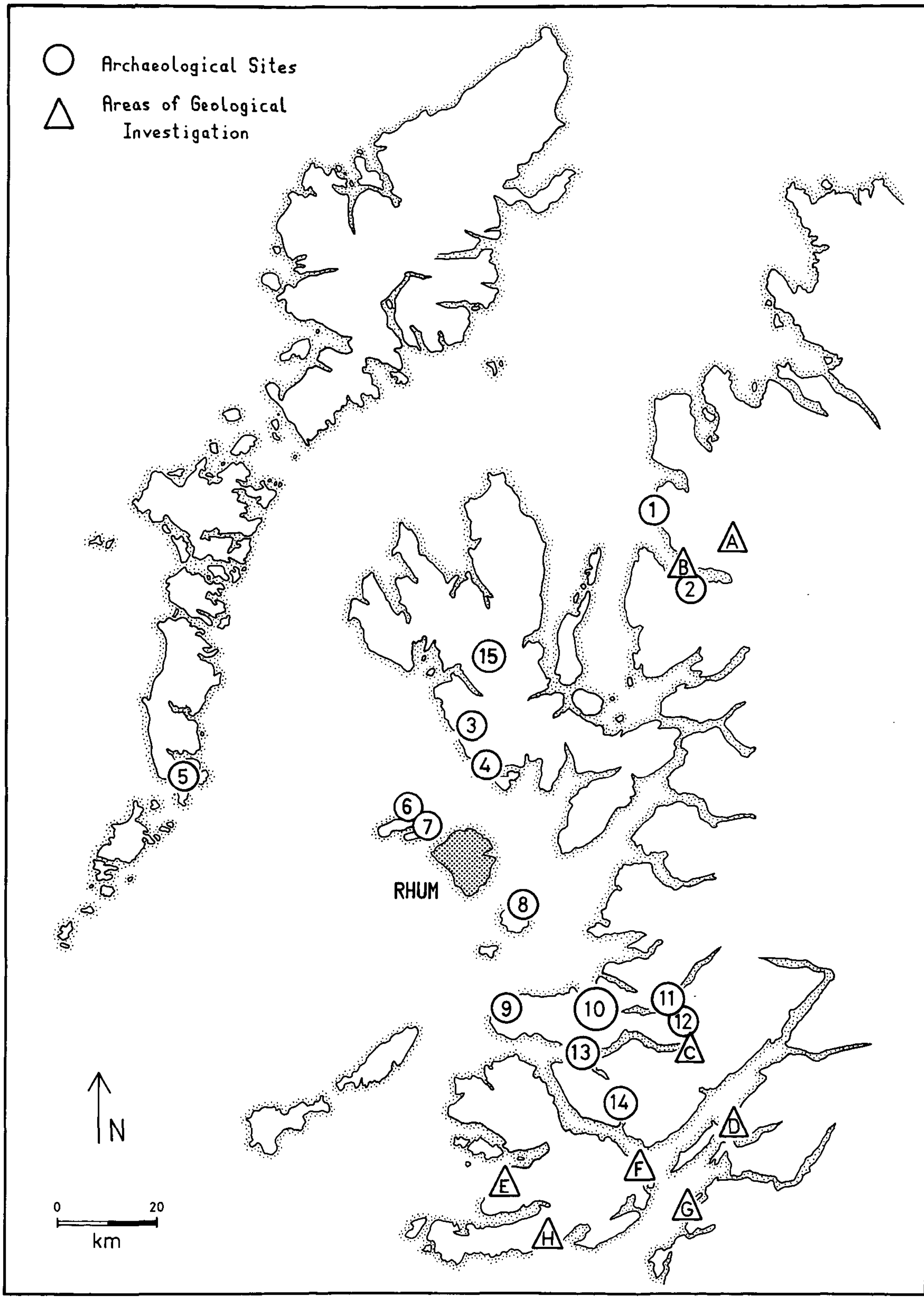
The peat cover of Rhum has sealed much of the prehistoric land surface, and prehistoric sites were only found in areas of natural erosion or artificial disturbance. Ploughing, in particular, both for forestry and crop cultivation, has resulted in the discovery of five of the sites (Clarke mf, 1:E6–E9). Hence, the coastal distribution of sites (Ill 93) does not necessarily reflect the prehistoric settlement patterns, but it probably indicates the impact of modern development. Despite this, there is considerable evidence for prehistoric activity around the north shore of Loch Scresort. In addition to the main site at Farm Fields, lithics are present in the fields adjacent and along the slopes to the NE of the site. In particular, the site at Buail a' Ghoirtein has produced a large assemblage of lithics from several concentrations exposed along a modern track. In 1985 a part of this area was excavated (Trench AN), and over 600 lithics were recovered although no archaeological features were found (Chapter 3). An examination of the lithic artifact types present in Trench AN shows that they are essentially similar to those from the Farm Fields (Tab 27).

TYPE	NUMBER
Pebbles	5
Scalar Cores	16
Platform Cores	3
Disc Cores	1
Amorphous Cores	2
Blades	14
Flakes	273
Debris	343
Chunks	7
Retouched	4
Microliths	3
TOTAL	671

Table 27: Trench AN: composition of the lithic assemblage.

CONCLUSIONS

The spread of lithic artifactual material around Rhum indicates that prehistoric activity was widespread. The analysis of the assemblages confirms the role of bloodstone as a major resource, but it adds little to the interpretation of the prehistoric settlement of the island. It must be remembered, however, that these assemblages all result from surface collection only (with the exception of Trench AN), and many comprise few pieces.



ILL 94: The location of the areas of geological investigation and of archaeological sites with bloodstone artifacts. Areas of geological investigation: A Kinlochewe; B Shieldaig beach; C Strontian; D Port Appin; E Gribun, Mull; F Torosay Castle, Mull; G Kerrara; H Carsaig, Mull. Archaeological sites (see table 28): 1 Redpoint; 2 Sheildaig cairn & Sheildaig mesolithic site; 3 Kraiknish; 4 Rubh'an Dunain cave and cairn; 5 Glendale; 6 Isle of Canna; 7 Isle of Sanday; 8 Isle of Eigg (one isolated find and a lithic scatter); 9 Sanna Sands; 10 Cul na Croise, Drymen Sands, Kentra, Arivegaig & Bruach na Maorach; 11 Polloch; 12 Allt lochan na Caraidh; 13 Risga; 14 Acharn; 15 Tungadale.

SITES OFF RHUM A CLARKE & D GRIFFITHS

INTRODUCTION A CLARKE

The use of bloodstone as a raw material for the manufacture of flaked tools is not restricted to Rhum, and assemblages containing worked bloodstone occur on the neighbouring islands and the mainland, but bloodstone is not a major component of the assemblage at any site. The sites where bloodstone was used have been documented and mapped (Ritchie 1968), but their contents were not examined in detail, nor were the possible mechanics of the distribution of the raw material. At that time little was known about the prehistoric occupation of Rhum, but with the excavations at Kinloch and the analysis of the lithic industry, which was known to contain large quantities of bloodstone, it is felt an appropriate time to reappraise the prehistoric distribution and use of bloodstone. Furthermore, a number of unrecorded sites incorporating bloodstone artifacts have been identified since the publication of Ritchie's work and these could be added to the picture.

The overall aim of the reappraisal was to assess the prehistoric use of bloodstone as a raw material for flaked stone tools. The study was divided into two parts:

- the location and examination of potential sources of bloodstone;
- the location of sites making use of bloodstone, and the examination of their lithic assemblages.

METHODS

DOCUMENTARY SEARCH

Museum catalogues and relevant publications were examined for references to the sources of bloodstone and to collections of bloodstone artifacts.

ARTIFACT EXAMINATION

Sites containing worked bloodstone were first listed, then the lithic assemblage from each site was examined. It was considered important to look at the whole range of lithic materials used at any site, but unfortunately access to complete assemblages was not always possible. Some assemblages rest in private hands, and surface collections are not always fully representative of a site. The examination of the assemblages was designed to provide a basic catalogue of the types of raw materials used and of the artifacts present within each assemblage. As a result of the problems inherent in the recognition of bloodstone (Chapter 4), this study is concerned only with those pieces of a green colour (with or without red inclusions), and with pieces containing vesicules whatever their colour. These pieces are certainly of bloodstone, but the exclusion of the more doubtful pieces (those of a grey or cream colour, and those with much abrasion), means that the amount of bloodstone recorded for any site represents only a minimum quantity.

FIELD WORK

Sources D Griffiths

Although Bloodstone Hill on the west coast of Rhum has long been considered to be the primary source of bloodstone, other possible sources are cited in geological texts (Ritchie 1968), and it was considered important to ascertain their potential as sources of raw material in prehistory. To this end the sources were visited, where possible, and the raw material at each was examined. The survey was particularly concerned with the abundance and type of material to be found at these sources, and samples were collected to assess the potential for source characterisation using Electron Spin Resonance spectroscopy (see below this section). Finally, the extensive geological collections of the Royal Museum of Scotland were searched for examples of bloodstone from sources that might otherwise have been missed.

Sites A Clarke

All of the archaeological sites from which bloodstone had been recorded were visited. Both the sites and their surroundings were checked for potential sources of raw bloodstone (eg nodules in beach or river gravels). During the course of this work a search was also made for new sites with bloodstone artifacts.

SITE	SITE TYPE	EXCAVATED	PERIOD	BLOODSTONE %	RETOUCHED BLOODSTONE	REFERENCES
Shieldaig, Wester Ross	Occupation	X	Meso	1.1	X	Walker (1973)
Risga, Loch Sunart	Midden	X	Meso	0.5	X	Lacaille (1954)
Polloch, Sunart	Lithic Scatter		Meso	4.1		D & E (1983)
Acharn, Morvern	Lithic Scatter		Meso	0.4		Ritchie et al (1975)
Arivegaig, Ardnamurchan	Lithic Scatter		Meso	7.0		
Allt Lochan na Caraidh Sunart	Lithic Scatter		Meso	6.0		D & E (1983)
Cul na Croise Ardnamurchan	Lithic Scatter		Meso ?	3.5		Lacaille (1954)
* Rubh'an Dunain Cave, Skye	Cave Midden	X	Neo/BA ?	≥4.1	X	Lindsay Scott (1934 b)
* Canna	Lithic Scatter		Neo/BA ?	40.0	X	
* Rubh'an Dunain Cairn, Skye	Chambered Cairn	X	Beaker	50.0	X	Lindsay Scott (1932, 1934 a)
Eigg 1	Single Find		BA	100.0	X	
* Shieldaig Cairn, Wester Ross	Kerb Cairn	X	BA	10.0		Hedges (1978)
Glendale, Uist	Lithic Scatter		BA ?	11.0	X	
* Tungadale, Skye	Souterrain	X	IA	100.0		D & E (1989)
Redpoint, Wester Ross	Lithic Scatter		?	2.7	X	Gray (1960)
* Eigg 2	Lithic Scatter		?	5.0		Clarke (1976)
Kentra, Ardnamurchan	Lithic Scatter		?	6.2	X	Lacaille (1954)
Bruach na Maorach, Ardnamurchan	Lithic Scatter		?	2.8		Lacaille (1954)
* Kraiknish, Skye	Single Find by Chambered Cairn		?	100.0		
Drymen Sands, Ardnamurchan	Lithic Scatter		?	7.0	X	Lacaille (1954)
* Sanna Sands, Ardnamurchan	Lithic Scatter		?	12.5		
* Sanday	Lithic Scatter		?	100.0		Lacaille (1954) D & E (1983)

* Sites not included in quantitative analysis

Table 28: The use of bloodstone in prehistory, sites off the island of Rhum: site type and period.

RESULTS

THE LOCATION AND EXAMINATION OF SOURCES D GRIFFITHS

Nine locations were examined to determine whether they might provide a source of raw material for the archaeological assemblages (Ill 94). Whilst the raw materials used in the Kinloch assemblage are not (for the most part) bloodstone in the strict geological sense, they are the sort of material generally found in geological association with bloodstone (Chapter 4). Thus, the examination of sources of bloodstone is justified as a starting point in looking for the raw material sources of prehistory.

With the exception of the source at Bloodstone Hill, none of the other locations yielded material at all similar to that used in prehistory (Griffiths mf, 1:F8–F13). Bloodstone was only found at two sites: a few pebble nodules were found on a beach on the west coast of Mull; and the collections of the Royal Museum of Scotland contained one pebble nodule from Machrihanish, Kintyre. Neither of these finds, however, could be said to provide evidence for viable alternative sources of raw material in prehistory, and the nature of the pebbles and their association with beach deposits at both sites suggests that *in situ* sources are not represented at either location. It seems likely that past research has used the term 'bloodstone' loosely, to identify a variety of green or red coloured rocks.

The evidence from fieldwork, therefore, suggested that Bloodstone Hill was indeed the only source of bloodstone exploited in prehistory. The next step was to verify this with an attempt to provenance some of the archaeological artifacts. A number of techniques have been used to source other microcrystalline siliceous rocks (eg thin-sectioning, trace element analysis, and microfossil composition), but all of these techniques posed special problems when applied to bloodstone. A recent pilot study (Griffiths & Woodman 1987) has shown that the non-destructive technique of Electron Spin Resonance (ESR) spectroscopy may also be used for such work, and this was the analysis pursued.

The ESR spectrum of a geological sample is a function of its composition and the conditions of its formation. The spectrum may subsequently change due to the chemical or physical processes that affect the atomic environments or the numbers of unpaired electrons, such as re-crystallisation, heating, or irradiation. The effects of gamma irradiation and heat on the ESR spectra of flint have already been investigated (Griffiths *et al* 1983 & 1987), and similar behaviour may be expected in hydrothermal silica rocks. Geological provenancing depends on finding some property of the raw material that is characteristic of samples of that material from a given region, and serves to differentiate them from samples from other regions. The use of ESR spectroscopy for reliable provenancing is dependant on having a thorough knowledge of the range of variation that is present in the ESR spectra of each of the geological sources under investigation. This requires comprehensive sampling which is both time consuming and expensive. In order to investigate whether the effort and expense of such a programme might be justifiable, the ESR spectra of a preliminary batch of 29 samples of micro crystalline siliceous rocks from western Scotland were recorded and examined. A particular question that needed to be answered was whether or not the samples showed a significant variation in their ESR spectra, for if all of the spectra were similar, it would be less likely that features characteristic of provenance could be discerned. The preliminary batch of samples (all of bloodstone), comprised one geological sample from Fionchra, Rhum; ten geological samples from Bloodstone Hill, Rhum; four geological samples from Mull; and fourteen archaeological samples from various sites in western Scotland (Griffiths mf, 1:F8–F13).

Although the sample numbers were small, the results of this analysis suggested that there might be distinct differences between the nodules from Mull and those from Rhum. The results suggested that this technique might be applicable to the provenancing of bloodstone, but there was a major problem in the considerable variation present within the geological material from Bloodstone Hill itself. This variation meant that it would be difficult to match the spectra of material from Kinloch to the spectra of material from the island sources. For this and other reasons, the investigation of the application of ESR spectroscopy to the sourcing of bloodstone was not pursued. As the survey stands, the small sample size used means that the detailed provenancing of the archaeological material is not possible (Griffiths mf 1:F8–F13).

THE LOCATION AND EXAMINATION OF ARCHAEOLOGICAL SITES AND THEIR ASSOCIATED ASSEMBLAGES A CLARKE

Twenty-two sites were found to include worked bloodstone in the lithic assemblage (Tab 28; in addition it has recently been reported amongst the assemblages from Mercer's excavations on Jura, Finlayson *pers comm*). All the sites lie within 70km of Rhum; they are to be found on the neighbouring islands and peninsulas of the west coast of Scotland; none of the sites are far inland. The sites comprise most (but not all), of the lithic scatters known in the area. However, the distribution of material seen today owes more to the *ad hoc* collecting practices that have taken place across the area than it does to the likely spread of prehistoric activity. Thus, it reflects both the existence of active collectors, particularly in the Ardnamurchan peninsula, and the locations of recent ground disturbance, as on Eigg. Nevertheless, it is likely that the distribution of these sites does represent the area within which bloodstone was considered to be a resource in prehistory. In the future targeted fieldwork must be used to determine whether the lacunae, seen on Ill 94, represent true gaps in the prehistoric settlement of the area and in the use of bloodstone.

Only five of the sites have been excavated; the assemblages from the remainder of the sites result from the surface collection of material, and, as such, they reflect all of the biases usually present in surface collections. The associated data suggest that the majority of the sites are mesolithic, although both neolithic and bronze age sites are included. Eight sites comprised such small assemblages that they were not considered in the quantitive analysis of the catalogued data (Tabs 28, 29).

Tables 28 and 29 both illustrate that the bloodstone artifacts comprise only a small percentage of the total lithic assemblage from any site. All the assemblages are dominated either by flint or by quartz, supplemented by small quantities of other raw materials; on half the sites less than 5% of the assemblage is of bloodstone. All the materials are local; both flint and quartz are available throughout the area (Wickham-Jones 1986), the other materials may be more restricted and were used only within their immediate source area. Many local rocks were more or less suitable for stone tool manufacture, and they were used at individual sites on an *ad hoc* basis, eg the mudstones of Redpoint, or the chalcedonies of Ardnamurchan. On two

	SITE	MATERIAL	TOTAL	CORES %	DEBRIS %	BLADES %	RETOUCHED %	% WITH CORTEX
1	Redpoint	Bloodstone	37		97.2		2.7	8
		Flint	35		97.1		2.8	] 4
	T = 1356	Mudstone	197	1.0	97.4	0.5	1.0	
		Quartz	1087	1.2	97.1	1.2	0.4	
2	Shieldaig	Bloodstone	68		86.7		13.2	3
		Flint	655	3.6	90.9	1.0	4.2	] 17
	T = 6001	Chalcedony	8		87.5		12.5	
		Quartz	5270	0.6	96.4	2.2	0.6	
5	Glendale	Bloodstone	7		57.0		42.8	0
		Flint	52	1.9	86.5		11.5	
	T = 62	Quartz	2		100.0			] 32
		Sandstone	1		100.0			
8	Eigg 1	Bloodstone	5		100.0			0
		Flint	71		85.9		14.0	
	T = 100	Agate	22	13.6	86.3			] 30
		Pitchstone	2		100.0			
13	Risga	Bloodstone	67	16.4	79.0		4.4	1
	T = 14080	Rest	14013	2.1	91.6		6.4	?
12	Allt Lochan na Caraidh	Bloodstone	5		100.0			20
	T = 77	Flint	45	2.2	93.3	2.2	2.2	
		Chalcedony	27		100.0			] 12
10	Arivegaig	Bloodstone	3		100.0			0
	T = 41	Flint	38		97.3		2.6	23
10	Cul na Croise	Bloodstone	12	8.3	91.6			0
		Flint	60	3.3	91.6		5.0	
	T = 336	Chalcedony	142		100.0			] 13
		Quartz	122		100.0			
10	Kentra	Bloodstone	8	25.0	62.5		12.5	12
		Flint	52		88.4		11.4	
	T = 128	Chalcedony	68		100.0			] 38
10	Bruach na Maorach	Bloodstone	1		100.0			0
	T = 35	Flint	24		95.8		4.1	
		Quartz	10	20.0	80.0			] 5
11	Polloch	Bloodstone	6		100.0			0
	T = 143	Flint	126	2.3	94.3		3.1	
		Chalcedony	11		100.0			] 19
14	Acharn	Bloodstone	3	33.3	66.6			0
		Flint	661	1.3	85.4	9.2	3.9	
		Chalcedony	165	7.2	90.2	1.2	1.2	
	T = 843	Pitchstone	1			100.0		] 13
		Mudstone	4		100.0			
		Quartz	9	11.1	88.8			
10	Drymen Sands	Bloodstone	6		66.6		33.3	0
	T = 85	Flint	77		78.5		21.5	
		Chalcedony	2		100.0			] ?

Table 29: The use of bloodstone in prehistory, sites off the island of Rhum: raw material types.

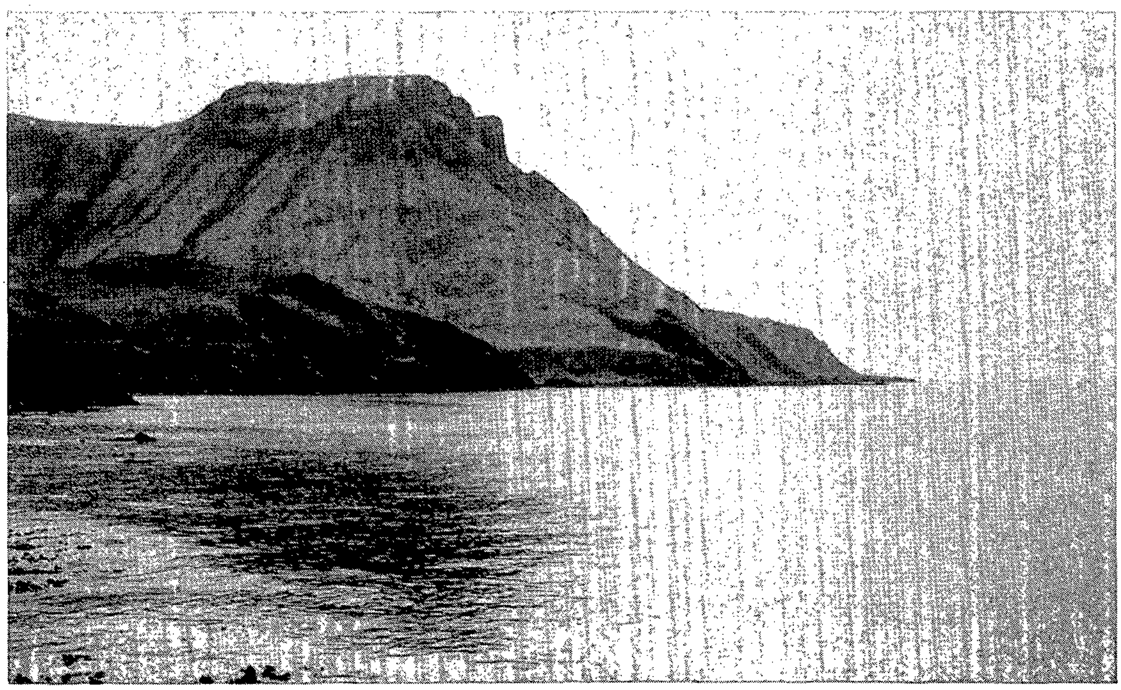
sites (Acharn and Eigg 1), there are also small quantities of pitchstone and these pose a problem. Pitchstone from Arran is known to occur in archaeological assemblages across Scotland (Thorpe and Thorpe 1984), but there are pitchstone outcrops on Eigg. The pitchstone artifacts from these two sites were not included within the previous work on the sourcing of pitchstone artifacts and so it is possible that the material was locally derived from Eigg, rather than from Arran.

In order to assess whether bloodstone was transported as pebble nodules, the percentage of cortical pieces on each site was calculated, together with the percentage of bloodstone cores and knapping debris (Tab 29). On most sites cortical pieces were scarce, they were 'numerous' at only three sites, and there were bloodstone cores at only three sites. Knapping debris occurred on all sites, but only ten of the twenty-one sites contained retouched artifacts of bloodstone.

The analysis of the artifact assemblages was difficult because of the poor quality of the data. Most assemblages contain only small quantities of bloodstone, and it is noticeable that the two largest assemblages come from the only two sites in the series that have been excavated. Despite these problems, there are points of interest. The cortical component of the archaeological assemblages is generally low (Tab 29), and this suggests that the nodules were reduced before leaving Rhum (perhaps to limit weight or to test the quality of the raw material). Knapping debris does occur on all of the sites, however, so that some additional reduction of bloodstone is likely to have taken place locally. This may have included the production of flakes on some sites, in particular those from which bloodstone cores were recovered (three of these sites are mesolithic). Elsewhere it may be that the bloodstone was transported as flakes and these flakes could then be further worked as necessary. As it stands, the evidence does not suggest that bloodstone fulfilled a specific function at any of the sites. There is a relatively high number of retouched pieces of bloodstone, and this might reflect the value assigned to the material in prehistory (perhaps for its visual quality and its rarity off the island), but it might also be a result of the biases of past collection techniques.

DISCUSSION

Although not fully confirmed by geological provenancing, the available evidence does suggest that Bloodstone Hill, Rhum (Ill 95), was the only prehistoric source of bloodstone. Given this assumption, and though the archaeological evidence is not abundant, certain patterns are discernible. The use of bloodstone extended over a long period of time (from the mesolithic into the bronze age). Bloodstone was only one of a number of lithic resources available throughout the area, but it was the only raw material likely to have been collected from any distance. Throughout the period of its use, some slight changes are visible. In the mesolithic there is more evidence for the on-site manufacture of bloodstone artifacts (reflected in the quantities of knapping debris recovered), and as the mesolithic sites are all (so far) on the Ardnamurchan or Morvern peninsulas there is the possibility that their inhabitants maintained direct access to Rhum and removed raw material in the form of cores. In this period the exploitation of bloodstone may have been a subsidiary to other subsistence activities. In the later periods it seems that bloodstone may have been used more specifically, particularly for retouched artifacts, and it may have been transported as prepared flakes. It must be remembered, however, that many different types of site are involved; excavation is necessary to verify the details of the emerging picture of the use of bloodstone in prehistory throughout the area.



ILL 95: Bloodstone Hill from the N.

14 INTERPRETATION AND CONTEXT

INTRODUCTION

The prehistoric remains at Kinloch are associated with two broad periods of human activity, one mesolithic the other primarily neolithic. The mesolithic remains consist of pits, hollows and stakeholes accompanied by a substantial body of lithic artifactual debris. The neolithic remains are sparse and with the exception of one small hollow are not solely of anthropogenic origin. For the purposes of interpreting the archaeological evidence they are dealt with as distinctly separate periods.

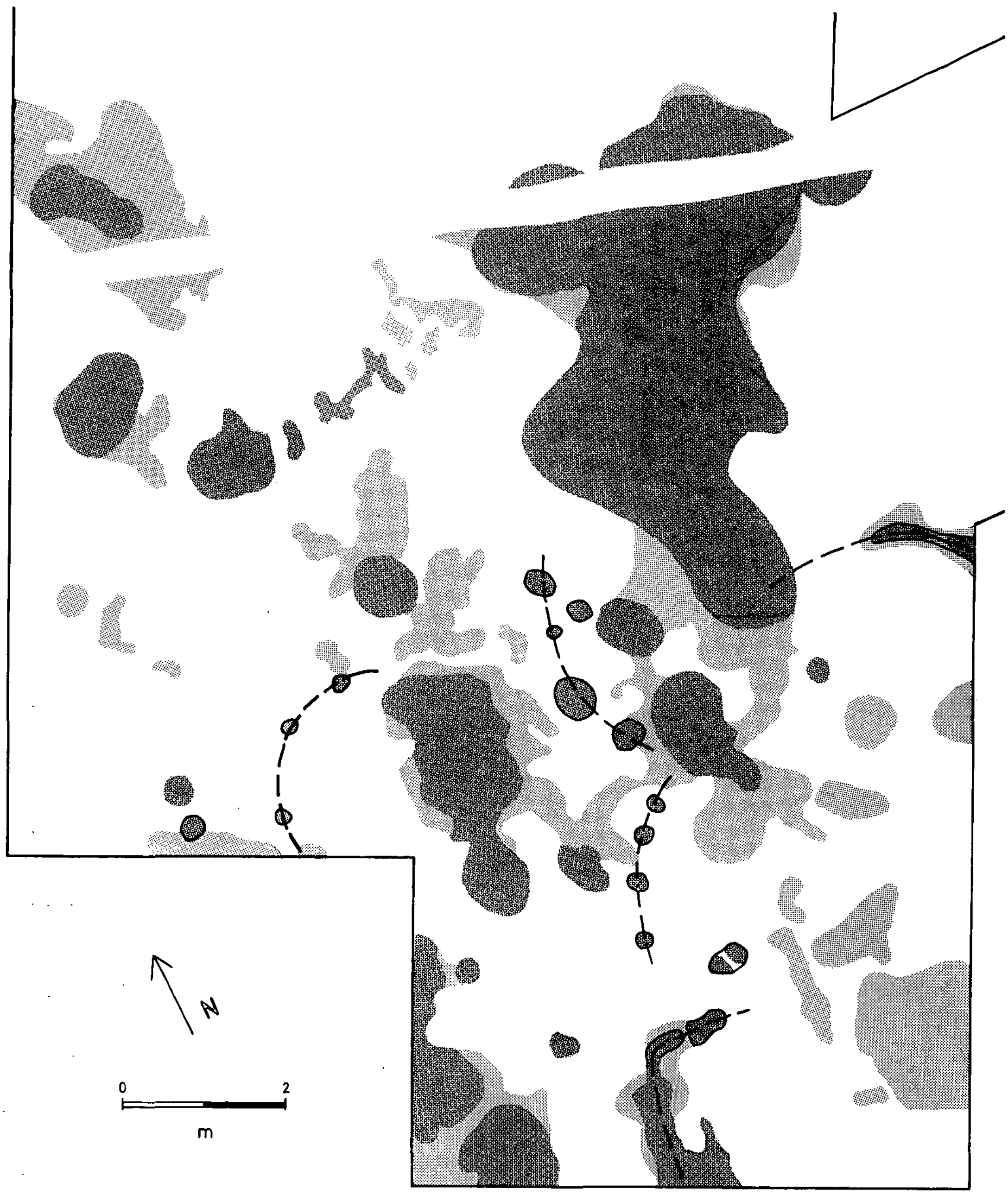
KINLOCH IN THE MESOLITHIC

STRUCTURAL EVIDENCE

The structural evidence for the mesolithic period consisted primarily of pits and hollows, together with a number of stakeholes and two slots. These occurred across the site, with the exception of the W where the distribution of lithic artifacts in the ploughsoil of Trench AH suggested that features had once existed, but were now ploughed out.

The interpretation of pits and hollows is notoriously difficult (Woodman 1985a, 123–9). Hollows may be deliberately dug, or they may be enlarged around a natural feature; pits, on the other hand, are usually artificial. At Kinloch the pits and hollows have been regarded as variants of the same type of negative feature. They are present in a variety of shapes and sizes, from the small steep-sided pits of AD 5 and AD 6 to the shallower more rounded outlines of BA 1 and BA 2. This variety of shape and size is usually apparent wherever pits and hollows are found, and it may relate to function. On some sites pits and hollows are present in sufficient quantity to allow groups to be identified (Woodman 1985a, 126–9), but this was not possible at Kinloch because not all of those recorded were excavated.

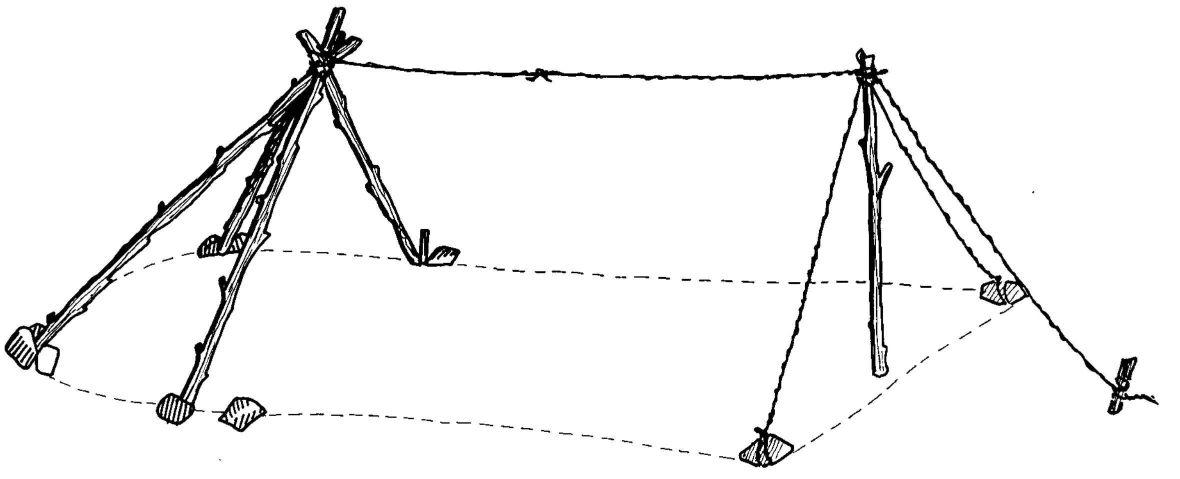
Many functional explanations have been proposed to account for the presence of pits and hollows. These include rubbish disposal, raw material extraction, storage, and cooking. In addition, pits and hollows have been interpreted as dwellings, though it has been noted that the presence of 'pit-dwellings' has perhaps been too readily accepted in the past, and that possible natural explanations for some of these features, such as tree-falls, should have been examined more closely (Newell 1981; Woodman 1985a, 126). There is little evidence, however, to support any of these explanations at Kinloch; there was no indication that any of the pits or hollows had been used as shelters, most were too small for habitation. None of the pits and hollows were associated with signs of burning, or with large quantities of burnt material, as might be expected if they had been used as hearths or as cooking pits. Raw material extraction is also unlikely as there is little of use within the gravel matrix of the site. Storage is a possibility, but there are other ways in which objects may be stored; rubbish disposal is also possible, particularly in view of the quantities of lithic waste, and carbonised hazel-nut shell, present in the fills. In any interpretation of function, however, it must be remembered that a pit may be used for many different purposes throughout its life, and that the excavated fills will, by and large, only relate to the last stages of



ILL 96: Trench BA: Interpreted locations of arcs of stakeholes.

use. Whatever the reason for their original creation, the pits and hollows at Kinloch certainly ended up filled with a mixture containing lithic debris.

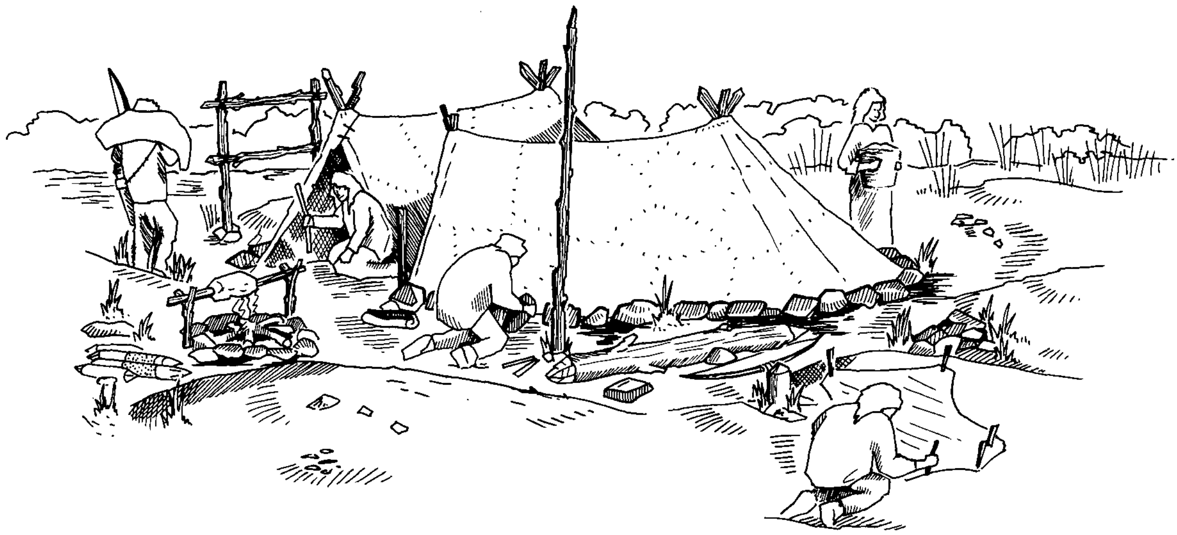
The uncertainties of interpreting the functions of the pits and hollows at Kinloch are exacerbated by the homogeneity of the fills. In most areas post-depositional processes have obliterated any internal stratigraphy, so that any sequences of filling are no longer apparent. Furthermore, the acidity of the soil means that much of the material presumed to have been incorporated as organic remains has not survived. The artifactual contents are predominantly debris from the manufacture of flaked stone tools, together with tools themselves and coarse stone hammers and cobbles; all are set within a uniform matrix of comminuted organic matter, including charcoal. Detailed chemical analysis has been used to assist the interpretation of fills such as these

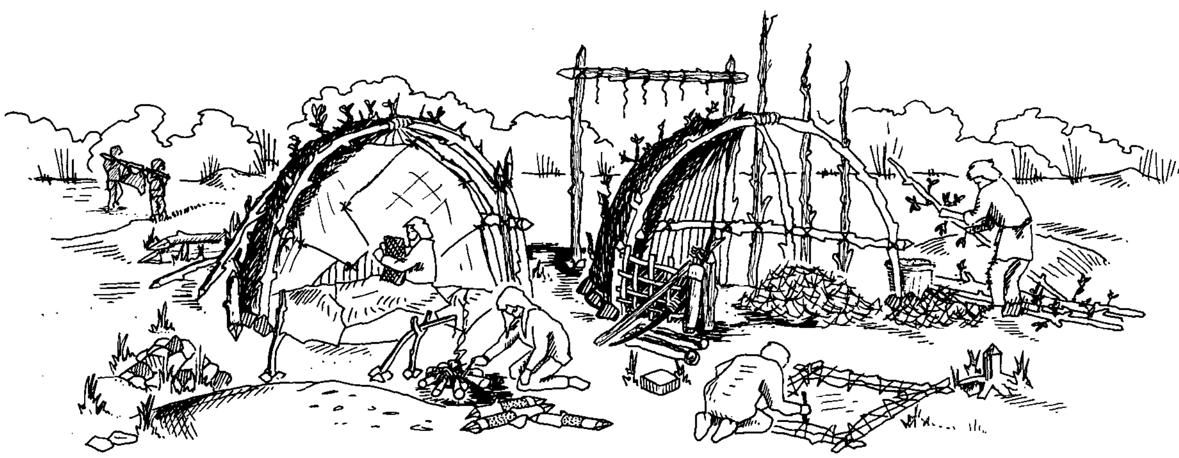


ILL 97: The stake-hole evidence; one possible reconstruction of a structure drawn from Inuit variations.

elsewhere (Hamond 1985), and it might have been of use at Kinloch (Hirons & Edwards mf b, 2:E1–E14), though the results of soil phosphate analysis were disappointing (Hirons & Edwards mf b, 2:E1–E14; Lee mf, 3:E1–E10).

The only positive structural evidence consists of stakeholes and slots, most of which were uncovered in Trench BA (this was, however, the largest excavated area). In Trench AD there were two pits with post-pipes, but no other structural features were identified. These post-pipes may have been marker posts for the pits, or they may have stood as the base of a rack or frame. In view of the small size of the trench, it is possible that other structural features lie undiscovered nearby, and that these posts formed part of a more complex structure. In Trench BA the stakeholes did not occur within pits. They lay in arcs suggesting more stable structures (Ill 96), but reconstruction on the surviving evidence is difficult because there are no complete circumferences of stakeholes and the posts were slender (c. 0.1m in diameter). Arcs of stakeholes, such as these, occur on other sites, and they have commonly been interpreted as windbreaks (eg Morton, Fife; Coles 1971, 321–41). In support of windbreaks as a possible reconstruction at Kinloch, all the arcs face against the prevailing wind. It is possible, however, that the Kinloch stakeholes represent more substantial, fully enclosed structures. Firstly, ethnographic work shows that quite stable and functional dwellings may be built around a minimal framework of poles. The ridge tent of the Central Inuit, for example, consists of an arc of poles at the rear, joined, in various ways, to a single pole, or a pair of poles, at the front (Ill 97) (Faegre 1979, 125-31). Secondly, complete circles of stakeholes may originally have been present on site, but are now destroyed. If so, then they could have been built up in several different ways, from a conical tipi-type dwelling, to a domed bender or yurt-like dwelling (Faegre 1979). If full circles of stakeholes were originally present, then an explanation must be sought for the destruction of part of each circumference. The most likely explanation would be truncation, whether by natural erosion or by human action, but excavation in Trench BA suggested that this had not taken place. Furthermore, if the truncation were the result of human action, then it would be expected to show as features which cut into the stakehole arcs, but this was not the case. The westernmost arc does terminate in a pit-like feature, but as neither the pit nor the stakeholes were excavated it is impossible to say which came first; elsewhere in the trench the likely locations of 'missing' stakeholes do not coincide with pit complexes. The similarities of the stakehole arcs, therefore, do suggest that they reflect accurately the original structures on site, but the palimpsest of features, and the lack of complete excavation, mean that it is impossible to speculate whether closed tents or open windbreaks were present (Ills 98a and b). Certainly, though the evidence does not suggest dense woodland on the island, there would have been a plentiful supply of trees, such as hazel and birch, from which poles, quite suitable for the framework of huts, could be procured.





ILL 98: Artist's impressions (a and b) of the site during occupation with two possible reconstructions of the structures in use (Reconstructions by Alan R Braby).

Whatever the structures on site, they could have provided considerable shelter from the weather of the day. The inhabitants of Kinloch had access to a number of resources from which to make coverings for their dwellings. Animal skins are perhaps the most obvious, but, in addition, birch and other bark, and even brush wood, might have been employed. In connection with this, the quantity of stone in the nearby watercourse must be considered. The stone was apparently derived from the surface of the area of mesolithic settlement, and, with the absence of stone in similar quantity elsewhere, an explanation for its original concentration in this particular area must be sought. The amount of stone was not enough to suggest stone built dwellings, but it seems that stones once formed an integral part of the wooden framed structures, perhaps holding down the coverings and providing additional support against the wind.

On some sites the distribution of artifacts has been used to suggest the locations and forms of structures; both sharply delineated concentrations of lithics and gaps or lower densities of material have been used to pinpoint a structure (Blankholm 1987; Leroi Gourhan & Brezillon 1972). At Kinloch both concentrations and gaps occurred, but their relationship to the features, in particular to the arcs of stakeholes, remains unclear (as does their interpretation). Artifacts have also been used elsewhere to identify the locations of specific features; most particularly concentrations of burnt material which have been taken to suggest the locations of hearths. At Kinloch, however, the recognition of burnt artifacts was difficult, and, although easily identifiable burnt material was spread over the site, there were no clear concentrations to suggest the locations of hearths. The presence of burnt material in large quantity, however, does indicate that fires were certainly present. This point was confirmed by the recovery of heat fractured stone slabs which had apparently been used as hearth slabs; these were found particularly in the pits of Trench BA. It is likely, therefore, that the settlement site at Kinloch was used to provide both shelter and warmth for the mesolithic occupants.

THE FUNCTION AND ORGANISATION OF THE SITE IN THE MESOLITHIC

Structures may be used for a variety of purposes, and the detailed analysis of an artifact assemblage is frequently used to indicate the function of a site, even where only the stone tools have survived (Skar & Coulson 1986). At Kinloch, the lithic assemblage across the site mainly consists of the debris from the manufacture of stone tools, but there is also a range of tools and material derived from their use. The wide range of tools present suggests that many different tasks were undertaken and, although it is impossible to identify individual tasks, a similarly broad range has been interpreted on other sites to indicate domestic settlement (Mellars 1976a).

The distribution of lithic artifacts across the site reveals spatial differences that may be related to specific working areas, but the relationship between the final disposal of a tool and the place in which it was used is complex (Schiffer 1976). Across the site, blades are more abundant towards the W, whereas cores and knapping debris are more important towards the SE. Specific concentrations of manufacturing waste were identified in Trench BA, and they varied in content (most particularly in the ratio of debris to cores and in the quantity of tiny fragments). These concentrations probably relate to discrete deposits of knapping debris. Elsewhere in Trench BA blades were more prolific, but too few modified artifacts occurred for the reconstruction of specific functional deposits.

The locations of 'functional' material did reveal patterning across the site as a whole. It is of interest that spatial patterning occurs, but it is impossible to speculate fruitfully as to the uses of the different areas of the site, on the basis of artifact distributions alone. Given the long period of time from which the mesolithic remains date, it is likely that some of the spatial differences may relate to chronology, but it is also likely that the use of the site was structured in some way, eg with different activities taking place in different areas and with separate family groups making use of separate dwellings.

Lithic Technology

Two different processes must be considered: the manufacture of tools and the use of tools. The manufacture of tools included the selection of raw materials, the choice of knapping techniques, and the reduction method. At Kinloch, soft hammer percussion (probably using sandstone hammers), was preferred, and it was applied to flint cores to make blades. The blades could then be used as they were, or altered into formal tools, eg microliths. As flint was not available in great quantity, the prehistoric knappers also made much use of the bloodstone which occurs naturally on the west coast of the island. Bloodstone is poorer in quality than flint but, with some modification of knapping methods, it was possible to produce a similar range of artifacts from it. These modifications lay mainly in the different treatment of the nodules, and in the alteration of the reduction method. Nodules of bloodstone were apparently tested and prepared into cores away from the site; once on site, the bipolar method was more common in the knapping of bloodstone than of flint.

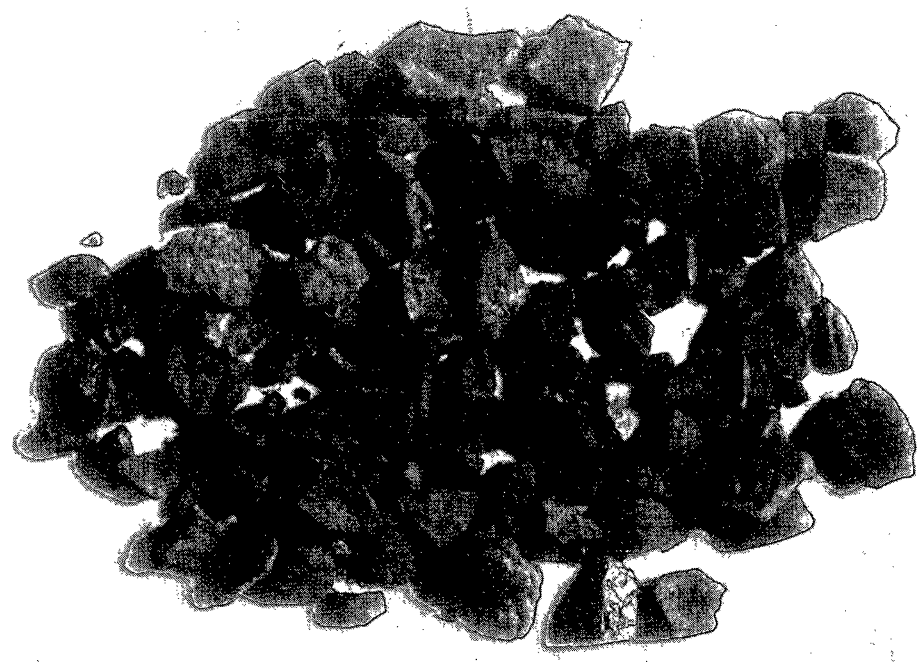
There was no analysis of the individual tasks for which tools were used. However, several tool types were recognised and, despite the problems of emic and etic classification in prehistory (Knutsson 1988b, 11–6), it is likely that they fulfilled a range of functions. Detailed consideration of function is confounded at Kinloch by the poor survival of material; stone tools were only part of the material culture of the settlement, and probably only a small part at that (Coles 1983, 9–11).

The necessities of everyday living were provided for by a variety of artifacts of many different mediums, and most of these have disappeared. The analysis of the functions of the stone tools would help to illustrate the range of activities present at Kinloch, but it can never reconstruct the complete life of the settlement.

Resources

Little survived to indicate the resources used at Kinloch, but from the raw material range of the lithic assemblage it may be deduced that both very local resources and resources from further afield were collected. Whether settlement at Kinloch lasted throughout the year is unknown, but Rhum, as an island, had to be reached by sea; some form of sea transport undoubtedly existed. Thus, there were opportunities, not only for sea fishing, but also for the exploration of resources on other islands and the mainland. Though there has never been intensive fieldwork in the area, the presence of bloodstone artifacts and mesolithic sites reinforces the argument that the mesolithic populations were mobile.

Little is known of the history of the fauna of Rhum, but the vegetational history shows that many plant resources were present from early in the postglacial period. Around the head of Loch Scresort, esturine saltmarsh had developed by 7800 BP; inland, much of the island was covered by open grass and heathlands, with some shrubs like juniper and bog myrtle; in more sheltered areas, light woodland, including copses of birch and hazel, had been able to develop. Several authors have tackled the complex problem of reconstructing resource use, often on sites where the remains were better preserved than at Kinloch, and they have emphasised that the inhabitants of any one site might be expected to exploit a variety of habitats for both plant (Ill 99) and animal resources (Bonsall 1981; Clark 1976; Mellars 1987; Woodman 1985b). At the time of occupation it is likely that the sea level was slightly lower than that of today (Sutherland mf, 3:E11–G6). Although the site was never far from the sea, it may have been set back from it, separated by a flat littoral area. Elsewhere on Rhum, the habitats include the sheltered glens and the higher more exposed grasslands and rocky peaks; the population of Kinloch must have travelled through a variety of habitats on their way to Guirdil Bay for bloodstone.



ILL 99: Fragments of hazelnut shell (Photograph – I Larner).

CHRONOLOGICAL EVIDENCE

Site chronology is concerned with two questions: the date and the duration of settlement. There are two main sources of evidence: radiocarbon determinations obtained from samples of carbonised hazel-nut shell; and stylistic cultural comparisons of the stone tools.

The radiocarbon determinations relating to the mesolithic settlement all lie within the millennium between 8685 and 7520 BP, which place the site firmly at the beginning of the known postglacial settlement of Scotland. Early postglacial occupation is confirmed by the stylistic affinities of the stone tools. Primary technology geared to the production of blades has only been recorded in Scotland on mesolithic sites, and microliths are a well known mesolithic indicator. There is a lack of securely dated mesolithic sites in Scotland, and this makes it difficult to discern changing cultural trends throughout the period, but microliths stylistically similar to those from Kinloch have been found on other early sites, eg Newton, Islay (7805±90 BP, GU–1954; 7765±225 BP, GU–1953; McCullagh forthcoming) and Lussa Wood, Jura (8194±350 BP SRR–160 & 7963±200 BP SRR–159, Mercer 1980). Simple scrapers on the ends of blades and regular flakes often occur on mesolithic sites (eg Mercer 1974, 25–7). They are frequently truncated (as are some at Kinloch), but many of the other formal tools are types that occur throughout prehistory; they were, doubtless, well adapted to a range of uses and, thus, less subject to stylistic and chronological variation.

One artifact (the small bifacial point from Pit AD 5; Ill 59.1), is idiosyncratic within a mesolithic context. Both the method used to produce it (invasive bifacial flaking), and the resultant stylistic type (a leaf point), have previously been considered to be neolithic. At Kinloch this artifact is securely stratified within a mesolithic pit, and hazel-nut shell from the same context produced two of the earliest dates for the site (8590±95 BP, GU–1873 & 8515±190 BP, GU–1874). In Europe, invasive bifacial flaking does occur on mesolithic sites (Huyge & Vermeersch 1982, 157, fig 17; Gendel 1987, 71, fig 5.5), and similar artifacts have been recovered from mixed or unstratified sites with a mesolithic component in Scotland (eg Mullholland 1970, 94; Mercer 1968, 35–6). In the past these Scottish finds have been assigned to the neolithic, but this is no longer a valid generalisation, and invasive bifacial flaking may have formed part of the repertoire of prehistoric knappers for longer than previously recognised. It is worth noting that the bifacial points that are potentially associated with mesolithic material in Scotland are generally much smaller in size than those with secure neolithic associations.

The radiocarbon determinations indicate that human activity continued over a period of some one thousand years. They suggest that the features to the N (in Trench BA) might be more recent than those to the W and S (in Trenches AD and AJ), but they do not indicate whether occupation was continuous. As the duration of the site is likely to be related to the amount of archaeological material present, it is useful to consider the area of remains. The S, E and W edges of the site have been obliterated by more recent activity, but the minimum area covered by the remains may be estimated to be 4500 sq m. This is unusually large for a mesolithic site (Mellars 1976a, 378), but it might be accounted for by the long period of use. The excavation trenches, however, were widely scattered and they only investigated a small proportion of the site (c. 10%), so that they do not demonstrate how the different parts of the site relate to one another. In effect, so little of the site was excavated that it is impossible to determine whether or not settlement was continuous.

It would certainly have been possible for settlement at Kinloch to have lasted throughout the year. A range of resources were accessible on Rhum, and there was no need for the occupants of the site to move from season to season. Given the vaguaries of human nature and the limited, if renewable, supplies of essentials, such as firewood, it would seem likely, however, that there were periods in the life of the site when the focus of settlement moved elsewhere, even if only further around the shores of Loch Scresort. The scatters of lithic artifacts along the N shore of Loch Scresort may represent other locations of mesolithic occupation. Whether or not the settlement at Kinloch was continuous, the long period over which activity took place has caused the archaeological remains to be mixed, and so the problems of interpreting the mechanics of the use of the site have increased. The gross spatial patterning of artifacts may be related more to changes through time, than to different uses in any one period.

SUMMARY

The evidence suggests that the mesolithic site developed as a result of domestic settlement at the head of Loch Scresort in the early post-glacial period. Shelters of some type were constructed (Ills 98 a and b), together with incidental racks and frames. Although hearths were certainly present, no *in situ* hearths were preserved. Stone for tools was carefully selected from a variety of local sources and the technology was adapted to make the most of the material available. The spatial distribution of the artifacts suggests that the separate areas of the site were differentiated in some way, but this pattern is confused by the long, and probably intermittent, period over which occupation took place. The variety of features present most probably reflect a range of functions, but latterly they were used for rubbish disposal. There is no evidence as to the duration of occupation each year; given the resources of Rhum, it would have been quite possible for the settlement to have lasted throughout the year. In the wider sphere, however, the inhabitants of Kinloch were certainly mobile, and there is evidence for a network of contacts stretching over the coastlands and islands of NW Scotland.

NEOLITHIC AND LATER ACTIVITY

Included here are all remains relating to prehistoric activity later than the mesolithic. As discussed in Chapter 3, the precise dating of some of these remains is impossible. In comparison with the evidence for mesolithic activity, the later remains are scant.

The main evidence for neolithic activity consists of the dumps of material preserved within the developing bog of the defunct burn. In addition, there is one shallow hollow (AD 7), which, on the basis of the associated radiocarbon determination, was filled in in the late third millennium BC. At some time a spread of gravels was formed along the southern edge of the watercourse. These gravels were apparently derived from the mesolithic site surface, but the stratigraphy suggests that the site was long out of use by the time that the gravel was scraped up. As there was no evidence for great truncation of the mesolithic features in the area immediately adjacent to this gravel dump, the material must have come from further away (most of the site in this area remains unexcavated). By this period the burn had become sluggish and a thin layer of peat lay under the gravels where they had spilled out over the edge of the burn. This gravel 'bank' was not substantial, and it is difficult to understand what led to the creation of a feature such as this, but the most likely explanation is that it represents an attempt to consolidate the edge of the growing bog. The burn at this time had silted up, and the gravel spreads could have been used to increase the amount of dry, free-draining land at the burn edge. As the gravels are overlain by peat, the effort was only temporarily successful.

The exact date of this activity remains obscure. The stratigraphy of the watercourse section indicates that the gravels post-date the mesolithic remains. Smaller dumps of different materials lie within the peat of the watercourse and are associated with the neolithic activity, but there is no direct stratigraphical relationship between these and the gravel spreads. The watercourse must have silted up over a long period of time, and indications of human activity between the two main periods on site are preserved in the local pollen record. So, it is possible that the gravel dumps relate to activity prior to the neolithic remains. Given a slowly developing bog, consolidation of the edges might have taken place at any time if there were people in the vicinity.

The majority of the more securely dated neolithic deposits were also associated with the peat of the bog. Towards the eastern end of the main excavated length of the watercourse lay a deposit of rocks and wood, together with sherds of pottery and flaked lithic material. Given the small size of the trench, interpretation of this feature is difficult. The protruding rocks make it unlikely that the bog was deliberately filled for cultivation. On the contrary, the rocks may be an attempt to improve the free-flow of water (and therefore drainage); no drain cuts were observed, but the wet peaty matrix was not conducive to excavation and observation. Alternatively, the rocks may be the fragmentary remains of a causeway across the bog, or simply a dump of redeposited rubbish (including the lithic debris and abraded pot sherds). The presence of flax pollen in the deposit also opens the possibility that the rocks were associated with the retting of flax. If so, then just such a dump in sluggish water would be expected, but it must be borne in mind that only 5 grains of flax were recorded. Whatever the function of the deposit, it is tempting to equate the deposit of rocks with the clearance of the surrounding land for cultivation (Chapter 11).

The interpretation of this deposit is further complicated by the apparently conflicting dating evidence incorporated within it. One radiocarbon determination (3890±65 BP, GU–2043), was obtained from a sample of wood, but the typological analysis of the associated pottery suggests that this date might be rather late (Chapter 9), whilst geochemical analysis of a piece of pumice from the deposit suggests that the radiocarbon determination may be some one thousand years too early (Chapter 9: Dugmore mf, 3:G7–G10). In addition, detailed analysis of the lithic assemblage from the deposit revealed a number of mesolithic traits, indicating contamination from the earlier settlement of the site (Chapter 6). None of these dates are absolute, but together they suggest that the deposit may have had a longer and more complicated history than that revealed by the stratigraphy during excavation. The area examined was small, it had been cut by numerous modern field drains, and it was excavated in appalling weather conditions. Whatever the reason for the incorporation of the rocks into the watercourse, it is likely that the pottery, at least, was redeposited, and the possibility of both early contamination and later intrusion (if only represented by the pumice) into this deposit, must be considered.

Further evidence of neolithic activity in the watercourse consists of a small number of matted rafts of organic debris and brushwood lying within the peat. Analysis of the brushwood indicated that it had probably resulted from the clearance of scrub. These rafts may also have been deliberate attempts to consolidate the bog surface, or they may simply have resulted from the clearance of debris, after a storm perhaps. The organic debris provides a midden-like consistency and the rafts may include an element of rubbish disposal.

Whatever they were doing in the area of the watercourse, people were present in the vicinity in the late second and early third millennia BC. They made both pottery and stone tools, and, though individual functions cannot be interpreted with certainty, there is evidence that both were used. Residues surviving on the pot sherds have been interpreted as possibly the result of prehistoric fermentation, an interpretation supported by the brewing of an acceptable drink from the ingredients identified by the analysis (Chapter 9.2). The refuse-like nature of these deposits suggests that the neolithic habitations were close-by and the excavation did attempt to locate structural evidence from this period. To the north of the watercourse the land slopes steeply and is composed of damp boulder clay. Trench BB was opened here, but it revealed nothing. It now seems likely that any neolithic settlement may have lain to the east, where it would have been destroyed by the dyking, ditching and erosion at the edge of the field; or it may have lain to the south. If settlement were to the south, then the remains must lie in the unexcavated parts of the site, amongst those of the mesolithic settlement. Within the trenches there were features that were never excavated, notably in Trench BA, and it is possible that some of these may date to the neolithic. There were no obvious neolithic type-fossils (such as pottery) in the associated artifact concentrations of the ploughsoil, however, and the only certain evidence of neolithic activity was a shallow hollow (AD 7) which lay across the top of the mesolithic pit complex in Trench AD. Both the fill of this hollow and its contents were unremarkable; there was nothing to differentiate them from the mesolithic material below, but the fill was separated from the mesolithic fills by a thin peaty layer, which presumably represented a time when the hollow lay open. The neolithic date was provided by a radiocarbon determination obtained on hazel-nut shell found within the fill (4725±140 BP, GU–2043). This determination is several hundred years earlier than those associated with activity around the watercourse. Elsewhere, hints of neolithic activity may be detected in the occasional occurrence of neolithic type fossils within the ploughsoil. Large bifacially flaked points (quite different to that of AD 5), and sherds of pottery, were recovered in small numbers across the site, but so far the evidence suggests that the majority of the features uncovered away from the watercourse are associated with mesolithic activity.

SUMMARY

The existence of neolithic material on site, and the dating of some of the deposits to the late second and early third millennia BC, indicate that the site was re-visited at this time. No structural evidence from this period was located, however, and the material remains are sparse so that it is not possible to interpret the activity that was taking place.

KINLOCH IN THE WIDER CONTEXT

Only evidence relating to mesolithic settlement will be considered here. The remains of neolithic activity are unremarkable, and in this context they offer little to the knowledge of the neolithic settlement in the north of Britain.

THE CONTRIBUTION OF KINLOCH

Although the site is early, the location of Rhum makes it unlikely that this was the springboard for the human settlement of Scotland. Other sites at least as early as Kinloch must exist. Mesolithic sites usually occur as scatters of lithic artifacts and they are not highly visible, but this is compounded by a combination of demographic, historical and geomorphological factors which mitigate against the discovery of new sites (see Woodman 1978, 2–5 and forthcoming). Recognised sites, therefore, reflect neither the likely density of population, nor the likely patterns of settlement. Furthermore, few sites have been excavated and even fewer published in full, and in any case the survival of material on most excavated sites is so poor that analysis is biased towards a small part of the original cultural remains. As a result the literature (including this publication) is full of analogies drawn from work elsewhere. Hence there is a clear idea of how the mesolithic populations of Scotland *should* have lived but little idea of how they *actually* lived.

The traditional view of mesolithic occupation is that of a pattern of transient bands living in a period of environmental change and responding to this by grouping and regrouping at different times of the year in order to make the most of available resources. This view owes as much to contemporary anthropology (eg Riches 1982) as to the poor survival of archaeological remains, but analysis of the mesolithic is slowly being refined with the development of techniques that allow a more detailed study of individual sites. The site at Kinloch conforms to this pattern in that unsuitable soils and more recent disturbance have meant that the physical remains of human occupation have all but gone. It is impossible to say whether the settlement was transient or permanent, or how many people used it at any one time. It is likely that Rhum could have supported a year-round population, but there is no evidence that it did. On the one hand, diverse lithic scatters have been located on the island and they might represent a year-round pattern of mesolithic occupation; on the other hand, the use of bloodstone on the mesolithic sites of the neighbouring islands and mainland provides evidence for the movement of people throughout the area.

Mellars (1976a), amongst others, has tried to approach the question of settlement type and duration by analysis of the area of a site together with the quantity and variety of artifacts present. If this analysis is applied to Kinloch then the whole site may be assigned to his type B 'Balanced Assemblages', and it would be interpreted as the result of occupation by at least multiple family groups, generally winter based and often coastal, with a reliance upon hunting as well as more 'domestic' tasks. However, there are methodological problems in such sweeping applications of analysis. An assemblage is as much an artifact of the recovery techniques of excavation as it is an artifact of prehistoric deposition, and neither it, nor the site, may be considered a unity. A site develops over many years, and so represents a series of occupations, even if these occupations are continuous. At Kinloch, the nature of the assemblage varies across the site. If the site is divided into constituent areas, then these areas produce very different results when Mellars' analysis is applied. The south, being microlith dominated, would represent summer occupation; the north (dominated by scrapers), would be a winter camp. Elsewhere, other explanations for this type of variation have been advanced, eg microliths have been assigned to male activities related to subsistence, and scrapers to female activities related to maintenance (Welinder 1971). All of these interpretations may be explanations for the variation in the mesolithic remains, but on the basis of the data available they tend to say more about contemporary archaeological thought than about the life-style of the past (Whallon Jr 1978).

The same problems beset any interpretation of the number of people occupying the site. Much work has been done to equate settlement size with population, often with differing results (Cook & Heizer 1968; Weissner 1974), and attempts have been made to apply this to archaeological remains (Price 1978; Blankholm 1987). At Kinloch, however, the long period of use means that the settlement built up as a palimpsest and, as it was not excavated in full, it has not been possible to sort out the detailed chronology of the different structural elements. Mellars has tried to avoid this problem by looking for localised concentrations of lithic material across a site (1976a, 377–9), but so little was excavated at Kinloch that not even this was possible. There are, in any case, many different reasons for the build up of discrete concentrations of artifacts across a site, and the presence of habitations is only one.

In the face of so many unresolved questions about the nature of the site one point stands out, namely the contribution of the detailed examination of the lithic assemblage. This has served to fill out the available information about the site, even if it can provide little more than a hint of the original complexities involved. Given the general predominance of lithic artifacts as a data base for the mesolithic, the increased use of lithic analysis (eg Broadbent 1979; Cahen 1987; Zvelebil *et al* 1987) is of great importance for the future analysis of the period. Many techniques for obtaining information from stone tools are under development and, although not all are applicable to every site, the ubiquity of stone tools means that some, at least, will be of value on most sites. At Kinloch, the lithic assemblage led to the discovery of the site, and assessment of the lithic procurement system has provided the first concrete evidence for mobility in the mesolithic of Scotland (even though the details have still to be determined). Although it was not possible to interpret the spatial patterning of material across the site, it is of interest for the interpretation of social organisation to know that such patterning does exist. The composition of the assemblage was also patterned, suggesting that it served a range of functions. Finally, the assemblage provided detail of one facet of mesolithic technology, lithic reduction, and in particular of the adaptations made by the prehistoric knappers to produce the tools that they needed. As much archaeological theory is built upon stylistic comparisons of tools from different assemblages, it is of great importance to be able to assess the constraints in operation upon assemblage formation.

At Kinloch these constraints relate in particular to the different lithic materials that were available and to the use of different methods to reduce them. The latter included the bipolar method and, as the identification and interpretation of this method has provided much debate on a number of sites, it is instructive to examine it in more detail. Bipolar cores occur on a variety of prehistoric sites, and the use of the method has been variously ascribed: to a scarcity of raw material; to the poor quality or small size of available material; to the work of women knappers; and to cultural preconditioning (Broadbent 1979, 108–11; Hayden 1980; Kobayashi 1975; Mercer 1980, 21–2; Thorsberg 1985, 3). At Kinloch the bipolar method is not a response to a scarcity of raw material, for the bipolar cores are predominantly of bloodstone, which was abundant. Nor is it a cultural trait, as it occurs on a variety of sites throughout Scottish prehistory and it has never been isolated to any one period, geographical region, or type of site. It may be an adaption to the available raw material, but if this was so, then at Kinloch it is unlikely to be related to small nodule size, given the range of nodules available on Guirdil beach.

The most likely explanation for the use of the bipolar method at Kinloch is that it was related to the relatively poor quality of the bloodstone in relation to the flint. By using this method the knappers were able to make the most of the intractible and uneven material of the bloodstone nodules, and analysis showed that they preferred to knap flint when they could procure it. In this way the technology of the site was determined by the raw materials that were available. As a result, the assemblage is constrained by the materials of which it is made, but consideration of these materials, as well as of the individual tool morphology and knapping characteristics shows how the knappers carefully selected in order to minimize the material constraints. The knappers of Kinloch were fortunate for they had access to a variety of plentiful, and generally good quality, raw materials. Knappers at other sites in Scotland were not so fortunate, the available material was often limited, and so both the manufacturing techniques and the tool types show further constraints.

As a postscript to the discussion of bipolar cores at Kinloch, it should be noted that they have also been interpreted as functional tools (Mercer 1971, 18–19). This possibility is not ruled out here, but in the absence of a detailed functional analysis of the pieces themselves, it cannot be developed. Whether or not they were used, these artifacts are primarily cores. They are the debris left from the manufacture of flakes and blades by a specific reduction method. They may well have been used subsequently, for it was not uncommon for lithic debris to be turned into serviceable tools, and the use of bipolar cores would be a typical example of this.

Finally, the very survival of the site is of interest. Although the features had suffered plough damage, the preservation of information in the ploughsoil suggests that the potential for the excavation of mesolithic sites elsewhere in Scotland may not be as bleak as once believed. 'Ghost' features could be identified in the ploughsoil even where lazy-bed cultivation had taken place.

THE MESOLITHIC IN SCOTLAND

The mesolithic sites of Scotland are predominantly coastal; here they are both more visible and more accessible to the present day populations who locate and record them, and this has served to over-emphasise the value of the coastal environment for the mesolithic community (Woodman forthcoming). However, in other parts of Europe survey work has demonstrated the importance of the mountain environment for mesolithic occupation (Bang-Andersen forthcoming; Holm forthcoming), and until fieldwork in the interior of Scotland has confirmed the validity of the coastal bias it should be regarded with caution. In this respect, the invisibility of mesolithic sites does create a difficulty. Although many lithic scatters are recorded, few are securely dated, and it is salutory that Kinloch was not recognised as a mesolithic site until it was excavated. A rapid surface collection over the field did not recover any microliths and the only type-fossil known when excavation commenced was a barbed-and-tanged point (usually bronze age; no other remains of this date have been recovered). The problems of recognising mesolithic sites mean that in order to improve knowledge of the mesolithic across Scotland it will be necessary to do more than surface survey. Shovel-pit sampling provides one rapid method to locate scatters of small artifacts in terrain such as that of Scotland (Bang-Andersen 1987), and a close examination of the situations where the peat cover has already been disturbed (as in forestry ploughing) can be of use. Where this has been undertaken it has yielded artifact scatters, even microliths (Clarke forthcoming; *D & E* 1983, 13). Only by employing such techniques will the biases inherent in the present knowledge of the mesolithic settlement of Scotland be removed.

The material traditions of the mesolithic are, of necessity, based on lithic artifacts and the lack of sites means that Scotland lacks a good data base. Further south many more sites have been identified and there has been much research upon the lithic assemblages of England (eg Pitts 1978a; 1978b). This has had an important effect upon the interpretation of the mesolithic of Scotland for there has always been a tacit assumption that the Scottish mesolithic developed out of the mesolithic settlement of England, and that it is closely related to its southern neighbours (*cf* Mulholland 1970, 103–07).

In 1976 Jacobi drew up a typological scheme for the chronological development of the lithic industries of England, comparing the broad changes in the microlith types with those of Europe (Jacobi 1976). In his scheme he identified two main chronological phases which divided around 8000 BP. The microliths of the earlier industries were based on broad blades (generally non-geometric types), those of the later industries were based upon narrow blades (geometric types). Since its publication Jacobi's work has dominated research into the mesolithic. The most important impact on Scotland has been that all Scottish sites are quickly assigned to one of Jacobi's two sub-divisions (Morrison 1980, 114–73). In fact, it was soon apparent that the evidence from Scotland did not fit easily into these sub-divisions, but this was taken to be an effect of the perceived 'peripheral' northern location of the mesolithic settlement of Scotland. In particular, the discussion has centred around the site of Morton, Fife, where apparently broad microliths seemed to be associated with fifth millennium BC dates, although by then broad-blade industries had disappeared from further south (Myers 1988). However, in his original paper Jacobi did not consider Scottish material at all. It is theoretically dubious to attempt to fit assemblages from one area (Scotland) into a typology based upon material from a different area (England). In any case, the early postglacial inhabitants of the British Isles are unlikely to have paid heed to modern political boundaries. Britain encompasses a variety of regions and this geographical diversity must have helped to shape the development of its mesolithic cultures. The sweeping application of analysis across the country will only serve to obscure the developing relationships between the mesolithic settlement of the different areas. Modern political names are of use to archaeologists because they identify separate archaeological systems, but it is important to remember that an individual system represents both cultural and geographical diversities and is not a natural unity.

The lithic industries of Ireland, another diversity of regions, have recently been examined, and this has led to increased information about chronological developments (Woodman 1978). The relationship between the early postglacial settlement of Ireland and that of Scotland is still unclear, but, unlike the relationship between Scotland and England, no cultural priority has been assigned. Thus, freed from the need to conform to an existing chronological typology, work on the mesolithic settlement of Scotland may be assisted by comparison with the methods and results of the Irish work. This opens the way to use the English and Welsh data in the same way; from this work regional comparisons may spring that are of more value to a study of the mesolithic settlement of the British Isles as a whole.

THE MESOLITHIC SETTLEMENT OF THE BRITISH ISLES

Since Jacobi's assessment of the material from England in 1976, many sites have been located, some have been excavated and a few analysed in detail. The new sites uphold Jacobi's chronological division. In addition, work in both Wales and Ireland has added detail to knowledge of the mesolithic settlement of this part of north-western Europe. In Wales many sites are known, but most consist of unexcavated artifact scatters. However, in combination with information from the excavated sites, the detailed examination of these assemblages shows that the major chronological division identified by Jacobi does occur throughout Wales (David *pers comm*). In Ireland, in contrast, there are still few early postglacial sites, but fieldwork is increasing the data base (Woodman 1984; Zvelebil *et al* 1987) and the sites show a diversity of material culture. Some of this diversity may be ascribed to chronological factors, but (although the major chronological break is around 8000 BP as in England), it is the earlier mesolithic sites in Ireland that have an artifact assemblage based upon narrow blade microliths. The later sites have an artifact assemblage without microliths at all, but they have a range of tools based upon the modification of large blades (Woodman 1985a, 169–74).

Sites with assemblages that reflect the narrow blade traditions are to be found across the British Isles. On mainland Britain they may be assigned to the same general period, but they do not all have precisely the same composition. As more sites are recognised it is increasingly apparent that there is great material diversity between the narrow blade sites. In particular the proportions of the microlith types vary; some sites are dominated by scalene triangles, some by backed bladelets, and some by other tools. In Scotland, all of the evidence suggests that the microliths of the earliest mesolithic industries are based on narrow blades. Kinloch is but one of a group of sites that have produced industries associated with seventh millennium BC dates; other early sites with narrow blade microliths include Newton, Islay (McCullagh forthcoming) and Lussa Wood, Jura (Mercer 1980). Broad blade microliths do occur on Scottish sites but there are no certain associated dates. There were no broad blade microlith types at Kinloch.

In a development of his typological chronology for the mesolithic Jacobi divided the narrow blade sites of England and Wales into groups, and he interpreted these groups as 'social territories'

(Jacobi 1979); more recently he has examined the weaknesses of this argument (Jacobi 1987), and from this it is clear that the data is not yet adequate for this sort of explanation. The details of the groups of sites, both spatial and chronological, are not properly documented, and neither are the details of the contents of the assemblages and associated features. The diversity of the later mesolithic period in Britain is well known, and it is by now apparent that there is no longer any need to 'fit' the Scottish sites into an English framework. Instead, the developments of material culture in Scotland, although still only hazily known, are plainly just one facet of the heterogeneous nature of life across postglacial Britain.

From this it follows that to improve understanding of the mesolithic settlement of the British Isles it is not enough to locate and examine more sites. It is also important to look in more detail at the patterns of information produced by those sites, and this includes information relating to site size, assemblage composition, topographical location, and date. Ethnographic analogy has shown that variation in any one field may result from several things: seasonal differences; functional differences; or cultural differences; and all of these differences are interlinked (Binford 1983, 109–92). From the earliest archaeological synthesis this variation in the archaeological evidence has provided a basis for general social interpretation (eg Wilson 1863, vol 1, 41–64; Lacaille 1954; Mellars 1976a; Gendel 1986), and its application is of great value today because it is under constant review, both with the refinements of middle range theory and with the additional data provided by new sites. Inter-site analysis is still fraught with difficulty, however, for it does not usually involve adequate source criticism. If the explanations for inter-site diversity are to be valid then the analysis must be certain that the variation observed relates to geniune prehistoric differences and not to the effects of post-depositional processes. This is best illustrated where analysis is based on a comparison of the artifact assemblages; differences between artifact assemblages are as likely to result from the recovery techniques as they are to result from the prehistoric deposition practices, eg a manually recovered lithic assemblage is not a true reflection of the prehistoric assemblage, both the quantity of material and (more importantly) the proportions of tool types change when sieving techniques are introduced.

ILL 100: Kinloch: work in progress on site (Photograph – Andy Barlow).

Inter-site analyses are important, for it is only through them that overall knowledge of the mesolithic period can advance, but because of the difficulties there will be no attempt here to slot Kinloch into the structure of the mesolithic settlement of Britain. The site is large, and covers a long time-span, even if occupation was intermittent, and the internal organisation of that occupation is unclear. It has not been possible to identify contemporaneous features, nor has it been possible to recognise chronological relationships except at a broad level. Some functional interpretation has been undertaken, but it is general, and in the absence of full excavation and more detailed analysis it can only be tentative. As for comparisons of the general composition of the assemblage, account must be taken of the considerable variation across the site. Finally, the recovery techniques used at Kinloch have undoubtedly affected the assemblage so that detailed comparisons with assemblages recovered elsewhere are at present of limited value. Only through the development of inter-site interpretation will the complexities of the early postglacial settlement of the British Isles be revealed, but detailed studies of more sites are needed. The information from Kinloch is now available should others feel braver, and have more time, than this author.

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INDEX

CR WICKHAM-JONES

RHUM : MESOLITHIC AND LATER SITES AT KINLOCH

EXCAVATIONS 1984-86

WITH

A CLARKE B FINLAYSON K HIRONS D SUTHERLAND

AND P ZETTERLUND

AND CONTRIBUTIONS BY

S BUTLER G COOK D DAVIDSON A DUGMORE G DURANT K EDWARDS

D GRIFFITHS D JORDAN M KEMP S LEE B MAHER S MCCARTEN

R MCCULLAGH B MOFFAT R PARISH E SCOTT AND D WATSON

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H. POTTERY
I. COARSE STONE
J. PUMICE
K. BONE/ SHELL
M/C. MASTER LAYER/ CUT NUMBER

MESOLITHIC: PITS AND HOLLOWS

LAYER	A	B	C	D	E	F	G	H	I	J	K	M/C	INTERPRETATION
1AD117	-	-	-	1	-	-	-	-	-	-	-	117	FILL (NO CUT NUMBER)
1AD151	-	-	2	9	1	-	x	-	-	-	-	151	FILL (NO CUT NUMBER)
1AD155	-	-	-	-	-	-	-	-	-	-	-	155	UNEXCAVATED
1AD156	-	-	2	70	-	-	x	-	-	-	-	156	FILL (NO CUT NUMBER)
1AD165	-	-	-	-	-	-	-	-	-	-	-	165	CUT = AD221
1AD221	-	-	-	-	-	-	-	-	-	-	-	165	CUT = AD165

1AD035	-	-	6	111	1	-	-	-	-	-	-	165	FILL	
1AD118	-	-	-	-	-	-	-	-	-	-	-	165	FILL	
1AD145	-	-	10	49	-	-	x	-	-	-	-	165	FILL	
1AD152	-	-	-	10	-	-	x	-	-	-	-	165	FILL	
1AD154	1	1	24	269	12	4	x	-	-	-	-	165	FILL	
1AD166	-	-	-	14	-	-	x	-	-	-	-	165	FILL	
1AD038	-	-	-	-	-	-	-	-	-	-	-	038	CUT =	AD206
														AD207
1AD206	-	-	-	-	-	-	-	-	-	-	-	038	CUT =	AD038
														AD207
1AD207	-	-	-	-	-	-	-	-	-	-	-	038	CUT =	AD038
														AD206
1AD029	-	8	50	1601	24	2	-	-	1	-	-	038	FILL	
1AD036	-	2	6	94	1	1	-	-	-	-	-	038	FILL	
1AD119	-	-	-	83	-	-	x	-	-	-	-	038	FILL	
1AD144	-	1	16	595	9	-	x	-	-	-	-	038	FILL	
1AD162	1	-	2	75	1	-	x	-	-	1	-	038	FILL	
1AD163	-	1	24	565	15	-	x	-	-	-	-	038	FILL	
1AD224	-	-	4	72	-	-	x	-	-	-	-	038	FILL	
1AD226	-	-	1	10	-	-	x	-	-	-	-	038	FILL	
1AD227	-	-	1	1	-	-	-	-	-	-	-	038	FILL	
1AD040	-	-	-	-	-	-	-	-	-	-	-	040	CUT =	AD234
1AD234	-	-	-	-	-	-	-	-	-	-	-	040	CUT =	AD040
1AD037	-	-	-	34	-	-	-	-	-	-	-	040	FILL	
1AD039	-	-	1	13	-	-	-	-	-	-	-	040	FILL	
1AD141	-	-	3	5	-	-	x	-	-	-	-	040	FILL	
1AD142	-	-	-	7	-	-	-	-	-	-	-	040	FILL	

1AD203	-	-	-	3	1	-	-	-	-	-	-	203	FILL (NO CUT
													NUMBER)
1AD228	-	-	-	-	-	-	-	-	-	-	-	228	CUT
1AD147	-	-	-	1	-	-	-	-	-	-	-	228	FILL
1AD230	-	-	-	-	-	-	-	-	-	-	-	230	CUT
1AD150	-	-	1	8	-	-	x	-	-	-	-	230	FILL
1AD231	-	-	-	-	-	-	-	-	-	-	-	231	CUT
1AD204	-	-	-	-	-	-	-	-	-	-	-	231	FILL
1AD232	-	-	-	-	-	-	-	-	-	-	-	232	CUT
1AD148	-	-	-	-	-	-	-	-	-	-	-	232	FILL
1AD149	-	-	-	-	-	-	-	-	-	-	-	232	FILL
1AD158	-	-	-	4	-	-	x	-	-	-	-	232	FILL
1AD160	-	-	-	-	-	-	-	-	-	-	-	232	FILL
1AD203	-	-	-	3	1	-	-	-	-	-	-	232	FILL
1AD208	-	-	-	-	-	-	-	-	-	-	-	208	CUT
1AD028	-	8	69	1159	14	4	x	-	14	-	-	208	FILL **
1AD161	1	3	47	920	28	-	x	-	1	1	-	208	FILL
1AD168	-	-	-	3	-	-	x	-	-	-	-	208	FILL
1AD210	-	-	1	67	-	-	x	-	-	-	-	208	FILL OF
													POST PIPE 1
1AD223	-	-	-	2	-	-	x	-	-	-	-	208	FILL OF
													POST PIPE 2
1AD233	-	-	-	-	-	-	-	-	-	-	-	208	CUT OF
													POST PIPE 1
1AD222	-	-	-	-	-	-	-	-	-	-	-	222	CUT
1AD159	-	2	8	248	5	-	x	-	1	-	-	222	FILL
1AD201	-	-	-	4	-	-	-	-	-	-	-	222	FILL OF

													POST PIPE
1AD209	-	-	-	-	-	-	-	-	-	-	-	222	FILL OF
													POST PIPE
1AD225	-	-	5	53	2	-	-	-	-	-	-	222	FILL
1AG121	-	7	31	1159	9	4	x	-	1	-	x	121	FILL (NO CUT
													NUMBER)*
1AG122	-	-	-	-	-	-	-	-	-	-	-	121	FILL
1AG214	-	-	-	4	-	-	x	-	-	-	-	121	FILL
1AG191	-	-	-	-	-	-	-	-	-	-	-	191	CUT
													NATURAL?
1AG123	-	1	2	20	1	-	-	-	-	-	-	191	FILL
													NATURAL?
1AG190	-	-	-	-	-	-	-	-	-	-	-	191	FILL
													NATURAL?
1AG192	-	-	-	-	-	-	-	-	-	-	-	191	FILL
													NATURAL?
1AG193	-	-	-	28	-	-	x	-	-	-	-	193	FILL (NO CUT
													NUMBER)
													NATURAL?
1AG238	-	-	-	59	2	-	-	-	-	-	-	238	FILL (NO CUT
													NUMBER)
1AG187	-	-	-	-	-	-	-	-	-	-	-	187	UNEXCAVATED
1AG188	-	-	-	-	-	-	-	-	-	-	-	188	UNEXCAVATED
1AG189	-	-	-	-	-	-	-	-	-	-	-	189	UNEXCAVATED
1AJ178	-	-	-	-	-	-	-	-	-	-	-	178	CUT
1AJ104	-	1	5	156	1	-	x	-	-	-	-	178	FILL

1AJ175	-	-	7	576	3	-	x	-	-	-	x	178	FILL *
1AJ176	-	-	-	-	-	-	-	-	-	-	-	178	FILL
1AJ177	1	-	1	47	-	-	x	-	-	-	-	178	FILL
1AJ179	-	-	-	-	-	-	-	-	-	-	-	179	CUT
1AJ173	-	-	8	188	2	-	x	-	-	-	-	179	FILL
1AJ180	-	-	-	-	-	-	-	-	-	-	-	180	CUT
1AJ108	-	-	3	83	-	-	x	-	-	-	-	180	FILL
1AJ171	-	-	-	-	-	-	-	-	-	-	-	171	UNEXCAVATED
1BA048	-	-	-	-	-	-	-	-	-	-	-	048	CUT
1BA021	-	3	23	772	6	2	x	-	1	-	-	048	FILL *
1BA053	-	-	-	-	-	-	-	-	-	-	-	053	CUT
1BA023	-	1	19	660	4	1	x	-	1	-	-	053	FILL*
1BA054	-	-	-	-	-	-	-	-	-	-	-	054	CUT
1BA047	-	5	6	246	1	-	x	-	1	-	-	054	FILL
1BA049	-	-	-	-	-	-	-	-	-	-	-	054	FILL
1BA050	-	-	-	-	-	-	-	-	-	-	-	054	FILL
1BA052	1	2	16	668	5	1	x	-	-	1	-	032	FILL (NO CUT NUMBER)*
1BA028	-	-	-	-	-	-	-	-	-	-	-	028	UNEXCAVATED
1BA029	-	-	-	-	-	-	-	-	-	-	-	029	UNEXCAVATED
1BA042	-	-	-	-	-	-	-	-	-	-	-	042	UNEXCAVATED
1BA101	-	-	-	-	-	-	-	-	-	-	-	101	UNEXCAVATED
1BA110	-	-	-	-	-	-	-	-	-	-	-	110	MASTER CONTEXT FOR PIT COMPLEX.
1BA030	-	29	102	3300	36	7	x	-	2	-	x	110	FILL, INC. BA130 AB

													EXTRA LAYER FOR FINDS.	
1BA087	-	-	16	965	6	2	x	-	-	-	x	110	FILL	
1BA088	1	1	18	435	3	-	x	-	1	-	x	110	FILL	
1BA089	-	2	9	709	3	-	x	-	2	-	x	110	FILL	
1BA090	1	11	19	2208	6	2	x	-	1	1	x	110	FILL	*
1BA091	-	2	9	774	3	2	-	-	-	-	[illegible]	110	FILL	
1BA093	-	2	9	579	3	-	x	-	-	-	[illegible]	110	FILL	
1BA094	-	6	26	2576	3	-	x	-	1	1	x	110	FILL	
1BA102	-	7	13	571	5	2	x	-	-	-	x	110	FILL	
1BA103	-	2	2	244	2	-	x	-	-	-	x	110	FILL	
1BA104	-	-	-	13	-	1	x	-	-	-	-	110	FILL	
1BA105	-	-	4	227	2	-	x	-	-	-	x	110	FILL	
1BA106	-	-	-	19	-	-	x	-	-	-	x	110	FILL	
1BA107	-	-	-	-	-	-	-	-	-	-	-	110	FILL	
1BA108	-	-	-	-	-	-	-	-	-	-	-	110	FILL	
1BA109	-	-	-	-	-	-	-	-	-	-	-	110	FILL	

MESOLITHIC: STAKEHOLES

1AC015	-	1	1	26	1	-	x	-	-	-	-	015	FILL (NO CUT NUMBER)
1BA027	-	-	-	-	-	-	-	-	-	-	-	027	UNEXCAVATED
1BA035	-	-	-	-	-	-	-	-	-	-	-	035	UNEXCAVATED
1BA036	-	-	-	-	-	-	-	-	-	-	-	036	UNEXCAVATED
1BA039	-	-	-	-	-	-	-	-	-	-	-	039	UNEXCAVATED
1BA040	-	-	-	-	-	-	-	-	-	-	-	040	UNEXCAVATED

1BA041	-	-	-	-	-	-	-	-	-	-	-	041	UNEXCAVATED
1BA043	-	-	-	-	-	-	-	-	-	-	-	043	UNEXCAVATED
1BA044	-	-	-	-	-	-	-	-	-	-	-	044	UNEXCAVATED
1BA045	-	-	-	-	-	-	-	-	-	-	-	045	UNEXCAVATED
1BA096	-	-	-	-	-	-	-	-	-	-	-	096	UNEXCAVATED
1BA097	-	-	-	-	-	-	-	-	-	-	-	097	UNEXCAVATED
1BA098	-	-	-	-	-	-	-	-	-	-	-	098	UNEXCAVATED
1BA099	-	-	-	-	-	-	-	-	-	-	-	099	UNEXCAVATED CONJOINING TOP FILLS.
1BB025	-	-	-	-	-	-	-	-	-	-	-	025	FILL (NO CUT NUMBER)
1BB028	-	-	-	-	-	-	-	-	-	-	-	028	FILL (NO CUT NUMBER)
1BB031	-	-	-	-	-	-	-	-	-	-	-	031	CUT
1BB032	-	-	-	-	-	-	-	-	-	-	-	031	FILL

MESOLITHIC: SLOTS FOR VERTICAL TIMBERS

1BA095	-	-	-	-	-	-	-	-	-	-	-	095	FILL (NO CUT NUMBER)
1BA100	-	2	4	27	3	-	x	-	-	-	-	100	CONJOINING FILLS?*

MESOLITHIC: PATCHES

1BA025	-	-	-	-	-	-	-	-	-	-	-	025	UNEXCAVATED
1BA026	-	-	-	-	-	-	-	-	-	-	-	026	UNEXCAVATED
1BA031	-	-	-	-	-	-	-	-	-	-	-	031	FILL (NO CUT NUMBER)
1BA032	-	-	-	-	-	-	-	-	-	-	-	032	FILL (NO CUT NUMBER)
1BC026	-	-	-	-	-	-	-	-	-	-	-	026	FILL (NO CUT NUMBER)

MESOLITHIC/NEOLITHIC GRAVEL BANK DUMP

1AE031	-	-	-	-	-	-	-	-	-	-	-	120	
2AM312	-	-	-	6	-	-	-	-	-	-	-	120	
2AM315	-	-	-	2	-	-	-	-	-	-	-	120	
1BA024	-	-	-	-	-	-	-	-	-	-	-	120	
1BF037	-	-	-	-	-	-	-	-	-	-	-	120	SPIT
1BA038	-	-	-	-	-	-	-	-	-	-	-	120	
1BA051	-	-	1	14	-	-	-	1	-	-	-	120	SPIT
1BA070	1	4	8	138	2	1	-	-	3	-	-	120	WATERCOURSE
1BA071	-	-	-	1	-	-	-	-	-	-	-	120	WATERCOURSE
1BA072	-	1	-	41	-	-	-	-	2	-	-	120	WATERCOURSE
1BA074	-	2	2	24	-	-	-	-	-	-	-	120	
1BA081	-	1	1	5	-	-	-	-	-	-	-	120	
1BA086	-	-	-	-	-	-	-	-	-	-	-	120	
1BC018	-	-	-	9	-	-	-	-	-	-	-	120	

NEOLITHIC: PEAT IN WATERCOURSE

2AM313	-	-	-	10	-	-	-	-	-	-	-	020	
1BA060	-	3	2	48	1	-	x	-	-	-	-	020	SPIT
1BA061	-	-	-	4	-	-	-	-	-	-	-	020	SPIT
1BA062	-	-	-	21	-	-	x	-	-	-	-	020	SPIT
1BA063	-	-	-	32	-	-	x	-	-	-	-	020	SPIT
1BA064	-	-	1	34	-	-	x	-	-	-	-	020	SPIT
1BA065	-	-	1	33	1	1	x	-	-	-	-	020	SPIT
1BA066	-	1	-	31	-	-	x	-	-	-	-	020	SPIT
1BA073	-	-	-	8	-	-	-	-	-	-	-	020	
1BA079	-	-	-	-	-	-	-	-	-	-	-	020	
1BB003	-	3	6	48	1	2	-	1	1	-	-	020	
1BB004	-	1	1	25	1	-	-	-	-	-	-	020	
1BC005	-	2	1	133	-	-	x	3	-	-	x	020	
1BC011	-	-	-	-	-	-	-	-	-	-	-	020	
1BC020	1	-	-	34	-	-	-	2	-	-	-	020	
1BC022	-	-	1	8	-	-	-	-	-	-	-	020	
1BC023	1	-	2	28	-	1	x	4	-	-	-	020	
1BC028	-	1	-	2	-	-	-	-	-	-	-	020	
1BC029	-	-	-	-	-	-	-	-	-	-	-	020	
1BC031	1	1	2	77	-	-	-	-	-	-	-	020	

NEOLITHIC: PITS AND HOLLOWS

1AD153	-	-	2	257	3	-	x	-	-	-	-	153	FILL*
1BB027	-	-	-	1	-	-	-	-	-	-	-	027	FILL

NEOLITHIC: DUMPS IN PEAT OF WATERCOURSE

1AG126	1	2	2	332	-	-	x	13	-	-	-	020	ROCKS AND GRAVEL =AG128, BC012, BC014, BC021.
1AG128	1	19	23	2234	16	5	x	52	3	2	x	020	ROCKS AND GRAVEL =AG126, BC012, BC014, BC021.*
1AG185	-	-	-	-	-	1	-	-	-	-	-	020	ROCKS
2AM314	-	-	-	22	-	-	-	1	-	-	-	020	ROCKS IN AM313
1BA076	-	-	-	-	-	-	-	-	-	-	-	020	GRAVEL = BB033
1BA077	-	-	-	10	1	-	x	-	-	-	-	020	MIDDEN AND BRUSHWOOD*
1BA078	-	-	1	1	-	-	-	-	-	-	-	020	STONES

1BB021	-	-	-	-	-	-	-	-	-	-	-	020	STONES
1BB023	-	-	-	-	-	-	-	-	-	-	-	020	BRUSHWOOD
1BB024	-	-	-	-	-	-	-	-	-	-	-	020	BRUSHWOOD
1BB026	-	-	-	-	-	-	-	-	-	-	-	020	GRAVEL
1BB033	-	-	-	-	-	-	-	-	-	-	-	020	GRAVEL * BA076
1BC010	-	-	-	-	-	-	-	-	-	-	-	020	GRAVEL
1BC012	-	2	-	35	-	-	-	1	-	-	-	020	ROCKS AND GRAVEL * AG126, AG128, BC014, BC021.
1BC014	-	-	-	-	-	-	-	-	-	-	-	020	ROCKS AND GRAVEL * AG126, AG128, BC012, BC021.
1BC021	-	1	2	17	-	-	-	1	-	-	-	020	ROCKS AND GRAVEL * AG126, AG128,BC012 BC014.
1BC025	-	-	-	-	-	-	-	-	-	-	-	020	ROCKS

NATURAL

1AA007	-	-	-	-	-	-	-	-	-	-	-	007	TREE HOLE CUT
1AA006	-	-	-	-	-	-	-	-	-	-	-	007	FILL
1AA025	-	-	-	-	-	-	-	-	-	-	-	007	FILL
1AB027	-	-	-	-	-	-	-	-	-	-	-	027	SLOPEWASH?
1AC012	-	-	-	4	-	-	-	-	-	-	-	012	GRAVEL
1AC016	-	-	-	-	-	-	-	-	-	-	-	016	GRAVEL
1AC017	-	-	-	-	-	-	-	-	-	-	-	017	PEBBLES
1AC018	-	-	-	-	-	-	-	-	-	-	-	018	PEBBLES
1AC020	-	-	-	-	-	-	-	-	-	-	-	020	GRAVELS
1AC021	-	-	-	-	-	-	-	-	-	-	-	021	GRAVELS
1AC022	-	-	-	-	-	-	-	-	-	-	-	022	GRAVELS
1AC023	-	-	-	-	-	-	-	-	-	-	-	023	GRAVELS
1AC024	-	-	-	-	-	-	-	-	-	-	-	024	GRAVELS
1AD112	-	-	-	7	1	-	-	-	-	-	-	112	GRAVELS
1AD113	-	-	-	-	-	-	-	-	-	-	-	113	GRAVELS
1AD120	-	-	-	10	-	-	x	-	-	-	-	120	GRAVELLY SAND =AD164
1AD143	1	-	1	55	1	-	x	-	-	-	-	143	SANDY GRAVEL
1AD164	-	-	-	6	-	-	-	-	-	-	-	164	GRAVELLY SAND =AD120
1AD167	-	-	1	20	1	-	x	-	-	-	-	167	SILTY GRAVEL
1AD169	-	-	-	-	-	-	-	-	-	-	-	169	GRAVELS
1AD170	-	-	-	-	-	-	-	-	-	-	-	170	NATURAL
1AD202	-	-	-	-	-	-	-	-	-	-	-	202	CUT OF

													STONE HOLE
1AD229	-	-	-	-	-	-	-	-	-	-	-	202	FILL
1AD205	-	-	-	11	-	-	-	-	-	-	-	205	NATURAL
1AG184	-	-	-	-	-	-	-	-	-	-	-	184	GRAVELS
1AG186	-	-	-	-	-	-	-	-	-	-	-	186	STONES
1AG212	-	-	-	-	-	-	-	-	-	-	-	212	BURIED SOIL
1AG213	-	-	-	-	-	-	-	-	-	-	-	213	CUT OF
													WATERCOURSE
1AG245	-	-	-	-	-	-	-	-	-	-	-	245	BASAL CLAY*
1AG252	-	-	-	-	-	-	-	-	-	-	-	213	GRAVEL
													=BC027?
1AG241	-	-	-	-	-	-	-	-	-	-	-	241	SLOPEWASH
1AJ107	-	-	2	162	1	-	-	-	-	-	-	107	GRAVELS
1AJ109	-	-	-	24	-	-	x	-	-	-	-	109	STONE HOLE
1AJ172	-	-	-	-	-	-	-	-	-	-	-	172	GRAVELS
1AJ174	-	-	9	51	1	-	x	-	-	-	-	174	ROOTHOLE
2AK302	1	-	-	13	-	-	-	-	-	-	-	302	GRAVEL
2AM316	-	-	-	-	-	-	-	-	-	-	-	316	BOULDER CLAY
2AN322	-	1	5	92	-	1	-	-	-	-	-	322	SLOPEWASH
2AN323	-	2	1	31	-	-	-	-	-	-	-	323	SLOPEWASH
2AN324	-	-	-	1	-	-	-	-	-	-	-	324	BURIED SOIL
1BA034	-	-	-	-	-	-	-	-	-	-	-	034	LOAM
1BA046	-	-	-	-	-	-	-	-	-	-	-	046	GRAVEL
1BA075	-	-	-	-	-	-	-	-	-	-	-	075	BURIED SOIL
1BA080	-	-	-	-	-	-	-	-	-	-	-	080	GRAVELS
													= BA083
1BA083	-	-	4	12	1	-	-	-	-	-	-	080	GRAVELS

													= BA080
1BA082	-	1	1	6	-	-	-	-	-	-	-	082	BURIED SOIL
													= BA084
1BA084	-	-	2	6	-	-	-	-	-	-	-	082	BURIED SOIL
													= BA082
1BA085	-	1	3	19	-	-	x	-	1	-	x	085	BURIED SOIL*
1BA092	-	-	-	-	-	-	-	-	-	-	-	092	ROOTHOLES
1BB006	-	1	1	-	-	-	-	-	-	-	-	006	BOULDER CLAY
1BB007	-	1	-	8	1	1	-	-	-	-	-	007	HILL AND
													STREAM WASH
1BB013	-	-	-	-	-	-	-	-	-	-	-	013	STONES
1BB020	-	-	-	-	-	-	-	-	-	-	-	020	STONE HEAP
1BB029	-	-	-	-	-	-	-	-	-	-	-	029	CUT OF
													STONE HOLE
1BB018	-	-	1	3	-	-	-	-	-	-	-	029	FILL
1BB030	-	-	-	-	-	-	-	-	-	-	-	030	CUT OF
													STONE HOLE
1BB019	-	-	-	3	-	-	-	-	-	-	-	030	FILL
1BC003	-	-	-	-	-	-	-	1	-	-	-	003	GRAVEL
1BC007	-	-	-	1	-	-	-	1	-	-	-	007	SLOPEWASH
1BC019	-	-	1	8	-	-	-	-	-	-	-	019	SLOPEWASH
1BC027	-	-	-	-	-	-	-	-	-	-	-	027	GRAVEL
													=AB2527

UNDATED CONTEXTS

1AC011	-	-	-	1	-	-	-	-	-	-	-	011	PIT CUT?

1AC014	-	1	4	62	1	-	x	-	-	-	-	014	CHARCOAL PATCH
1AG125	-	-	-	-	-	-	-	-	-	-	-	125	UNEXCAVATED PIT FILL WITH POT.
1AJ103	-	-	-	-	-	-	-	-	-	-	-	103	CUT OF LAZYBED FURROW
1AJ102	-	-	2	8	-	-	-	-	-	-	-	103	FILL
1AJ105	-	-	-	1	-	-	x	-	-	-	-	105	FILL OF FURROW (NO CUT NUMBER).

PLOUGHSOIL

1AB001	-	-	1	7	-	-	-	-	-	-	-	001	PLOUGHSOIL
1AB002	-	-	-	3	-	-	-	-	-	-	-	001	MODERN PLOUGHMARKS
1AC001	9	59	48	16587	63	11	x	-	-	-	-	001	PLOUGHSOIL
1AC013	-	-	-	9	-	-	-	-	-	-	-	001	PLOUGHSOIL IN HUMP CAUSED BY AC014.
1AC019	-	-	-	4	-	-	-	-	-	-	-	001	PLOUGHSOIL IN UNDUL-ATION CAUSED

													BY AC014
1AD001	1	36	130	6898	74	17	x	2	2	1	-	001	PLOUGHSOIL.
													INCLUDES
													AD270 AS
													EXTRA LAYER
													NUMBER FOR
													FINDS.
1AD008	-	6	73	3209	46	7	x	-	2	2	-	001	CLEANING SPIT
													BELOW
													PLOUGHSOIL.
1AD146	-	2	15	219	3	1	x	-	-	-	-	001	CLEANING SPIT
													BELOW
													PLOUGHSOIL.
1AE001	-	2	1	70	-	-	-	-	-	-	-	001	PLOUGHSOIL
1AG001	7	44	109	5117	50	10	-	184	2	-	-	001	PLOUGHSOIL
													INCLUDES
													AG271 AS
													EXTRA LAYER
													NUMBER FOR
													FINDS.
1AG211	-	1	8	227	2	-	x	-	-	1	-	001	CLEANING SPIT
													BELOW
													PLOUGHSOIL.
1AH001	8	27	241	5528	86	7	x	-	1	-	-	001	PLOUGHSOIL
													INCLUDES
													AH272, AH273
													AS EXTRA

													LAYER NUMBERS FOR FINDS.
1AJ001	10	56	271	14225	144	30	x	2	-	-	-	001	PLOUGHSOIL INCLUDES AJ274, AJ275 AS EXTRA LAYER NUMBERS FOR FINDS.
1AJ106	-	1	28	1183	21	-	x	-	-	-	-	001	CLEANING SPIT BELOW PLOUGHSOIL.
2AK301	-	-	-	56	-	1	-	-	-	-	-	301	PLOUGHSOIL INCLUDES AK303,304.
2AL331	-	-	1	170	-	-	-	-	-	-	-	331	PLOUGHSOIL
2AM311	-	2	1	100	-	1	-	-	1	-	-	311	PLOUGHSOIL
2AN321	5	19	8	496	1	3	-	-	-	-	-	321	PLOUGHSOIL
1BA001	18	335	365	6758	20	82	-	-	20	-	-	001	PLOUGHSOIL INCLUDES BA002-004 AS EXTRA LAYER NUMBERS FOR FINDS.
1BA010	11	122	116	6231	28	25	x	-	17	-	-	001	CLEANING SPIT BELOW PLOUGHSOIL

													INCLUDES BA008-009 AS EXTRA LAYER NUMBERS FOR FINDS.
1BA011	-	2	2	21	-	-	-	-	-		-	001	CLEANING SPIT OF AG86
1BA022	-	5	34	282	1	3	-	-	-	-	-	001	SECOND CLEANING SPIT BELOW PLOUGHSOIL.
1BB001	-	5	5	116	-	2	-	-	-	-	-	001	PLOUGHSOIL
1BB002	1	2	5	142	1	-	-	-	-	-	-	001	CLEANING SPIT BELOW PLOUGHSOIL
1BC001	1	7	14	258	-	-	-	-	1	-	-	001	PLOUGHSOIL
1BC002	1	9	24	897	3	4	x	11	-	-	-	001	CLEANING SPIT BELOW PLOUGHSOIL.
1PS001	26	156	238	27967	318	153-		3	3	-	-	001	PLOUGHSOIL SAMPLE SQUARES INCLUDES PS002,003 AS EXTRA LAYER NUMBERS FOR FINDS.

1FW001	17	203	55	5165	29	41	-	-	1	-	-	001	FIELDWALKING OF WHOLE SITE INCLUDES FW002.
1US001	-	-	-	-	-	-	-	-	2	-	-	001	STRAY FINDS

MODERN

1AB009	-	-	-	-	-	-	-	-	-	-	-	009	RECENT DOWNSLOPE MOVEMENT CAUSED BY PLOUGHING.
1AB034	-	-	-	-	-	-	-	-	-	-	-	034	PLOUGH DAMAGE
1AD114	-	-	1	7	-	-	-	-	-	-	-	114	PLOUGH DAMAGE
1AD115	-	-	-	-	-	-	-	-	-	-	-	115	PLOUGH DAMAGE
1AD116	-	-	-	-	-	-	-	-	-	-	-	116	PLOUGH DAMAGE
1AE030	-	-	-	-	-	-	-	-	-	-	-	030	FIELD DRAIN
1AE033	-	-	-	-	-	-	-	-	-	-	-	033	FIELD DRAIN
1AE041	-	-	-	-	-	-	-	-	-	-	-	041	GULLY CUT
1AE032	-	-	-	-	-	-	-	-	-	-	-	041	FILL
1AG127	-	-	3	55	-	-	-	18	-	-	-	127	FIELD DRAIN
1AG181	-	-	-	-	-	-	-	-	-	-	-	181	DRAIN CUT
1AG129	-	-	-	-	-	-	-	-	-	-	-	181	FILL
1AG183	-	-	-	-	-	-	-	-	-	-	-	183	DRAIN CUT
1AG124	-	3	4	273	5	-	x	1	-	-	-	183	FILL

1AG130	-	-	-	-	-	-	-	-	-	-	-	183	FILL
1AG182	-	-	-	-	-	-	-	-	-	-	-	183	FILL
1AG242	-	-	-	-	-	-	-	-	-	-	-	242	DRAIN CUT
1AG243	-	-	-	-	-	-	-	-	-	-	-	242	FILL
1AG256	-	-	-	-	-	-	-	-	-	-	-	256	DRAIN CUT
1AG215	-	-	-	3	-	-	-	-	-	-	-	256	FILL
1AG216	-	-	-	-	-	-	-	-	-	-	-	256	FILL
1AG253	-	-	-	-	-	-	-	-	-	-	-	256	FILL
1AG254	-	-	-	-	-	-	-	-	-	-	-	256	FILL
1AG255	-	-	-	-	-	-	-	-	-	-	-	256	FILL
1BA012	-	3	4	40	-	-	-	-	-	-	-	012	DRAIN FILL
1BA013	-	-	-	-	-	-	-	-	-	-	-	013	DRAIN FILL
1BA014	-	1	1	11	-	1	-	-	-	-	-	014	DRAIN FILL
1BA015	-	-	4	77	-	-	-	-	-	-	-	015	DRAIN FILL
1BA016	-	-	-	2	-	-	-	-	-	-	-	016	DRAIN FILL
1BA017	-	-	-	-	-	-	-	-	-	-	-	017	DRAIN FILL
1BA018	-	-	-	-	-	-	-	-	-	-	-	018	DRAIN FILL
1BA019	-	-	-	-	-	-	-	-	-	-	-	019	DRAIN FILL
1BB005	-	-	-	-	-	-	-	-	-	-	-	005	MODERN PLOUGHMARKS
1BB008	-	-	-	2	-	-	-	-	-	-	-	008	DRAIN FILL
1BB009	-	-	-	-	-	-	-	-	-	-	-	009	DRAIN FILL
1BB010	-	-	-	-	-	-	-	-	-	-	-	010	DRAIN FILL
1BB011	-	-	-	-	-	-	-	-	-	-	-	011	DRAIN FILL
1BB012	-	-	-	-	-	-	-	-	-	-	-	012	DRAIN FILL
1BB014	-	-	-	-	-	-	-	-	-	-	-	014	DRAIN FILL
1BB015	-	-	-	-	-	-	-	-	-	-	-	015	DRAIN FILL

1BB016	-	-	1	4	-	-	-	-	-	-	-	016	DRAIN FILL
1BB017	-	-	-	1	-	-	-	-	-	-	-	017	DRAIN FILL
1BB022	-	-	-	-	-	-	-	-	-	-	-	022	DRAIN FILL
1BC004	-	-	-	-	-	-	-	-	-	-	-	004	DRAIN CUT
1BC006	-	-	-	-	-	-	-	-	-	-	-	004	FILL
1BC008	-	-	-	-	-	-	-	-	-	-	-	008	DRAIN CUT
1BC009	-	-	-	-	-	-	-	-	-	-	-	008	FILL
1BC015	-	-	-	-	-	-	-	-	-	-	-	015	DRAIN CUT
1BC016	-	-	1	1	-	-	-	-	-	-	-	015	FILL
1BC017	-	-	-	-	-	-	-	-	-	-	-	017	DRAIN CUT
1BC013	-	-	-	9	-	1	-	-	-	-	-	017	FILL

THE ILLUSTRATION OF THE ARTEFACT ASSEMBLAGE: CONTEXTS AND FINDS RECORDING NUMBERS OF ILLUSTRATED ARTEFACTS, TABLE 31

ILL 26 CORES

1. 1PS001UV; 2. 1PS001QX; 3. 1AG001BL; 4. 1AG271CF; 5. 1AD001VK; 6. 1AD270BD; 7. 1AD001WF; 8. 1AG001GB; 9. 1AG001HN.

ILL 28 CORES

1. 1PS001UU; 2. 1PS001UT; 3. 1AG001NM; 4. 1AG271NH; 5. 1AD001XL; 6. 1PS002EH; 7, 1AG271MV; 8. 1PS001UR.

ILL 29 BLADES

1. 1PS001VY; 2. 1PS001UH; 3,4. 1PS001UA; 5-10. 1PS001 QA & QB; 11. 1PS001VY, 1PS001UH, 1PS001UR.

ILL 54 RETOUCHED ARTEFACTS, SCRAPERS

1. 1PS001HU; 2. 1BA021CU; 3. 1AD154AY; 4. 1BA003MB; 5. 1BA003DK; 6. 1PS003MH; 7. 1PS002XT; 8. 1BA010CJ; 9. 1PS001LB; 10. 1PS003AM; 11. 1PS001TE; 12. 1PS001MU.

ILL 55 RETOUCHED ARTEFACTS, SCRAPERS

1. 1PS002PK; 2. 1BA004AM; 3. 1FW001SC; 4. 1AJ001DD; 5. 1FW001PQ;

6. 1PS001GF; 7. 1PS002QH.

ILL 56 **RETOUCHED ARTEFACTS, SCRAPERS**

1. 1AJ274CA; 2. 1PS001BB; 3. 1PS001AK; 4. 1BA010SQ; 5. 1BA022FT;
6. 1PS002VD; 7. 1AD008HK; 8. 1BA009RV; 9. 1AH001LY; 10. 1PS001PC;
11. 1BA004CK; 12. 1BA009QD; 13. 1PS001WB; 14. 1PS002EW;
15. 1AG001PE; 16. 1AD001LI; 17. 1PS003QE; 18. 1BA001NV.

ILL 57 **RETOUCHED ARTEFACTS, EDGE RETOUCHED PIECES**

1. 1BA001MY; 2. 1AE001BP; 3. 1BC001DI; 4. 1PS001RE; 5. 1PS003LU;
6. 1BA002CD; 7. 1PS001AW; 8. 1AG001AC; 9. 1AD001AW; 10. 1AD154AZ;
11. 1BA004IN; 12. 1PS003QJ; 13. 1AC001HN; 14. 1PS001PD;
15. 1PS002AC; 16. 1FW001JD; 17. 1PS003PZ; 18. 1AJ001KV.

ILL 58 **RETOUCHED ARTEFACTS, BORERS**

1. 1BA008LL, 1BA002KB; 2. 1AD029CF; 3. 1AG121AO; 4. 1BA023CU;
5. 1PS002NF; 6. 1BA004AB, 7. 1AD001DO; 8. 1BA002DW; 9. 1FW001HK;
10. 1PS001NY; 11. 1BA002AS; 12. 2AM311AU; 13. 1BA070AH;
14. 1AD154CZ.

ILL 59 **RETOUCHED ARTEFACTS, INVASIVE FLAKED POINTS**

1. 1AD028AT; 2. 1PS003LR; 3. 2AK301AC; 4. 1BA004GW; 5. 1BC023AB;
6. 1AG128FV; 7. 1PS002JU; 8. 1AJ001EB; 9. 1PS003LE; 10. 1PS002JV;

11. 1PS003LD; 12. 1AJ001OK; 13. Farm Fields 1983; 14. Hallival;
15. 1AG271FQ.

ILL 63 **MICROLITHS**

1. 1AD001AX; 2. 1AD270EG; 3. 1AJ275HW; 4. 1AG126CA; 5. 1AH273ET;
6. 1AD028ER; 7. 1AH001JK; 8. 1AD143AG; 9. 1AH273EQ; 10. 1AJ274CD;
11. 1PS003EB; 12. 1AJ001JA; 13. 1AH272HD; 14. 1PS003ZW;
15. 1PS003FF; 16. 1PS003KR; 17. 1PS003ID; 18. 1AD001XO;
19. 1AJ106BP; 20. 1BC002AZ; 21. 1PS003PC; 22. 1AC001CB;
23. 1PS001YJ; 24. 1AD270CQ; 25. 1AD270CJ; 26; 1AH001HK;
27. 1AJ274CC; 28. 1BA130DZ; 29. 1AD154BZ; 30. 1AG001EH;
31. 1AH001VE; 32. 1FW001DQ; 33. 1AG271EA; 34. 1AD144AF;
35. 1AG121BY; 36. 1AD029EN; 37. 1AH001WQ; 38. 1AD029DQ;
39. 1AD029DE; 40. 1AD029EF; 41. 1AD029GE; 42. 1AD029ED;
43. 1AD029EE; 44. 1AG271BW; 45. 1AG001LV; 46. 1AG271BG;
47. 1AD028DY; 48. 1AJ001WW; 49. 1AC001OZ; 50. 1AD001NC;
51. 1AJ001WX; 52. 1AJ275IN; 53. 1AD161BJ; 54. 1AJ104AV;
55. 1AG128CN; 56. 1BA030XN.

ILL 64 **MICROLITHS**

1. 1AJ001PH; 2. 1AG211AW; 3. 1AG271AF; 4. 1AH001AY; 5. 1BA065AD;
6. 1PS003NJ; 7. 1AG001SN; 8. 1BA009XI; 9. 1BA002NU; 10. 1AG001XJ;
11. 1BA090BB; 12. 1BA090HW; 13. 1AJ001LZ; 14. 1BA030XA;
15. 1BC002BZ; 16. 1BA102BD; 17. 1BA030WR; 18. 1AG001KT;
19. 1AD029DQ; 20. 1FW001CB; 21. 1AG271LI; 22. 1AD001DQ;

23. 1BA090BD; 24. 1PS001VK; 25. 1PS001VM; 26. 1AD001EQ; 27. 1AC001KE; 28. 1PS002BS; 29. 1AC001LK; 30. 1AJ106ER; 31. 1BB004BA; 32. 1AJ001TU; 33. 1AJ001PB.

ILL 86 **POTTERY**

1. 1AG271AV; 2. 1AG271UJ; 3. 1AG127AP; 4. 1AG271DC; 5. 1AG271UC; 6. 1AG271QC; 7. 1AG128SL; 8. 1AG124CY.

ILL 87 **POTTERY**

1. 1AG271WB; 2. 1AG271RQ; 3. 1AG271DM; 4. 1AG128RR; 5. 1AG271DT; 6. 1AG271UU; 7. 1AG271NW; 8. 1AG271NU; 9. 1AG128SE; 10. 1AG128RY; 11. 1AG271SB; 12. 1AG271PR; 13. 1AG271PB.

ILL 78 **COARSE STONE TOOLS**

1. 1BA008VJ; 2. 1BA088AW; 3. 1BA004HL; 4. 1AD029BC.

ILL 81 **COARSE STONE TOOLS**

1. 1AD028HR; 2. 1AD028HW; 3. 1AD028HT; 4. 1PS003OS; 5. 1BA008VC; 6. 1AD028HS; 7. 1BA004HI; 8. 1BA008VH; 9. 1AD270FB.

ILL 80 **COARSE STONE TOOLS**

1. 1AD008ID; 2. 1US001AA; 3. 1P6003DT; 4. 1AD028HY; 5. 1BA089AT;
6. 1BA070AT; 7. 1BA070AS.

ILL 88 **PUMICE**

1. 1AD0081A; 2. 1AD008IB.

LAYER CONCORDANCE FOR THE INTERPRETED CONTEXTS IN TEXT, TABLE 32

AC1: 1AC014

AC2: 1AC015

AD1: (1AD165 = 221) CUT; (1AD035, 1AD118, 1AD145, 1AD152, 1AD154, 1AD166) FILLS.

AD2: (1AD206 = 207 = 038) CUT; (1AD029, 1AD036, 1AD119, 1AD144, 1AD162, 1AD163, 1AD167, 1AD224, 1AD226, 1AD227) FILLS.

AD3: (1AD234 = 040) CUT; (1AD037, 1AD039, 1AD141, 1AD142) FILLS.

AD4: (1AD232) CUT; (1AD148, 1AD149, 1AD158, 1AD160, 1AD203) FILLS.

AD5: (1AD208) CUT; (1AD028, 1AD161, 1AD168, 1AD210, 1AD223, 1AD233) FILLS.

AD6: (1AD222) CUT; (1AD159, 1AD201, 1AD209, 1AD225) FILLS.

AD7: (1AD153) FILL.

AJ1: (1AJ179) CUT; (1AJ173) FILL.

AJ2: (1AJ178) CUT; (1AJ104, 1AJ175, 1AJ176, 1AJ177) FILLS.

AJ3: (1AJ180) CUT; (1AJ108) FILL.

BA1: (1BA053) CUT; (1BA023) FILL.

BA2: (1BA054) CUT; (1BA047, 1BA049, 1BA050) FILLS.

BA3: (1BA048) CUT; (1BA021) FILL.

BA4/5: (1BA090, 1BA102, 1BA103, 1BA104, 1BA106, 1BA109) FILLS.

BA6: (1AG238) FILL.

BA7: (1BA087, 1BA088, 1BA105, 1BA107) FILLS.

BA8: (1BA089, 1BA094, 1BA108) FILLS.

BA9: (1BA091, 1BA093) FILLS.

BA10: (1BA052) FILL.

PEAT: 1BA020, 1BA060-66, 1BA073, 1BB003, 1BB004, 1BC005, 1BC020, 1BC031.

MAIN DUMP: 1AG185, 1BC012, 1BC018, 1BC019, 1BC021.

BANK: 1AE031, 1BA024, 1BA037, 1BA051, 1BA070-72, 1BA074, 1BA081, 1BA086.

MAIN DUMP/BANK ABUTTING: 1AG128, 1BC022, 1BC023.

DUMP1: 1BA076, 1BA077, 1BB023, 1BB024, 1BB033.

DUMP2: 1BC025.

SITE		1, 2		
TRENCH		AA-AN, BA-BC		
CONTEXT		0001-9999	(Trench Specific)	
FIND CODE		AA-ZZ		
NUMBER OF PIECES		1-254		
TYPE	Pebbles	(1)	Cores	(2)
	Blades	(3)	Flakes	(4)
	Flake Debris	(5)	Chunks	(6)
	Retouched Cores	(7)	Retouched Blades	(8)
	Retouched Flakes	(9)	Retouched Flake Debris	(10)
	Retouched Chunks	(11)	Microliths	(12)
	Coarse Stone Tools	(13)	Sherds	(14)
	Carbonised Object	(15)	Pottery Fragment	(16)
SUB TYPE	Whole	(1)	Flaked	(2)
	With Cortex	(3)	Without Cortex	(4)
	Primary	(5)	Secondary	(6)
	Inner	(7)	Cobble	(8)
	Stone Flake	(9)	Rim	(10)
	Base	(11)	Body	(12)
	Worked Pumice	(13)	Unworked Pumice	(14)
CLASSIFICATION	Bipolar	(1)	Platform	(2)
	Disc	(3)	Amorphous	(4)
	Crested	(5)	Plain	(6)
	Core Rejuvenation	(7)	Core Trimming	(8)
	Regular	(9)	End Scraper	(10)
	Side Scraper	(11)	Edge Retouched	(12)
	Bifacial Leaf Point	(13)	Bifacial Indeterminate	(14)
	Miscellaneous	(15)	Broken	(16)
	Notched	(17)	Borer	(18)
	Disc Scraper	(19)	Microburin	(20)
	Rod	(21)	Backed Bladelet	(22)
	Scalene Triangle	(23)	Crescent	(24)
	Fine Point	(25)	Broken Fragment	(26)
	Obliquely Blunted	(27)	Lamelle à Cran	(28)
	Invasive Flaked Point	(29)	Rounded Hammerstone	(30)
	Faceted Hammerstone	(31)	Ground Edge Tool	(32)
	Anvil	(33)	Spherical	(34)
	Undamaged	(35)	Scraper Resharpening Flake	(40)
	Burin	(41)	Tanged Scraper	(42)
	Double Ended Scraper	(43)	Burin Spall	(44)
	End + Two Sides Scraper	(45)	End + One Side Scraper	(46)
	Blip-Borer	(47)	Truncated Scraper	(48)
	Double Edged Crescent	(49)		

Table 33 On-site artifact catalogue: fields, attributes and code numbers

			Coarse Pottery	(80)
	Gun Flint	(81)	Tile Field Drain	(82)
	Plain Pottury	(83)	Decorated Pottery	(84)
	Indeterminate Pottery	(85)		
MATERIAL			Pottery	(2)
	Flint True	(7)	Lava ?	(8)
	Ambiguous Rock	(9)		
	Stone	(21)	Bloodstone	(22)
	Chert	(23)		
	Sandstone	(29)		
	Bone	(31)		
	Charcoal	(41)		
	Shell	(43)		
	Hazel Nut	(47)		
	Pumice	(49)		
			Quartz	(54)
	Agate	(57)	Quartzite	(58)
	Pitchstone	(59)		
CONDITION			Burnt	(2)
	As New	(9)		
	Abraded	(17)		
RECOVERY METHOD			Surface Collection	(2)
	Manual	(3)	Part Removed	(4)
	Unstratified	(5)		
	Dry Sieved	(7)	Wet Sieved	(8)
LOCATION	[8 Figure grid reference]			
NOTES	[Text]			

Type	Sub Type	Classification
1	1 - 2	
2	3 - 4	1 - 4
3	5 - 7	5 - 6
4	5 - 7	7 - 9
5	5 - 7	
6	5 - 7	
7	3 - 4	10 - 19, 29, 40 - 48
8	5 - 7	10 - 19, 29, 40 - 48
9	5 - 7	10 - 19, 29, 40 - 48
10	5 - 7	10 - 19, 29, 40 - 48
11	5 - 7	10 - 19, 29, 40 - 48
12	5 - 7	20 - 28, 49
13	8 - 9	30 - 35
14	10 - 12	83 - 85
15		
16		
	13 - 14	

Table 34 On-site artifact catalogue: relationships of type, sub-type and classification

FLAKES, BLADES AND RETOUCHED

COLOUR ____________________ [1]

Light Green	(1)	Dark Green	(2)
Grey	(3)	Cream	(4)
Purple	(5)	White/Grey	(6)
Cream/Grey	(7)	White	(8)
Purple/Green/Cream	(9)	Light Green/White	(10)
White/Tan/Green	(11)	Dark Green/White	(12)
Dark Green/Purple/Green	(13)	Light Brown	(14)
Dark Brown	(15)	Tan	(16)
Purple/Green	(17)		

SURVIVAL ____________________ [2]

Small Fragment Missing	(1)	Proximal Surviving	(2)
Distal Surviving	(3)	Right Side Surviving	(4)
Left Side Surviving	(5)	Segment Surviving	(6)
Complete	(7)		
Indeterminate	(9)		

PLATFORM TYPE ____________________ [3]

Platform Missing	(1)	Platform Delib. Removed	(2)
Scalar	(3)	Planar Artificial	(4)
Faceted Artificial	(5)	Natural ie. Cortical	(6)
Broken	(7)	Retouched	(8)
Indeterminate	(9)		

PLATFORM MORPHOLOGY ____________________ [4]

Punctiform	(1)	Linear	(2)
Crescentic	(3)	Lozenge	(4)
Triangular	(5)	Amorphous	(6)
Indeterminate	(9)		

PLATFORM TRIMMED ON CORE FACE __________ [5] Y/N

PLATFORM TRIMMED ON PLATFORM EDGE ______ [6] Y/N

PLATFORM ISOLATED ____________________ [7] Y/N

RING CRACKS VISIBLE ____________________ [8] Y/N

PLATFORM LIP PRESENT ____________________ [9] Y/N

PLATFORM WIDTH ____________________ [10] ___mm

PLATFORM THICKNESS ____________________ [11] ___mm

PLATFORM ANGLE ____________________ [12] ___

BULB CHARACTERISTICS ____________________ [13]

Positive	(1)	Negative	(2)
Flat Bulb Area	(3)		
Indeterminate	(9)	Not Applicable	(10)

Table 35 Detailed lithic analysis: extract catalogue, fields attributes and codes

BULB TYPE ________________ [14]

Diffuse	(1)	Pronounced	(2)
Punctiform	(3)	Planar	(4)
		Artificially Removed	(6)
Indeterminate	(9)	Not Applicable	(10)

BULB THICKNESS ________________ [15] ___mm

TERMINATION ________________ [16]

Bipolar	(1)	Feather	(2)
Obtuse	(3)	Step	(4)
Hinge	(5)	Overshot	(6)
Broken	(7)	Modified	(8)
Indeterminate	(9)	Not Applicable	(10)

FLAKE MORPHOLOGY ________________ [17]

Parallel	(1)	Divergent	(2)
Convergent	(3)	Displaced	(4)
Irregular	(5)	Modified	(6)
Indeterminate	(9)	Not Applicable	(10)

MORPHOLOGY OF THE DORSAL SCARS ________ [18]

Parallel	(1)	Angular	(2)
Rounded	(3)	Miscellaneous	(4)
Cortical	(5)		
Indeterminate	(9)		

PREDOMINANT ORIENTATION OF DORSAL SCARS_[19]

Same Direction	(1)	Opposed	(2)
Oblique	(3)	Lateral	(4)
Multiple	(5)	Cortical	(6)
Indeterminate	(9)		

LONGITUDINAL PROFILE ________________ [20]

Straight	(1)	Concave	(2)
Convex	(3)	Sinuous	(4)
Irregular	(5)		
Indeterminate	(9)		

NUMBER OF PREVIOUS REMOVALS ON DORSAL __[21] ___

POSITION OF RETOUCH ON DORSAL ________[22]

By polar coordinates 1 - 8

POSITION OF RETOUCH ON VENTRAL ________[23]

By polar coordinates 1 - 8

GENERAL MORPHOLOGY OF RETOUCH ________[24]

Scalar	(1)	Oblique-Parallel	(2)
Sub-Parallel	(3)	Straight-Parallel	(4)
Irregular	(5)	Fine	(6)
Combination	(7)		

INVASIVENESS OF RETOUCH ________ [25]

Surface (to centre)	(1)	Invasive (not quite centre)	(2)
Edge	(3)	Combination	(4)

AVERAGE MORPHOLOGY OF RETOUCHED EDGES __ [25a]

Convex	(1)	Concave	(2)
Notch	(3)	Straight	(4)
Sinuous	(5)	Irregular	(6)
Denticulate	(7)	Point	(8)

ANGLE OF RETOUCH ________ [26]

Abrupt	(1)	Acute	(2)
Irregular	(3)		

AVERAGE DEPTH OF RETOUCH SCARS ____ [27]

Deep	(1)	Shallow	(2)
Irregular	(3)		

AVERAGE TERMINATION OF RETOUCH SCARS __ [28]

Step	(1)	Scalar	(2)
Feather	(3)	Combination	(4)

MACROSCOPIC EDGE DAMAGE ON DORSAL ____ [29]

By polar coordinates 1 - 8

MACROSCOPIC EDGE DAMAGE ON VENTRAL ____ [30]

By polar coordinates 1 - 8

MACROSCOPIC GLOSS ON DORSAL EDGE ____ [31]

By polar coordinates 1 - 8

MACROSCOPIC GLOSS ON DORSAL SURFACE __ [32]

Randomly situated Y/N

MACROSCOPIC GLOSS ON DORSAL SURFACE __ [33]

By polar coordinates 1 - 8

MACROSCOPIC GLOSS ON VENTRAL EDGE ____ [34]

By polar coordinates 1 - 8

MACROSCOPIC GLOSS ON VENTRAL SURFACE __ [35]

Randomly situated Y/N

MACROSCOPIC GLOSS ON VENTRAL SURFACE __ [36]

By polar coordinates 1 - 8

HAMMERSTONES

PITTING PRESENT ________ [37]

Proximal End	(1)	Distal End	(2)
Left Side	(3)	Right Side	(4)
Ventral Surface	(5)	Dorsal Surface	(6)
Not Present	(7)		

FLAKING PRESENT ______________________ [38]

Proximal End	(1)	Distal End	(2)
Left Side	(3)	Right Side	(4)
Ventral Surface	(5)	Dorsal Surface	(6)
Not Present	(7)		

FACETING PRESENT ______________________ [39]

Proximal End	(1)	Distal End	(2)
Left Side	(3)	Right Side	(4)
Ventral Surface	(5)	Dorsal Surface	(6)
Not Present	(7)		

ROUNDED GROUND SURFACE PRESENT ________ [40]

Proximal End	(1)	Distal End	(2)
Left Side	(3)	Right Side	(4)
Ventral Surface	(5)	Dorsal Surface	(6)
Not Present	(7)		

GROOVES PRESENT ______________________ [41]

Proximal End	(1)	Distal End	(2)
Left Side	(3)	Right Side	(4)
Ventral Surface	(5)	Dorsal Surface	(6)
Not Present	(7)		

PERFORATIONS PRESENT _________________ [42]

Proximal End	(1)	Distal End	(2)
Left Side	(3)	Right Side	(4)
Ventral Surface	(5)	Dorsal Surface	(6)
Not Present	(7)		

POLISH PRESENT _______________________ [43]

Proximal End	(1)	Distal End	(2)
Left Side	(3)	Right Side	(4)
Ventral Surface	(5)	Dorsal Surface	(6)
Not Present	(7)		

INDENTATIONS PRESENT _________________ [44]

Proximal End	(1)	Distal End	(2)
Left Side	(3)	Right Side	(4)
Ventral Surface	(5)	Dorsal Surface	(6)
Not Present	(7)		

STRIATIONS PRESENT ___________________ [45]

Proximal End	(1)	Distal End	(2)
Left Side	(3)	Right Side	(4)
Ventral Surface	(5)	Dorsal Surface	(6)
Not Present	(7)		

SPREAD OF WEAR _______________________ [46]

One Area Localised	(1)	More than One Area Localised	(2)
Diffuse	(3)	Random	(4)
Mixed	(5)		

COBBLE SHAPE ______ [47]				
Spherical	(1)	Sub-Round	(2)	
Ovoid	(3)	Elongated Oval	(4)	
Rectangular	(5)	Irregular	(6)	
Flat Oval	(7)	Flat Round	(8)	
FLAKING ALTERATION BEFORE USE ______ [48]				
Proximal End	(1)	Distal End	(2)	
Left Side	(3)	Right Side	(4)	
Ventral Surface	(5)	Dorsal Surface	(6)	
Not Present	(7)			
GRINDING BEFORE USE ______ [49]				
Proximal End	(1)	Distal End	(2)	
Left Side	(3)	Right Side	(4)	
Ventral Surface	(5)	Dorsal Surface	(6)	
Not Present	(7)			
PECKING BEFORE USE ______ [50]				
Proximal End	(1)	Distal End	(2)	
Left Side	(3)	Right Side	(4)	
Ventral Surface	(5)	Dorsal Surface	(6)	
Not Present	(7)			
POLISHING BEFORE USE ______ [51]				
Proximal End	(1)	Distal End	(2)	
Left Side	(3)	Right Side	(4)	
Ventral Surface	(5)	Dorsal Surface	(6)	
Not Present	(7)			
NUMBER OF FACETS ______ [52]				___
RIDGES BETWEEN FACETS ______ [53]				Y/N
AVERAGE AREA OF FACETS ______ [54]				___
NUMBER OF GROOVES ______ [55]				___
SIZE OF GROOVE ______ [56]				
Length				___mm
Width				___mm
Depth				___mm
LOCATION OF PERFORATIONS ______ [57]				
Central	(1)	Offset	(2)	
Cannot Determine	(3)			
MEANS OF PERFORATION ______ [58]				
Pecking	(1)	Drilling	(2)	
Cannot Determine	(3)			
SHAPE OF PERFORATION ______ [59]				
Conical	(1)	Parallel	(2)	
Hour Glass	(3)	Irregular	(4)	

PERFORATION SIZE ______________________ [60]

Length	___mm
Width	___mm
Depth	___mm

LOCATION OF INDENTATIONS ______________ [61]

Central	(1)	Offset	(2)
Cannot Determine	(3)		

MEANS OF INDENTING ____________________ [62]

Pecking	(1)	Drilling	(2)
Cannot Determine	(3)		

PLAN VIEW OF INDENTATION ______________ [63]

Round	(1)	Long	(2)
Irregular	(3)		

INDENTATION SIZE ______________________ [64]

Length	___mm
Width	___mm
Depth	___mm

CORES

PLATFORM SHAPE ________________________ [65]

Punctiform	(1)	Round	(2)
Oval	(3)	Amorphous	(4)
Bipolar	(5)	Mixture	(6)

NUMBER OF FLAKE SCARS VISIBLE _________ [66] ___

GENERAL TYPE OF REMOVAL _______________ [67]

Blades	(1)	Flakes	(2)
Mixture	(3)		

PREDOMINANT TERMINATION _______________ [68]

Bipolar	(1)	Feather	(2)
Obtuse	(3)	Hinge	(4)
Stepped	(5)		
Indeterminate	(9)		

ABANDONMENT ___________________________ [69]

Natural Flaw	(1)	Knapping Error	(2)
Overhang	(3)	Nothing Obvious	(4)

AVERAGE PLATFORM SIZE _________________ [70] ___mm

AVERAGE PLATFORM ANGLE ________________ [71] ___

ALL PIECES

LENGTH ____________________ [72] ___mm

WIDTH ____________________ [73] ___mm

THICKNESS AWAY FROM BULB __________ [74] ___mm

PROXIMAL EDGE ANGLE, if appropriate ____ [75] ___

DISTAL EDGE ANGLE, if appropriate _____ [76] ___

RIGHT EDGE ANGLE, if appropriate ______ [77] ___

LEFT EDGE ANGLE, if appropriate _______ [78] ___

KINLOCH, RHUM: POTTERY CATALOGUE, TABLE 36

MB KEMP

FABRIC 1A: Coarse pottery, orange buff outer surface, darker buff inner surface, crumbly sand tempered black core.

Nos. 1-23 Featureless sherds.
21 AG271, 2 AG128

No. 24 Simple carination on body sherd with a lug below it, the tip of which is lost.
Sherd size 70mmx65mm.
AG271

No. 25 Possible fragment of a flat based vessel.
Sherd size 60mmx35mm.
AG271

No. 26 Curved sherd, possibly a plain shoulder.
AG271

No. 27 Curved sherd, possibly a plain shoulder.
AG271

No. 28* Very abraded small sherd with a possible simple cordon, or maybe a shoulder fragment.
AG271/AG128

No. 29 Curved sherd, possibly a plain shoulder.
AG128

FABRIC 1B: Coarse pottery, dark orange buff outer surface well prepared orange buff inner surface, core like that of fabric 1A. Worn.

Nos. 30-88 Featureless sherds.

11 AG126, 11 AG127, 1 AG128,26 AG271,7 BC02,1 BC07, 2 BC23.

No. 89 Single fine incision on outer surface of sherd. Not decoration.

AG271.

No. 90 Possible incised decoration: one horizontal line (2mm wide) and two oblique ones below it.

Sherd size 40mmx35mm.

AG271.

No. 91 Plain shoulder.

AG 271.

No. 92 A waster or possibly a bit off a trumpet lug.

AG271.

No. 93 Sherd showing prepared edge where lug would have been stuck. The break occurred where the coils joined.

Sherd size 100mmx50mm.

AG 127/271.

No. 94 Sherd broken where edge has been flattened and prepared to join another coil.

AG271.

No. 95 Plain shoulder.

AG127.

FABRIC 1C: Coarse pottery, with good surface preparation, orange buff inner and outer surfaces, sandy grey to black core.

Nos. 96-128 Featureless sherds.

2 AD270, 1 AG126, 1 AG128, 16 AG271, 1 BC02, 1 BC03, 1 BC12, 1 BC21, 2 BC23.

No. 129 Fragment of flat base.

Sherd size 35mmx45mmx12mm thick.

AG271.

No. 130 Plain shoulder.

AG128.

No. 131 Externally expanded bevelled rim probably from same pot as no. 132.

Sherd size 21mmx36mm15mm thick.

BC02.

No. 132 Fragment from an apparently similar rim to no.131.

BC02.

FABRIC 1D: Coarse pottery, orange buff outer surface, grey abraded inner surface, grey to black fine core. Worn.

Nos. 133-184 Featureless sherds.

2 AG127, 25 AG128, 24 AG271, 1 035/895.

No. 185 Plain rounded rim.

Sherd size 25mmx30mmx10mm thick.

AG271.

No. 186 Plain fine carination which may have been just below the rim (now lost).

AG124

No. 187 Sherd showing coil join and an incision on the inner surface.
AG271.

FABRIC 2: Hard pottery, well built with good surface treatment (almost like a slip). Orange buff on inner and outer surfaces, fine grey core.

Nos. 188-208 Featureless sherds.
1 AG127, 18 AG271, 1 BB03, 1 BC02.

No. 209 Plain thinned rim.
Sherd size 40mmx30mmx5mm thick.
AG271.

No. 210 Plain thinned rim.
Sherd size 20mmx15mmx6mm thick.
AG128.

No. 211 Plain thinned rim.
Sherd size 30mmx20mmx6mm thick.
AG271.

No. 212 Sherd showing edge prepared to join coil.
AG271.

No. 213 Plain rounded rim with a simple narrow cordon below it.
Sherd size 30mmx45mmx8mm thick.
AG271.

FABRIC 3: Very fine pottery, brown/black burnished outer surface, fine black core, 5mm thick.

No. 214 Featureless body sherd.

AG128.

FABRIC 4A: Coarse pottery, orange buff surfaces, grey thick core with large inclusions. Very worn.

Nos. 215-241 Featureless sherds.

12 AG128, 14 AG271, 1 BA51.

No. 242 Body sherd with broken lug.

Sherd size 55mmx45mmx13mm thick.

AG271.

FABRIC 4B: Thick vesicular pottery, 'corky ware', orange buff surfaces, brown core. Worn.

Nos. 243-248 Featureless sherds.

6 AG271.

No. 249 Possible sherd of plain rounded rim.

AG271.

FABRIC 4C: Refired pottery, orange to red buff surfaces with grey cores like those in fabric 4A. Very worn.

Nos. 250-253 Featureless sherds.

1 AG126, 1 AG127, 2 AG271.

FABRIC 5A: Coarse pottery, orange buff surfaces with fine grey core. Very abraded and worn.

Nos. 254-276 Featureless sherds.

2 AG127, 17 AG271, 2 AJ275, 1 BA20, 1 135/853.

No. 277 Sherd with simple cordon, 8mm wide.

AG271

No. 278 Sherd with incision on inner surface.

AG271.

FABRIC 5B: Fine pottery, brown buff surfaces, fine grey to black core. Very abraded.

Nos. 279-298 Featureless sherds.

17 AG271, 1 AM314, 1 BA20, 1 008/899.

No. 299 Sherd with impressed line on rough outer surface.

AG271.

NB * signifies a sherd made up of two conjoining pieces from different contexts.

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KINLOCH, RHUM: COARSE STONE CATALOGUE, TABLE 37

Ann CLARKE

KEY: CONTEXT AND FINDS REGISTRATION NUMBER; LENGTH x WIDTH x THICKNESS; MATERIAL TYPE (IF OF A SEDIMENTARY ROCK THEN GRAIN SIZE ONLY IS GIVEN); CONTEXTUAL INTERPRETATION.

For definitions see text (Chapter 9.1).

PLAIN HAMMERSTONES

1AD028HX: 120 x 49 x 28; MEDIUM GRAINED; AD5.

1AD028HY: 80 x 62 x 50; COARSE GRAINED; AD5.

1AD028HZ: 127 x 102 x 80; COARSE GRAINED; AD5.

1AD028IA: 160 x 47 x 24; COARSE GRAINED; AD5.

1AD161FD: 130 x 88 x 63; COARSE GRAINED; AD5.

1AB128UE: 66 x 50 x 43; COARSE GRAINED; MAIN DUMP/ BANK ABUTTING.

2AM311AW: 71 x 67 x 42; COARSE GRAINED; PLOUGHSOIL.

1BA004HM: 85 x 43 x 29; COARSE GRAINED; BROKEN; PLOUGHSOIL.

1BA004HN: 106 x 70 x 28; MEDIUM GRAINED; PLOUGHSOIL.

1BA004HO: 98 x 67 x 58; COARSE GRAINED; PLOUGHSOIL.

1BA004IT: 129 x 49 x 35; COARSE GRAINED; PLOUGHSOIL.

1BA004IU: 63 x 50 x 23; FINE GRAINED; BROKEN; PLOUGHSOIL.

1BA008VO: 77 x 58 x 30; COARSE GRAINED; PLOUGHSOIL CLEANING LAYER.

BA072AL: 96 x 60 x 30; COARSE GRAINED; BANK.

1BA085AJ: 97 x 35 x 25; MEDIUM GRAINED; BROKEN; BURIED SOIL.

1BA094BN: 43 x 53 x 29; MEDIUM GRAINED; BROKEN; BA8.

BEVELLED PEBBLES

1AD028HR: 120 x 50 x 21; MEDIUM GRAINED; AD5.

1AD028HS: 114 x 34 x 14; TUFF; AD5.

1AD028HT: 108 x 45 x 21; MICROGABBRO; AD5.

1AD028HU: 152 x 54 x 20; MICROGABBRO; AD5.

1AD028HV: 118 x 51 x 26; COARSE GRAINED; AD5.

1AD028HW: 107 x 56 x 24; MEDIUM GRAINED; AD5.

1AD270FB: 99 x 38 x 22; FINE GRAINED; PLOUGHSOIL.

1BA004HH: 120 x 44 x 24; MEDIUM GRAINED; PLOUGHSOIL.

1BA004HI: 160 x 61 x 33; FINE GRAINED; PLOUGHSOIL.

1BA004HJ: 108 x 40 x 24; MEDIUM GRAINED; PLOUGHSOIL.

1BA008VC: 115 x 38 x 22; MEDIUM GRAINED; PLOUGHSOIL CLEANING LAYER.

1BA008VD: 103 x 38 x 19; MEDIUM GRAINED; PLOUGHSOIL CLEANING LAYER.

1BA008VE: 109 x 38 x 23; MEDIUM GRAINED; PLOUGHSOIL CLEANING LAYER.

1BA008VF: 95 x 48 x 23; MEDIUM GRAINED; PLOUGHSOIL CLEANING LAYER.

1BA008VG: 108 x 44 x 20; MEDIUM GRAINED; PLOUGHSOIL CLEANING LAYER.

1BA008VH: 90 x 40 x 27; MEDIUM GRAINED; PLOUGHSOIL CLEANING LAYER.

1BA023DY: 102 x 32 x 18; FINE GRAINED; BA1.

1PS00308: 91 x 22 x 15; FINE GRAINED; PLOUGHSOIL.

FACETED HAMMERSTONES

1AD270FC: 48 x 36 x 29; MEDIUM GRAINED; PLOUGHSOIL.

1AG271WQ: 50 x 37 x 28; UNIDENTIFIED; PLOUGHSOIL.

1BA008VI: 65 x 56 x 27; MEDIUM GRAINED; PLOUGHSOIL CLEANING LAYER.

1BA008VU: 56 x 36 x 24; MEDIUM GRAINED; BROKEN; PLOUGHSOIL CLEANING LAYER.

1BA008VV: 103 x 51 x 24; COARSE GRAINED; PLOUGHSOIL CLEANING LAYER.

1BA021EU: 89 x 59 x 34; COARSE GRAINED; BA3.

1BA070AS: 54 x 38 x 28; COARSE GRAINED; BANK.

1BA070AT: 75 x 36 x 29; MEDIUM GRAINED; BANK.

1BA089AT: 78 x 50 x 22; MEDIUM GRAINED; BA8.

ROUNDED HAMMERSTONES

1AD008ID: 63 x 49 x 38; COARSE GRAINED; PLOUGHSOIL CLEANING LAYER.

1BA004HK: 86 x 48 x 36; COARSE GRAINED; PLOUGHSOIL.

1BA070AR: 50 x 44 x 36; COARSE GRAINED; BANK.

1FW001ZW: 66 x 48 x 36; MEDIUM GRAINED; PLOUGHSOIL.

1PS0030T: 63 x 56 x 47; COARSE GRAINED; PLOUGHSOIL.

1PS0030U: 79 x 63 x 35; MEDIUM GRAINED; PLOUGHSOIL.

1US001AA: 67 x 59 x 43; QUARTZ; STRAY FIND.

ANVILS

1AG128UD: 108 x 67 x 36; COARSE GRAINED; BROKEN; MAIN DUMP/BANK ABUTTING.

1BA004HL: 125 x 81 x 36; FINE GRAINED; FLAT SIDED; PLOUGHSOIL.

1BA004IR: 123 x 61 x 29; COARSE GRAINED; PLOUGHSOIL.

1BA004IS: 120 x 56 x 33; TUFF; PLOUGHSOIL.

1BA030EE: 68 x 58 x 26; MEDIUM GRAINED; BROKEN; BA4-9.

1BA047CE: 112 x 67 x 19; MEDIUM GRAINED; BROKEN; FLAT SIDED; BA2.

1BA088AW: 86 x 70 x 37; MICROGABBRO; BROKEN; BA6.

FLAT SIDED COBBLES

1BA004HL: 125 x 81 x 36; FINE GRAINED; ANVIL; PLOUGHSOIL.

1BA008VJ: 120 x 60 x 33; MEDIUM GRAINED; PLOUGHSOIL CLEANING LAYER.

1BA047CE: 112 x 67 x 19; MEDIUM GRAINED; BROKEN; ANVIL; BA2.

1US001AB: 136 x 75 x 34; COARSE GRAINED; STRAY FIND.

GROUND EDGE FLAKE

1AD029GC: 80 x 24 x 10; EDGE ANGLE 55 ;MICROGABBRO; AD2.

? POLISHER

1BA004IV: 68 x 35 x 10; FINE GRAINED; PLOUGHSOIL.

LOCATION OF MANUPORTS

1AD008 x 1 PLOUGHSOIL CLEANING LAYER

1AD028 x 4 AD5

1AD159 x 1 AD6

1AG121 x 1 MESO PIT

1AG128 x 1 MAIN DUMP/ BANK ABUTTING

1AG271 x 1 PLOUGHSOIL

1AH273 x 1 PLOUGHSOIL

1BA004 x 7 PLOUGHSOIL

1BA008 x 6 PLOUGHSOIL CLEANING LAYER

1BA030 x 1 BA4-9

1BA072 x 1 BANK

1BA089 x 1 BA8

1BA090 x 1 BA4/5

1BB003 x 1 PEAT

1BC001 x 1 PLOUGHSOIL

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OTHER LITHIC SCATTERS ON RHUM: CATALOGUE

Ann CLARKE

This catalogue covers only those sites found during fieldwalking in 1984. For locations of previously known sites see RCAMS 1983 nos.10, 12, 13, 14.

(SEE ILLUSTRATION 101)

PORT NA CARANEAN NM425 988, 264 ARTEFACTS

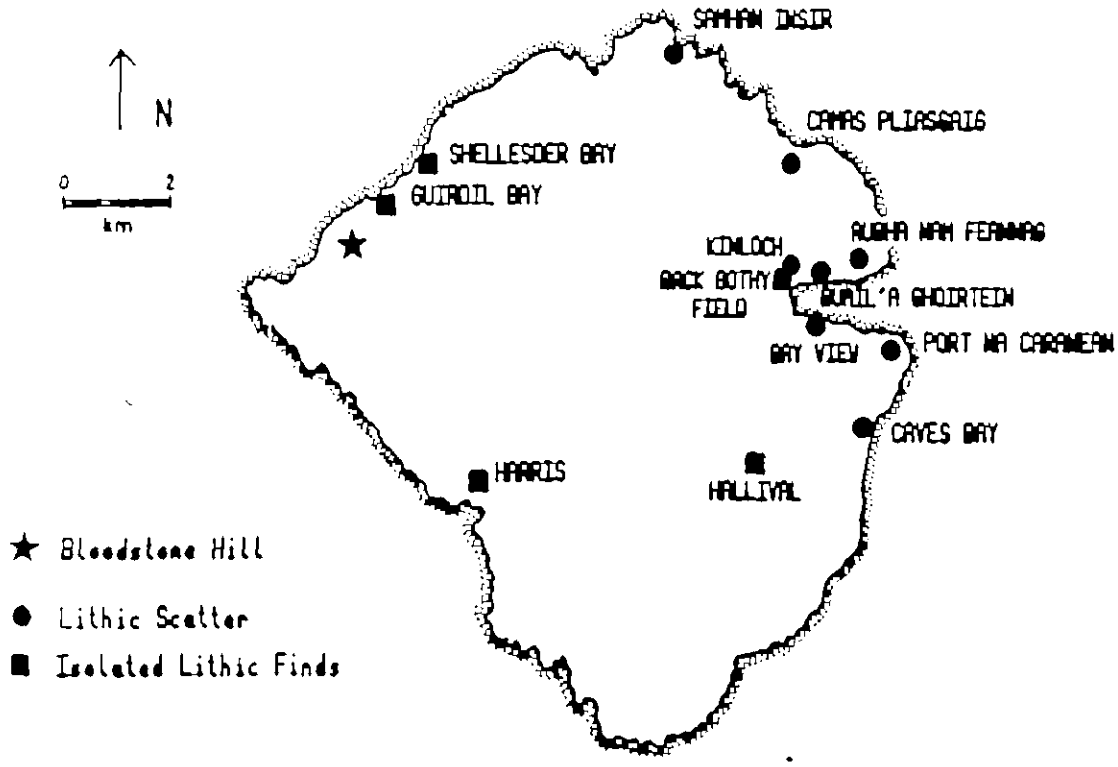
Site lies 25-50m LD on flat area beyond beach. The main collection of artefacts was found in a forestry drainage ditch, c20m long, lying parallel to the old settlement. A few pieces were found in an area of forestry ploughing to the south. Most of the ploughing was too shallow to expose the OGS through the peat.

BAY VIEW NM402 994, 25 ARTEFACTS

The site lies <8m LD. It was revealed by a cutting in the gravel for an electricity cable in 1983. Most of the lithics were found in gravel at the top of the cutting or above it where tree roots had been disturbed. Three pieces were found in the wood across the road in disturbed tree roots.

CAVES BAY NM421 973, 43 ARTEFACTS

The site first came to our attention with a flake found



ILL 101: **Rhum. Location of lithic scatters**

during forestry ploughing by the NCC. There were three main areas of ploughing: to the north the ploughing was on steep ground and nothing was found; to the south the ploughing was on flatter land but it was too shallow to break the peat cover. Flakes were found in the central ploughed area just seawards of the 10m break of slope. Most of these lithics were found in the NE quadrant of this area beside break of slope.

HARRIS NM337 962, 1 ARTEFACT

On a bluff on the south bank of the river.

HARRIS NM338 961, 3 ARTEFACTS

In a drainage ditch running parallel to road and forestry plantation. Two pieces of pottery were also found here.

SHELLESDER CAVE NG327 020, 3 ARTEFACTS

The flakes were found on the surface of a midden at the entrance to the cave. The cave sits at the back of the present day beach.

GUIRDIL BAY NG320 010, 20 ARTEFACTS

This, and Glen Guirdil were fieldwalked on a very wet day so much may have been missed. There were no fixings for the three find spots although two were located to the east of the river and one to the west. They were generally areas where the peat had been eroded by running water to reveal the OGS.

BACK BOTHY FIELD NM402 998, 6 ARTEFACTS

The field immediately to the west of Farm Fields where the site lies. A small number of artefacts were found during potato planting.

BUAIL NA GHORTEIN NM404 998, 632 ARTEFACTS

Four lithic scatters were found along a track to the east of the excavations (BNG1-4). BNG1 was located at the eastern end of the track and included over half of the pieces found. BNG2 at stream crossing of track. BNG3 c.50m west of the stream. BNG4 an area of c.100m square around SE corner of excavations. All the sites lie on an area of gently shelving land similar to that of the excavation. BNG1 at 11.97m LD.

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THE AVAILABILITY OF CHALCEDONIC SILICA, INCLUDING BLOODSTONE, ON RHUM AND SOME POSSIBLE METHODS OF DISTINGUISHING IT FROM FLINT IN EXCAVATED SAMPLES.

DR G DURANT

Introduction

Rhum has long been famed as a source of bloodstone and agate for use by lapidarists and jewellers. The demand for bloodstone was sufficiently high for a small quarry to be opened at the northern end of Bloodstone Hill to exploit a particularly good 'seam' of it. It is because of the popularity of such varieties of chalcedonic silica that any assessment of the current availability of these materials must be regarded as being considerably less than in former times although the isolation of Rhum has served to protect naturally occurring stocks. Nevertheless a good deal of bloodstone, agate and other varieties of chalcedonic silica can still be found on Rhum, testifying to a considerably much greater abundance in the past.

The various types of chalcedonic or cryptocrystalline silica occur in association with the lavas of Tertiary age which form Fionchra and Bloodstone Hill in western Rhum. The silica minerals occupy amygdales, irregular cavities and fissures within the lavas where they were deposited from hydrothermal solutions which percolated through the rocks at some stage after consolidation of the lavas. It is not currently known why several different varieties of silica are present and there seems to be no obvious control on which of the varieties occurs where within the lava pile.

The principal sources of bloodstone and agate at present are in the screes beneath Fionchra and Bloodstone Hill and also on the beaches to the west of Bloodstone Hill and in Guirdil Bay. It is still possible to collect both bloodstone and agate at outcrop but since the principal outcrop of the lavas is in the steep, largely inaccessible western cliff of Bloodstone Hill it is unlikely that this ever provided much material other than by natural erosion.

In addition to the main varieties of chalcedonic silica present, bloodstone, jasper, plasma and chalcedony, a vein of opaline silica is still present on the north side of Bloodstone Hill. However opal is unlikely to be significant for working and it is only of interest here because of its rarity.

Samples of chalcedony, bloodstone, plasma and jasper were found amongst the excavated material at Kinloch. There seems to be no natural way that significant amounts of bloodstone, agate or chalcedony could have moved naturally from the areas of outcrop in the west of Rhum to Kinloch. The direction of ice-movement appears to have been from east to west, and although longshore drift could disperse pebbles northwards from the beach below Bloodstone Hill it is unlikely that such movement would carry pebbles right around the north of the island. It is envisaged that the material now in Kinloch was deliberately collected and carried across the island.

Flint or Chalcedony?

Samples of the various forms of chalcedonic silica were collected from Rhum for subsequent analysis in an attempt to discover the best method of distinguishing such material from flint, within excavated assemblages (table 38).

Hand specimen examination

Several features enable flint and chalcedonic silica to be distinguished by simple visual inspection. The chalcedony which occurs on Rhum shows a great variety of colours many of which can be directly distinguished from flint. For example no dark green, light green, pink or red varieties of flint occur within the current area of interest. Some of the grey chalcedony shows agate banding which readily distinguishes it from flint. Most importantly much of the chalcedonic silica from Rhum contains small (1-2mm), rounded spherulites of ferroan calcite. This is seen as small round, brown spots on the surface of the sample. Such spots are absent from flint samples. If these spots are not seen on the surface of the sample it may be worth breaking it to see if any are revealed. The opal found on Rhum is readily distinguished due to its opalescence.

A simple examination of any excavated material should therefore distinguish chalcedonic silica from flint and could indicate a provenance from Rhum. However, there will usually be samples of chalcedony and other material present which cannot be readily distinguished from flint in this way and other techniques may be required. The white variety of chalcedonic silica is particularly difficult to distinguish from flint in the absence of the ferroan calcite spherulites.

Sample Number	
1)	Green chalcedonic silica, Fionchra, Rhum
2)	Pale green chalcedonic silica, Guirdil Bay, Rhum
3)	White flint-like chalcedony, Guirdil Bay, Rhum
4)	Pink and grey chalcedony, beach below Bloodstone Hill, Rhum
5)	Butterscotch chalcedony, beach below Bloodstone Hill, Rhum
6)	Dark green chalcedony, beach below Bloodstone Hill, Rhum
7)	Grey chalcedony, beach below Bloodstone Hill, Rhum
8)	Opaline silica, from a vein within lavas, Bloodstone Hill, Rhum
Flint	Cretaceous flint in chalk, Antrim, Northern Ireland

Table 38 Samples used for the analysis of the differentiation between flint and chalcedony

Thin section examination

(The photographs of the thin sections are kept with the excavation archive at the Royal Commission for Ancient and Historical Monuments, Edinburgh.)

Examination of thin sections can in some cases provide a rapid and definitive means of distinguishing between flint and chalcedonic silica. However since flint and chalcedony are both varieties of cryptocrystalline silica they do look remarkably similar (plates 3b, 4b, 6b, 7b).

Flint often contains traces of organic remains which, if recognised, readily distinguishes flint of sedimentary origin from the chalcedonic silica of Rhum formed by hydrothermal activity (plates 8 & 9).

The presence of ferroan calcite spherulites in some of the chalcedonic silica from Rhum distinguishes it from flint (plates 1, 2 & 3a). A thin section may reveal these when they are not obvious in the hand specimen. Pyrite was seen to be present in one of the Rhum samples and was not observed in flint (plate 3b). Some forms of chalcedony show agate-banding which is clearly revealed in thin sections even if it is not obvious in hand specimen (plate 5). The recognition of such a texture in a sample would clearly distinguish it from flint.

In thin section the opal from Rhum is distinguished by its tendency to fracture (plate 6a) and by the infilling of such fractures.

The sample of flint examined showed a greater amount of crystalline quartz of coarser grain size infilling cavities and other irregularities, than was observed in any of the chalcedonic silicas (plate 7a). However such more-coarsely crystalline silica was also present in one of the thin sections of chalcedony examined and since chalcedony is frequently associated with quartz on Rhum this feature is considered to have only limited importance as a means of discrimination.

Chemistry

Eight of the collected samples were analysed for major and trace elements and the results compared with an analysed flint from Antrim (table 39).

The hardness of the samples led to minor preparation problems and a chromium anomaly was introduced during the crushing process which uses chrome-steel jaws for breaking the sample. The results listed for chromium are therefore all higher than the actual results but not by a fixed factor. The high totals for the analyses are the result of the high levels of silica which fall outside the normal range of calibration for rock analysis.

In terms of the major elements the principal constituent is silica and all of the samples show relatively similar values with the exception of the heliotrope sample (no. 6) which has a lower amount. This sample is exceptional in other ways insofar as it shows much higher Al_2O_3, CaO and K_2O than the other chalcedonic silicas. Further analysis of this type of material would be required to determine whether all of the dark green chalcedony (heliotrope) shows these chemical characteristics. The major elements which appear to be of most value as discriminants between flint and the Rhum chalcedonic silicas are Al_2O_3, TiO_2, FeO, Fe_2O_3 and K_2O which are lower in the analysed flint. CaO and P_2O_5 values are higher in the flint than in the chalcedonic silicas (except for no. 6).

Of the analysed trace elements barium, gallium and rubidium are higher in the flint than in the chalcedonic silicas. The content of uranium is also slightly higher in the flint and this may open up the possibility of using the low levels of radioactivity as a discriminant function. The other analysed elements in the flint are present in amounts within the total range of those of the other samples and hence these are of limited value for discriminatory functions.

The use of selected elements to distinguish between flint and chalcedony is illustrated (Ill.102a-c). Plots of CaO and Al_2O_3, $FeO+Fe_2O_3$ v Na_2O+K_2O and P_2O_5 v TiO_2 show that the flint sample is chemically distinct from the analysed chalcedonic silica. However further analyses of chalcedony from Rhum and particularly of flint from various other localities must be made to fully test this idea.

<u>Summary</u>

There seems to be potential for discriminating between flint and chalcedony from Rhum on the basis of three main criteria:

1. Rounded spherulites of a ferroan calcite are present in many of the samples of chalcedony from Rhum. These spherulites are absent

in flints.

2. Examination of thin-sections in plane polarised light often reveals some trace of fossils in flint, reflecting its sedimentary origin. Such fossils are absent in Rhum chalcedony.

3. Chemical analysis of flint and chalcedony seems to offer potential for discrimination since flint tends to have lower amounts of iron, aluminium, titanium and potassium and higher amounts of calcium and phosphorus.

Recommendations for future work

There is clearly a need for a technique or series of techniques which can distinguish flint from the various types of chalcedony from Rhum. Such methods will need to be accurate and cost effective, particularly in the current financial climate.

Simple examination of the excavated samples could successfully discriminate between flint and chalcedony for a good deal of a particular sample. This is a non-destructive technique which has no costs over and above the time of the person undertaking the examination.

A follow up to this would be a thin-section study to see whether there are any fossils or trace fossils present, indicative of flint. However thin-section preparation takes time and can become expensive if these are obtained commercially. The technique is destructive insofar as samples have to be cut up in thin-section production. If biological traces are present then this is a clear indication of a sedimentary origin and hence of flint.

A technique which may be useful for detecting fossils or former-fossils if they have been replaced by silica is cathodoluminescence. In this technique a polished slice of a rock/artefact can be examined. Areas of silica replacement may luminesce differently to the remainder and reveal features not visible optically. A smaller sample size would be required than for conventional thin-sectioning. Preparation time is less than for a thin-section.

Chemical analysis of excavated samples is a destructive technique but one which does offer considerable potential as a means of discriminating between samples of flint and chalcedony. The technique is however destructive and expensive if costed on a commercial basis. In addition there is a minimum sample size which means that it may not be possible to analyse small samples. With the currently available database there is also some uncertainty about the interpretation of the results. Further analysis of flint from various localities would have to be undertaken as a prerequisite to any future study.

Stable isotopic analysis offers considerable potential as a means of discriminating between flint and chalcedonic silica since these form in markedly different ways. Oxygen isotope analysis may offer a failsafe way of distinguishing between the two materials. However it is likely that there is a lack of data currently available and a database would need to be built up. The technique is destructive but only needs relatively small amounts of sample for analysis. The techniques involved are currently available at the Scottish Universities Research and Reactor Centre, East Kilbride.

Scanning electron microscopy offers potential for discriminating flint from chalcedony of various forms since the structure of the two varieties of cryptocrystalline silica is different. Work is currently in hand to evaluate the likely effectiveness of this technique.

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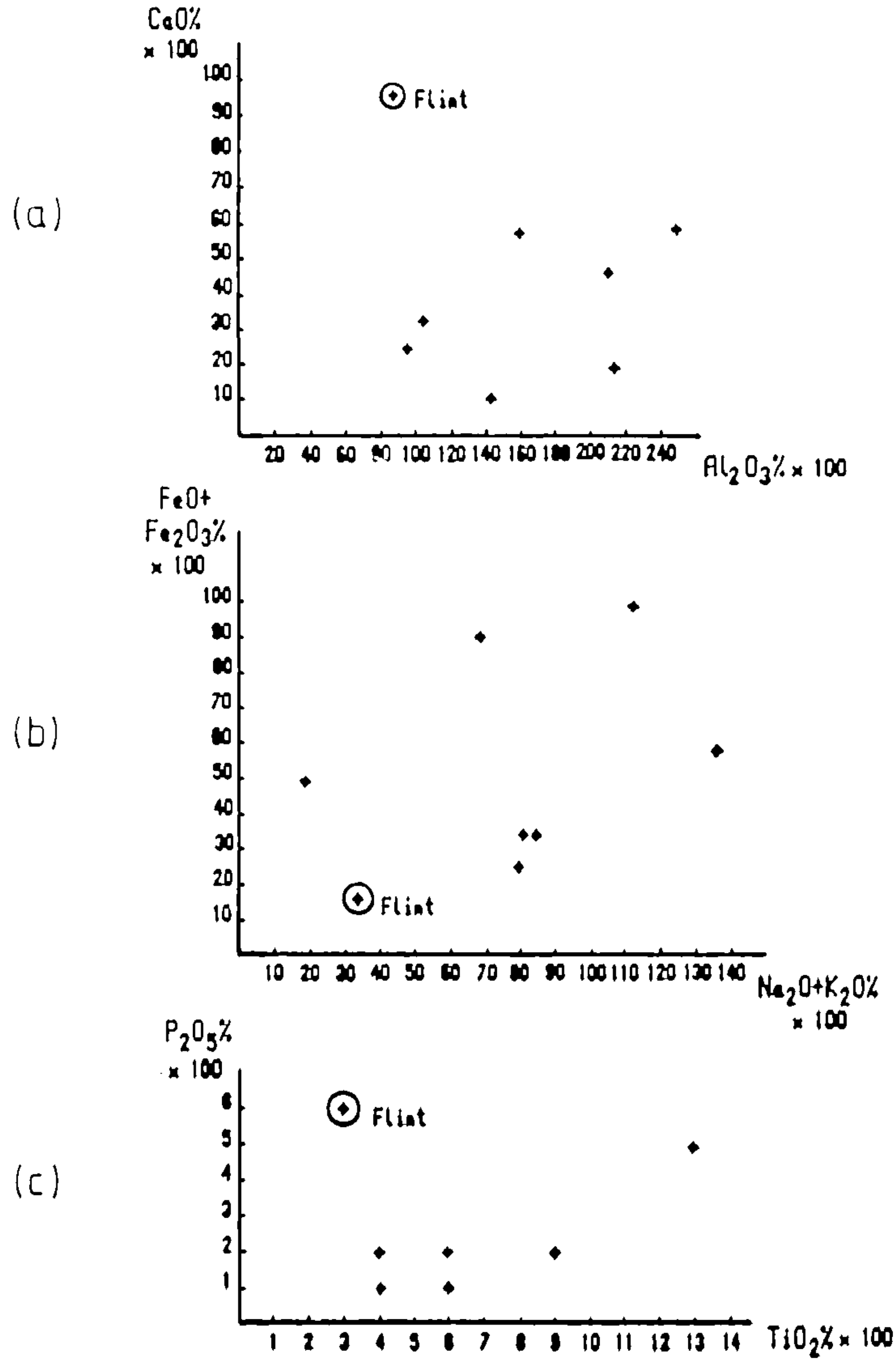


ILL 102 : Use of selected elements to distinguish between flint and chalcedony. (a) Calcium and aluminium. (b) Iron and potassium. (c) Phosphate and titanium.

1 : F6

Chemical analyses of silica minerals from Rhum and flint from Antrim

	1	2	3	4	5	6	7	8	Flint
SiO_2	93.80	96.20	97.52	95.77	98.77	79.69	98.57	95.75	87.16
TiO_2	0.06	0.04	0.04	0.06	0.06	0.09	0.04	0.13	0.03
Al_2O_3	2.11	2.13	1.43	1.61	0.95	6.85	1.06	2.50	0.88
Fe_2O_3	0.54	0.38	0.00	0.31	0.29	0.73	0.10	0.20	0.02
FeO	0.45	0.20	0.25	0.60	0.20	0.38	0.24	0.14	0.14
MnO	0.00	0.01	0.00	0.02	0.01	0.05	0.02	0.01	0.00
MgO	0.41	0.37	0.32	0.48	0.32	0.49	0.36	0.34	0.34
CaO	0.46	0.18	0.10	0.57	0.25	3.35	0.33	0.58	0.96
Na_2O	0.43	0.51	0.50	0.38	0.06	0.10	0.57	0.55	0.22
K_2O	0.70	0.86	0.30	0.30	0.12	5.37	0.28	0.26	0.12
P_2O_5	0.01	0.02	0.01	0.02	0.02	0.02	0.01	0.05	0.06
H_2O^+	1.58	0.60	0.79	0.85	0.66	0.49	0.70	1.12	0.51
CO_2	1.15	0.10	0.26	0.70	0.16	2.40	0.30	0.02	0.75
TOTAL	101.70	101.61	101.52	101.67	101.87	100.01	102.58	101.65	101.19
Ba	11	29	25	42	16	67	12	207	bdl
Ce	3	2	bdl	2	3	7	bdl	9	4
Cr	143	108	128	103	148	89	59	28	127
Cu	29	31	8	12	55	43	18	bdl	18
Ga	3	3	2	2	3	7	2	2	1
La	7	bdl	1	bdl	6	3	0	3	3
Pb	1	2	bdl	1	2	19	3	2	bdl
Rb	13	17	8	10	5	77	7	12	4
Sr	22	10	10	19	12	24	8	154	19
U	2	1	2	0	2	2	0	2	3
Y	3	4	2	3	5	4	1	4	[illegible]
Zn	19	27	8	10	48	32	16	7	18
Zr	33	18	10	16	14	28	11	24	11

bdl = below detection limit

Analysts C. Farrow, D. MacIntyre, Dept. of Geology, University of Glasgow.
Major and trace elements determined by X.R.F. analysis, FeO by titration.

Table 39 Chemical analysis of silica minerals from Rhum and flint from Antrim

RAW MATERIAL PROVENANCE SURVEY: PRELIMINARY REPORT

DR D GRIFFITHS

Having examined the lithic material excavated at Farm Fields, Kinloch, Rhum in the 1984 season, the following locations were examined to determine whether they might provide a source of raw material for the Farm Fields assemblage:

Kinlochewe (Glen Docherty and Abhainn Bruachaig)

Shieldaig beach

Stontian, Loch Sunart

Gribun, Mull

Carsaig, Mull

Torosay Castle, Mull

Isle of Kerrara

Port Appin

Guirdil beach and Bloodstone Hill (Isle of Rhum)

The majority of these locations were chosen because of reports in the geological literature of bloodstone having been found at them. While the raw materials used in the Farm Fields assemblage are not (for the most part at least) bloodstone in the strict geological sense of the word, they are the sort of material that one might expect to find in geological association with bloodstone. Thus the examination of bloodstone sources as a starting point in looking for raw material sources is well justified.

KINLOCHEWE. Glen Docherty NH 064597

Examined stream bed on NE side of road. Mostly mica schist (the geological descriptions in this report must be regarded as provisional). Some quartz veins. No microcrystalline silica found.

KINLOCHEWE. Abhainn Bruachaig valley, ENE of Kinlochewe

Followed path from road to south side of river, examining path stones and gravel. Traversed up from about NH 045623 up to the screes below the first major crag of the valley at the top of the stream (NH 056622). The road and river gravel contain much ?granite with bright red and green minerals and also a metamorphosed red and green rock. The bulk of the river gravels is sedimentary or lightly metamorphosed fine grained rock. There is also some white quartzite. No microcrystalline silica rock was found and none of the rocks exhibited conchoidal fracture. The outcrops of rock passed during the upward traverse were examined without finding anything of note. The main outcrop and the scree below were of a ?slightly metamorphosed sedimentary rock showing ?mica flakes parallel to the bedding and having a few narrow veins of quartz. No microcrystalline silica found.

Descended from the crag to the main river via the stream course examining the bed along the way. This yielded mostly the same rock as the crag, though with some quartz and red and green rocks, especially near the main river. Followed the main river NE up the valley on the SE bank, and crossed at the weir/waterfall at NH 058628. The rock in the track on the north bank of the river was similar to that already mentioned. In some parts white quartzite predominated, but this was too sugary upon fracture to be useful for tools.

The valley provided no microcrystalline silica rock. It is possible that the dark green and red rock, which often looks at first glance as though it might be bloodstone, or at least heliotrope, may have been mistaken for bloodstone by laymen. As for all tho locations examined, our failure to find bloodstone or microcrystallline silica rock does not discredit previous reports of its discovery nor prove that there is none there. The fact that we could search for hours without finding a single sample does suggest that the locations are rather implausible as sources for the large amount of raw material necessary to produce the Farm Fields assemblage.

SHIELDAIG

The beach opposite the island was examined in view of the proximity of the Shieldaig and Redpoint sites. No microcrystalline silica found. Mostly a red sandstone. The quartzite fou' was too sugary for tools.

STRONTIA' .och Sunart

The river mouth gravels at NM 814614 were examined and one lump of green ?chert was found. Up the valley amongst the spoilheaps around the mineshafts and quarries NM 833659 better quality green ?chert was found. This material appears to occur in ?silicified bands in the common green local rock.

GRIBUN, Mull

At the coast NM 444333 are outcrops of red conglomerate sandwiched between more homogenous rocks. The fragments in the conglomerate (which sometimes tended to breccia) were predominantly red-brown ?quartzite or ?granite. Most of the rock around Gribun is ?metamorphosed granite with a few veins of quartz. Examined outcrops, veins, boulders and beach pebbles from approximately NM 444333 to NM435327. Beach pebbles provided ?silicified chalk, ?lightly silicified mudstone, ?silicified green material similar to that found above Strontian but no material similar to that used at Farm Fields, or indeed anything very knappable.

CARSAIG, Mull

Examined the beach pebbles, scree and outcrops from the pier NM 534213 along the coast to Rubh'a'Chromain point NM 523303. This yielded no material similar to that used at Farm Fields. The best flaking stone was ?pitchstone, a black glassy rock with some pale veins and inclusions. This was fairly common, especially SW of the bay. There was also a fine grained ?basalt which might serve for flaking in the absence of the ?pitchstone. Some rounded flint pebbles were present in a grey matrix in boulders on the beach, but these were quite rare.

TOROSAY CASTLE, Mull (1 mile SSE of Craignure)

Stopped at a small quarry on the west side of the A849 just south of the castle entrance NM 726352. Nothing better for knapping than some reasonably fine-grained quartz pebbles.

PORT APPIN NM9054

Walked around the peninsula. Much fine-grained quartzite suitable for knapping, with veins of purer more coarsley crystalline quartz running through. A broken flake, possibly man-made, was found between the jetties to the seaward of the road at NM 903454.

ISLE OF KERRARA

Not able to get a boat across to the island, but Heddle says there are pebbles of coarse heliotrope in the Old Red Conglomerate of Kerrara. Accordingly examined outcrops of this rock on the mainland opposite the island NM 835284 and pebbles along the beach. No microcrystalline silica found.

GUIRDIL BEACH and BLOODSTONE HILL, Rhum

Ample material on the beach to replicate, in appearance at least, the majority of the Farm Fields lithics. Microcrystalline silica in all colours and good quality material for knapping. Larger chunks on the screes below the crags on Bloodstone Hill (largely overgrown) and large in situ pockets of pale and dark green material in the crags near the top of Bloodstone Hill overlooking Guirdil. The outcrops on top of Bloodstone Hill and Fionchra did not yield suitable material for replicating Farm Fields artefacts as far as I could tell, but my acquaintance with the material is limited and I did not search for very long as there was a rich source nearby.

A possible mismatch between the Farm Fields and the Bloodstone Hill material occurs in the case of the opaque off-white flint like material from Farm Fields. There were a number of pieces of this in the sample bag of Farm Fields material I took with me, but no similar material from Guirdil bay or Bloodstone Hill was found.

DR D GRIFFITHS, INSTITUTE OF ARCHAEOLOGY, GORDON SQUARE, LONDON.

RAW MATERIALS: SURFACE ALTERATION EXPERIMENTS, TABLE 40

B.FINLAYSON

Catalogue of experiments conducted to examine surface alteration of bloodstone. The EP numbers refer to the experiment number and may include more than one piece. Pieces shattered and subsequently further treated account for many pieces although a lot of very small fragments were not saved. NB temperature is given in degrees centigrade.

EP1 Nodule Dark Green bloodstone

Heated to 300° over 200 minutes, temp maintained 20 minutes, cooled overnight, fully immersed in sand bath. No visible change.

EP2 Nodule Light Green bloodstone

Heated to 300° over 200 minutes. temp maintained 20 minutes, cooled overnight, fully immersed in sand bath. No visible change.

EP3 Flake Light Green bloodstone

Heated to 400° over 150 minutes. temp maintained 60 minutes, cooled overnight, fully immersed in sand bath. No visible change.

EP4 Nodule Translucent Grey bloodstone

Heated to 300° over 100 minutes. temp maintained 20 minutes. cooled overnight, partially immersed in sand bath. Exposed portion cracked.

EP5 Flake Dark Green bloodstone

Heated to 400° over 150 minutes, temp maintained 20 minutes, cooled overnight, partially immersed in sand bath. Exposed portion cracked, some small pieces detached.

EP6 Flake Light Green bloodstone

Heated to 300° over 100 minutes, temp maintained 150 minutes, rapid cooling, fully immersed in sand bath. No visible change.

EP7 Flake Light Green bloodstone

Placed in 10% HCl for 6 months. Colour gradually fading.

EP8 Flake Chalk flint

Heated to 300° over 200 minutes, temp maintained 60 minutes, cooled overnight, fully immersed in sand bath. No visible change.

EP9 Flake Dark Green bloodstone

Placed in 10% HCl for 6 months. Colour gradually fading.

EP10 Flake Chert

Placed in 10% HCl for 6 months. No visible change.

EP11 Flake Chert

Heated to 300° over 200 minutes, temp maintained 30 minutes, cooled overnight, fully immersed in sand bath. No visible change.

EP12 Chunk Chalk flint

Placed in 10% HCl for 6 months. Partial patination.

EP13 Flake Beach flint

Placed in 10% HCl for 6 months. Partial patination.

EP14 Flake Beach flint

Placed in 10% HCl for 6 months. Partial patination.

EP15 Flake Translucent Grey bloodstone

Placed in 10% HCl for 6 months. Colour gradually fading.

EP16 Flake Purple bloodstone

Placed in 10% HCl for 6 months. Colour gradual darkening.

EP17 Nodule Light Green bloodstone

Heated to 600° over 500 minutes, temp maintained for 200 minutes, cooled overnight, fully immersed in sand bath. Bleaching.

EP18 Nodule Dark Green bloodstone

Heated to 600° over 100 minutes, temp maintained 50 minutes, rapid cooling, partially immersed in sand bath. Nodule completely shattered.

EP19 Flake Translucent Grey bloodstone

Heated to 500° over 150 minutes, temp maintained for 100 minutes, fully immersed in sand bath, cooled overnight. Bleaching, some cracking.

EP20 Flake Light Green bloodstone

Shaken 120 minutes in topsoil with stones. No visible change.

EP21 Flake Dark Green bloodstone

Shaken 120 minutes in topsoil with stones. No visible change.

EP22 Flake Translucent Grey bloodstone

Shaken 120 minutes in topsoil with stones. No visible change.

EP23 Flake Chalk flint

Shaken 120 minutes in topsoil with stones. No visible change.

EP24 Chunk Chert

Shaken 120 minutes in topsoil with stones. No visible change.

EP25 Flake Beach flint

Shaken 120 minutes in topsoil with stones. No visible change.

EP26 Flake Light Green bloodstone

Placed in 10% NaOH over 6 months. No visible change.

EP27 Chunk Dark Green bloodstone

Placed in 10% NaOH over 6 months. No visible change.

EP28 Chunk Chert

Placed in 10% NaOH over 6 months. No visible change.

EP29 Chunk Purple bloodstone

Placed in 10% NaOH over 6 months. No visible change.

EP30 Flake Chalk flint

Placed in 10% NaOH over 6 months. No visible change.

EP31 Flake Beach flint

Placed in 10% NaOH over 6 months. No visible change.

EP32 Flake Translucent Grey bloodstone

Placed in 10% NaOH over 6 months. No visible change.

EP33 Flake Light Green bloodstone

Placed in 10% NaOH over 6 months. No visible change.

EP34 Chunk Light Green bloodstone

Placed in water, frozen, allowed to warm slowly. No visible change.

EP35 Flake Dark Green bloodstone

Placed in water, frozen, warmed quickly. No visible change.

EP36 Flake Light Green bloodstone

Placed in wet topsoil, frozen, warmed quickly. No visible change.

EP37 Flake Light Green bloodstone

Heated to 400° in 150 minutes, temp maintained for 100 minutes, cooled rapidly, partially immersed in sand bath. Partial shattering.

EP38 Chunk Dark Green bloodstone

Heated to 500° in 100 minutes, exposed. Exploded before cooling.

EP39 Chunk Chert

Heated to 600° in 400 minutes, temp maintained 200 minutes, cooled overnight, fully immersed in sand bath. No visible change.

EP40 Flake Dark Green bloodstone

Immersed in 20% HCl over 4 weeks. Colour turned brown.

EP41 Flake Light Green bloodstone

Immersed in 20% HCl over 4 weeks. Colour fading.

EP42 Flake Light Green bloodstone

Immersed in 5% HCl over 6 months. No visible change.

EP43 Flake Dark Green bloodstone

Immersed in 5% HCl over 6 months. No visible change.

EP44 Chunk Chert

Immersed in 5% HCl over 6 months. No visible change.

EP45 Flake Chalk flint

Immersed in 5% HCl over 6 months. Faint patina.

EP46 Flake Beach flint

Immersed in 5% HCl over 6 months. No visible change.

EP47 Flake Light Green bloodstone

Frozen exposed, warmed quickly. No visible change.

EP48 Flake Light Green bloodstone

Frozen exposed, warmed quickly. No visible change.

EP49 Flake Light Green bloodstone

Shaken in dry sand for 120 minutes. No visible change.

EP50 Flake Dark Green bloodstone

Shaken in dry sand for 120 minutes. No visible change.

EP51 Flake Chalk flint

Shaken in dry sand for 120 minutes. No visible change.

EP52 Flake Translucent Grey bloodstone

Shaken in dry sand for 120 minutes. No visible change.

EP53 Flake Chert

Shaken in dry sand for 120 minutes. No visible change.

EP54 Flake Light Green bloodstone

Shaken in dry sand for 120 minutes. No visible change.

EP55 Flake Light Green bloodstone

Shaken in damp sand for 120 minutes. No visible change.

EP56 Flake Dark Green bloodstone

Shaken in damp sand for 120 minutes. No visible change.

EP57 Flake Chalk flint

Shaken in damp sand for 120 minutes. No visible change.

EP58 Flake Translucent Grey bloodstone

Shaken in damp sand for 120 minutes. No visible change.

EP59 Flake Red bloodstone

Heated to 600° in 300 minutes, temp maintained for 100 minutes, partially immersed in sand bath, rapid cooling. Exploded, many pieces brown, surface texture ruined by crazing.

EP60 Flake Dark Green bloodstone

Heated to 600° in 200 minutes, temp maintained for 200 minutes, partially immersed in sand bath, rapid cooling. Exploded, pieces exposed of a darker colour.

EP61 Flake Light Green bloodstone

Heated to 600° in 200 minutes, temp maintained for 200 minutes, partially exposed in sand bath, slow cooling. Shattered, pieces exposed darker, surface texture damaged by crazing and fracturing.

EP62 Chunk Translucent Grey bloodstone

Heated to 600° in 200 minutes, temp maintained for 200 minutes, partially exposed in sandbath, slow cooling. Shattered, lighter in colour. Exposed surfaces white and exposed surface textures ruined by crazing and shattering.

EP63 Flake Chalk flint

Heated to 600° in 200 minutes, partially exposed in sand bath, slow cooling. Shattered, exposed surfaces paler, surface texture damaged by crazing and fracturing.

EP64 Nodule Light Green bloodstone

Heated to 500° in 150 minutes, exposed. Exploded on heating, tiny frags.

EP65 Flake Light Green bloodstone

Heated to 600° in 250 mniutes, fully immersed in sandbath, temp maintained for 100 minutes, cooled overnight. Some cracking along texture boundary.

EP66 Flake Translucent Grey bloodstone

Heated to 600° in 250 minutes, fully immersed in sandbath, temp maintained for 100 minutes, cooled overnight. Some cracking along texture boundary.

EP67 Flake Light Green bloodstone

Immersed in 10% HCl 2 weeks (no visible change), heated to 600° over 300 minutes, temp maintained 100 minutes, partially exposed, slow cooling. Shattered, cracking, loss of surface texture, some pieces darker, a few lighter. Shaken 120 minutes in topsoil.Abrasion of weakened surface.

EP68 Flake Dark Green bloodstone

Immersed in 10% HCl 2 weeks (no visible change), heated to 600° over 300 minutes, temp maintained 100 minutes, partially exposed, slow cooling. Partially shattered, some small fragments brown, some cracking. Shaken in topsoil 120 minutes, no visible change in colour.

EP69 Flake Translucent Grey bloodstone

Immersed in 10% HCl for 2 weeks (no visible change), heated to 600° over 300 minutes, temp maintained 100 minutes, partially exposed, slow cooling (partially shattered, cracking, many fragments lighter in colour, serious damage to surface texture), shaken in topsoil 120 minutes (some abrasion).

EP70 Flake Chalk flint

Immersed in 10% HCl 2 weeks (no visible change), heated to 600° over 300 minutes, temp maintained 100 minutes, partially exposed, slow cooling (exposed shattered, cracking, bleaching), shaken in topsoil 120 minutes (no visible change).

EP71 Flake Translucent Grey bloodstone

Heated to 600° over 300 minutes, temp maintained 100 minutes, partially exposed, slow cooling (shattered, cracking, loss of surface texture paler, some pieces very pale with chalky insides), Immersed in 10% HCl 2 weeks (possibly slightly paler), shaken in topsoil 120 minutes (surface abrasion, some fragments broken).

EP72 Flake Light Green bloodstone

Heated to 600° over 300 minutes, temp maintained 100 minutes, partially exposed, slow cooling (exposed surfaces shattered, some cracking, occasional damage to surface texture, no colour change), immersed in 10% HCl 4 weeks (no visible change), immersed in 20% HCl 2 weeks (slight patination), shaken in topsoil 120 minutes (no visible change).

EP73 Flake Dark Green bloodstone

Heated to 600° over 300 minutes, temp maintained 100 minutes, partially exposed, slow cooling (exposed surfaces partially shattered, especially on texture boundaries, occasional cracking, darker), immersed in 10% HCl 4 weeks (no visible change), immersed in 20% HCl 2 weeks (no visible change), warmed in 20% HCl (slight discolouration), shaken in topsoil 120 minutes (no visible change).

EP74 Flake Light Green bloodstone

Heated to 600° over 300 minutes, temp maintained 100 minutes, partially exposed, slow cooling (exposed surfaces shattered, some cracking, exposed surfaces darker, some erosion of surface texture), and some rapid cooling (much cracking), immersed in 10% HCl 4 weeks (faint discolouration), shaken in topsoil 120 minutes (no visible change), frozen in mud (further cracking).

EP75 Flake Purple bloodstone

Heated to 600° over 300 minutes, temp maintained for 100 minutes, slow cooling, partially exposed (exposed surfaces shattered, covered surfaces cracked along flaws and texture changes, browning, some cracking), immersed in 10% HCl 4 weeks (no visible change), immersed in 20% HCl 2 weeks (no visible change), heated in 20% HCl (browner), shaken in topsoil 120 minutes (some abrasion of damaged surfaces), frozen in mud (no visible change).

1) Colour		
	a) Coverage	uniform/mottled/banded/varied
	b) Actual Colour	white/off white/grey-white/light grey/med grey dark grey/yellow/yellow-white/translucent brown translucent grey/translucent yellow/pink purple/red/pale green/dark green
2) Surface Alteration		
	a) Condition	fresh/weathered/burnt
	b) Edge	sharp/rounded/crushed
	c) Surface	smooth/matt smooth/part abraded/abraded/chalky crazed/cracked/hairline cracks/heat spalls
3) Cavities		
	a) Micropitting	present/absent
	b) Larger Cavities	present/absent
		Shape: circular/elliptical irregular
		Diameter: (mm)
		Fill: empty/colour
		Core & Rim: present/absent
		(Shape, Diameter, Fill, Core & Rim) Frequency: rare / common / frequent
4) Fossils	Presence	present/absent
5) Crystals		
	a) Presence	present/absent
	b) Extent	
	c) Size	(mm)
6) Cortex	Presence	present/absent
7) "Fresh Centre" [without breaking]		
	a) Not Visible	
	b) Visible	present/absent
	c) Colour	
8) Dimensions	Length, Width, Thickness (mm)	
9) Hardness	hard/medium/soft/very soft	

Table 41 Lithic raw materials: attributes used to differentiate between materials

MATERIAL	Significance	Features
Bloodstone	Obvious	colour/texture/presence of vesicules/agate banding
	Probably	less clear traces of colour/texture/presence of vesicules/agate banding
	Possibly	even less clear traces of above, spherulites, for example are only visible with a magnifying glass, texture unclear due to weathering of surface
Ambiguous		pieces without any clear discriminating features
Flint	Possibly	smooth textured grey/white mottled pieces
	Probably	as above, but with other features, such as pitted rough cortex, frequently with grey unpatinated area next to cortex
	Obvious	as with the 'probable' significance, but with presence of fossils
Lava ?		used to describe the very soft grey material, with a hard black centre where visible, not actually a lava, probably a siliceous rock, but the term was retained to distinguish this material

CONDITION	Features
Fresh	fresh or nearly fresh surface
Partically Weathered	partially or lightly patinated
Weathered	completely or heavily patinated, partially abraded
Abraded	surface completely eroded/chalky, edges rounded or crushed, loss of weight
Burnt	hairline crazing, heat spalls

Table 42 Lithic raw materials : classification

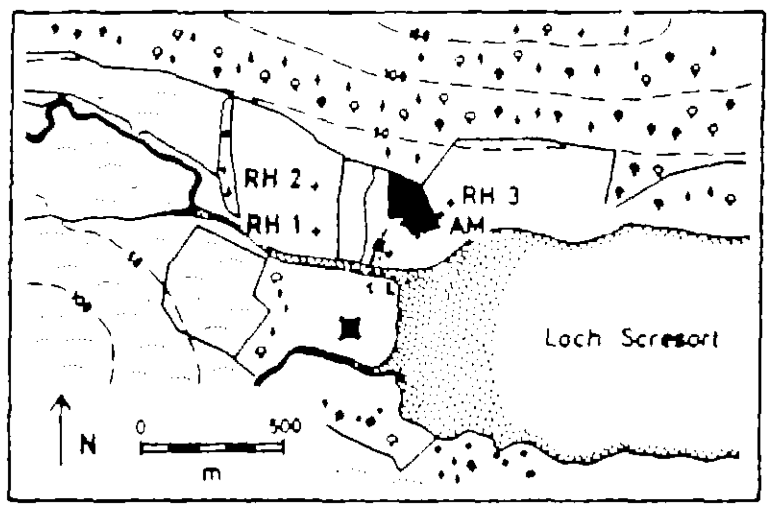
would have been maintained by periodic burning - if this had occured only on the uplands it may expain why no charcoal was found in the core.

Zone 4b 0.35-0m Gramineae-Potentilla-Plantaginaceae PAZ

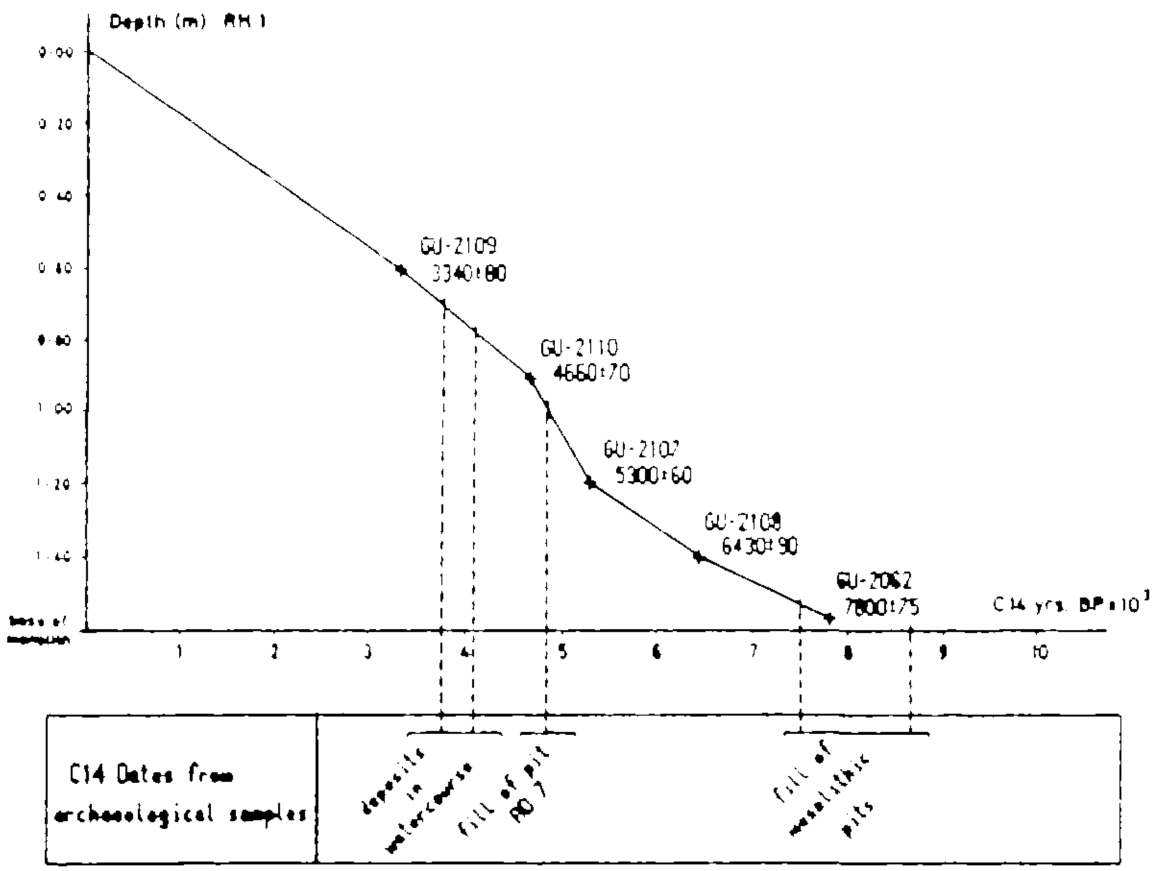
The beginning of this zone is marked by a sudden rise in the importance of Potentillau, Plantago spp, Rumex and Artemisia; the last three of which are weeds of arable cultivation. There are several species of Plantago on Rhum today but the pollen in this core is presumed to be predominantly P.lanceolata and P.maritima.

Quercus and Pinus both decline towards the surface, and Betula resumes dominance. Alnus persists at a low fluctuating level. Acer reappears at the surface. No other tree taxa were identified. Juniperus and Ulex occur near to the surface, and Corylus persists intermittently. Herbaceous taxa consist of a sustained high level of Ericaceae, lower levels of Gramineae and a slight rise in Compositae. Many taxa make their first appearances in the pollen record: Anthemis, Aster, Arctium, Drosera, Cirsium and Rubiac ie. Many of these may derive from species of agricultural weeds.

Sphagnum and Polypodium are the only spores identified in the surface sample, although higher frequencies of the latter were expected. However, the grazing pressures reduced due to the



ILL 104 : Location of environmental sampling sites



ILL 107 : RH1. Time depth curve for the growth of peat. Constructed by interpolation between the means of the radiocarbon age determinations assuming a date of zero years BP. for the surface

Sample	Mn		Zn		Ca		Mg	
P1	500		120		6000		7200	
P2	310		60		5000		6800	
P3	700		70		13000		20000	
P4	240		80		8000		8600	
P5	410		80		11000		7800	
P6	320		90		10000		13000	
P7	180		50		4000		5800	
P8	260		70		5000		8200	
P9	330		100		8000		11000	
P10	350	330	40	40	5000	5000	4200	4350
	310		40		5000		4500	
P11	230		80		8000		7800	
P12	150		40		3000		4200	
P13	250		60		8000		8300	
P14	480	505	50	55	10000	10000	8600	9300
	530		60		10000		10000	
P15	270		50		6000		6800	
P16	330		50		8000		11000	
P17	290		110		7000		10000	
P18	180	240	50	55	7000	7000	6500	6750
	300		60		7000		7000	
P19	210		110		6000		7900	
P20	700		100		9000		12000	
P21	360		60		7000		7300	
P22	250		80		7000		7000	
P23	210		180		7000		5900	
P24	410		60		9000		8600	
P25	250		40		8000		8400	
P26	270		70		6000		6200	
P27	200	200	60	65	7000	7500	7500	7700
	200		70		8000		7900	
P28	180		70		6000		6900	
P29	270		50		8000		7100	
P30	210		70		8000		7300	
P31	360		80		7000		9000	
P32	200		60		8000		8500	
P33	290		90		7000		7800	
P34	360		60		8000		10000	
P35	290		70		9000		12000	
P36	230		80		8000		8100	

Table 52 Chemical analysis across the excavation site : trace element analysis, results (ppm)

CONTENTS

A PALYNOLOGICAL ANALYSIS OF A PEAT CORE FROM THE KINLOCH GLEN, ISLE OF RHUM

Romola Parish

INTRODUCTION

This study is based on a four metre core obtained by Sue Bellamy in 1984 from a bog 1750m inland of the excavation sites in the Kinloch Glen (NG 386002). The bog is situated on gently shelving sandstone having a dominant vegetation of *Calluna vulgaris*, *Eriophorum vaginatum* and *Sphagnum* spp.(in June 1987). The basal deposits were a dark peat with woody fragments of *Betula* or *Alnus* overlain by a light coloured peat, about 3m deep. This was topped by a layer of recent, undecomposed plant material. The bottom 8770 ± 90 BP (HAR-6608).

LABORATORY TECHNIQUES

Samples for analysis were taken at .05m intervals and prepared following the method of Faegri and Iversen (1975). After acetolysis the samples were sieved using a 10um mesh and an ultrasonic agitator to remove silica and other mineral matter. The slides were examined using a Zeiss binocular microscope at a magnification of x450. An oil immersion lens was used for detailed identifications (x1000). The two principal sources of reference used for pollen identification were Erdtman *et al.*,

(1961) and Moore & Webb (1978). The whole area under the 16mm coverslip was examined on each slide by traversing the area in strips equal in width to the field of view.

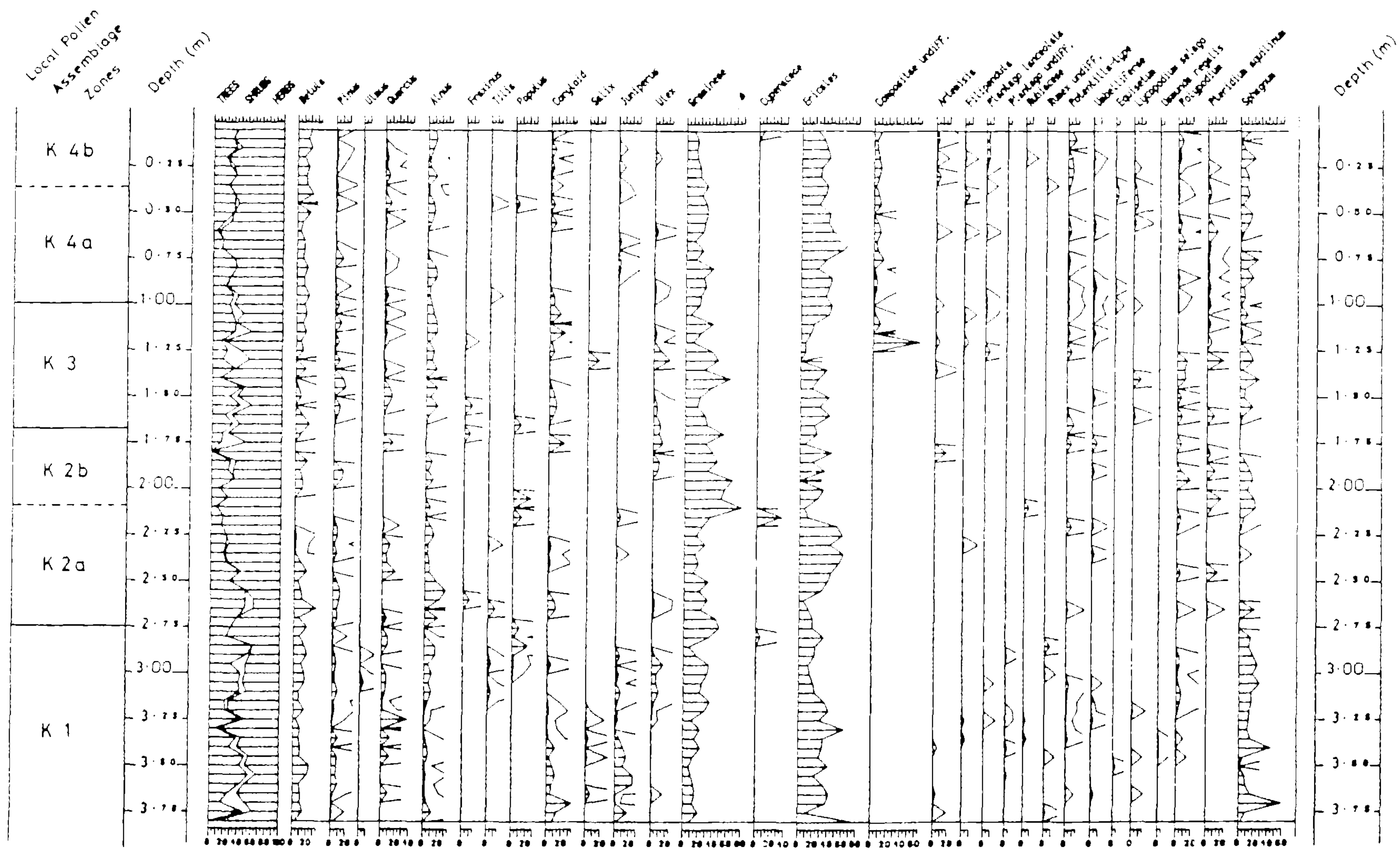
PRESENTATION OF RESULTS

The pollen counts were calculated as percentages of total terrestrial pollen and drawn up to produce the pollen diagram (Ill 103). A total land pollen sum was chosen as the basis for calculation because in some instances there were no AP grains identified. Counts of aquatic taxa are excluded from the pollen sum as they represent only the local aquatic environment. Proportions of tree, shrubs and herbs, were calculated as percentages of total pollen ard spores to produce a summary pollen curve. Only levels where the pollen sum exceeded 50 pollen grains were included in the pollen diagram.

INTERPRETATION OF RESULTS

The diagram was divided into four local pollen assemblage zones (PAZ), two of which are divided into sub-zones. Dating of this core is based on the tentative assumption of a steady peat accumulation rate, the basal radiocarbon date, and comparison with assemblages from other cores from N.W. Scotland.

<u>Zone 1 3.80-2.80m Betula-Ericaceae PAZ 8770+90-7500</u>



Pollen sum = total land plant pollen: taxa outside sum as percent sum + taxon
Exaggeration of open curve is x10.

ILL 103 : The Kinloch Glen core. Pollen count

This is the basal zone of dark brown peat. The radiocarbon date for the lowest 0.20m (4.00-3.80m) was 8770+90 BP (HAR-6608).

Of the tree species Betula is the most important, with a small amount of B. nana, a dwarf birch native to mountainous areas of Britain, Scandinavia, Siberia and the Arctic circle today, here taken to represent open, cold conditions. Pinus pollen here may be derived by wind transport from the Scottish mainland. Quercus begins to appear after B. nana declines, suggesting a more temperate climate although its peak at 3.25m, may be due to washing of pollen onto the bog by increased surface drainage. Oak remains relatively unimportant after this peak. Alnus appears consistently in small quantities throughout the zone, and Acer, Abies and Picea occur intermittently. Abies and Picea may arise here from long distance transport. As they are not native to Britain it is likely that they are derived from earlier sediments.

Shrubs are dominated by Corylus and Juniperus in alternating peaks. Juniperus indicates base-rich soil conditions and tends to be usurped as shading from taller trees increased, and by more acid soil conditions. Salix pollen occurs near the base of the core. This group includes many taxa with wide ecologic and geographic ranges. Ulex peaks in this zone; Lonicera and Frangula make their only appearances and Prunus occurs; these pollen taxa may all derive from northern temperate or cosmopolitan species

(Clapham *et al*. 1952).

Gramineae persists at low levels but rises towards the top of this zone. *Ericaceae* comprises the other main dominant of Zone 1; initially at very high frequencies (75% at 3.80m), it declines to a high, fluctuating level, and then falls as grass pollen increases in frequency. Many herbs occur sporadically including *Artemisia* (possibly the late-glacial species A. *norvegica*), *Armeria*, *Helianthemum*, *Linaria*, *Plantago maritima*, *Polygonum*, *Rubiaceae*, *Euphorbiaceae*, *Potentilla* and *Succisa*; *Umbelliferae* and *Urtica*. The herb spectrum includes a large number of ruderals and late-glacial elements. *Plantago*., *Potentilla* and *Urtica* are commonly associated with disturbed ground. *Humulus* pollen is difficult to distinguish from that of *Cannabis* (Whittington *et al* 1987) but it is the more likely here being a natural liana of alder woods (Godwin 1975).

Sphagnum occurs in very high frequencies near the base of the core (57% at 3.70m) and the presence of spores of the liverwort *Odontoschisma sphagnae* which grows in the *Spahgnum* spore capsule indicates that *Sphagnum* was the major peat forming plant. Other *Pteridophytes* are relatively unimportant; the most common being *Polypodium*. This occurs in woodland, but spores are more easily distributed in open environments.

The low AP (arboreal pollen) values in Zone 1 indicate fairly open conditions. This may be due to human impact or it may, as suggested for this time on Skye and Lewis, be due to climate (eg. Birks 1973). It is not possible to distinguish between the effects of these two factors in pollen data of this type. The vegetation was mainly grassland, with scattered birch in less exposed areas. Heather and [illegible] dominate an important scrub component possibly indi[illegible] [illegible]ntinental climate. Strongly competitive ruderal gras[illegible] [illegible]est some disturbance although no charcoal was rec[illegible] [illegible] the pollen preparations.

Zone 2a 2.75-2.15m Alnus-Ericaceae PAZ 7500-5000BP.

The boundary of this zone is marked by a change in colour, but not texture, of the deposit to a lighter brown at 2.75m. There is an increase in *Betula*, but more importantly, in *Alnus* which reaches its highest frequences here - (30%).

A fall in Gramineae is matched by a simultaneous rise in Ericaceae. There is a complete decline in all shrub species, with only *Corylus* and *Juniperus* appearing at one or two levels. The proportion of AP : NAP (non-arboreal pollen) rises initially, but falls to a fairly steady lower level of around 25%. There is a decline in herbaceous taxa in mid-zone, co[illegible]responding with a large peak of Ericaceous taxa. Following this, *Centaurea* appears in significant quantites. Common in both late-glacial and anthropogeneous floras (Godwin 1975), *Centaurea* is rare in Scotland today and often associated with cultivation of rye. It may have been a native late-glacial relic. *Plantago*, *Potentilla* and *Umbelliferae* also occur, which support the possibility of human disturbance. *Potentilla* is a pollen-type including a range of plants of wide tolerance of pH often associated with declining AP frequencies.

Pteridophyta and aquatic taxa decline throughout this zone, which is characterised by low TAP frequencies. The decline of *Sphagnum* is associated with drier conditions of a post-glacial warm period, and subsequent out-shading by expansion of alder.

Zone 2a vegetation is dominated by an Ericaceous scrub and alder is an important element, probably in damper, more sheltered areas or as a successional species of drying bogland. The indications of human presence show that human activity continued on Rhum through the time not represented in the Kinloch Excavations. Indeed it is unlikely that Rhum would not have been occupied during this period when climate was at its most favourable.

Zone 2b 2.10-1.75m Gramineae-Pteridophyte PAZ 5000-2000 BP.

The general trend of low TAP is continued but the relative proportions of AP : NAP fluctate more, reaching zero at 1.83m. Within this sub-zone is a total decline of trees and shrubs. *Betula* alone recovers in mid-zone, although *Pinus* and *Pinus* reappear in smaller quantitites. *Ulex* survives and peaks near the top of the zone, and at two consecutive levels, *Prunus* makes its most significant appearance before vanishing totally.

There is a rise in Gramineae corresponding to the decline in arboreal taxa and Ericaceae. Centaurea peaks, but Potentilla is the only other herb of any significance. Others do occur, but only sporadically. Sanguisorba and Umbelliferae are the most important; the former occurs on limestone on Canna today, but has a wide pH tolerance so could survive in the more acid environment of Rhum. Spores are more frequent at this level, with rising Sphagnum, Pteridium and Polypodium. Aquatics are at their highest levels here also, possibly indicating a wetter bog surface.

This total decline of AP is of considerable importance in the context of the demonstrated activity of the people of Rhum. It suggests widespread forest clearance and its replacement by grassland, probably associated with the introduction of grazing animals and possibly correlated with the second phase of occupation at the Farm Fields excavation sites.

Zone 3 1.70-1.05m Betula-Alnus-Corylus PAZ 2000-1000 BP.

The boundary is marked by a rise in AP, sustained at higher, but fluctuating levels. The rise consists mainly of increases in Betula and Alnus, although Quercus and Pinus are again of some importance. Acer, Fraxinus and Populus are recorded only sporadically.

Shrubs show a general increase; Corylus and Ulex being the most dominant, but *Ilex* also occurs. A fall in Gramineae is matched by a rise in Ericaceae but not to previous high frequencies. *Centaurea* and *Artemisia* (probably a different species, associated with disturbance here, from the late-glacial species of Zone 1) are present but *Plantago* is missing for much of the lower part of this zone. Other herb species identified include *Convolvulus*, *Euphorbia*, *Filipendula*, *Knautia*, *Malvaceae*, *Polygonum* and *Umbelliferae*. *Teucrium* occurs on Rhum today but is known to be highly susceptible to sheep grazing on Canna, and is commoner in wet calcareous environments.

Pollen of *Linum usitatissimum*, the cultivated flax, was found in this zone. Flax pollen is believed to be disseminated only very locally to the parent plant suggesting that the cultivation was nearby. The distance of the sampling site from likely suitable areas, however, suggests that the single flax pollen grain was possibly derived from long distance transport. Pollen of flax was also found in the on site samples by Moffat (mf).

The zone suggests an incomplete recovery of forest with wetter bog surfaces and possibly wetter climatic conditions indicated by rises in alder and *Sphagnum*, and a fall in Ericaceae.

Zone 4a 1.00-0.40m Compositae-Betula-Ericaceae PAZ

The beginning of this zone is identified by a fall in AP and a recovery of Ericaceae, together with appearance of Compositae.

Betula continues to dominate the tree taxa; there is a fall in *Pinus* and in *Quercus* after an initial peak. *Alnus* remains a secondary dominant, but does not appear initially. A scatter of pollen from other tree taxa occurs which may be derived from more distant sources.

Juniperus reappears, and remains at low levels throughout the rest of the core. *Corylus* declines in importance; *Ulex* appears in two samples. Gramineae fall to lower levels but persist to the top of the zone. Ericaceae show a large initial rise, and *Centaurea*, *Euphorbiaceae*, *Filipendula*, *Malvaceae*, *Umbelliferae* and *Potentilla* make up the herb spectrum. Spores remain relatively important - *Pteridium*, *Polypodium* and, initially, *Lycopodium*, and the ubiquitous *Sphagnum*. Aquatics are dominated by *Myriophyllum*.

Continued disturbance and relatively intensive land use is implied in this zone; probably by sheep grazing which is thought to have been an important part of the economy at this time (Love 1983). Historical evidence suggests the continuous occupation of Rhum throughout this period.

The importance of Ericaceae reflects the natural, and possibly man-induced podsolization process to which all British soils have been subjected, due to deteriorating climate after the post-glacial thermal optimum. It also reflects the recent history of intensive landuse on Rhum - primarily grazing by sheep. Moorland removal of sheep have been replaced by restocking with deer and it may also be suppressed by competition. Nymphaea is the only aquatic present. It occurs in acidic waters possibly colonizing bog pools formed in old peat cuttings. AP : NAP rises again to about 25%.

SUMMARY

Woodland was never fully developed throughout the Flandrian across the bottom of the Kinloch Glen on Rhum. Possibly many of the open areas were not available for tree colonisation due to the early development of bog. Woodland reached its maximum extent at 2.60m depth in the peat core where AP attains 63% of total pollen. Ericaceae and Gramineae were the dominant taxa throughout. Birch and alder were the most frequent trees but pollen data suggest that pine and oak may have occurred locally. Hazel, juniper and whin occurred in favourable locations within a matrix of grass heath.

Compositae, plantain and Potentilla assume greater importance near the surface presumably as agricultural activity was intensified. The domination of grassland over woodland may have been due to a combination of a harsh environment, podsolization of soils , unfavourable topography and extensive influence of man, both temporally and spatially. Trees will grow on Rhum today, however, so climate cannot be the sole determining factor.

FURTHER STUDY

Two further pilot studies were carried out as part of the investigation of the Kinloch Glen peat core; an attempt to apply the Kontron Digital Image Processing System to aid in the identification of fossil pollen, and the application of DNA characterisation techniques to the stratigraphic study of the peat.

USE OF KONTRON DIGITAL IMAGE PROCESSING SYSTEM (K.I.P.S.) FOR POLLEN ANALYSIS

The aims of the pilot study were

- to analyse prepared slides using KIPS as an alternative to the optical microscope.
- to obtain enlarged images and photographs.
- to attempt to automate the pollen searching process.

The Kontron Image Processing System was devised for use in cytology, particularly in the identification of anomalies in cell division. The equipment consists of an automated scanning stage under a normal binocular microscope; the stage has an 8-slide capacity. The monitor can be programmed to set up a 'meander', a series of squares covering the area to be studied; the squares are contiguous, but not overlapping, thus ensuring no duplication or omission of any field of view. Co-ordinates of fields of view can be stored, and later recalled for image processing. At er field of vision, two autofocus routines, operating on x, y, and z axes, focus on the most prominant object. This is also manually adjustable.

The IPM (Image Processing Module) is programmed to enhance contrast between feature and background; this appears to 'lift' the feature out of the screen. The feature can be enlarged (x4) up to three times, and photographed at any stage. After each enlargement there is a 'stilling' process of image integration, which removes noise and movement introduced by camera; and a filter process to eliminate the effect caused by enlargement of the individual squares of which the video screen consists. A calibrated scale of any size can be added (to the original video field) and new features photographed.

Several focal planes of an object of some depth can be combined to form one linear picture containing all elements of the object in focus. An infinite number of planes can be used, thus reducing a 3D object to 2D without losing any detail of resolution.

<u>Application to The Peat Core</u>

An attempt was made to automate pollen searching by asking the computer to eliminate from any given field of vision those particles above or below a given size, and below a given sphericity. The sizes selected were 10-100um, and the circularity index scale was from 0.5 to 1u (1u = total perfect circle). The sizes chosen were assumed to cover the range of British pollen species. However, there was considerable difficulty in developing the programme because the computer was unable to distinguish between pollen grains and other matter when these were in contact with each other in any given focal plane. The size range chosen was also too large, because this included most of the other organic matter on the slide.

A final attempt was made to distinguish grains by an area-perimeter ratio - it was assumed that relatively 'solid' structured grains would have a low ratio compared with degenerate fibrous material. This failed for the same reasons as above. The main problem with automating analysis was the fact that the size and shape range of pollen was too great, and problems ensued relating to damaged grains, or naturally split ones, e.g. *Juniperus*.

Cesar

This is a new software package which is becoming available for KIPS. It was developed for cytology screening of cancer cells, but is adaptable for any cell-like shape (i.e. almost any shape).

This enables the computer to 'learn' about 18 characteristics, including shape, size and surface pattern of the target object;

locate these on slides, and store their co-ordinates for recall. It would thus be possible for KIPS to 'identify' and count a large number of individual species of pollen grains, providing that suitable parameters to distinguish between closely related species, could be communicated to it.

ATTEMPT TO EXTRACT DNA FROM PEAT FIBRE

The composition of DNA from cell nuclei is genus and species specific. The aims of this study were to extract and examine DNA from samples of peat, to characterize the peat deposit and help confirm the composition of past peat forming vegetation.

All living cells able to divide contain a nucleus which is comprised mainly of deoxyribosenucleic acid (DNA), which encodes the genetic information of the cell and the whole plant. Every plant species has a characteristic composition of DNA, by which that genus, and species, may be recognised.

The technique of extracting and modifying plant DNA is now being widely used in many laboratories for 'genetic engineering' to obtain high-yielding, disease-reristant plants. Similar techniques could be used to identify vegetation debris and observe any differences from present day strains, provided that the DNA has been preserved intact.

The essential features of the simplest form of the procedure are:

i) extract the DNA separated from non relevant material.

ii) place it in an agarose or similar gel and electrophoretically separate its components according to charge and density.

iii) strain to detect the various bands of separated DNA.

The test substance, e.g. extract from the peat core, could be separated alongside DNA extracted from fresh heather, birch, alder, etc. A comparison of the bands indicates any homology between known control samples and the test material from core fibre.

There are more select ve procedures in which a DNA probe or extract of the ntrol material, labelled with a radio-isotope, is applied to the test sample. If there is homology between the DNA components, the probe will bind to the bands of the test sample. The amount of binding indicates the degree of DNA similarity.

Pilot test for DNA extraction

As a first step to test the feasibility of the idea, an attempt was made to extract DNA from a sample of the peat core. Unfortunately, there are two immediate limitations to DNA analysis of peat :

1) in the examination of Lindow Man recovered from a peat bog,

the acidity and tannins had completely denatured proteins, including DNA (Stead *et al.* 1986), and provided the conditions for preservation.

2) The presence of bacteria and other soil microflora, which contain DNA, would seriously contaminate any plant DNA.

To examine for contamination by bacteria, 16 samples of the peat at different depths were taken using a sterile spatula, dispersed in sterile distilled water, and plated out on nutrient agar in duplicate. Tubes with distilled water shaken with the spatula were negative controls. One set of plates was incubated at 37°C; the other at room temperature, about 21°C. Plates incubated at 37°C showed occasional colonies after 3 days. Those kept at room temperature showed fairly heavy growth of bacteria and fungi, indicating significant contamination by modern organisms at all depths.

Thus the samples were unsuitable for extraction of plant DNA. There were two possible approaches :

1. *Prepare probes of the micro-organism DNA to determine* similarity with any DNA extracted. This is a complex long-term procedure, and probably valueless.

2. Wash the fibres with large amounts of sterile water and filter off all bacteria and small debris.

To examine 2), one small sample of large fibres was vigorously shaken six times, each with 25ml sterile distilled water, and the fibres separated by retention on the surface of a coarse millipore filter.

The bacterial count was greatly reduced; the final wash fluid showed no bacterial growth. However, fibres laid out on the agar grew some bacteria along their length. This indicated that some bacteria were strongly bound to the peat fibre, and would contaminate any DNA extracted.

It is still to be resolved whether any plant DNA could be extracted from the peat fibre but it seems unlikely due to the acidity of the deposit.

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ENVIRONMENTAL ANALYSES OF SAMPLES FROM TRENCH AM AND A BLANKET PEAT REMNANT, FARM FIELDS EXCAVATIONS KINLOCH, ISLE OF RHUM.

Kevin J Edwards and Ken R Hirons

During the course of excavations in trench AM, a peat-like organic deposit was discovered sealed beneath slopewash. At the request of the excavators the deposit was sampled for its pollen content. The amount of identifiable pollen was meagre and in an attempt to extract as much environmental information as possible the opportunity was taken to assess the material for its charcoal and insect content. The deposit contained fragments of lithic material and a small piece of pottery. The preliminary examination of a small remnant of near-by blanket peat was also undertaken.

Trench AM is located 6 m east of the western wall of the principal excavation field at grid reference NM 404 999. The ground surface here is on an incline with the watercourse running NW to SE through the trench (to the north of the sample spot) and the southern limit of the slopewash deposit lying south of the trench. The organic material was found in the southern portion of the trench and the stratigraphy at the sampling point is described in table 43.

A monolith of material was collected and returned to the laboratory for analysis. An adjacent sample of the peaty material (8 cm in thickness) submitted for radiocarbon determination to the University of Glasgow laboratory gave a result of 4260± 70 (GU-2106).

The peaty material was sub-sampled for palynological analysis and received standard pretreatments based on NaOH, acetolysis and HF (Faegri and Iversen 1975). All samples were volumetrically prepared by displacement and tablets of Lycopodium annotinum were added to allow estimates of palynomorph concentration (Stockmarr 1971). Pollen and microscopic charcoal preparations were mounted in silicone oil of 12500cSt viscosity. Five duplicate slides per sample level were examined but the scarcity of pollen, its poor condition and the obfuscating charcoal prevented routine pollen counts and it was only feasible to record numbers of pollen grains and spores. Charcoal microfragments greater than 151 um in area were counted and estimates of concentration were made. The pollen and charcoal data are presented in table 44.
Further sub-samples of material were subjected to paraffin flotation (Coope 1985), in order to concentrate insect remains. No remains were found but small fragments of Sphagnum were present.

The remaining peaty material was passed through a 1mm seive. A large number of charcoal fragments were found of which charred hazel-nut shells (Corylus avellana) were readily identifiable. In addition there were 29 fragments of lithic material and a single sherd of coarse pottery.

The organic material would appear to be similar to a highly humified peat with very little indication of the peat forming vegetation (which included <u>Sphagnum</u>) remaining. There was a high content of both macroscopic (mainly hazel) and microscopic charcoal.

The radiocarbon date obtained from the organic material was 4260+70 bp (GU-2106), which, suggests a neolithic rather than mesolithic age for the deposit. This date might also be consistent with the coarseware find (unknown at the time of submission for dating) which appears to be similar to sherds found in the neolithic contexts of the main excavation area. Also, the dated material underlies the supposed slopewash deposit and is not dissimilar to the date of 3945$\pm$ 60 bp (GU-2041) for a wood sample at the base of the slopewash material in trench AG. The date must, though, be viewed with caution. If the peaty material from trench AM does contain intrusive organic material (eg. older eroded peat or charcoal transported from upslope/upstream) then the date (as could also be the case for the trench AG sample) will precede the date of slopewash by an unknown period. Likewise, the possible mixture of organic materials means that any C-14 determinations could post-date local mesolithic activity.

The low quantities of pollen (table 44) cannot reliably be

Depth (m)	Description of Deposits
Surface	Grass dominant flora
0.00–0.30	Organic ploughsoil, some angular stones up to 0.05 m diameter
0.30–0.50	Rolled, rounded sandstone pebbles in matrix of sandy mineral soil
0.50–0.57	Black peat-like deposit with visible fragments of charcoal and bloodstone
0.57–0.70+	Large, slightly rounded cobbles

Table 43 Trench AM: stratigraphy at the sampling point

Taxon (no. of grains/spores)	Depth (metres from base of deposit)						
	0.00–0.01	0.01–0.02	0.02–0.03	0.03–0.04	0.04–0.05	0.05–0.06	0.06–0.07
Pinus (pine)			1	1		1	
Ulmus (elm)	2		2				
Alnus (alder)	3	3	3	1		5	2
Coryloid (hazel/myrtle)	1	2			1	1	
Salix (willow)			1				
Gramineae (grasses)	1	1	1			2	
Cyperaceae (sedges)		1	7			7	
Plantago (plantain)		1	2				
Rumex (sorrel)		1	1				
Rosaceae (rose family)			1				
Indeterminate Pollen	3	9	21	4	2	21	6
Filicales (fern)	5	4	8	6	3	12	1
Polypodium (polypody)						1	
Charcoal ($mm^2/cm^3 x 10^3$)	32.8	22.2	51.2	29.8	36.2	12.8	18.5

Table 44 Trench AM : Pollen and charcoal counts

assessed for environmental purposes and this would especially be the case if the deposit was subject to the processes of contamination conjectured above, since the microfossil content would be similarly affected. the samples are dominated by *Alnus* and Cyperaceae pollen, both of which are indicative of wet conditions. The resistant spores of *Filicales* are frequently differentially preserved in pollen preparations but they do indicate the local presence of fern species. All of the pollen and spore types are present in detailed analyses from both the Farm Fields soil samples (Moffat mf) and the raised beach deposit to the west of the excavation (Hirons and Edwards mfa). The ubiquity of the taxa from trench AM in many different age levels in the raised beach profile, precludes a realistic assessment of either deposit age or the existence of contamination but the presence of *Alnus* suggests a post 6500BP date for the final accumulation at the site.

Upslope of trench AM, there is an area of denuded blanket peat which has been eroded by drainage waters and agricultural activity (see III104). A small remnant of peat 98 m north-east of trench AM was cored and the maximum peat depth recoverable in the chamber of the Russian corer (Jowsey 1966) was found to be 1.13 m. The deposit consisted of a humified fibrous peat. A basal sample and two from higher in the profile were taken and processed for pollen analysis. The results are shown in table 45.

The basal sample has much higher *Alnus*, Coryloid and Filicales values than those higher in the profile wheras the reverse is the case for Gramineae and *Calluna*. The decline in woodland taxa at the raised beach site is dated at around 3950 BP. It is not certain that this date would apply to the decline in *Alnus* and Coryloid in the blanket peat but it is possible that the event is analogous. The basal sample also contains more *Quercus* pollen than is found in the raised beach profile. These findings suggest that prior to the period of woodland reduction indicated in the blanket peat samples, the soil conditions upslope of the Farm Fields were drier and able to support some oak with alder-hazel woodland, although this was probably open with an understorey of herbs and ferns. After the woodland decline an acid-heath replaced the woodland here rather than the acid-grassland around the damper raised beach site.

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Taxon (% total land pollen)	Depth (metres from top of deposit) 0.64-0.65	0.87-0.88	1.12-1.13
Betula (birch)	2.10	3.50	16.70
Pinus (pine)	0.50	0.50	0.50
Ulmus (elm)	0.50		
Quercus (oak)	0.50	2.90	7.70
Alnus (alder)	0.90	3.20	19.90
Coryloid (hazel/myrtle)	0.50	4.30	19.00
Gramineae (grasses)	29.40	57.90	20.80
Cyperaceae (sedges)	20.90	6.90	9.20
Calluna (heather)	25.10	2.60	0.90
Erica-type (heath)	5.50	0.60	
Filipendula (meadowsweet)	0.50	0.50	
Plantago lanceolata (ribwort plantain)	1.70	7.50	
Potentilla (tormentil, etc.)	3.40	5.20	3.90
Sphagnum (bog mosses)	11.00	22.90	1.50
Filicales (ferns)		0.50	22.90
Pteridium (bracken)	0.50	0.60	3.70
AP	4.30	10.10	45.20
Shrub	0.50	4.90	19.30
Ericaceae	32.80	4.90	1.20
Herbs	62.40	80.10	34.30
Pollen (no. of grains)	235	347	336

Table 45 RH 3 : Pollen count

POLLEN AND CHARCOAL ANALSES FROM THE FARM FIELDS SITE, KINLOCH, ISLE OF RHUM

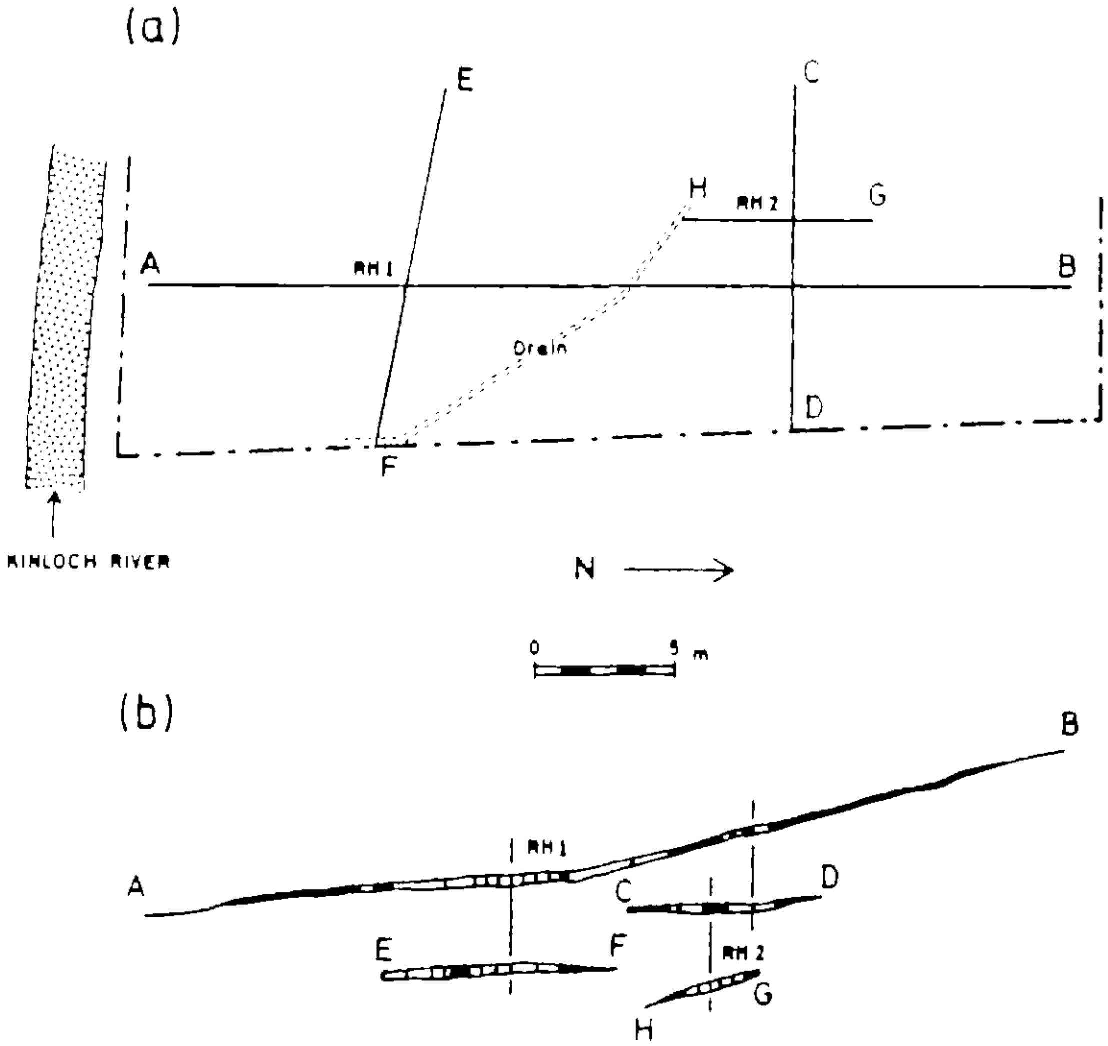
Ken R Hirons and Kevin J Edwards

The organic deposits near the Farm Fields excavation site (Moffat mf, Edwards & Hirons mf), provide only 'snapshots' of their respective environmental contexts. A promising locality for providing a long-term record of environmental events at the Farm Fields was that of the raised beach area to the west. At a distance of some 200 m from the excavations, a peat deposit began forming at around 7800 radiocarbon years BP and its investigation forms the basis of this report.

METHODS

The Site and Field Sampling

The sampling site is a soligenous mire found on estuarine clays first investigated by Dr Donald Sutherland. The aim was to find the transition from marine-clay to terrestrial peat and so provide a date for the retreat of the sea after the main postglacial transgression. Sutherland's site (designated site Rh1, Ill 104) was surveyed by us as part of an upslope transect (Ill 105) carried out in order to define the shape of the hillslope and the basin of accumulation. A sample monolith was collected from the deepest point on the transect at an altitude



ILL 105 : (a) Plan showing transect lines of the core sites RH 1 and RH 2. (b) Transect lines showing peat depths. NB. 2·5 x vertical exaggeration.

of 9.9 m local OD. The base of this profile is located close to the maximum height of the postglacial transgression. The stratigraphy is shown in table 46.

The immediate environment of the site is rough grazing dominated by Juncus but former cultivation ridges attest to a more varied history of agriculture. Above the field the land rises sharply and the sandstone slopes are dominated by Calluna vulgaris and Molinia caerulea. There is a coniferous shelter-belt to the east of the site and hedgerows containing Crataegus monogyna and Salix spp.

Laboratory Analysis and presentation of results.

Loss-on-ignition determinations were made on contiguous 1 cm thick samples which were dried at 110 C for 12 hours and ignited at 550 C for 8 hours. The results are calculated as percentage dry weight and they are plotted in Ill 106.

Samples for pollen and microscopic charcoal analyses were processed by standard NaOH, acetolysis and HF techniques prior to mounting in silicone oil (Faegri & Iversen 1975). All samples were volumetrically prepared by displacement and tablets of Lycopodium annotinum added in order that palynomorph concentrations could be estimated (Stockmarr 1962). The pollen sum aimed at was 500 determinable land pollen grains which was not attained for all levels (e.g. between 1.03-1.17 m and in the

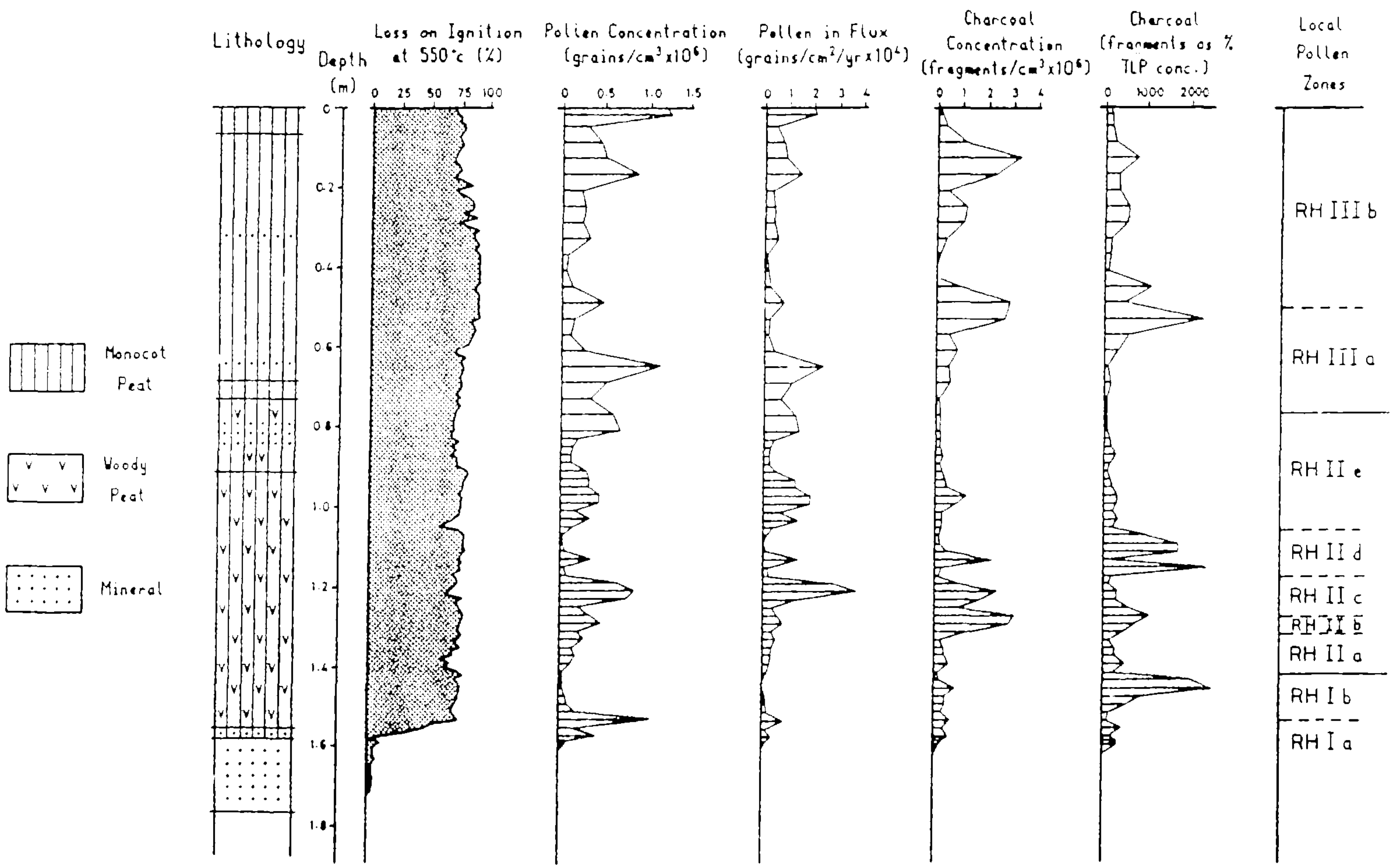
0.00–0.07	m	Dark brown, fibrous, unhumified peat with grass/sedge fragments, some coarse sand-fine grit.
0.07–0.67	m	Dark brown-black humified peat with fibres and grass/sedge fragments. Some mineral 0.26–0.27m. Mica platelets visible 0.60–0.62m.
0.67–0.73	m	Less humified light brown wood-sedge peat with some silt particles.
0.73–0.88	m	Light brown sedge-wood peat, some mineral content 0.77–0.80m.
0.88–1.51	m	Brown wood peat with fibres and sedge component.
1.51–1.55	m	Sandy peat, sand increasing with depth, roots and rhizomes of *Phragmites* and *Equisetum* present. Some sandstone grit and mica present.
1.55–1.70	m	Silty clay with *Equisetum* rhizomes, roots and mica present and sandstone chips up to 0.01m in size. Clay blue but with red mottling due to rotting sandstone stones.

Table 46 Core RH 1 : stratigraphy

basal clays which were barren of pollen). The pollen data are presented as a percentage of the total land pollen sum with pollen and spores outside the sum calculated as sum + taxon. The pollen diagram (Ill 105) is divided into local pollen assemblage zones (RhI-RhIII) some of which are further subdivided into subzones. Full concentration data are not given here but a curve for total pollen concentrations is presented in Ill 1[illegible] . The counts for microscopic charcoal are based on fragments greater than 151 um in size. Curves for charcoal concentration and the total pollen to charcoal ratio (Swain 1973) are also presented in Ill 106 .

Five samples were used for the C-14 dating of site Rh1. Four samples were taken from the pollen monolith and a fifth came from the same sample hole at the base of the peat (Sutherland mf). Dating was carried out on 2 cm or, in the case of the uppermost sample where the peat had less organic content, 3 cm slices of peat by The University of Glasgow Radiocarbon Dating Laboratory. A chronology of sedimentation may be proposed by plotting the available C-14 dates (table 47) against depth and interpolating between mean quoted sample ages. Illustration shows such a time-depth curve which has been completed by assuming a date of 0 years bp for the surface and assuming the date taken from the basal 2 cm of peat by Sutherland corresponds to the basal 2 cm of peat in the sample monolith.

The time-depth curve has been used to convert pollen



ILL 106 : RH1. Environmental data

concentrations into total pollen accumulation rates or pollen influx in illustration 107.

RESULTS

The stratigraphy recorded at sample site Rh1 is given in table 46.

Pollen zone Rh1 (1.57-1.41 m, 8400-6500 BP)

This zone preceeds the rise in alder pollen. It is characterized by a peak of Cyperaceae (sedge) rising from 12% to the highest sedge pollen frequencies in the profile (71%) before declining by the end of the zone. Two subzones are defined:

Subzone Rh1a (1.57-1.53 m, 8400-7500 BP)

This subzone is characterised by increasing Coryloid (cf. hazel) and Cyperaceae percentages, falling Gramineae (grass) and Compositae values and Ranunculaceae, *Thalictrum*, *Lycopodium selago* and *Empetrum* are present. Other herb pollen types include *Koenigia islandica*, *Caryophyllaceae*, *Saxifrageaceae*, *Artemisia*, *Cruciferae*, *Plantago coronopus* and P. *maritima*, and *Selliaginella selliaginoides* spores Some of these taxa indicate the presence of plant communities which may reflect the proximity of the sea (e.g., Caryophyllaceae, *Plantago maritima*, Compositae). Others are characteristic of late- or early postglacial open environments (e.g., *Artemisia*, *Koenigia islandica*, *Thalictrum*, *Empetrum*, *Lycopodium selago*). This subzone suggests the establishment of open hazel scrub with an understorey of horsetails, ferns and sedges and with tall-herb communities including *Filipendula*, *Rumex acetosa* and Umbelliferae. *Betula* (birch) and *Pinus* (pine) may have been present on the island at the time but were probably not local to the Farm Fields. The closing of the hazel canopy appears to have supressed the flowering of Compositae, *Thalictrum*, *Lycopodium selago* and *Empetrum*. Charcoal is low in concentration and percentage terms.

Subzone RhIb (1.53-1.41 m, 7500-6500 BP)

Coryloid and Cyperaceae pollen are dominant and *Filipendula*, *Filicales* and *Equisetum* increase. *Osmunda* spores are present from near the start of this subzone and *Pteridium* (bracken) becomes important in the latter part. Open hazel scrub with an understorey of sedges, *Filipendula*, *Melampyrum*, *Rumex*, ferns and *Equisetum* spp. dominated this long period. The increased frequencies of *Potentilla* and *Succisa*, the appearance of *Calluna* (heather) pollen suggest the establishment of dwarf-shrub heaths on the drier sandstone soils near the site.

Microscopic charcoal fragments are present throughout the analysed profile but are low in concentration in zone RhI. Local anthropogenic activity may be indicated by the peak of *Rumex acetosa*-type pollen in KIb and the increased frequencies of several pollen types which may, arguably, support a suggestion of local burning; *Pteridium aquilinum*, *Potentilla* and *Melampyrum*. In combination these lines of evidence suggest that the vegetation of the mire surface was disturbed by fire at times in this zone and that this disturbance could have contributed to the establishment of *Alnus* (alder) in the next zone (McVean 1956a). It is not possible to attribute this disturbance to either anthropogenic or natural fires on the data presented here.

Pollen zone RhII (1.41-0.74 m, 6500-3950 BP)

This zone starts at the rise in *Alnus* pollen and ends just after *Alnus* and Coryloid pollen begin major declines and grass pollen increases. The zone is divided into five subzones on the basis of major fluctuations in *Alnus* pollen frequencies.

Subzone RhIIa (1.41-1.31 m, 6500-5950 BP)

An initial *Salix* (willow) pollen peak declines (50-<1%) as *Alnus* frequencies increase and ferns expand. There is less *Potentilla*, *Melampyrum* and Cyperaceae pollen than in the previous zone. *Sphagnum* and sedges were replaced by local stands of willow which were in turn, replaced by *Alnus*. There is a loss-on-ignition peak at 1.40 m which suggests a period of erosion resulting in the flushing of mineral material onto the mire. McVean (1956b, 327) has shown that *Alnus glutinosa* is a pioneer species capable of colonising a wide range of wet habitats as they become available and would not normally be involved in a simple *Salix*-*Alnus* hydroseral sucession. *Alnus* was clearly immigrating to an area already suited to its colonisation.

Coryloid pollen frequencies were not affected by the *Salix*-*Alnus*

Lab no.	Radiocarbon yrs. BP 1 sd.	Depth (m)
GU-2062	7800 ± 75	1.55–1.57
GU-210[illegible]	6430 ± 80	1.39–1.41
GU-2107	5300 ± 60	1.19–1.21
GU-2110	4680 ± 70	0.89–0.91
GU-210[illegible]	3340 ± 80	0.59–0.62

Table 47 Core RH1 : radiocarbon determinations

sucession, although its concentration declined briefly at the lower zone boundary. This might indicate that *Corylus avellana* was the species concerned here as the alternative *Myrica gale* would probably have been influenced by the local changes on the bog surface had it been present. The scarcity of *Myrica* on Rhum at the present time is notable (eg. McVean & Ratcliffe 1962, Ratcliffe 1977).

Subzone RhIIb (1.31-1.27 m, 5950-5700 BP)

This subzone is characterised by greatly reduced *Alnus* and Coryloid and increased *Pteridium* and Gramineae values. These changes indicate a reduced tree cover both on the damp alder-fern woodland suggested for wet areas of the mire and on the drier surrounding slopes which may have supported hazel. The change to grasses and bracken and further reduced *Sphagnum* and *Equisetum* indicates a continued drying of the local mire surfaces. Charcoal concentrations and percentages are higher in RhIIb and the start of RhIIc than in RhIIa.

The pollen changes and increased frequency of charcoal in this subzone suggest the decline of woodland may be associated with an increased incidence of fire.

Subzone RhIIc (1.27-1.17 m, 5700-5250 BP)

Alnus and *Coryloid* pollen frequencies recover in this subzone and a gradual decline of grasses and bracken takes place. *Potentilla* pollen values are low and *Melampyrum* is absent, *Sphagnum* remains low and *Polypodium* rises. These changes suggest that the mire surface was still fairly dry but there is also loss-on-ignition evidence for the washing of mineral onto the surface of the site. This is the period of maximum *Pinus* pollen frequencies and corresponds to the expansion of *Pinus* onto drier aerated bog surfaces on Skye (Williams 1976). *Alnus* and *Corylus* expanded to regain their former habitats, suggesting open woodland as in subzone RhIIa. Grass and sedges maintain a major presence and a range of herbs is present. *Fraxinus* pollen has its first appearance. Pollen frequencies of *Filipendula* and *Osmunda* are low perhaps indicating that they were unable to regain their former prominence in the regenerating woodland.

Subzone RhIId (1.17-1.03 m, 5250-4950 BP)

In this subzone *Alnus* pollen frequencies are reduced and those of sedges increase. *Filipendula* pollen and *Equisetum*, *Osmunda* and *Sphagnum* spores increase. *Potentilla*, Ranunculaceae and *Melampyrum* all expand and *Pteridium* has a peak. There is some evidence that charcoal production increased, certainly in relation to pollen. This coupled with the possibility that *Pteridium*, some species of *Potentilla* and *Melampyrum*, may increase in response to fire, could indicate the disturbance of vegetation arising from burning.

In the first part of the subzone increased *Sphagnum*, *Equisetum*, and Cyperaceae all suggest a wetter mire surface. In the latter part of the subzone a similar succession of pollen-types to that found in RhIIa takes place. *Sphagnum* and *Cyperaceae* were replaced by *Salix*, again coinciding with an increase in mineral content of the peat, indicated by loss-on-ignition decreasing from 75-80% to 60 %. This change was followed by the decline of *Salix* and the re-expansion of *Alnus* with ferns. In RhIIa similar changes were interpreted as resulting from drying of the mire and the expansion of *Alnus* was interpreted as resulting from the invasion of *Salix* by arriving *Alnus* populations.

The expansions of *Osmunda* and *Filipendula* are interesting as both are resistant to salt-spray and this might indicate that an increased incidence of gales contributed to the pattern of events. The start of this subzone (c. 5200 BP) dates to around the time of the elm decline when climatic shifts have been suggested for north-western Scotland (Pennington *et al.* 1972; Williams 1976) possibly involving increased precipitation resulting fro[illegible] southward displacement of the polar front (Magny 1982).

Subzone RhIIe (1.03-0.74 m, 4950-3950 BP)

This subzone has a recovery of *Alnus* and Coryloid pollen to their highest frequencies in the diagram. Lower frequencies of ferns, herbs of open ground and herb taxa possibly local to the mire surface, for example, *Filipendula* and *Osmunda*, suggest that this was the period of most closed tree vegetation at the site.

Evidence for possible human impact begins at the time of a mid-subzone increase in mineral matter. _Plantago lanceolata_ and _Potentilla_-type pollen start a slow increase while _Filipendula_ and _Osmunda_ values begin to decline. There is also the beginning of a shift towards higher grass pollen frequencies. The composition of the tree pollen assemblage begins to include such open habitat taxa as _Ilex_, _Fraxinus_ and _Sorbus_, and _Lonicera_ is present. At the end of the subzone _Betula_ expands to reach its highest frequency in the profile.

Subzone RhIII (0.74-0 m, 3950-present)

This zone starts as _Alnus_ begins to decline and is close to the start of reductions in Filicales and Coryloid frequencies. Grass pollen frequencies rise significantly at the start of the phase. _Potentilla_, _Betula_ and Ericaceae undiff. pollen is better represented and _Filipendula_, _Pteridium_, _Osmunda_ and _Salix_ are less frequent. Two subzones are defined; RhIIIa is a transitional zone where _Alnus_ and Coryloid are declining and RhIIIb after the decline has taken place.

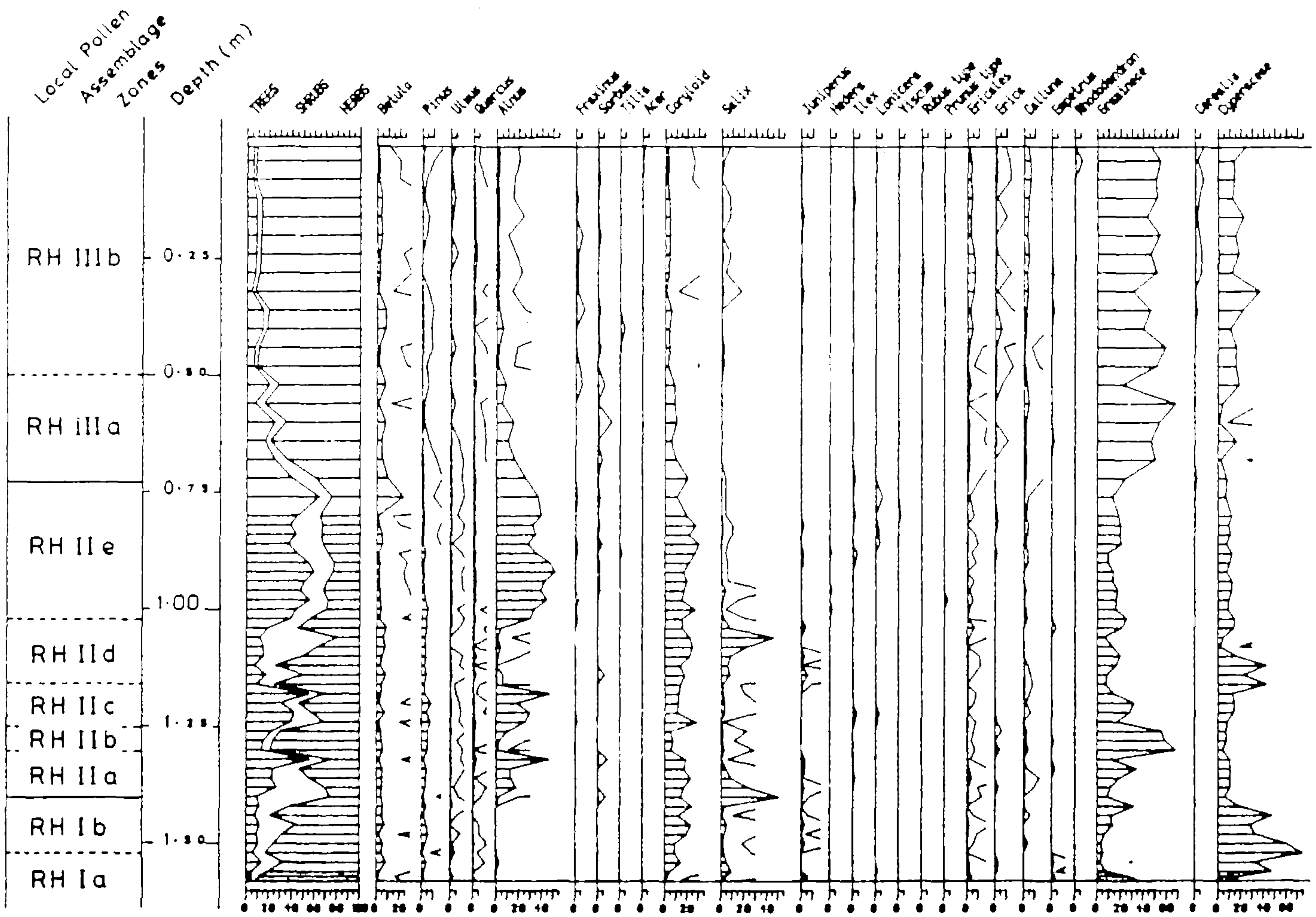
Subzone RhIIIa (0.74-0.50 cm, 3950-2800 BP)

This subzone is defined by falling _Alnus_ and Coryloid pollen frequencies which are replaced by grass and to a lesser extent sedge pollen. _Potentilla_ is slightly increased over the previous zone. These changes suggest a decline in the alder woodland and tall-herb communities previously dominating the mire surface, and the hazel on surrounding drier soils. This is reflected by a change in the peat between 0.67–0.73 m where the wood content decreases. *Calluna* and *Succisa* pollen expand suggesting the replacement of *Corylus* on drier slopes by the spread of heath vegetation. *Betula* and *Sorbus* pollen are present in high frequencies, both possibly expanding as pioneer taxa on drier cleared areas left open by the removal of hazel. One cereal-type pollen grain was found at the start of RhIIIa. In combination with the increased frequencies of *Plantago lanceolata*, *P. media* and increased charcoal frequencies, clearance for agriculture is suggested. The start of this subzone also coincides with a decline in *Pinus*. This decline is approximately coeval with the regional pine decline at c. 4000 BP and it is often interpreted elsewhere as a being caused by either man and/or climate (Bennett 1984).

Subzone RhIIIb (0.50–0 m, 2800–present)

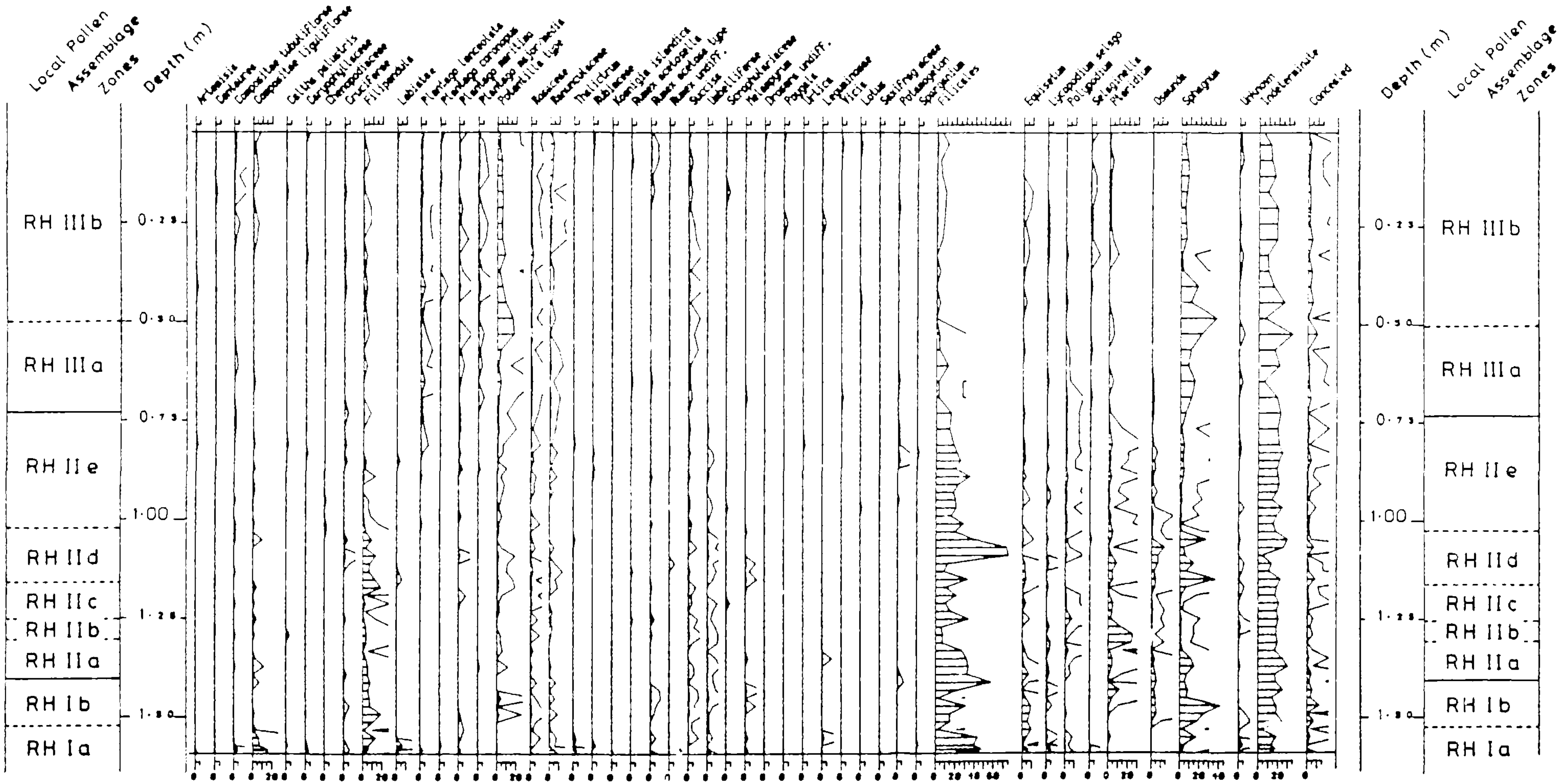
This subzone has the lowest frequencies of tree pollen, Coryloid pollen and fern spores. These are replaced by pollen of heaths, grasses, sedges and *Potentilla*. This suggests the development of base-poor grassland perhaps similar to that on the site at present. The reduced mineral content of the peat in the first half of the subzone shows that local soils had reached an equilibrium after the decline of alder and hazel.

Cereal-type pollen forms a continuous curve in the latter half of this zone and the presence of pollen of ruderal taxa (eg, Compositae, *Artemisia*, Ranunculaceae and *Rumex acetosa*), suggests



Pollen sum = total land plant pollen: taxa outside sum as percent sum + taxon
Exaggeration of open curve is x10.

ILL108: RH 1. Percentage pollen diagram



ILL 108 (contd) RH 1. Percentage pollen diagram

Pollen sum = total land plant pollen: taxa outside sum as percent sum + taxon. Exaggeration of open curve is x10.

that this was the period of most intensive cultivation. Starting around 0.28 m (the beginning of a continuous cereal curve and dated to c. 1500 BP) this period coincides with increased mineral input to the peat. This probably represents the consequences of soil instability resulting from agricultural activity directly upslope of the pollen site. Local recent cultivation is evidenced by the lazy beds at the site itself. The increase in Fraxinus pollen probably relates to the expansion of Fraxinus after local vegetation had become more open.

It has been shown above that there is pollen evidence of possible Mesolithic activity at Farm Fields at least between c. 5950-5700 BP. Before this time pollen evidence for the impact of man is difficult to distinguish from the general background pollen of early postglacial open and exposed habitats. A combination of herb pollen types from plants which may respond to fire, and charcoal evidence, suggests that fire was an important ecological factor and may have contributed to conditions leading to the expansi n of Alnus at 6500 BP. Whether such fire was deliberate and associated with the mesolithic inhabitants of Rhum or whether it was accidental or the result of lightning strikes is unknown.

The first appearance of Plantago lanceolata (ribwort plantain) occurs at 100 cm depth and is dated to 4900 BP. This suggests that Rhum was inhabited at the time although the occupants' impact on the alder woodland was minimal. The start of the first sustained hillwash event recorded by mineral inwash at Rh1 was at 0.90 m depth and dated to c. 4700 BP. At 0.80 m (4200 BP) the *P. lanceolata* curve becomes continuous suggesting that man's impact, possibly associated with grazing activities, spread to the drier slopes above Rh1 first causing some washing of mineral onto the mire and that several hundred years elapsed before direct impact started on the mire itself. The major accelerated impact on the mire started at the begining of zone RhIIIa at c. 3900BP. There is a suggestion of local arable cultivation after clearance of alder and hazel, charcoal becomes more frequent and a general change to open conditions is apparent. This takes the form of local sedge-grassland with plantains, Ranunculaceae and Compositae and expansion of heaths with *Succisa* and *Potentilla*.

Environmental disturbances in the neolithic may be examined in the light of radiocarbon dates associated with colluvial slopewash deposits in the excavation area (III). Wood from beneath colluvium in trench AG was dated to 3945$\pm$ 60 BP (GU-2041), while peaty organic material beneath colluvium in trench AM was dated to 4260 $\pm$ 70 BP GU-2106). The interpretation of these dates requires some caution (Edwards & Hirons mf) but they may provide the earliest dates for upslope erosion for their respective sampling sites. The evidence for neolithic impact at the pollen profile site to the west of Farm Fields is consistent with the dates.

The suggestion of anthropogenic impact from the pollen record at

Rh1 in the time between 7500 and 4900 when no settlement evidence is evident in the excavation is not necessarily anomolous. The raised beach area is effectively off-site with regard to the excavated area; its pollen record thus reflects different influences though the pollen catchment areas of the pollen and archaeological sites may well overlap. The environmental record is predominantly local and indicates anthropogenic and other factors which are similarly local. Nevertheless, the profile does show vegetational changes consistant with human impact during the mesolithic, neolithic and later periods and they would also appear to demonstrate disturbances which have yet to be accounted for in the archaeological record of the area.

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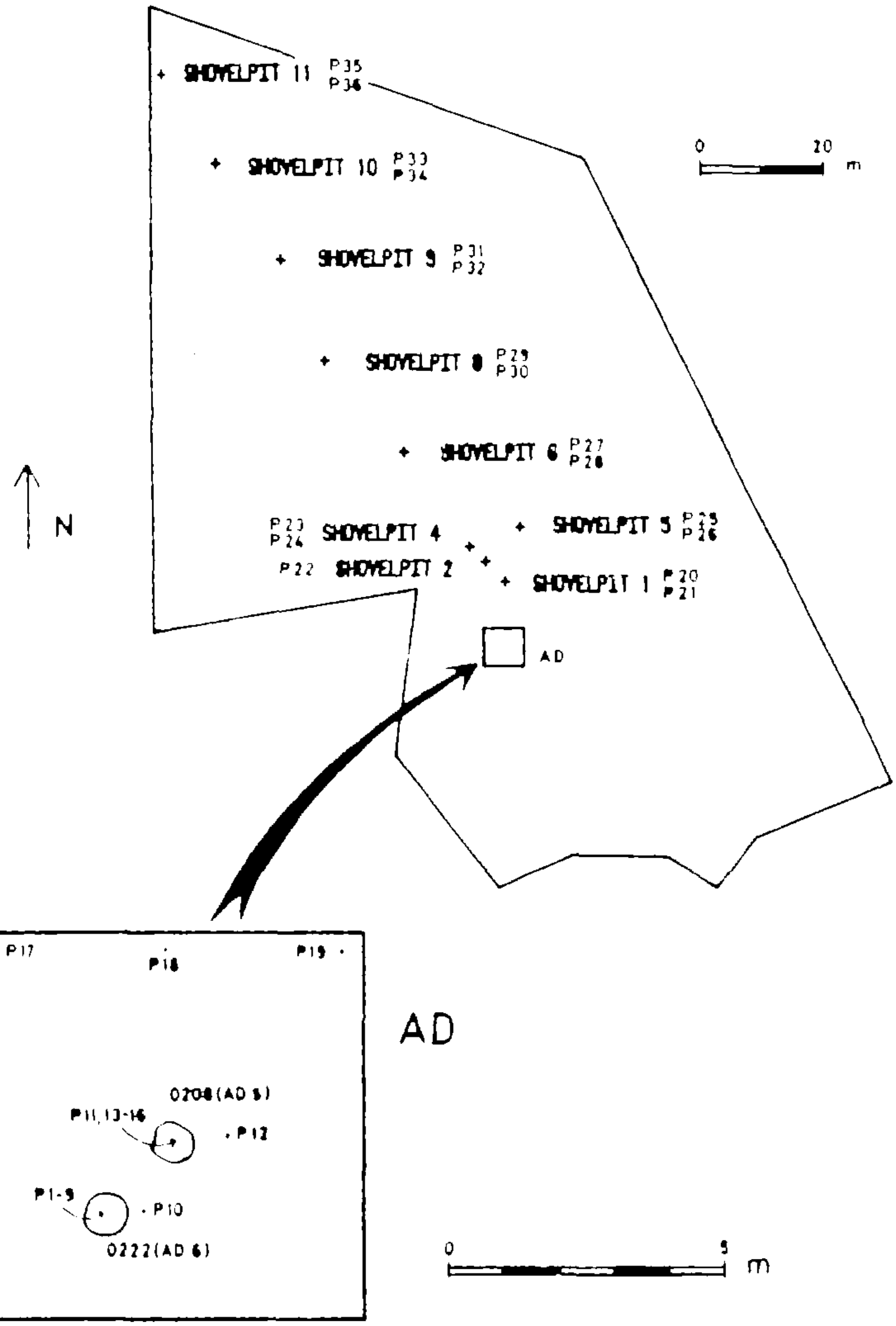
CHEMICAL ANALYSIS OF SOIL SAMPLES FROM THE FARM FIELDS EXCAVATION, KINLOCH, ISLE OF RHUM.

Ken R Hirons and Kevin J Edwards

INTRODUCTION

The analysis of phosphates, organic matter and trace elements in soils associated with archaeological excavation takes place primarily to assist in the interpretation of human activity. This works on the premise that the disposal of domestic rubbish and human and animal waste products over a sufficient period of time, may lead to the enhancement of certain chemical elements in the soil. The analysis of soil phosphates is the most common soil chemistry test to be used in archaeological contexts, particularly in an effort to assess the spatial extent, intensity or type of activity (Provan 1971, Proudfoot 1976, Edwards <u>et al</u>. 1983). An assessment of soil organic content may indicate the presence of burning, biological residues or the accumulation of soil organic matter (cf. Hamond 1983)and, although less useful, trace element determinations have been used for similar purposes (Sokoloff and Carter 1952, Cook and Heizer 1965, Hamond 1983).

This report presents chemical data from 36 samples submitted by the excavators in 1985. The principal aim of the investigation was to compare soil phosphate concentrations in samples from excavation trench AD with phosphate levels along a transect in



ILL 109 : Location of sampling points for chemical analysis across the excavation site the same field (Ill 109). The opportunity was also taken to assess the samples for organic matter and limited trace element content.

Sampling procedures

The soils in the excavation field have been assessed (Davidson 1984) as comprising a topsoil of sandy loam (0-24 cm in sample trench 080856) underlain by stony loamy sand (24-58 cm) and a stony sand/gravel layer (58-116+ cm). The stony horizons are interpreted as being of glacial/fluvio-glacial origin. The topsoil is now a cultivation horizon and the prehistoric soil may have been a peaty gley (with podzols occurring in better drained areas). Davidson suggests that cultivation may have resulted in the loss of an earlier peat layer.

Details of soil sample locations are shown in Ill109and table 48. Within the constraints of the sampling programme, it was the aim of the excavators to obtain data showing both horizontal and vertical variations in chemical content. Samples P1 to P19 relate to trench AD and two of its pits (AD 5 and AD 6). Samples P20 to P36 were obtained from 9 shovel pits spaced at a maximum interval of 23 m along a transect running north-west of trench AD (Ill 109). In each shovel pit (except P22), samples were collected from the surface of the subsoil (i.e. from immediately below the visible cultivation horizon) and from the same depth again within the subsoil. A working hypothesis was that the transect samples would provide 'background' levels for the chemical composition of the soils in the proximity of the excavations.

Methods of Analysis

Samples were dried at 110 C for 24 hrs and sieved through a 2 mm mesh. For phosphorus determination, samples were ignited for 1 hour at 550 C and digested for 1 hour in 1N HCl to extract organic and inorganic phases (Andersen 1976). The extract was filtered, made up to 100 ml and total phosphorus was determined by the phospho-molybdate method of Murphy & Riley (1962). Every fourth sample was repeated and cross-batch replicates were included for an estimate of overall between - and within - batch precision.

Initial estimates of organic matter content were made using low temperature loss on ignition (8 hrs at 400 C). More acceptable estimates were sought using the oxidisable organic carbon method of Walkley & Black (1934). Again every fourth sample was duplicated. Values of total organic matter (%OM) were calculated from the oxidisable organic carbon data using a correction factor of 1.724 (Hesse 1971, Finlayson 1975).

Measures of total manganese (Mn), zinc (Zn), calcium (Ca), magnesium (Mg) and copper (Cu) were made by atomic absorption spectrophotometry on a Perkin-Elmer 306 AAS after sample

Sample No.	
P1	bottom centre of emptied 0222 [AD 6]
P2	bottom E. side of emptied 0222 [AD 6]
P3	0.05m up E. side of emptied 0222 [AD 6]
P4	0.10m .. ..
P5	0.15m .. ..
P6	0.20m .. ..
P7	0.25m .. ..
P8	0.30m .. ..
P9	0.35m up (top edge) E. side of emptied 0222 [AD 6]
P10	subsoil surface, 0.50m E. of E. side of emptied 0222 [AD 6]
P11	bottom centre of emptied 0208 [AD 1]
P12	subsoil surface, 0.50m E. of emptied 0208 [AD 1]
P13	top edge, E. side of emptied 0208 [AD 1]
P14	0.20m down E. side of emptied 0208 [AD 1]
P15	0.30m .. ..
P16	bottom E. side of emptied 0208 [AD 1]
P17	NW corner trench AD, subsoil surface
P18	3.00m E. of NW corner trench AD, subsoil surface
P19	NE corner trench AD, subsoil surface
P20, P21	shovelpit 1 0730/[illegible]810
P22	.. 2 [illegible]
P23, 24	.. 4 [illegible]
P25, 26	.. 5 04[illegible]0/[illegible]020
P27, 28	.. 6 0530/[illegible]170
P29, 30	.. 8 0370/[illegible]
P31, 32	.. 9 [illegible]
P33, 34	.. 10 0150/[illegible]740
P35, 36	.. 11 0020/[illegible]040

Table 48 Description of the sampling points for chemical analysis across the excavation site

digestion by the acid-pressure decomposition method of Bernas (1978). The Cu content was below the limits of detection in all samples.

Results

Results of total phosphorus and organic matter determinations are given in table 49. The overall precision of the method in terms of laboratory precision (using the values for replicates) and of background (shovel pit) vertical and horizontal variability, using replicates from different soil levels (subsoil and subsoil surface) and from closely spaced pits 1, 2 and 4, was estimated by the method of Vermeulen (1953). These, and estimates of confidence intervals (following Chambers 1964) are shown in table 50. The data suggest that differences greater than 250 ppm (90% significance) or 350ppm (95%) are likely to be significantly different given laboratory imprecision. Background soil vertical and horizontal variability suggests that only differences between samples which exceed 550 ppm (90%) or 800 ppm (95%) are likely to be meaningful for the purposes of identifying artificial enhancement. Variability of less than this could be expected by varying depth of sampling in the soil. For estimated total organic matter determinations, precisions are given in table 51. Horizontal variability is greater than vertical variations for organic matter.

1) The shovelpit samples used to assess possible background

Sample No.	Total Phosphorous ppm.	Oxidisable Organic Carbon %	Est. Total Organic Matter	Loss on Ignition %
P1	528	3.1	5.3	10.9
P2	700	7.0	12.1	17.8
P3	550	2.9	5.0	8.2
P4	640 560] 600	4.9 4.9] 4.9	8.5 8.5] 8.5	12.5
P5	720	2.1	3.6	6.2
P6	700 720] 710	2.4	4.1	10.6
P7	516 652] 584	2.5	4.3	8.5
P8	710 3.6] 3.5	3.4 6.2] 6.1	5.9	8.4
P9	820 950] 885	2.8	4.8	10.4
P10	1370	8.6	14.8	22.3
P11	690	4.1	7.1	11.9
P12	456 2.2] 2.2	2.1 3.8] 3.7	3.6	4.9
P13	520 664] 592	3.1	5.3	7.1
P14	360	2.3	4.0	4.8
P15	480	3.0	5.2	9.0
P16	590 740] 665	3.0	5.2	8.0
P17	650	3.2	5.5	7.5
P18	650 500] 575	6.5 7.8] 7.2	11.2 13.5] 12.4	17.5
P19	870 750] 810	4.7	8.1	14.4
P20	390	2.8	4.8	8.9
P21	264 168] 216	2.8	4.8	10.6

Table 49 Chemical analysis across the excavation site : total phosphate and organic matter determinations

Sample No.	Total Phosphorous ppm.	Oxidisable Organic Carbon %	Est. Total Organic Matter	Loss on Ignition %
P22	344	4.7 4.7] 4.7	8.1 8.1] 8.1	17.7
P23	360	5.7	9.8	21.7
P24	432 440] 436	1.3	2.2	6.1
P25	136 136] 136	4.3	7.4	18.6
P26	660	4.3 4.1] 4.2	7.4 7.1] 7.2	14.1
P27	204 212] 207 204	3.6	6.2	13.2
P28	280	2.8	4.8	12.5
P29	340 350] 345	3.0	5.2	9.9
P30	456	3.0 3.5] 3.3	5.2 6.0] 5.7	13.4
P31	456 388] 392 336	2.3	4.0	8.6
P32	560 450] 510 520	2.8	4.8	11.6
P33	356 372] 337 284	3.9	6.7	12.1
P34	300	2.9	5.0	12.2
P35	260 272] 266	1.9	3.3	8.5
P36	420 400] 410	3.0 2.7] 2.9	5.2 4.7] 5.0	11.9

	Precision	Difference likely to be significant 90% confidence	95% confidence
Laboratory variation	± 0.6	± 2.6	± 3.8
Background vertical variation	± 2.0	± 8.4	± 12.4
Background horizontal variation	± 3.4	± 13.9	± 20.5

Table 50 Chemical analysis across the excavation site : total phosphate determination, estimate of variability (ppm P)

	Precision	Difference likely to be significant 90% confidence	95% confidence
Laboratory variation	± 60	± 250	± 350
Background vertical variation	± 135	± 550	± 800
Background horizontal variation	± 120	± 500	± 750

Table 51 Chemical analysis across the excavation site : total organic matter determination, estimate of variability (% om)

levels of P from the Kinloch field vary in concentration between 136 and 660 ppm P (both shovelpit 5). There is a general tendency for samples from within the subsoil to have P values exceeding those at the surface of the subsoils (ranges; 216-660 ppm for subsoils and 136-3C3 ppm for subsoil surface). This pattern holds for all but shovelpit 1 but is never significant even at 90% confidence level. Illustration 110 shows frequency histograms of the phosphorus determinations : 2a) from the surface of the subsoil and 2b) from within the subsoil. The slight difference in values is apparent from the histograms. There is no apparent spatial trend in P concentrations within the transect samples.

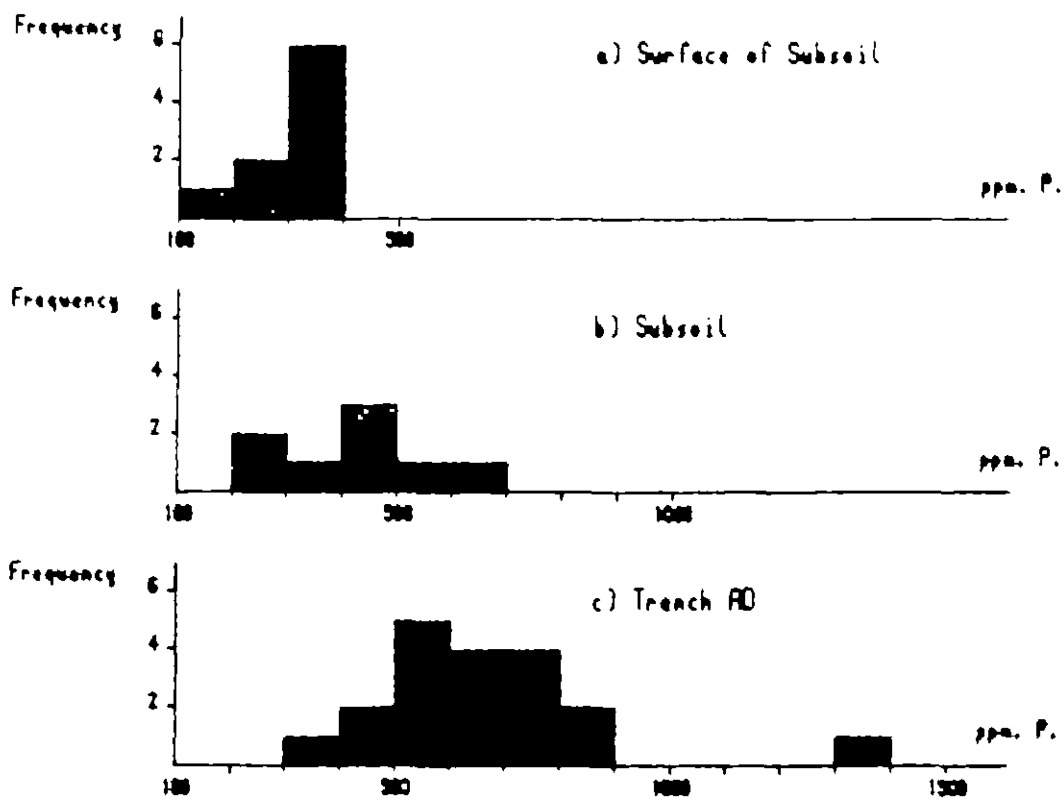
2) Phosphate samples from the subsoil surfaces in trench AD (P10, P12, P17-19) range in concentrtion between 446ppm and 1370ppm. P10, P17 and P19 are all significantly higher in P than shovelpit samples at the 90% probability level. Illustration 110 shows a histogram of all samples from trench AD including those from the two pits.

3) Vertical phosphate variability within the two pits AD208 and AD222 showed no consistent trend or any layers with significantly enhanced P levels. The two samples with highest concentrations occur at the top of AD222 (P9) and at P10 close by. A students t-test of differences between means for samples of unequal variance was used to compare the background samples (X = 356 ppm P, s = + 124) with samples from trench AD (X = 665 ppm P, s = + 211). This gave a t obs of 5.27 which is significant at p 0.01 given d.f. =

31. Thus, assuming both sample sets to be normally distributed, which seems reasonable on inspection of Ill 109 , the samples from AD have significantly higher P concentrations than the background samples.

4) There is some tendency for organic matter to increase downslope in the surface and subsoil samples of the background transect. The lack of consistent vertical variation is not unexpected given that samples came from beneath the cultivated surface horizon. Maximum organic matter values of 8.1% and 9.8% are lower down the field (pits 2 and 4) whilst the lowest value is at pit 11 at the top of the field. Pit 1 has low values but is on the knoll with trench AD. Some organic matter values within trench AD tend to be high; P10 = 14.8% (highest value) and P18 = 12.4%. However, background variation is large and AD values other than the two aforementioned fall within the background range.
Organic matter profiles from pits AD5 and AD6 show no clear patterning, although P2 at 12.1% from the base of AD6 is significantly higher than samples overlying it and its near neighbour P1.

5) An extended discussion of the trace element analyses is beyond the remit for this study. The data in table 32 are included for interest. Such bases as Ca and Mg are highly susceptible to leaching processes, Ca and Mn values may be enhanced by the disintegration of bone in acid soils while Zn and



ILL 110 : Chemical analysis across the site. Frequency distributions for phosphate determinations

Cu are concentrated in shellfish and the viscera of such wildlife as fish, animals and birds (cf. Hamond 1985). A more comprehensive study of the chemistry of soils at the site would be of interest.

Phosphate concentrations from several samples taken from trench AD at Kinloch Farm field were found to be significantly higher than background levels determined from shovelpits within the excavation field. It is unlikely that this concentration has been caused by lateral translocation of topsoil as AD is situated on a slight knoll which has presumably been a sediment shedding rather than receiving site. The enhancement is more likely to be due to an accumulation of human/animal derived phosphates related to a period of localised activity. However, the enhancement is not great, being of the order of 300 ppmP (X for background samples 356 ppm and for trench AD samples 665 ppm). The enhancement observed could be explained by P accumulation from animal corralling and human waste due to proximity to the bothy over a period of time and could well be modern. Phosphate values from pits AD5 and AD6 show no enhancement over values from the rest of trench AD. The two highest P concentrations are from the subsoil surface at the top of AD6 and at nearby P10.

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REPORT ON POLLEN AND ANCILLARY ANALYSES IN SUPPORT OF THE EXCAVATIONS AT KINLOCH, RHUM 1984, 1985, 1986

B MOFFAT

Introduction

This report presents the results of the analysis of pollen and plant macro-remains from on-site deposits in support of the excavations at Kinloch, Farm Fields, Rhum in 1984, '85 and '86. The study comprised three parts:

1) Samples taken from excavated contexts in or adjacent to archaeological features to aid in the definition and interpretation of the features.

2) Samples taken from material attached to pottery.

3) Pollen analyses from a peat monolith collected from the infill of a watercourse that once crossed part of the site. This sampling point was the site closest to the excavations where stratified deposits could be found. 'Loss on ignition' and aluminium content of the infill were determined. A radiocarbon date was obtained from a buried soil below the base of the deposit.

Samples were collected from carefully cleaned faces or by scraping from the potsherd in question. The monolith was collected by hammering a metal monolith tin into the cleaned face of the trench. Sub sampling for pollen was then carried out in the laboratory.

Preparation for pollen analysis was by a modification of the concentration techniques of Faegri and Iversen (1975). This included sieving, deflocculation with KOH, acetolysation and removal of mineral silicates with HF. Finally, the samples were stained with safarin and mounted in glycerine for examination under the microscope.

'Loss on ignition' was measured on samples from the monolith as an estimate of organic content. Aluminium values were determined by atomic absorption spectrophotometry as an index of active soil erosion. The determinations were carried out by Dr. Michael Penny in the Department of Forestry and Natural Resources, University of Edinburgh.

Sample Descriptions

In all, seventy-one samples were collected for palynological examination as part of this study. These were numbered consecutively and are described in the concordance below along with an assessment of their archaeological period, brief description, the radiocarbon age (if determined) and a finds number where appropriate.

Samples were collected from the following groups;

1. Samples from the fill of mesolithic pits.

2. Sample from neolithic context AD7.

3. Scrapings from neolithic potsherds.

4. Samples from artificial dumps within the peaty fill of the watercourse.

5. A series of samples taken from the peaty fill of the watercourse including a monolith taken through the deposit.

CONCORDANCE OF SAMPLES

1. Samples from the fill of Mesolithic pits.

a) Context AD6, Samples from fill of post pipe within AD0222.

1.AD0209:

Pit AD0222. Base of post pipe at edge of woody part of core. Peaty soil.

2.AD0209:

Woody part of core at base of post pipe. Partly humified wood with three pieces identified as Betula spp.

3. AD0225:

Organic 'pellet' in lowest fill of AD0222.

4. AD0225:

Lowest fill of AD0222, peaty soil from body of deposit.

8. AD0159:

Upper part of post-pipe fill. Peaty soil with comminuted charcoal abundant.

11. AD0225:

Sub-sample of lowest fill of AD 0222; matrix of fibrous peat with Eriophorum spp. remains.

b) Context AG122

6. AG121:

Fill of pit AG0121. Stems of Calluna , some charred, included in greasy, black peaty fill.

7825+65BP GU-2039

7. AG122:

Sample from fill of pit AG0122.

c) Context BA3 mesolithic pits.

BA0048 dated to 7850±50 BP GU-2145.

80. BA0021:

Fine black soil from within shallow depression. Much burnt amorphous material and small angular stones.

d) Context BA4/5 fill of master hollow BA0110.

64-68. BA0106:

Pit fills from from shallow depression under master context 110. Samples taken from beneath slab stones that lie set in pit.

e) Context BA8 mesolithic fill of hollow BA0110.

69-70. BA0108:

Samples of pit fill from set of shallow depressions recorded under master context BA0110, samples taken from below slab.

f) Context BA9 mesolithic fills from master hollow BA0110.

58. BA0091:

Fine black soil from within shallow depression. Much burnt amorphous material and small pebbles.

59. BA0093:

Fine black soil from within shallow depression. Much burnt amorphous material and small pebbles.

2. Sample from Neolithic context AD7.

8. AD0153:

Taken from layer sealing pit A1 and from beneath large slab stone. Subsided silty material.

3. Scrapings from Neolithic Potsherds

a) Samples collected from the ploughsoil context AG0271.

18. AG0271:

Residues encrusted on pot sherds. Sherd 10.

17. AG0271:

Residues encrusted on pot sherds. Sherd 4.

18. AG0271:

Residues encrusted on pot sherds. Sherd 24.

19. AG0271:

Residues encrusted on pot sherds, context interpreted as modern contamination from field drain. Sherd 91.

20. AG0271:

Residues encrusted on pot sherds, context interpreted as modern contamination from field drain. Sherd 27.

21. AG0271:

Residues encrusted on pot sherds. Sherd 28.

22. AG0271:

Residues encrusted on pot sherds. Sherd 214.

29. AG0271

Residues encrusted on pot sherds. Sherd 13.

b) Samples from modern field-drain disturbing the site.

Context AG0181.

23. AG0127:

Residues encrusted on pot sherds. Fill of drain 181. Black fibrous soil. Sherd 38.

24. AG0127:

Residues encrusted on pot sherds. Fill of drain 181. Black fibrous soil. Sherd 42.

28. AG0127:

Fill of drain 181. Residues encrusted on pot sherds, context interpreted as modern contamination from field drain. Sherd 38.

c) Samples from rock and gravel dumps in fill of watercourse.

Context AG0128.

25. AG0128:

Residues encrusted on pot sherds. Top layer of peaty fill of watercourse (mixed wood/grass/sedge). Sherd 29.

26. AG0128:

Residues encrusted on pot sherds. Top layer of peaty fill of watercourse (mixed wood/grass/sedge). Sherd 1.

27. AG0128:

Residues encrusted on pot sherds. Top layer of peaty fill of watercourse (mixed wood/grass/sedge). Sherd 104.

4. Samples from dumps within peaty fill of watercourse.

a) Samples from "Midden Dump"

BA0077 comprised dumps of neolithic midden and brushwood in part of the watercourse (Samples 30-38). Radiocarbon determination 4080±80 BP GU-2148.

30-38. BA0077:

From "midden deposit" dumped in watercourse. Haswithin it charred brushwood (Alnus , Betula spp. and Corylus). Near sherd in lens of woody peat, mainly Alnus .

b) Samples from rock and stone dumps. Context AG0128.

5. AG0128:

From deep top layer of watercourse fill, stems of <u>Calluna</u> and fibrous peat. 7925±65 BP GU-2042

10. AG0128:

Sample of top layer in watercourse fill.

12. AG0128:

Boxed samples from E edge of AG0128 (12-15). Agglutinated peaty inclusion in basal sand.

13. AG0128:

Sample of basal sand in 0128.

14. AG0128:

Sand, peaty soil boundary overlying 12-13 in AG0128.

15. AG0128:

Peaty soil above 12-14 in 0128.

5. Series of samples taken from the peaty fill of the watercourse.

BA0060 'spit' across the peat fill of the watercourse (Samples 37-41).

37-41. BA0060:

Sample to characterise content of peat layer in gully of burn. Wood with macro-remains of cotton-grass, <u>Eriophorum</u>, and peaty detritus.

42-43. BC0028:

Gelatinous black mass smelling of resin, for a half-hour after exposure, in base of watercourse. Contains splinters of coniferous wood. Area highly disturbed by drains.

44-57. *Samples from monolith taken through fill of watercourse.*

RESULTS

Introduction

The results of the pollen analyses of on-site soil samples are tabulated (table 53). The tables give numbers of pollen counted with percentages of tree plus shrub, grass and sedge pollen, herb pollen, ericaceous and spore-bearing taxa.

Samples 11, 13, 18, 20, 21, 22, 27, 62, 64, 65 and 69-71 all proved to be barren of pollen. Full counts from samples 35, 38, 41, 61 and 68 provided only very few grains and these were also excluded from the pollen table. The pollen table shows samples calculated as percentages of the sum of pollen of dry land taxa with other pollen and spores represented as sum plus taxon.

There are no modern exotics in any of the pollen samples which would necessarily indicate modern contamination. However, the archaeological context of the samples shows that they were deposited as part of an 'open system' and as such they must have been subject to mixing of elements from different pollen accumulation sites. This is particularly true of the Monolith samples which will be discussed later. In general, however, slopewash has been suggested as the chief agency for infilling large parts of Trenches AG and AH and it is likely that overland flow has been active over most of the site bringing with it transported pollen. This pollen was possibly mainly pene-contemporaneous (ie. recently deposited pollen) but latterly, after peat formation, derived pollen also must be suspected.

More specifically, samples 19, 20, 23, 24, 25, 26, 27 and 28 all originate from either modern ploughsoil or from the top of the dump of rocks and other material in the watercourse (AG128), and the interpretation of this is problematical. Samples 42 and 43 must also be considered suspect on the basis that their localities were highly disturbed by field drains.

Resume

Context 1a: Samples 1-3 all contain birch pollen, unlike 4 and 6 and fewer ericas. There is no patterning evident evident in the samples from within AD8, and this suggests a fill of mixed provenance, as might be expected in a post hole fill.

Context 1b: The samples gave similar results to each other although 7 has slightly more alder pollen than 8.

Context 1c: Sample 60 has high Alnus pollen.

Context 1d: Samples 64 and 65 had no countable pollen.

Context 1e: All samples proved to have a very low pollen concentration.

SAMPLE NO.	POLLEN SUM	Alnus	Salix	Corylaid	Betula	Quercus	Ulmus	Pinus	Ilex	Sambucus	Hedera	Prunus type	TREES & SHRUBS % OF POLLEN SUM	Gramineae	Cereal type	Cyperaceae	GRASSES & SEDGES % OF POLLEN SUM	Ranunculaceae	Cruciferae	Caryophyllaceae	Chenopodiaceae	Linum catharticum	Potentilla type	Filipendula	Umbelliferae	Rumex sect. Rumex	Rumex sect. Acetosa	Urtica dioica	Teucrium	Plantago lanceolata	Plantago major	Campanula type	Galium type	Succisa	Compositae lig.	Compositae tub.	Iris pseudacorus	HERBS % OF POLLEN SUM	Calluna	Ericales	ERICOID SHRUBS % OF POLLEN SUM	Polypodium vulgare	Equisetum	Osmunda	Pteridium	Blechnum spicant	Dryopteris filix-mas	Filicales	Sphagnum	SPORIFEROUS TAXA % OF POLLEN SUM	SAMPLE NO.
1	214	4	9	7	13	1		1			1		16.8	86		52	64.5	1		1		1	2			1			1	2			1		1	2	2	7.0	21	4	11.7	5			3			25	6	18.2	1
2	272	11	5	11	102	2		4	1	1	4	1	32.2	54		8	22.8	1		1		1	1	1			1	4	1	4	1		3	1			4	8.8	37	7	16.2	43	2	4		19	3	146		79.8	2
3	198	7	6	8	29				1	1	7		29.8	48		20	34.3				4					1		25		6	6				1	1		22.2	21	6	13.6	7	14		1	1	1	17		20.7	3
4	317	1	1	1	6	1		1					3.5	73		27	31.5					1	1						1	1			2	1				2.2	145	54	62.8	8		17		8		39		23.0	4
5	280	3	1	2	4			1			1		4.3	31		7	13.6	1	1	2		5	5	1	1		1		3	2			5	1	1			10.4	176	25	71.8		1		25	5		80	5	41.4	5
6	274	4	1	3	12	11	3	2	1	1	4		15.3	65		31	35.0	2	2	7	1	1	3		2	1	4	1	3	1	1		3		1	2		12.8	58	43	36.9	8			17	1	1	96	6	47.4	6
7	42	5			2								16.7	9		3	28.6	1									1								2			9.5	19		45.2		1		5			38		104.8	7
8	76	3		1	2				1				9.2	9			11.8										1		1						1			3.9	51	6	75.0	5						20	19	57.9	8
9	218	11		3	14	1	1				3		15.1	43		11	24.8	2	1	2	1		1				1			2			6	2	1	1		9.2	89	22	50.9				2	7	1	30		18.3	9
10	56	5			4								16.0	5			8.9	1				1					1		1				3					12.5	31	4	62.5			8				28		64.3	10
11	nil																																																		11
12	242	4	1	3	15	1		1	1	1	2		12.0	45		19	26.4	1		3		2	2	3			3		3	2	1	4	4		1		1	12.4	87	32	49.2	2	5			8		67	5	36.0	12
13	nil																																																		13
14	412	23	2	5	41	2	1	1		1	3		19.2	97		41	33.5	2	3	4	1	5	1	3	1	8	4		1	3	1	3			2			10.2	119	34	37.1	40	5	2	8	5	5	93		38.3	14
15	286	11	1	9	28	6	2			2			20.6	60		22	31.5	1			1	1				1	2	4	3	4	2	1	3		2	3	1	10.1	79	29	37.8	5	5			1		35	6	18.2	15
16	20	2		1	1								20.0	2		1	15.0										1	1		1					1			20.0	9		45.0	2				1		4		35.0	16
17	173	8		4	3	1							9.2	23		8	17.9	3			2		1	2			4	2	1	4			2	1	4	2		16.1	79	19	56.6	3		1	5	1		11	1	12.7	17
18	nil																																																		18
19	234	14		6	9	2		2					14.1	52	9	9	29.9	8			3			2			4	2	3	5			2	2	9	2		17.9	83	6	38.0	5			3	2		21		13.2	19
20	nil																																									2			1			5			20
21	nil																																									3				1		6			21
22	nil																																															1			22
23	184	13		8	5	1		2					15.8	39	3	6	26.0	1			2		1	13			1			4				2	4			15.2	61	18	42.9		1	18	2			6	1	15.2	23
24	129	5		2	3	1		1					9.3	14		8	17.1	2			1		1	8		1	1		1	1				1	3	1		14.7	58	18	58.9	2	1	1		1		13	1	14.7	24
25	42	2		1	2								11.9	6		2	19.0	1									1			1				1	2			14.3	18	5	54.8	2				2		2		14.3	25
26	25	1		1	1								12.0	3		1	16.0													1	1				3			20.0	11	2	52.0	2						1		12.0	26
27	nil																																																		27

Table 53 Environmental samples from the excavation site: results of pollen analysis

SAMPLE NO.	POLLEN SUM	Alnus	Salix	Corylus	Betula	Quercus	Ulmus	Pinus	Ilex	Sambucus	Hedera	Prunus type	TREES & SHRUBS % OF POLLEN SUM	Gramineae	Cereal type	Cyperaceae	GRASSES & SEDGES % OF POLLEN SUM
28	214	24		5	7								16.8	38	5	19	29.0
29	82	6			2								9.8	17	2	5	29.3
30	212	32	1	5	8	1		1					22.6	21		15	17.0
31	240	61	2	7	18	3		3		2	1		40.4	33		19	21.7
32	624	262	18	98	110	7	3	8		6			82.1	27		29	9.0
33	486	172		61	82	6	2	6		4			68.5	38		24	12.8
34	702	306	13	32	17	7	1	11		11			56.7	119		82	28.6
35	11	2		3	1								54.5	2			18.2
36	4	1											25.0				
37	117	28		11	9	3		2		2			47.0	17		6	19.7
38	182	18	3	15	11	3	1	5		6			34.1	33		15	26.4
39	244	32	3	4	15	1	1	2		3			25.0	41		29	28.7
40	86	5	1	5	4	2		7					27.9	15		3	20.9
41	12	1		2	1								33.3	1		2	25.0
42	1800	362	37	172	231	16	2	792					89.6	48		28	4.2
43	972	186	17	66	92	9		492					88.7	22		19	4.2
58	219	31	1	2	3			9					21.0	37		14	23.3
59	179	19		1	9			4					18.4	48		12	33.5
60	311	136	1	4	25			6					55.3	21		11	10.3
61	14																
62	nil																
63	214	24		5	9	1		2					19.2	68		24	43.0
64	nil																
65	nil																
66	201	21		2	6			3					15.9	68		39	53.2
67	112	6		3	2			12					20.5	24		7	27.7
68	12	12											100.0				
69-70	nil																

SAMPLE NO.	Ranunculaceae	Cruciferae	Caryophyllaceae	Chenopodiaceae	Linum catharticum	Potentilla type	Filipendula	Umbelliferae	Rumex sect. Rumex	Rumex sect. Acetosa	Epilobium type	Urtica dioica	Teucrium	Plantago lanceolata	Plantago major	Campanula type	Galium type	Succisa	Compositae lig.	Compositae tub.	Scrophulariaceae	Plantago maritima	Iris pseudacorus	HERBS % OF POLLEN SUM
28	1		1			2	19		1	4				6	1		3	6						20.6
29						4	3			2				8				1	2					24.4
30	2		2	2		1	1	1	2	1		3	1	13	2	1	4		19	12		5		34.0
31		1		2		2	1		3	4			3	9	1				3					12.1
32	1			1		1				2		4		8					5					3.5
33	1			4	1	2				1		2		11			1		7	1				6.4
34				2		2			4	2		1		5	1		4	2	8	3				4.8
35																			1					9.1
36																								
37				1					1	1		1	1	4					5	2				13.7
38	1		1			2	2	1	3	4		3		4				1	2					13.2
39		1							6	4		23	2	11				1	8	2				23.8
40				3					1	2									2					9.3
41																			2					16.7
42	2			2		1			7			5		5					16					2.1
43				1					7			2		2	3				7	5				2.8
58	1	1	1	1				1	1	1				8	1			1	2	2				9.6
59		1	1											16					5	1				13.4
60		1							31		14								2		1			11.3
61																								
62																								
63		1					1		6								1		13					10.3
64																								
65																								
66		2	1				3		5					9	2				3	4				14.4
67		1						1	1			1		1			1		1					6.3
68																								
69-70																								

SAMPLE NO.	Calluna	Ericales	Empetrum	ERICOID SHRUBS % OF POLLEN	Polypodium vulgare	Equisetum	Osmunda	Pteridium	Blechnum spicant	Dryopteris filix-mas	Filicales	Sphagnum	SPORIFEROUS TAXA % OF POLLEN SUM	SAMPLE NO.
28	61	11		33.6	2		5	6			5		8.4	28
29	28	2		36.6	1		2				6		11.0	29
30	34	22		26.4	18		1	3		3	16	7	22.6	30
31	47	15		25.8	3			5			22	6	15.0	31
32	30	3	1	5.4	8	16		1			40	7	11.5	32
33	41	19		12.3	5	2		7			19	5	7.8	33
34	48	21		9.8	31	24		8			32	7	14.5	34
35	2			18.2							12		109.0	35
36	3			75.0						1	1		50.0	36
37	21	2		19.7	5		1				5	8	16.2	37
38	36	12		26.4	2		2	3			6	1	7.7	38
39	41	14		22.5	7			8			6		8.6	39
40	30	6		41.9	8		3	5			13	19	55.8	40
41	3			25.0	1		1	1			12	5	167.0	41
42	48	23		4.1	114	8					40		9.0	42
43	36	6		4.3	16						32		4.9	43
58	88	13		46.1	2			1			4	22	13.2	58
59	42	20		34.6	3						5		4.5	59
60	60	12		23.2	2		1				11	5	6.1	60
61														61
62														62
63	51	8		27.6	5	2				1	2	4	6.5	63
64														64
65														65
66	30	3		16.4	5	1		1		1	12	2	10.9	66
67	32	19		45.5	14			7		2	9	6	33.9	67
68														68
69-70														69-70

Table 53 (contd) Environmental samples from the excavation site: results of pollen analysis

Context 1f: Assemblages dominated by heathers, grasses and sedges.

Context 2: Sample 9 was dominated by heathers with some fern content.

Context 3a: Samples from potsherds collected from the ploughsoil. A fairly homogeneous group with a high Ericaceous content.

Context 3b: Scrapings from potsherds taken from the modern field-drains crossing the site. Again these form a homogenoeus group dominated by Ericaceae and Gramineae pollen.

Context 3c: Scrapings from potsherds taken from the rock and gravel dumps in the watercourse. Again very similar to 3a) and b).

Context 4a: Samples from peat within the "midden dump" material in the watercourse. These samples were taken to provide a background against which to compare the potsherd scrapings. They are somewhat different to the group three samples in having more tree pollen, mainly Alnus but also some Coryloid and Quercus, and lower Ericaceous pollen.

Context 4b: Samples from peat within the rock and stone dumps in the watercourse. These samples have a high Ericaceous pollen content similar to those in group three.

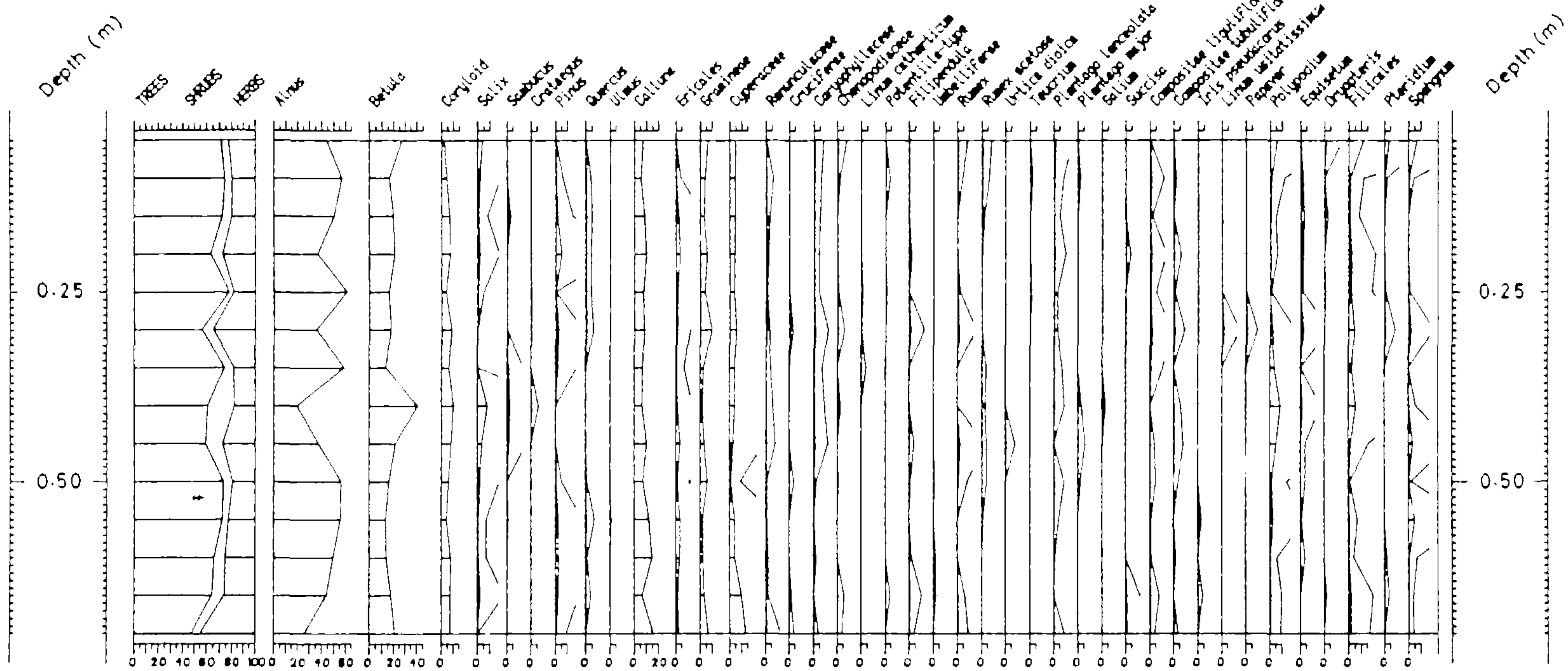
Context 5: Samples from the peaty fill of the watercourse. Samples have slightly more tree pollen and less Ericaceae than the group three-type. Samples 42 and 43 have very high pine pollen contents but are from a disturbed context.

Discussion

The results of the pollen analyses from the monolith through the watercourse crossing the site are presented in the form of a pollen diagram (Ill 111). The data are plotted against depth, calculated on the basis of total land pollen.

Sutherland (Chapter 12) has suggested that the channel was only active as a stream in late or immediate postglacial times and that an orderly accumulation of peat might have been possible. However, there are many problems inherent in attempting an investigation of such channel fills in a stratigraphic context; the assumed derivation of pollen and sediment from sources other than the immediate vicinity of the sampling site, and the likelihood of alluvial and colluvial episodes make it difficult to interpret the stratigraphy as a simple time series. Also the likelihood of hiatuses caused by sediment removal by flushing of the site during extreme events and possible sediment inversions by inwashing of eroded peat add to the uncertainties.

The pollen diagram shows a rather homogeneous pollen sequence dominated by Alnus which, at up to 80% was probably predominant



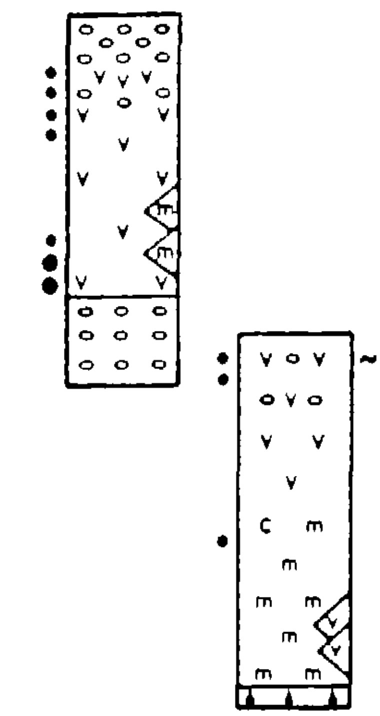
Pollen sum = total land plant pollen! taxa outside sum as percent sum + taxon
Exaggeration of open curve is x10.

ILL 111 : The watercourse monolith. Pollen count in the scrub around the wet flush. *Betula*, *Gramineae*, Coryloid and Cyperaceae are the other important taxa represented. *Salix* is present in some quantity but other trees are poorly represented. Many herb-pollen types were recorded throughout the profile. The only real trend apparent in the diagram is from slightly higher Cyperaceae and *Calluna* in lower parts of the diagram to slightly higher *Betula* and Gramineae in the upper parts of the profile. In the middle of the profile there is a phase with slightly higher *Salix* and *Betula* and a continuous *Sambucus* curve. The area near the burn was a wet flush with *Alnus* bushes rooted in it at various points. The plants contributing the birch pollen probably grew further up the slope where the soils would have been drier. The trend suggests slightly drier conditions in the period represented by the upper sediments presumably in response to the infilling of the channel.

The date of 7140±130 BP (GU-2211) from the buried soil below the base of the monolith precedes the date of the rise in *Alnus* pollen in the Rhum 1 monolith of 6430±80 BP (GU-2108). As *Alnus* pollen was found at the base of the watercourse monolith either we have local presence of *Alnus* at Farm Fields c. 500 years before the major expansion at the core site RH1, or a hiatus in sedimentation occurred between the soil sample date and the start of peat accumulation.

Ill 112 shows a stratigraphic column and sediment data from the watercourse monolith. The sediments are comprised of a *Molinia*

Sample No.	Wt mg	Org %	Al ppm
4/1	1426.0	10.2	257.0
4/2	1076.0	91.1	323.9
4/3	1122.0	90.4	337.3
4/4	1222.0	87.2	339.2
4/5	1195.0	80.2	356.5
4/6	993.0	90.3	407.4
5/1	866.0	23.8	412.8
5/2	913.0	44.8	478.6
5/3	468.0	92.5	711.5
5/4	1061.0	85.3	362.4
5/5	603.0	92.2	738.0
5/6	732.0	90.7	530.0
5/7	715.0	94.7	543.4
5/8	748.0	84.0	413.8



Boxes in position
Contents

v	Woody Peat
m	Molinia Peat
c	Sedge Peat
o	Stony Silts
▲	Basal Silts
•	common — Charcoal
●	abundant — Charcoal
~	Ova of sheep liver fluke (?)

ILL 112 : The watercourse monolith. Stratigraphic column and sediment characterisation data peat with woody inclusions, 30-cm in depth, overlain by a more woody peat of 30 cm depth. Between these layers there was a band of stony-silts around 25 cm in thickness. Stony silts again appear within the top 10 cm of the profile. A layer of brushwood is present within the lower peat stratum. The wood was identified as Alnus. The figures for organic matter and aluminium content outline the mineral layers in the profile; organic matter content being reduced where the layers occur. Aluminium follows this pattern being generally lower in the upper part of the monolith and declining where the mineral content of the sediment is higher. This suggests that the mineral content of the upper part of the monolith is lower in aluminium than the lower part perhaps indicating that the soils washing into the watercourse in the upper part of the sediment had been subject to more leaching of aluminium than those below.

The Presence of Linum pollen (flaxes).

Linum usitatissimum occurs as five grains at 30cm depth in the monolith. Linum pollen is large and not carried far by wind (eg. Gennard 1987, Hall *pers comm*) and under normal circumstances a find of its pollen would suggest cultivation of flax on or in the immediate vicinity of the site of discovery. The sediments in the watercourse are undoubtedly derived, though not necessarily from any great distance and it is most likely that flax cultivation took place within what is now the excavation field. The dating scheme suggested for the peat in the watercourse by the radiocarbon dates outlined above would indicate that the stones dump which overlies the finds of flax pollen dated to slightly before 4000 BP. It is of course possible that the date is influenced by redeposition of derived organic sediments but the secure dating of the slopewash suggests flax cultivation somewhere around the start of the second millennium BC. Jessen and Helbaek (1944) report the cultivation of flax in the neolithic of Britain and Godwin (1975) reports records of it as far north as the Lake District, flax has recently been reported from likely neolithic deposits in Kincardine, Deeside (Bond & Hunter 1987, 175).

Linum catharticum (purging flax), is a native annual characteristic of, but not confined to, calcareous grasslands. It is quite common in heathy grasslands on Rhum today. Linum catharticum possesses the fibrous and oleaginous properties of L. usitatissimum to a small degree but by any modern assessment it does not rival the properties of cultivated flax. Godwin (1975) reports finds of its pollen in association with Bronze Age and Early Iron Age cultivation. Linum catharticum was found in four samples assumed to be mesolithic (1, 2, 4, 8) and several neolithic (5, 10, 12, 14, 15, 33).

It is notable that all of the Neolithic contexts containing Linum pollen are associated with the watercourse. Samples 5 and 10 are from the rock dump; samples 12, 14 and 15 are from context AG0128; samples 30,31,32,33 and 34 are from the midden dump; and 38 is from the peat in the watercourse. Perhaps the watercourse was used as a retting pond for the flax. This was possibly in the neolithic but it is more likely that later, it took place after some of the upper sediments had been dug out of the flush. This might relate to the making up of the banks of the watercourse by the spreading of rubble, or to the laying down of a brushwood base, perhaps to consolidate the flush for use as a pond. Macro-remains of the cultivated flax Linum usitatissimum provide the best evidence of retting and without these the interpretation of these deposits must remain uncertain.

The Littoral Element

There is little evidence of an obligate littoral element in these pollen floras. However, many pollen taxa could represent plant species characteristic of local marine conditions. These include Caryophyllaceae, Chenopodiaceae, Rumex and Plantago maritima suggesting that the marine influence although strong has not been a predominant factor in the formation of the fossil assemblages.

Tree Pollen

Overall, there are significant differences in the amounts of tree pollen in the range of on-site samples investigated. Samples with low tree pollen counts include mesolithic samples from BA (58, 59, 66, 67) and both mesolithic and neolithic samples from AG and AD (5-7, 10, 12, 14 and pot encrustation samples 16-29). Samples with high tree pollen frequencies include BA 32-35 and BC 42 and 43 which are most likely neolithic or later. Off-site pollen analyses would tend to confirm that the period when tree and shrub vegetation was at its most prominent locally was after the time of mesolithic occupation excavated at Farm Fields. The pollen suggests a scrub woodland element with hazel and alder predominating. However there are in some samples with relatively high proportions of Betula (14.8 - 37.5% TLP in samples 2, 3, 32, 33) and in samples from the resinous mass in the burn-fill (samples 42 and 43) very high Pinus frequencies (44-48.2% TLP).

Cultivars

Only two undisputed cultivars have been identified amongst the pollen assemblages. Flax, which was found in the burn-fill and as discussed above, and cereal. The pollen of cereals occurred in four samples from on site (19, 23, 28 and 29), all of which were from potsherds. All four samples also contained higher proportions of Filipendula pollen than in samples from the sediment matrix (eg. group 4 samples) and these findings are interpreted as evidence of former pot contents (Moffat in press). It is difficult to place these samples in a wider context since all but sample 28 come from contexts with some contamination. However, given the finds of cereal-type pollen in the monolith from Farm Fields (Rh1, Hirons and Edwards mf) it is possible that cultivation was practised close to the excavation site in the Neolithic after 4000 BP. There were numerous herb taxa present in the pollen record many of which might be equated with weeds. These fit in to an occasional and seasonal outbreak of weed growth; they are unremarkable and do not compliment any particular agrarian or crop system.

Liver Fluke

The ova of the sheep liverfluke *Fasciola hepatica* were found in a sample from the monolith, in three samples of woody peat from the midden deposit (32-34), and in sample 7 of woody peat from alongside the watercourse (36 in all). Although known as the sheep liver fluke this parasite has been recorded in most orders of animal but it is a major epizootic infestor associated with livestock particularly when kept at high densities in enclosed conditions. Repeated feeding upon infested grasslands leads to pervasive and severe infestation. The swampy burn side is an appropriate habitat for the wetland snail which is specifically required *to complete the life cycle of the fluke and the boggy* watercourse may well have encouraged congregations of livestock.

Ms. Fiona Guinness, *Director of the Red Deer Project on* Rhum writes -

"Rhum deer are quite often infested with Fasciola hepatica. During a period between 17.3.74 and 11.2.75, I collected 132 faecal samples from deer in our study area, 23 % of which had positive F. h. egg counts. Counts varied between 0 and 38. Egg counts from a sample of three deer kept here in an enclosure at higher density varied between 0 & 5.

From 53 of our study deer I was able to carry out post mortems this spring and, of those which still had intact livers, I found that 42 % of the livers were infested by one or more fluke - mostly very few - i.e. 1 - 4 fluke but one hind had 28....." (*pers. comm.*)

Fluke may have originated in the native red deer of Rhum or any livestock, watering and excreting at this swampy waters edge.

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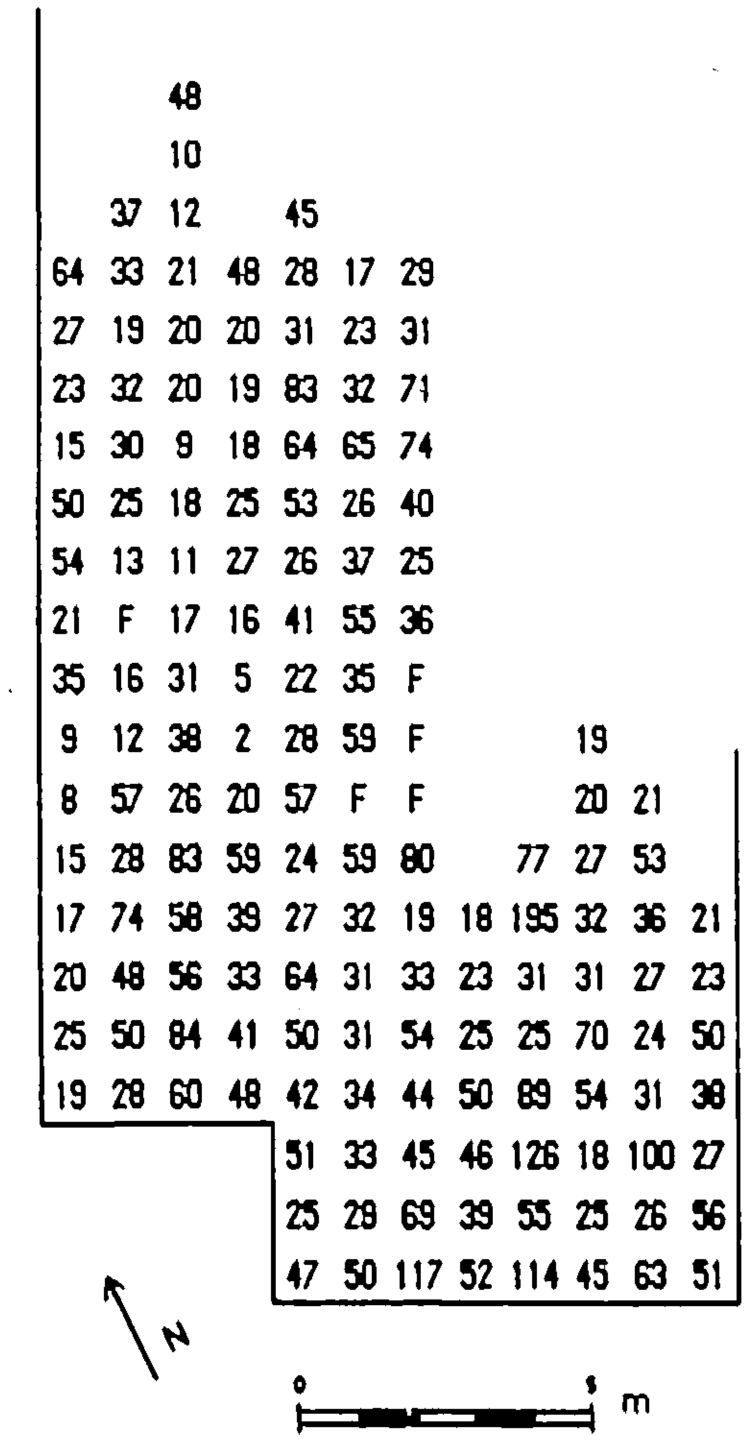

ILL 113: Trench BA. Surface magnetic susceptibility survey.
F = Feature fill removed

use over the centuries. The most extensive soil at the time of prehistoric occupation is likely to have been a peaty gley though a podzol may have occurred in the best drained situations, as in between seepage lines. The presence of a forest cover would also have improved drainage. Cultivation in recent historical times has resulted in the loss of the original peat layer and the production of a shallow stony mineral topsoil within which the bloodstone arifacts have been found.

Summary of Geomorphological and Pedological Evolution of Area in Vicinity of Excavation Site

POST GLACIAL	Historic time: cultivation and mixing of upper horizon (layer I); loss of peat layer; lazy bed formation. Flandrian transgression to 8m, occupation of site ? Development of a peaty gley-podzol soil suite.
LOCH LOMOND ADVANCE	Corrie glaciers on Rhum; intensive periglacial processes; extensive spreads of solifluction (layer II).
LATE GLACIAL TRANSGRESSION	Transgression to 30m O.D.; formation of shoreline; reworking, resorting fluvio-glacial deposits and landforms below 30m.

Horizon		A	B	B	C
Depth (m)		0.02-0.08	0.15-0.25	0.30-0.38	0.81-0.72
% Loss on ignition		12.60	3.78	3.75	2.41
% Sand U.S.D.A		61.6	80.6	82.9	83.6
% Silt U.S.D.A		8.1	3.3	2.0	2.6
% Sand int.		88.8	91.2	93.6	94.4
% Silt int.		4.2	2.7	1.4	1.8
% Clay int.		4.0	2.3	1.2	1.4
Exchangeable Cations me/100g	Ca	nil.	nil.	nil.	nil.
	Mg	0.43	0.10	0.08	0.06
	Na	0.18	0.08	0.08	0.11
	K	0.16	0.05	0.05	0.01
	H	18.2	3.31	1.80	2.00
% Saturation		4.4	6.8	10.4	8.3
pH		5.05	5.30	5.52	5.20
% Carbon		6.01	1.53		
% Nitrogen		0.355	0.118		
Total P_2O_5 mg/100g		125.0	115.0	134.0	158.0
Read. sol. P_2O_5 mg/100g		0.5	0.2	0.3	0.4

REMARKS

Exch. Ca very low throughout.
Exch. Mg low in B and C.
Soluble P_2O_5 very low throughout.

Table 61 Guirdil raised beach : soil analysis

These samples differ from the other feature fills in having comparatively spherical stones. These stones are also small and well sorted. The samples are similar to each other.

19, 20, 21. *BA90*

Samples 19 and 21 are moderately similar to each other, but 20 is slightly different. The stones in sample 19 are moderately spherical, while those in samples 20 and 21 are slightly more angular than the mean. The sphericity of 19 and 21 is very variable while that for 20 is much less so. Stones in all three samples are large and poorly sorted.

22, 23. *BA91*

These samples differ slightly from each other. Both contain stones which are less spherical than the mean, sample 23 very much so. Both have very variable sphericities. While the stones in sample 22 are smaller than the mean and moderately well sorted those in sample 23 are larger and moderately poorly sorted.

24, 25. *BA093*

These samples are very similar to each other. Both are slightly less spherical than the mean and contain stones which are slightly larger than the mean. The variability of both is slightly greater than the mean, for both criteria.

26, 27, 28. *BA094*

These samples differ from each other, 26 more so than 27 and 28. While 26 and 27 are less spherical than the mean and contain larger stones, 28 is more spherical and contains larger stones. This follows the trend established in other samples which shows that angular stones which are exotic to the parent material are also larger than the mean.

D JORDAN, ENGLISH HERITAGE, FORTRESS HOUSE, SAVILE ROW, LONDON.

Flandrian (i.e. c.10,000 BP to the present). More general reviews of raised shorelines around Scotland (e.g. Sissons 1976) have provided maps that indicate the altitude attained by the sea at the peak of the Main Postglacial Transgression (i.e. c.6500-7000 BP). On Rhum, this figure has been put at c.8-9m O.D. It is important to note, however, that figures derived from such national diagrams are broadly related to Newlyn Datum, a mean-tide datum, whilst Rhum local datum, according to the 2nd Edition 1:10,560 maps, is a low-tide datum. (No resurvey of bench marks was carried out during production of the 1:10,000 maps on Rhum: the bench mark altitudes given on these maps are the 6-inch 2nd Edition values converted to metres). Admiralty Tide Tables indicate the tidal range in this area of the Inner Hebrides to be c.4m. Hence, on the altitude reached by the Main Postglacial Transgression on Rhum when related to local datum should be increased by c.2m to 10-11m local O.D.

Local Shore-Forming Factors:

In addition to the datum problem, the development and altitude of any particular shoreline feature is a function of local factors such as sediment supply, exposure, offshore profile and coastal profile (as well as regional factors such as isostasy and eustasy which alter the altitude of operation of marine processes over long time periods).

On Rhum, sediment supply to the coast today, as apparently during the whole of the Flandrian, is very low. This is indicated by the component of foreign erratics, is suggestive of glacial action playing some role in the origin of the sediment, though no striations were noted on any of the clasts. The poorly sorted nature of the sediment would also support a glacial origin but the roundness analysis implies that, compared to most tills, which mainly have a modal class of subangular material, this sediment has been subjected to rounding, presumably by fluvial or marine processes. The average clast form is not dissimilar to that found in tills although the c/a ration is relatively low implying selection of or modification to flatter clasts such as occurs on beaches or as a result of frost shattering. Considering all the available information it is concluded that the sediment underlying the archaeological site is a stone-rich glacial till that has been partly modified, probably by marine processes, producing increased roundness and flatness in the clasts.

The altitude of the sample pit is slightly above the level to which it may be inferred that the uppermost Flandrian sea reached. It is therefore thought unlikely that marine modification occurred during the Flandrian. It is more probable that such modification took place during the Late glacial marine regression from the marine limit (at c.35m local O.D.) at the head of Loch Scresort.

Bloodstone Hill/Guirdil

A detailed geomorphological map of Guirdil/Bloodstone Hill is shown (Ill 122). The following account focusses on the

AGE CALCULATIONS

At the end of each five cycle period the sample count rates were converted to radiocarbon dates according to the standard treatment of Stuiver and Polach (1979). There is unfortunately no similarly rigorous approach to error analysis. In this laboratory the errors on (a) background, (b) modern standard and (c) the sample count rates, together with errors on (d) quenching, (e) fractionation and (f) replicate analysis all contributed to the final error in the age.

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CONTENTS

KINLOCH, RHUM 1988: REPORT ON THE WOOD

R. McCullagh

Specimens were acquired from the routine sampling of each layer or as "special" samples from contexts particularly rich in waterlogged wood. The work was carried out to provide verified sources for C14 dates and to qualify some of the context descriptions. The samples were also examined for tool marks that could possibly be related to some aspect of the site's tool assemblage.

All of the samples came from the peat filled watercourse that ran across the three areas of the site. While it is possible that some of the peat may be quite modern, much of the wood came from the lower levels which produced the assemblage of neolithic pottery and other specimens were revealed overlying the surface of the gravels beneath the peat. It is possible that the roots of much later trees on the site had intruded into the peaty deposits and to test for this root wood was descriminated from limb or trunk wood in thin sections using the method of Schweingruber (1978). However, in none of the contexts examined was root wood shown to be present.

The unsieved material was examined to provide the range of species of the larger material. Because the sieved material represented a very large assemblage a 10% sub-sample was examined. Of the unsieved material 7 samples contained either no wood at all or merely bark, in the latter case identification to species level was not possible. One particular sample (BA 117/024) contained a considerable amount of very small flakes of bloodstone. Of the 11 remaining samples only 2 (BC 0020 and BA 0077) contained species other than alder.

BC 0022

10 specimens were examined which represents about 30% of the total. All were <u>Alnus glutinosa</u>, and were fragments of roundwood. There was no evidence of tool damage; all the breaks in the bark appeared to result from damage in situ, though some of the ends appeared torn. Several specimens had what appeared to be patches of burning on the bark, the wood in these areas was more resistant to the sectioning knife but in thin section this was shown to result in a form of crystalline adhesion, the cell structure bore none of the characteristic alteration due to burning. One specimen bore a longitudinal split which appeared to have resulted from drying out at some stage. The diameters of the round wood ranged from 20-40mm, it was not possible to count the rings but the smooth nature of the bark suggested that the wood was derived from immature stems or branches. Most specimens had contorted patterns of growth.

BB 0023 115/034

The sample contained two specimens; one a fragment of alder roundwood and the other was a plant stem as yet unidentified. In cross section this was 7-8mm diameter with a hollow centre some

4mm in diameter, the outer surface was faceted with prominent vascular bundles at the junction of each pair of facets. The outer surface was stained to a dark brown but the interior cell structure was unstained. Compared with the wood specimen the cells bore little sign of fungal or bacterial damage. This may be cause for suspecting the stem to be intrusive.

BB 023 115/031

The sample contained two fragments of alder roundwood, one had been cut but the exposed wood beneath the bark was unstained and the damage must therefore be recent.

BC 0020

This context contained well preserved rods of alder and of Pomoideae (a sub-species of the Rosaceae grouped by their shared anatomy, it includes hawthorn (*Crataegus monogyna*), rowan (*Sorbus aucuparia*) and crab apple (*Malus sylvestris*) as well as other species not native to the west of Scotland (Schweingruber 1978, 124)) and single specimens of birch (*Betula* sp.) and of hazel (*Corylus avellana*). In addition it contained three, possibly worked fragments of larch (*Larix decidua*). They had been split from timber of about 100mm diameter in cross section and contained the later growth rings. The largest piece was tapered at one end, no clear cut marks survived but the tapering must presumably have been rendered with a sharp tool. Running down one side was a shallow groove with a slightly corrugated surface. The groove runs for 180mm but takes a sharp turn half way down.

Drilling is therefore discounted and the best explanation is that it is possibly part of the tunnel of a ship worm (Torredo sp. especially T. nivalis). The larch is not native to Scotland and damage by marine mollusca is very common on drift wood. This specimen was found in a near vertical position and may represent a fairly late insertion.

Of the remaining sectioned specimens two were identified as Pomoideae, one was birch and two were alder. All were round wood fragments but one specimen of Pomoideae bore an oblique cut mark that had completely severed the wood. The blow was delivered from an angle of about 30 degrees from the long axis of the wood. Such a steep angle is not usually replicated by a hafted stone blade but there are similar examples from the Sweet Track, Somerset Levels (Coles and Orme 1985, 43).

There was a considerable variation in the state of preservation of the specimens, some pieces had lost all the bark and some of the unsectioned material was no more than amorphous wood tissue. Microscopically the larch pieces were relatively free of the signs of cellular decay while much of the roundwood was difficult to thin section because of its poor state.

AB 0003 (Bottom)

Of 9 specimens from this sample four were thin sectioned and all were shown to be Alder. There was little morphological difference between the specimens, all were from rounwood of 30-40mm diameter with smooth bark except where the wood had bent. There was no sign of any worked surfaces.

BB 0023

This consisted of badly damaged roundwood, mostly torn surfaces and collapsed cell structures. All the sectioned specimens were alder and these matched the appearance of the unsectioned fraction.

BA 0077

This context was represented by a single large specimen and a very large volume of material recovered via the wet-sieve program. It contained both preserved wood and more charcoal than in any other context examined. The charcoal was derived from small diameter roundwood within the size range of twigs and small branches. The species present included alder, hazel and Pomoideae and also oak (Quercus sp.). The large specimen was a single piece of roundwood of alder. It had bent in several places and one end appeared to be cut. The damage was shown to be merely an area of collapsed cells beneath intact bark.

BB 0003

The sample contained numerous weathered fragments with one large piece of apparently squared timber. The sample was washed in water which removed most of the peat, the timber dissolved into a peaty slurry and a single piece of bark. Only two specimens could be identified and both were alder, in poor condition.

BB 0003

The sample contained a single fragment of alder roundwood in an advanced state of decay.

BB Fill of stake hole 025

Unidentifiable fragments of bark resembling the bark of previously identified wood but the cellular structure of bark is not diagnostic. Judging from the curvature of the bark the diameter of the original wood would have been about 30mm.

BC 0002 Tag No 540

Fragments of unidentifiable bark.

BC 0002 135/022

Stone.

BC 0002 133/021

Stone.

BA 117/024

The sample contained a single fragment of small twig of 5mm diameter, this was too fragile to section. Within the peat slurry there were numerous fine flakes of bloodstone.

BA 123/029

The sample contained fragments of bark which had come from wood of 30-50mm diameter, it was not identifiable to genus.

BB 023/031

The sample contained two large fragments of round wood of 40mm diameter. Both were alder and had been contorted in growth.

Bulk sieving programme

The following samples were derived from the bulk sieving programme: 122/013, [illegible]/022, 123/029, 123/010, 119/016. None contained any identifiable botanical remains.

The retent from the sieving of the bulk samples produced samples; BA 0021, 0023, 0047, 0052, 0077, 0087, 0089, 0090, 0091, 0093, 0094, BB 0003, 0023, BC 0003, 0023. These were re-sieved through 4.0mm, 1.0mm and 0.5mm seives. With the exception of BA 0077 none of the samples contained any identifiable material. They all contained small fragments of charcoal, unhumified plant debris and minute peat fragments. There are 23 samples from BA0077 and of these about 50% of the volume were examined. The retent of the smaller sieves (1.0mm and 0.5mm mesh size) contained a markedly higher proportion of charcoal than the other samples, though none could be identified. The larger size component contained amorphous fragments of wood, twigs (ranging in diameter from 3mm to 12mm), other plant debris and fragments of peat. The wood was all identified as alder, but the charcoal represented a range of species; few specimens were large enough to examine in section but of those that were 50% were hazel, 21% was alder, 14% was oak, and 14% was Pomoideae. The latter probably representing mainly hawthorn or rowan. The identification of such small specimens is tentative as the cell structure of the smaller branches may deviate from that of the mature trunk wood (Jane 1970).

With the exception of some of the charcoal there is no evidence of wood of any maturity. The wood varied from well preserved specimens with only surface staining to pieces rendered to formless masses of soft wood fibres. No specimen was more than 25 cm long and although some fresh breaks were visible it seems that most of the wood had broken in antiquity or after its incorporation within the peat. The charcoal similarly varied between well presrved pieces of roundwood and amorphous lumps.

Only one specimen bore a definite cut mark (a piece of roundwood of possibly rowan or hawthorn-Pomoideae from 0020). Three specimens of larch from the same context were possibly worked but these are thought to be a later intrusion of driftwood. Several other possible cut facets were examined but all were caused by the collapse of the wood structure under the bark and presumably resulted from the compaction of the wood against some harder material.

Two other forms of damage were observed: firstly, the ends were frequently jagged and secondly, some specimens bore longitudinal splits that penetrated to near the centre of the roundwood. The latter may have resulted from the drying out of the wood at some stage in the decay process; it is not possible to diagnose the cause of the former. Most of the specimens examined in thin section bore numerous fungal spores and hyphae suggesting that at least some if not most of the decay process had been aerobic. The incorporation within the peat will have arrested this decay.

The assemblage examined can be seen as derived from the local woodland species. If it represents the natural "windfall" debris from woodland it is surprising that no mature wood survived. It would seem fairly safe to assume that this woodland was maintained in an immature state or that there was selection of the mature wood for consumption elsewhere. If this is the case man must be seen as the major factor affecting the creation of this debris. It would seem likely that much of the wood and charcoal assemblage had decayed to an advanced state before incorporation within the peat.

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KINLOCH, RHUM: GEOMAGNETIC SURVEYS, MAY 1985

B. MAHER & D. WATSON

Site Conditions

Magnetic methods of remote sensing for the purposes of archaeological prospecting have been applied to a number of archaeological sites, with some success in detecting buried anthropogenic remains. The potential advantages of such techniques lie in the rapid location of artefacts and features, without wholesale site excavation, which is normally both time-consuming and expensive, and usually uncovers only a small fraction of the total area of human occupation. The most satisfactory method of magnetic surveying is to take readings at regular intervals, usually on a surveyed grid, so that any spatial patterns of variation in the data obtained can be revealed. Magnetic survey depends on measurable differences in the magnetic susceptibility of the soil and/or substrate across the investigated site. For example, topsoil and the fill of buried pits usually possess a higher susceptibility than the adjacent subsoil. Thus, magnetic detection of small, local modifications in the strength of the earth's field can, under favourable conditions, be related to the presence of man-induced site disturbance. Unfavourable conditions, such as the presence of natural magnetic variation, perhaps from geological heterogeneity, or post-occupation degradation of the site, will correspondingly reduce the discriminative power of the method in terms of its archaeological power. Finally, the preservation of any magnetic signal carried by specific sections of the site area, such as hearths or areas of fill, is obviously a pre-requisite for subsequent magnetic detection.

Optimal use of the magnetic survey as a prospecting technique on the Rhum excavations was negated in that the main area of interest had undergone extensive investigation in advance. Within the excavated trench BA only a surface susceptibility survey could be usefully carried out. Proton magnetometer and fluxgate gradiometer surveys were performed but only on the unexcavated area to the south of the main trench.

Methods

1. Surface susceptibility sensing

A search loop type M.S.2.D (Bartington Susceptibility Systems) was used to survey both the excavated trench and the adjacent unexcavated area. Readings were taken at 1m intervals.

2. Fluxgate gradiometer survey

3. Proton magnetometer survey

Both instruments detect local perturbations in the earth's field (the fluxgate providing a continuous record of the change in field, the proton magnetometer an absolute reding of field strength). All readings were taken at 1m intervals.

Results

1. The surface susceptibility pattern for Trench BA (Ill 113)

displays distinct areas of high susceptibility, superimposed on fairly low 'background' readings averaging c.15 (these values are uncalibrated, the precise volume of material sensed at each measurement being unknown). Interpretations in terms of archaeological features is difficult owing to the depth variations from selective removal of topsoil across the trench area. Combination of this pattern of results with already known information regarding the trench area may, however, prove useful.

The pattern obtained for the unexcavated area also shows areas of high susceptibility values; field observations indicate that spatially isolated high values arise from the presence of stones at the surface (brought up from deep ploughing?), but that clusters of high points represent true subsurface features. In the upper (northerly) section of the surveyed area, thicker vegetation and the presence of a path are likely to be responsible for some of the apparent variations.

2. The results of the fluxgate gradiometer survey are unpromising. This instrument is prone to drift and requires careful orientation throughout the survey. However, two distinct areas are identified; one, to the southerly edge of the area, displaying higher values, the other, to the north/northeast of the surveyed area, clearly low values. The lack of correspondance with the susceptibility survey indicates the different depths to which each instrument is sensitive, the susceptibility sensor operative to c.20cm depth only.

3. Of the three types of survey, that by proton magnetometer is least beset by calibration and drift problems. Exact orientation is unnecessary since the total field is measured rather than any component. Preliminary contouring of the data indicates three seperate anomalies. Interpretation of the significance of these features should take due regard of the possible options, which include: a) the presence of a linear geological feature (such as a dyke); b) recent ground disturbance or possible infill of drainage channels; and c) pre-modern ground disturbance.

With specific reference to the Rhum site, a last note of caution should be added. While magnetic surveys of the type implemented and described here have proved very valuable at sites in more southerly regions of the UK, the nature of the conditions operative on Rhum has produced poorly drained, highly acidic topsoil and substrate at this site. Such conditions are somewhat prejudicial to preservation of those ferrimagnetic iron oxide grains present in the soil which would otherwise testify to the occurrence of burning and/or land cut and fill. Evaluation of the results presented here should be cautious in view of the limitations of the techniques under these circumstances.

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SOILS AND GEOMORPHOLOGY: Report on Visi to Kinloch Archaeological Excavation, Rhum 7-10th May 1984

Dr. DA Davidson

Physical Setting of Excavation Site

The site is located in a ploughed field on the north side of Kinloch Bay (NM 40359995). The field sloped at 4-5 degrees in a generally southerly direction with an altitudinal range from c.9-23m O.D. The underlying geology is Torridonian and is mapped by the Geological Survey as the <u>Rudha Na Roinne Grit</u>. No outcrops of rock are exposed within the excavation area, but outcrops occur in the pasture fields to the west whilst rock outcrops are frequent in the area of rough moorland to the immediate east. A sequence of narrow benches on the hillslopes above the excavation area result from the Torridonian structure.

The Soil Survey of Scotland has mapped the excavation area as a podzol (locality name Harris) developed on a raised beach; to the east of the field peat is dominant whilst the hillslopes behind are mapped as the Mulloch Mor complex of peat and rock. The annual average rainfall for the Kinloch area is 2400mm; since bedrock is never far from surface, the soils have to transmit considerable quantities of water by throughflow and seepage line mechanisms. The rough moorland area to the immediate east of the excavation is dominated by peat seepage lines between rock outcrops.

Description of Soils and Hillslope Deposits Outwith the Excavation

Pit 1. Soil pit 11m to north of dyke in area of rough moorland (table 54).

Interpretation: this is a <u>peaty gley</u> soil.

Discussion: The two peat layers differ in stone content and consistence. It is possible that the lower has been subject to some disturbance in the past in order to account for the stone content as well as the slightly higher mineral level; peat has subsequently developed on top of this layer following cessation of agricultural activities.

Pit 2. Soil pit in lazy bed 17m from east corner of dyke of excavated field (table 55).

The aim of digging this pit was to determine if a buried soil was preserved at the base of a lazy bed ridge. The selected area had very distinctive lazy beds (c.3.3m across and c.0.4m in max depth).

Interpretation: this is a fine example of a man-made soil with the upper layer (3-25cm) being formed by the ridge.

Discussion: It is probable that the original soil surface was at 25cm, but former disturbance of layer 25-37cm is suggested by the stone distribution. The material at 37-61cm is similar to the slope deposits exposed immediately below the cultivated horizon in the excavation field as well as to the material at 39-75cm+ in the first soil pit. The water-worked nature of the stones is very

0.00-0.03 m	Dry dead grass.
0.03-0.29 m	Black amorphous homogeneous peat.
0.29-0.39 m	Black peat; more compact than above, one fresh stone and some weathered sandstones.
0.39-0.75+ m	Very compact stony drift consisting of many angular/subangular stones (0.01-0.02m) with a very dark greyish brown (10YR3/2) matrix of gravel and sands. Moderate abundance of angular to sub-rounded stone over 0.20 m ; suggestion of a concentration of larger stones at top of layer.

Table 54 Soil profile in soil pit 1

0.00-0.03 m	Thin turf layer.
0.03-0.25 m	Dark brown (7.5YR3/2) sandy loam; many angular, subangular and subrounded stones (0.01-0.05m).
0.25-0.37 m	Very dark greyish brown (10YR3/2) sandy loam, many angular and subangular stones (0.01-0-0.05m), weathered sandstone.
0.27-0.61 m	Dark greyish brown (10YR4/2) layer dominated by stones (0.01-0.03m); matrix of silt loam.

Table 55 Soil profile in soil pit 2

evident.

Pit 3. Soil pit to immediate east of excavation field in mid slope position (table 56).

This pit was located within the rough moorland area distinguished in terms of its variability from peat hags, peat seepage lines to rocky outcrops. This particular pit was sited in the middle of a seepage depression line running down slope at 6 degrees.

Interpretation: this is a peaty clay showing signs of disturbance by human activity.

Discussion: The lower silty clay is at least 60cm thick and was deposited by hillwash processes prior to peat growth. The material probably originated from pockets of glacial till on the upper slopes. A dark grey till (silt loam) was observed under a sequence of sands, gravels and peat in the bank of Allt Slugan a'Choilich on the lip of Coire Dubh (NH 389979). It is likely that this type of glacial till also mantles the slopes of Mullach Mor and provides the sediment source for such deposits, as in the lower part of this soil pit. It is not possible to determine if the root fragments in this silty clay are *in situ* or derived from down-slope processes.

Soils and Hillslope Deposits as Exposed within Excavation Field

In essence three types of material (I-III) can be distinguished, typified by the sequence exposed in sample quadrat 060/656 (table 57).

0.[illegible]-0.08 m	Turf.
0.08-0.25 m	Black stone free peat.
0.25-0.45 m	Horizon dominat[illegible] by weathered sandstone with a humus matrix.
0.45-1.05+ m	Very dark grey (7.5YR3/0) silty clay with occasional stones stone content increasing towards base; root fragments up to 0.01m in diameter; some lenses of coarse sands.

Table 56 Soil profile in soil pit 3

Layer I	0.00-0.24 m	Topsoil, sandy loam.
" II	0.24-0.58 m	Compact stone (0.01-0.05m) dominated layer with a very dark brown loamy sand as matrix, humus stained.
" III	0.58-1.16 m	Layer dominated by large round and subround stones (0.05-0.20m) with a matrix varying from medium sands to coarse sands and gravels.

Table 57 Soil profile from sample quadrat 080/856

A similar sequence is exposed in trench AC, although stratified sands and gravels are also evident in layer II.

Discussion: the origin of these deposits

Layer III

The waterworked nature of the larger stones in this layer is clear but the difficulty is in distinguishing the particular type of process responsible for such rounding. Marine or fluvioglacial processes or some combination are distinct possibilities. To aid interpretation, 50 stones from the top of layer III as exposed in trench AC were measured for maximum length (l), maximum width (w), maximum thickness (t), all at right angles, as well as maximum curvature (c as a radius) measured on the l-w plane. Hence the index of roundness was calculated (2000c/l) as well as the index of flatness (50[w+l]/t). For comparison, the same types of measures were made on the present day beach immediately below the excavation field. The results are presented in table 58.

A Student's t test was used to compare the differences in roundness, flatness and length between trench AC and the present day beach; all results proved to be statistically significant at the 5% level. In other words the tests established the differences in mean values of flatness, roundness and length between these two sampling positions.

An attempt was also made to determine if there was any difference

	$\overline{I}_r$	s_r	$\overline{I}_f$	s_f	$\overline{l}$	s_l
Layer III Trench AC	254.6	163.8	205.7	68.7	90.6	24.0
Present Beach	184.1	125.5	300.9	190.0	114.7	46.7

$\overline{I}_r$: mean value of index of roundness

$\overline{I}_f$: mean value of index of flatness

s_r : standard deviation of index of roundness

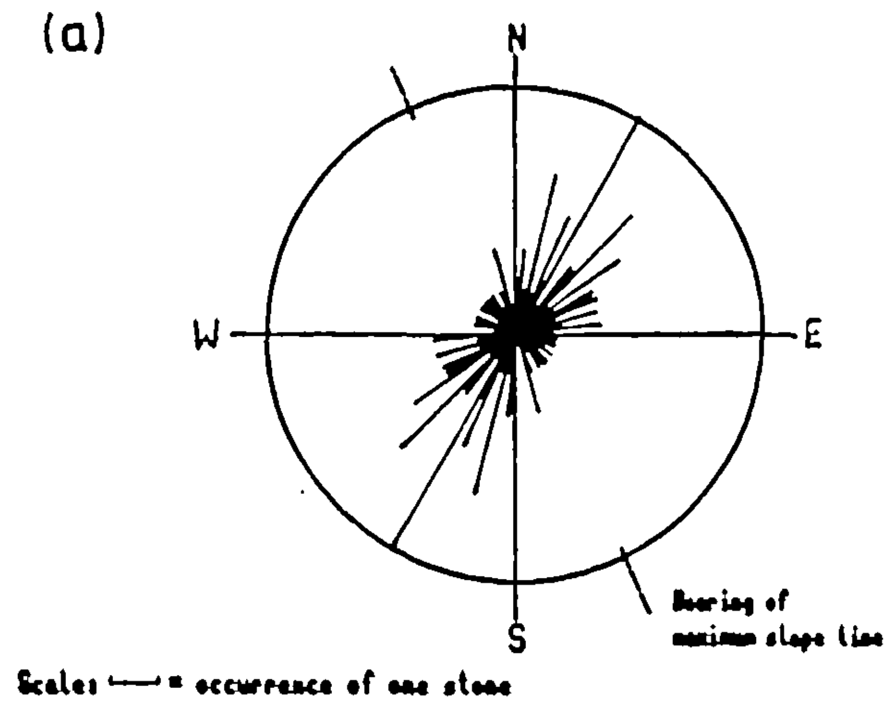
s_f : standard deviation of index of flatness

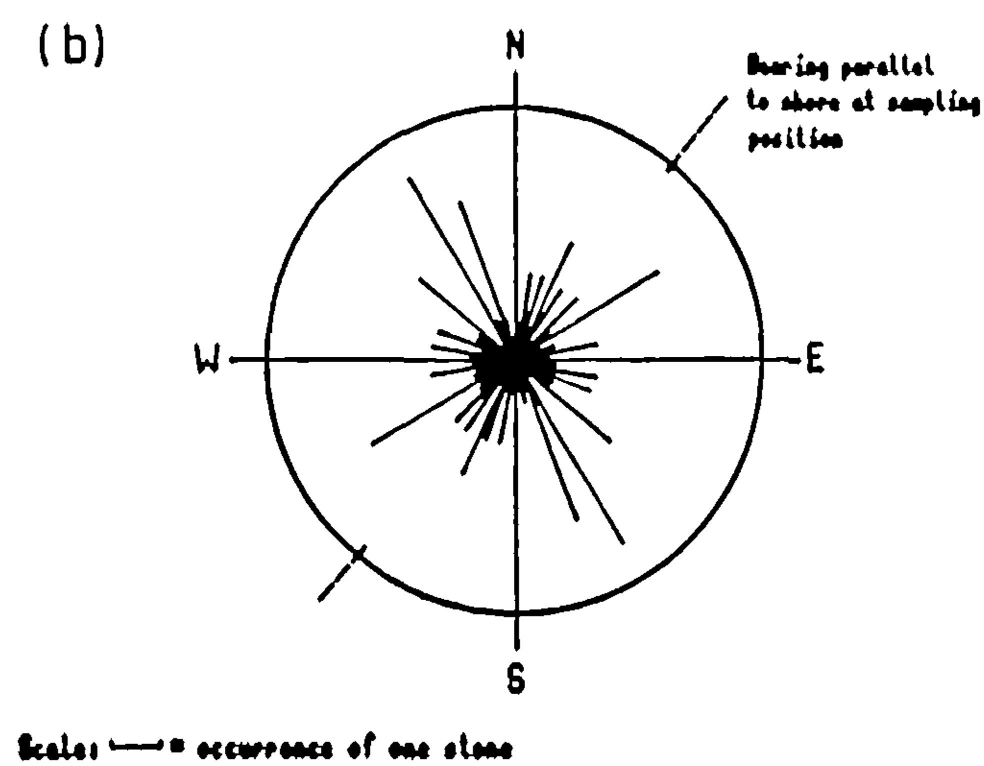
$\overline{l}$: mean value of maximum length measures

s_l : standard deviation of measures

Table 58 Roundness and flatness characteristics of stones from the matrix of the excavation site (trench AC) and from the present day beach at the head of Loch Scresort in the orientation of the long axis of the stones between trench AC and the present day beach. The results are plotted in Ill 114 using a circular graph; the bearing of the maximum slope at trench AC and the line of the shore at the beach sampling position are also indicated. The lack of any preferred orientation is evident at the present day beach with no relationship between orientation of stones and beach alignment. The stones in trench AC also do not display any very clear orientation pattern though a NNE-SSW emphasis is suggested. No relationship is evident between stone orientation and slope direction.

The aim of comparing these stone flatness, roundness, length and orientation measures between trench AC and the present day beach was to determine the degree of similarity. As can be seen from the results the stones on the present day beach are larger than in trench AC. Stones from the present day beach are flatter and less round than those in trench AC. The measures of roundness flatness and length are all marked by variability as expressed in the standard deviations, with variability in flatness for the beach being the most marked. These results indicate a difference in size and shape between the stones in the present day beach and those in trench AC, suggesting that the latter are not of simple marine origin. However, the limitations of sampling must be noted. Also Loch Soresort would have been much broader if at some stage the sea was at trench AC, hence the locality would have been exposed whereas, in contrast, the beach at the head of Loch





ILL 114 : Orientation of stones. (a) On the excavation site (Trench AC).
(b) On the present day beach below the excavation site

Soresort today is relatively well sheltered. Thus comparison between the present day beach and the stones in trench AC must be made with caution.

A fairly clear marine limit is evident c.80m to the north of the excavation field. This limit takes the form of a narrow discontinuous wave cut platform in the hillside; it extends eastwards along the lower slopes of Hulloch Mor and can be distinguished from the structural beaches on the basis of its consistency of elevation. The height of this shoreline was surveyed along grid line 050 and the result was 29.5m O.D. This elevation fits well with the figure of 30m given by Price (1983) for the maximum marine limit on Rhum. No date is available for this marine limit but it is presumed to relate to the transgression following the disappearance of Devensian ice. Eleven glaciers accumulated during the Loch Lomond Advance on Rhum, but only one reached sea level (Ballantyne and Waine-Hobson 1980). Thus the excavation field according to this interpretation was not over-run by this last glaciation but would have beeen subjected to intense periglacial conditions. A maximum marine transgression in postglacial times of 8m for Rhum is given by Price (1983) quoting research by Jardine (1982). No evidence exists at the head of Loch Soresort for such a limit, but an elevation of 8m means that the excavation field would have been above this transgression.

The excavation field was thus subject to a marine transgression in Late Glacial times but was not subject to later inundation by the sea. It is proposed that the original deposition of the large stones as in trench AC was by fluvioglacial processes, but the material was later reworked by the Late Glacial sea. During the final phase of Devensian ice on Rhum, deglaciation produced fluvioglacial deposits in the form of kames, kame terraces, eskers and possibly also outwash. It is precisely in such lower slope situations where fluvioglacial deposition takes place. No fluvioglacial landforms exist today and thus it can be postulated that marine processes subsequently reworked the fluvioglacial landforms. The matrix of sands and gravels is also of fluvioglacial origin.

Layer II

As already described this layer also indicates a water-worked origin. In trench AC the length of the longest axis was measured for 100 particles to give a mean value of 5.71mm and a standard deviation of 3.35mm. Thus the material is considerably finer than the underlying stones. It is proposed that much of the sands, gravel and small stones had a fluvioglacial origin, but much reworking and downslope movement has taken place, particularly during periglacial times. This could have been following the regression of the Late Glacial sea as well as during the Loch Lomond Advance.

Layer I

The topsoil is a cultivated horizon, the result of agricultural

(Layer III)

Active periglacial processes.

DEVENSIAN GLACIATION	Fluvioglacial deposition: spreads of sands, gravels, water-worked stones as kames? eskers? kame terraces? Pockets of a dark grey glacial till.

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KINLOCH, RHUM: SOILS AND SEDIMENTS ENCOUNTERED DURING EXCAVATION

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This work reports on:

The geomorphology, parent materials and soils of the site and its immediate vicinity.

Aspects of the archaeological features and their fills.

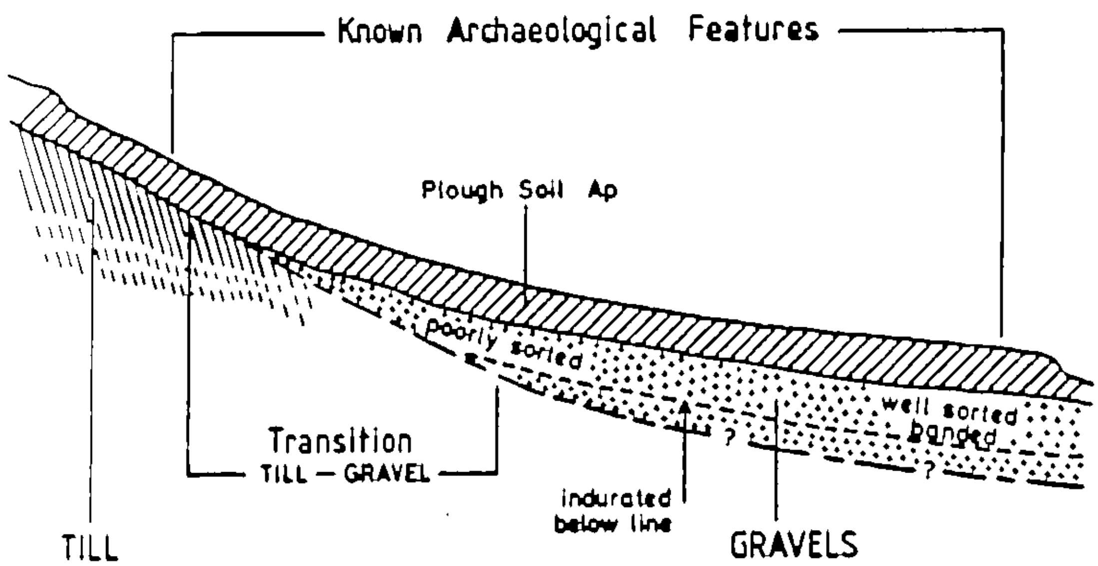
Erosion of soils and sediments in the vicinity of the site.

Parent Materials

The site overlies till and sorted sands and gravels. These rest on Torridonian sandstone which is exposed at several points in the immediate vicinity. The sorting has produced bands within which are found sands and gravels of similar sizes. This sorting is the result of water movement, probably waves on a raised beach.

The soil map of Rhum (Macaulay Institute 1958) indicates that the site partly lies on a raised beach and partly on till. These divide the field on which the site lies into two: till underlies the northern, uphill area of the site and field, occasionally broken by rock exposures. The southern part of the field is underlain by raised beach gravels which overlie the till (Ill:15).

The till deepens beneath the gravels and has been found in test pits 30m downslope of the contact at a depth of 1.6m. The contact passes through the site and across the field to the west, in



ILL 115 : Excavation site. Schematic section of underlying soils lobes. To the east it descends the slope and becomes complicated by rock exposures.

The till grades into gravels which have increasingly:

better drainage

better sorting

fewer cobbles

less fine matter

less-weathered stones

defined internal stratification

as the slope is descended.

Banding within the gravels lies sub-parallel to the slope of the field and stones tend to lie parallel to it. No imbrication was noted but traces of sorting and structure, probably periglacially derived, were observed in section. No evidence was found to suggest that the gravels have been laid down by pro-glacial streams. The consitent, sloping banding and lack of stream channel re-working or point bar type structures are consitent with this and support the suggestion that they are the result of raised beach sorting. The gravels could have originally been laid down by pro-glacial rivers and then have been resorted on a beach but they were seen to resemble the stones in the till which suggests that they had a very local origin.

Induration was encountered at a depth which increased from ca.40-

80cm downslope. Where fully developed, this hardening of the sands and gravels makes them impermeable, forcing water to flow over the top. Overlying this indurated horizon by 5-10cm was a band of gravels with silt cappings.

Near to the till contact the gravels become wetter and, as a result, more weathered. They drain poorly because they are closer to the impermeable till and because they contain more fine matter. They appear, as a result, to be more broken up than the better drained gravels and have a light blue, reduced tinge with diffuse, yellow mottles. This appearance was typical of a group of deposits , including archaeological stratigraphy, which was loosely and collectively named 'broken biscuit'.

The till derives from and contains a wide variety of rocks and sediments. Stones within it vary widely in shape. Most are angularly fractured while some have partly rounded surfaces suggesting that the till is partly derived from reworked outwash deposits.

Stones in the till surface tend to be oriented with the slope and this *suggests some movement, possibly due to solifluction. There* was no evidence of mass movement of the till down into the flush which diagonally crosses the site, nor of solifluction lobing or sorting.

The flush overlies the contact of till and gravels. Its limits have not been probed. Where it crosses the site its southern bank has been built up with material containing artefacts. It also contains isolated rafts of large stones the presence of which do not admit to any evident natural explanation.

The peat which fills it contained a few lenses of finer mineral matter but this was not well sorted and its stratigraphy did not suggest persistent stream flow.

Soils

The soil of the site is mapped as a podsol (locality name Harris) on the Rhum soil map (Macaulay Institute 1958).

That part of the site overlying till is formed on a non-calcareous gley similar to the peaty gleys of the 'Kinloch' locality name. The till soils are thin and have to transmit large amounts of water as a result.

The lower part of the site is found on a variety of soils including shallow gleys, gleyed podsols, podsols and iron-humus podsols. These soil variations are mainly due to minor changes in the ease and depth of drainage.

The majority of the site is found on an iron humus podsol with an occasionally gleyed C horizon.

Table 59 provides profile descriptions characteristic of the

(a) LOWER GRAVELS

Root Mat	0.02 m	Grasses
H	0.13 m	Greasy black well humified (Von Post grade 7) peat. Abundant grass roots. Massive, soft.
B1	0.12 m	Very coarse sandy clay loam with abundant stones, round to subangular. Abundant roots. 10YR3/1 very dark grey-brown.
B2s	0.65 m	Loamy coarse sand with dominant stones, round to subangular. 2.5YR3/2, dusky red. (Moister and less organic than B1)
C	+	Slightly indurated gravels and cobbles with silt cappings in situ.

(b) TILL

Ap	0.22 m	Mid to dark brown, moderately stony sandy clay loam. Slightly leached with common bleached sand grains. Abundant roots.
B/C	0.25 m	Firm disaggregated till with organic matter. Mid grey-brown, mottled yellow.
C	+	Soliflucted till ? Gleyed, mottled yellow.

Table 59 Kinloch: characteristic soil profiles. (a) Lower gravels. (b) Till

soils of the site the survival of banding and periglacial sorting features in the topmost layers of the gravels implies that the structures within the gravels are largely intact. This suggests that the apparently undisturbed relict archaeological features may actually be intact as well.

In the ploughsoil and in the archaeological features the organic matter component of the soil resembled the black, Mor type humus of acid soils. Soil analyses carried out by the Macaulay Institute on soils from a similar local site (unpublished) reflect this acidity with low exchangeable Ca and Mg as well as a low pH.

The Mor type humus found in the soils and archaeological features of the site is also found coating the stones of the upper gravels. It varies in the tenacity with which it sticks to stones across the site, probably due to changes in its nature and chemical environment.

Humus has infiltrated between the stones of the gravels, reducing in concentration with depth and is virtually indistinguishable in the field from the organic component of the pit fills. This organic matter seemingly acts to obscure boundaries of texture and colour by coating particles and reducing contrast. There seems no reason to suppose that it is not being moved around in the soil and several samples of it were found to be moderately easily dispersed in water. It may therefore contaminate feature fills. This implies that these fills contain fine matter which did not originate in them and thus that detailed analyses of the chemical and other properties of this fine matter must be treated with caution.

Rooting over the site was uneven and concentrated in the Ap and upper gravels, above 50cm. It had locally disturbed the gravels although it does not appear to have removed the gravel structure. Roots tended to penetrate into the till much less than into the gravels and appeared to concentrate in features.

The features and their fills

Features located in 1985 and 1988 were interpreted as scoops, pits and suchlike. They were filled with a mixture of fine organic mineral matter and stones of widely varying size and shape.

In section feature edges were unclear; careful cleaning showed that they had become obscured by the movement of fine organic matter into the gravels around. The stone textural and orientation boundaries seemed to be little disturbed suggesting that few stones had been moved from (or exchanged between) fill and surroundings.

A portion of the stones which the features contained were of shapes and sizes alien to the tills and gravels. These may be anthropogenic. A small amount of the organic fraction of a fill was examined under low power magnification, having been dispersed in 10% NaOH(aq). It was observed to consist of a dark brown, amorphous, alkali-soluble mass containing small fragments of apparently intact organic matter and fine mineral matter.

Erosion

Organic and mineral coatings on particles in the B horizons of the gravel soils indicate that fine matter has been mobile in the soil.

The distribution of artefacts in the ploughsoil and observations on the lower slopes of the site suggested that remarkably little erosion of soil had occurred over the surface. This was unexpected, unexplained and implies that much more evidence of the original nature of the site may remain in the ploughsoil than was expected.

No plough erosion lyncheting was noted on the site itself, nor were there increased depths of A horizon or A horizon stonyness on the flatter areas downslope of the excavation where eroded soil might be expected to accumulate.

Archaeological features found at the flatter, lower end of the known site were not overlain by eroded material. Erosion was seen to be in progress on the ploughed area to the west of the site although all the eroded material was smaller than 2mm. The good drainage of the soils overlying the gravels is likely to have reduced erosion by reducing overland flow.

The lack of evidence of plough induced erosion on the site might suggest that past cultivation has been limited here and, perhaps, that a long standing field division separated the area of the site from the rest of the field.

The apparently good correlation between features and ploughsoil artefact concentrations strongly supports the conclusion that erosion of the coarse fraction of the ploughsoil has been limited.

A note on the soil chemistry

To accompany the chemical analyses carried out on the fills of the features a soil profile was analysed. A comparison may be made with the standard profiles analysed by the Macaulay Institute (Tables 80-83).

1. Peaty gley from Kinloch Glen. Locality name Kinloch.
2. Podzol from Guirdil raised beach. Locality name Harris.
3. Podzol from Kilmory raised beach. Locality name Harris.
4. Cultivated Podzol profile from Kinloch site.

The site podzol has a very different chemistry from the peaty gley and is considerably less clay rich. It is siltier than the two othe podzols recorded, reflecting the proximity of the till and the incomplete sorting. The higher silt content of the site Ap may be the result of mixing with till from upslope but this is not reflected in the clay content.

Loss on ignition and %carbon are much higher in the site profile than in the other podsols as, in general, are the exchangeable cation concentrations, %nitrogen and phosphate concentrations (total and readily soluble).

Altogether then, the site soil chemistry, while not favourable to agriculture, is much less unfavourable than those of other Rhum podzols. This is partly the result of recent liming and fertilising as is suggested by the Calcium and Readily Soluble Phosphate concentrations. This does not appear to be the whole story since the phosphate level is relatively high throughout the profile, perhaps reflecting the influence of the archaeology. On the other hand the site is near to a major centre of agriculture and may have been fertilised for a long time. There is no evidence that the soils of the site are inherently more fertile than other soils of the island.

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Horizon		H	A_{2g}	B_{2g}	B_{3g}
Depth (m)		0.05-0.15	0.02-0.13	0.20-0.30	0.51-0.61
% Loss on ignition		18.80	5.58	4.31	4.87
% Sand U.S.D.A		64.7	31.6	48.3	34.8
% Silt U.S.D.A		20.7	34.1	27.8	32.5
% Sand int.		78.9	47.7	58.8	48.8
% Silt int.		8.5	18.0	15.3	17.2
% Clay int.		2.1	31.5	23.7	20.4
Exchangeable Cations me/100g	Ca	2.32	3.03	4.24	10.75
	Mg	1.86	2.58	2.98	8.35
	Na	0.37	0.29	0.28	0.27
	K	0.57	0.03	0.03	0.14
	H	10.02	1.40	nil.	nil.
% Saturation		32.1	80.9	100.0	100.0
pH		5.32	5.86	5.74	5.21
% Carbon		8.47	1.07		
% Nitrogen		0.804	0.074		
Total P_2O_5 mg/100g		228.0	57.0	45.0	48.0
Read. sol. P_2O_5 mg/100g		1.8	0.8	2.5	1.1

REMARKS

Low exch. Ca in H. High exch. Ca and Mg in B_2G.
Low total P_2O_5 in mineral horizons.
Low soluble P_2O_5 throughout.

Table 60 Kinloch Glen : soil analysis

Horizon		A_1	B_2	C
Depth (m)		0.02-0.13	0.18-0.25	0.36-0.46
% Loss on ignition		7.15	2.09	1.03
% Sand U.S.D.A		88.4	95.1	96.2
% Silt U.S.D.A		6.6	1.8	2.2
% Sand int.		92.7	95.5	97.2
% Silt int.		2.3	1.4	1.8
% Clay int.		1.4	1.0	nil.
Exchangeable Cations me/100g	Ca	0.87	0.08	0.08
	Mg	1.05	0.17	0.17
	Na	0.23	0.07	0.08
	K	0.17	0.01	0.01
	H	6.6	1.9	0.96
% Saturation		26.4	14.8	26.7
pH		5.80	5.86	6.00
% Carbon		4.40	0.78	
% Nitrogen		0.304	0.080	
Total P_2O_5 mg/100g		138.0	84.0	32.0
Read. sol. P_2O_5 mg/100g		0.9	1.0	1.8

REMARKS

Low exch. Ca in A_1.
Very low exch. Ca and low exch. Mg in B_2 and C.
Very low soluble P_2O_5 in A_1.
Low total and soluble P_2O_5 in B_2 and C.

Table 62 Kilmory raised beach : soil analysis

Horizon		Ap	B	C
% Loss on ignition		24.51	14.41	17.84
% Sand int.		78	83	87
% Silt int.		20	15	13
% Clay int.		1	2	<1
Exchangeable Cations me/100g	Ca	14.31	6.18	3.57
	Mg	2.13	1.77	0.64
	Na	0.46	0.23	0.21
	K	0.28	0.08	0.17
	H	18.87	14.88	21.68
% Base saturation		48.2	35.7	17.5
pH	H_2O	5.25	5.28	5.41
	$CaCl_2$	4.78	4.02	4.08
% Carbon		11.48	5.36	8.01
% Nitrogen		0.88	0.28	0.43
Total P_2O_5 mg/100g		508	204	514
Read. sol. P_2O_5 mg/100g		42	14	18

Table 63 Kinloch excavation site : soil analysis

KINLOCH, RHUM: A REPORT ON THE THIN SECTIONS

D JORDAN

Kubiena can samples were taken intact from the interior and edges of depressions interpreted as archaeological features. Thin sections were prepared from these in the normal way (Fitzpatrick 1980) and examined under low and high power magnification (x30 to x400). Examination and description followed the procedure of Fitzpatrick (op cit).

It was very difficult to resolve the components of the feature fills during excavation in the field. One of the great strengths of microscopic study thin sections of such fills is the clarity with which their component parts can be observed in most cases. Such observation can be taken considerably further than simple visual description since other techniques can be applied to the section such as optical mineralogy and X-ray spectroscopy under electron microprobe. This allows a study which relates the properties of components of archaeological features to their spatial arrangement. This present study was limited to microscopic examination of the sections.

One of the three thin sections was taken from the centre of the fill of BA023, one from across the bottom of the cut of BA023 and one from the centre of BA021 at the surface revealed by the removal of the ploughsoil.

Section 1, taken from the centre of BA023 is dominated by a very dark matrix in which fragments of carbonised ?hazelnut shell abound. Between these fragments, small fragments of other, intact plant materials are also found. Small stones are common and carry thin coatings of the dark matrix. Larger stones, of diameter greater than 2cm or so were also occasionally found in the feature. They were avoided to make it easier to recover intact samples. The dark matrix consisted of particles too small to be resolved in thin section. Earlier analyses had shown that a high proportion of such materials on this site consisted of alkali soluble decayed organic matter. Worm pores were common, although small in diameter. No trace of soil structure was found. Nor were there any divisions of the sectioned fill except into its individual components. Modern roots were occasionally found.

Section 2, taken across the lower boundary of the fill of BA023 showed a gradual change from a matrix with few stones to a matrix dominated by stones. This change marked the boundary of the feature which was seen on excavation to be less stony inside than out. The proportion of organic matter in the fine matrix was seen to be greater within the feature than outside it with a transition over 2cm as seen in thin section. The matrix of the feature showed no structure and contained few cracks or pores. The stones within the feature contrasted with those outside by being coated with dark organic matter which explains why the dark organic matrix of the feature so dominated its appearance. The stone content of the feature seems to have had comparatively little effect on the appearance of the features in excavation because the stones are largely masked by their dark organic coating. Abundant worm and mite faecal matter suggest that the fill of the feature is being actively reworked although few worms were found during excavation. Two small flakes of bloodstone were found in the fill. Very few coatings were found which might indicate the movement of fine matter through voids. Neither fine organic matter nor clay were seen to have formed layered coatings on pore surfaces although occasional, weakly oriented, clay domains were seen. Thus the movement of fine matter in suspension does not appear to have brought about the diffusion of the contents of the feature. Fragments of organic matter within the feature (as defined by colour and therefore by organic matter concentration) were found to be of a wide variety of particle sizes whereas those outside the colour change boundary were found to be predominantly of diameters greater than 200 microns. This could indicate that the visible boundary of the feature is partly the result of the removal of finer organic fragments and that the observed boundary is not that which was originally formed.

Section 3 was taken from the centre of BA021. Organic matter dominated the matrix of the feature less than in BA023 (section 1) and fragments of organic matter larger than 500 microns in diameter were very rare. Nevertheless the feature matrix was seen to be very organic and fragments of intact cellular organic matter were commonly found within it. The matrix contained approximately 30% stones by volume, much more than that of BA023, and it had a weak granular structure. Fine pores were found within the matrix and worm faeces were commonly encountered. Much of the organic matrix was too fine to be resolved. Within the dark organic matrix were areas of finer, more mineral rich matter. This was isotropic and might be the result of mixing. Stones carried a thin , unoriented coating of the dark organic matrix of the feature, again making them appear very dark. Oriented clay domains were occasionally observed as were rare clay and silt plugs.

What conclusions can be drawn from these sections? The volume sampled by this approach is very small when compared with the total volume of the possible archaeological features. Only one class of feature was examined, the 'pit'. The features of BA021 and BA023 differ in the make up of their matrices. BA023 contains more coarse organic matter and has less evident structure and mixing than BA021. The unresolvable fine organic matter in both features could not be differentiated from similar matter outside the features. The slightly smaller evidence of mixing of fine matter in BA023 when compared with BA021 suggests that this fine matter is more likely to have originated within the feature than is the case for the fine matter within BA021 but this is only a relative consideration. Rare, oriented and sorted fine coatings, domains and plugs suggest that fine organic matter has been mobile within the archaeological features. This would suggest that such fine matter found within the features may not originate within them and that the analysis of fine matter may not be a reliable guide to the original contents of the features. Uncertainty remains as to whether the colour change seen to indicate the edges of features is not the result of the sorting of fine organic matter from the features. as in the case of BA023. The clear change in stone abundance at the edge of the feature seems to indicate that the edge is as it was when first formed since later disturbance is unlikely to have brought about such a change.

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KINLOCH, RHUM: A REPORT ON THE STATISTICS OF STONES FROM CONTEXTS

D JORDAN

Introduction and Objectives

The features discovered during excavation were filled with material in which the sizes and shapes of the stones appeared to differ from the neighbouring ploughsoil and naturally occurring sediments. It was thought that information on the nature of these stones might help in understanding the manner in which the features were filled and the material that was used for filling. This might, in turn, suggest reasons why the features were formed and whether there were any associations between them.

Methodology

On site it was found that there was a close correspondence between the distribution of artefacts in the topsoil and features below. There was no significant accumulation of material at the base of breaks of slope and relict periglacial structures were preserved in the soil profile. Hence it was concluded that particles with a diameter greater than 2mm had not suffered significant movement in the soil since the site was occupied. Thus analyses were confined to stone sizes larger than this.

The following variables were measured in each sample:

* Particle size distribution in classes of 3-4mm; 4-8mm; 8-16mm and >16mm (all stones).
* Roundness of stones 8-16mm (100 stones)

* Shape of stones 8-16mm (100 stones)
* Mass of stones 8-16mm (100 stones)
* Roundness of stones >16mm (all stones, two scales)
* For the majority (28 out of 42) of the samples 50 stones were measured along their three principal axes so that their shape could be calculated.

The number of samples that could be analysed was limited. Samples were chosen in order to provide examples of several feature types, parent materials and ploughsoils. Nineteen of the forty-two samples were duplicates.

Once collected, each sample was wet-sieved at 3mm and the retentate dried. This was then shaken through sieves of 4mm, 8mm and 16mm mesh to constant weight and each of the four resulting fractions was weighed. The fraction of 8-16mm was then quartered and quartered again and eight of the resulting sub-samples were chosen at random and examined in random order. Stones were taken from the first sub-sample and their roundness estimated on a standard scale. Each stone was then assigned to a shape class and weighed. When all the stones of the first sub-sample had been examined, the second sub-sample was used until 100 stones had been examined. This elaborate procedure was instigated because it was found that there was a bias towards larger stones being selected if they were taken from the sample directly. One replicate of 50 stones was carried out and it was found that 10 stones were assigned to different shape classes and 14 to different shape classes on re-estimation. Thus reproducibility was low.

All the stones over 16mm in diameter were classified according to two classificatins of roundness (Gardiner & Dackombe 1983; Fitzpatrick 1980). One replicate of 50 stones was carried out and it was found that 10 of these 50 were assigned to different classes on the first index and 4 on the second. Thus again reproducibility was quite low.

Results

Each sample is briefly discussed below. Few generalisations can be made except for one which stands out. With only one exception (fill 0089), the natural parent materials are more rounded than the fills of the features. Thus it may be concluded that the material with which the features are filled is partly artificially angular. It can also be concluded that the pits are similar, at least in angularity of contained stones, although some contain many more angular stones than others. The variability in sphericity is considerable, even within fills, but some fills have consistently high or low spreads of stone sizes. Although similarly variable, mean maximum lengths show that some features contain consistently larger stones than do others. These features also tend to have considerable spread of stone sizes, suggesting that the high values of mean maximum length may be due to a proportion of large stones within fills which otherwise have normal stone sizes.

SAMPLE NO.	ORIGIN	SPHERICITY MEAN	SPHERICITY S.D.	MAXIMUM LENGTH MEAN	MAXIMUM LENGTH S.D.
1	Ap, Test pit 3	62.4	8.27	48.9	11.3
2	Till, 0.30-0.60m	64.0	8.60	54.5	29.5
3	Ap, South Extension	62.4	7.83	55.1	23.8
4	Gravel Natural	64.2	12.42	45.3	10.8
5	Gravel Natural T.P. 3	60.5	11.84	68.5	27.8
6	BA0021	59.4	9.96	53.8	14.6
7	"	56.7	9.40	56.6	22.4
8	"	52.7	10.20	55.2	17.4
9	BA0023	54.8	11.73	63.7	28.7
10	BA0047	48.2	10.28	56.7	20.8
11	"	51.1	9.02	57.0	24.2
12	"	51.7	9.87	50.1	13.8
13	BA0052	56.2	8.62	49.1	8.6
14	"	55.3	9.44	53.4	17.2
15	BA0087	58.1	8.12	46.0	10.0
16	"	58.9	11.63	44.6	8.8
17	BA0088	64.2	9.18	41.5	9.4
18	"	60.9	8.27	45.8	8.9
19	BA0080	57.4	12.78	58.7	25.8
20	"	54.4	8.74	57.8	21.6
21	"	53.5	12.62	62.4	25.8
22	BA0081	54.6	13.43	52.1	15.7
23	"	51.7	15.77	58.2	18.0
24	BA0083	55.2	10.58	54.7	22.0
25	"	53.2	10.87	58.5	20.2
26	BA0084	52.8	11.27	60.0	20.8
27	"	54.2	10.38	58.3	30.0
28	"	58.2	12.28	54.2	17.8

Table 64 Comparison of stones from the archaeological features and the excavation site matrix, sphericity and maximum length

The samples are discussed mainly in the light of the data for sphericity and maximum length (table 84) since these are most readily interpreted.

1. *The Ap horizon of soil test pit no.3.*

This is one of five samples of ploughsoil. Mean sphericity is very high and relatively invariant while mean maximum length is low and also relatively invariant. Thus sample 1 is comparatively well rounded and sorted. These are interesting and perhaps surprising attributes for a ploughsoil. It is not consistently similar or dissimilar to any particular class of samples or fills except that its high degree of rounding is similar to the other parent material samples.

2. *Till.*

The stones in this sample are comparatively well rounded, of approximately mean size and very poorly sorted.

3. *Ploughsoil.*

The stones in this sample are comparatively well rounded, of approximately mean size and moderately poorly sorted.

4. *Gravel parent material.*

The stones in this sample are comparatively well rounded although variable. They tend to be very small and very well sorted.

5. *Gravel parent material.*

This is moderately and moderately variably well rounded. Its stones are comparatively large and poorly sorted. It differs from sample 4 in these respects.

6, 7, 8. *BA021*.

These are quite similar to each other and near the mean for sphericity, size and their variabilities. Their properties are quite different from those of the parent material samples.

9. *BA023*

This is near the mean for sphericity and its variability. Its stones are very large and poorly sorted, however.

10, 11, 12. *BA047*

These are quite similar to each other, 10 and 11 more so. They are all very angular and not very variably so. They are close to the mean for mean maximum length and variability. This feature appears to be particularly rich in the exotic, angular stones.

13, 14. *BA052*

While quite different from the parent materials, these samples are only a little below the mean for sphericity and for mean maximum length. Sample 13 is less variable and sample 14 slightly less variable than the mean for both criteria.

15, 16. *BA087*

While these samples differ in sphericity, they contain stones of similar sizes and sorted to a similar degree. The sphericity of stones in sample 15 is close to mean while the associated standard deviation is low. Stones in sample 16 are moderately spherical but more variable than the mean. Stone sizes in both samples are low and vary very little ie. the samples are well sorted.

17, 18. *BA089*

KINLOCH, RHUM: TOTAL PHOSPHATE ANALYSIS OF SOILS

S LEE

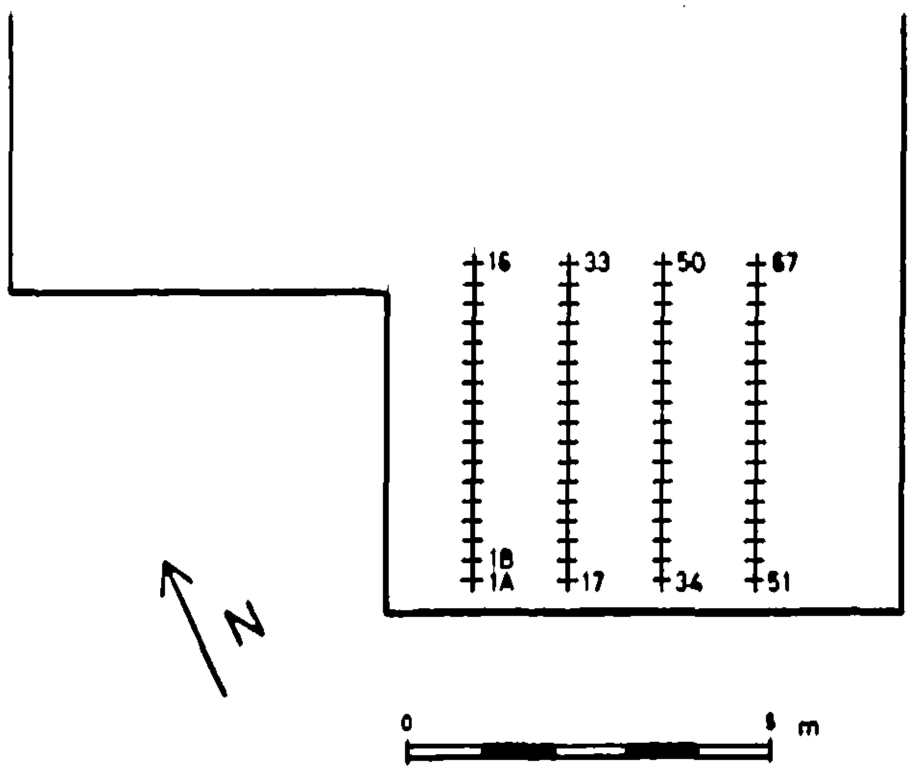
Introduction (Ill 116)

Total phosphate determinations were carried out on 88 samples taken from a grid survey of part of the site in trench 8A thought to have underlain a possible structure. The aim of this part of the analysis was to determine whether the distribution of phosphates correlated with the distribution of archaeological features. If this was found to be the case then it was hoped that phosphate levels could be used to clarify the status of the archaeological features.

The phosphate grid samples were taken from four lanes each one metre apart and within the lanes at 25cm intervals from a depth of 3cm below the ploughsoil. The area covered by the grid was 3m x 4m.

Also analysed were 28 background samples and further samples from around a feature AD222. These samples had previously been investigated using a different methodology (Hirons and Edwards, mf) and the aim of analysing them again was to check for comparability with the previous work.

The background samples were also used as a measure of the natural phosphate variability.



ILL 116 : Trench BA. Location of samples for total phosphate analysis of soils

Samples were also taken from a number of features in trench BA but outside the area covered by the grid. Samples were taken from the fills of features and also from 20cm under the visible edge of the feature. This work aimed to cast light on the behaviour of phosphate deposits with respect to their mobility.

Method

Samples were air dried and then sieved through a 2mm mesh. The samples were then placed in an oven at 50 degrees Celsius and dried to constant weight (24 hours was found to be sufficient for this).

Circa 0.2gm of soil was then taken and ignited at 550 degrees C for one hour. The soil was boiled in 25ml 1N HCl for thirty minutes to extract the phosphate (Anderson 1976). The cooled extract was filtered and made up to 25ml in a volumetric flask. 10ml of this extract was put in a 50ml volumetric flask and to this was added about 25ml of water. Then 10ml of the molybdovanadate solution was added and the mixture made up to volume. This was left for at least 10 minutes but less than an hour and the absorbance read on a Corning EE 197 Spectra Colorimeter. A calibration curve was prepared for each batch of readings although the curve itself was found to be consistent. THe curve was made by substituting aliquots of a 50ppm P stock solution for the extract in the assay mix. The calibration curve was found to be linear between 1 and 10ppm with a slight loss of linearity between 10 and 20 ppm.

The solutions were read against a phosphate free blank and also measured was an extraction blank (25ml HCl boiled for 30 minutes and a 10ml aliquot taken for assay). This blank was always found to contain no phosphate.

This method was used by Hamond (1985) and the assay is best described by Jackson (1958).

1 in 4 samples were replicated, the majority of these cross batch to enable an estimate of overall laboratory precision.

All glassware was thoroughly washed in phosphate free detergent solution, rinsed and left standing in 10% nitric acid for 24 hours before being rinsed three times in tap water and three times in distilled water.

Throughout the procedure steps were taken to avoid contamination of the samples from external sources of phosphate, thus following the advice: 'Dust, saliva, perspiration and tobacco ashes carry appreciable amounts of phosphorus and should therefore be excluded'! (Jackson 1958).

Results

The overall precision indicating the level of laboratory error was calculated using the method of Vermeulen (1953) and was found to be 102ppmP. Laboratory error was therefore around 5%.

1985 Samples (table 65)

The results of the re-analysis of the 1985 samples were found to be linearly related to the original values. Although this gave cause for concern, time was not available to investigate its origin. The cross batch duplicates suggested that the analysis was internally consistent and the results of this work are still of value.

1986 Samples (table 66)

Only a limited number of the samples taken from the pits excavated in 1986 were analysed due to a lack of available time. Nothing conclusive can be said about these results , however some interesting patterns have emerged and are worth considering.

The phosphate levels found in the fills of features BA23 and BA47 are not markedly higher than those found in the natural soils of the site. However, the control samples taken from 20cm below the visible edge of the feature do have enhanced phosphate levels. This may indicate movement of phosphate from the feature into the underlying natural soil where it is apparently bound.

Alternatively the samples from the fills of BA107 and BA108 do exhibit considerably enhanced phosphate levels. The control samples from these features were not analysed.

The Grid (table 67)

SAMPLE NO.	PPM	PPMREP	PPM BY HIRONS
P1	820	940	528
P2	1130	1220	700
P3	1250	1040	550
P4	1040	1120	600
P5	1380		720
P6	1850		710
P7	1080	1110	584
P8	1280		710
P9	1880		885
P10	2480	2800	1270
P20	520		280
P21	830		218
P22	580		344
P23	800		280
P24	1430		438
P25	240		138
P26	1200		880
P27	800		207
P28	880		280
P29	850		345
P30	1170		458
P31	1120		282
P32	810		510
P33	750		227
P34	880		300
P35	830		288
P36	1080		410

Table 65 Total phosphate analysis : replication of 1985 samples

FEATURE & SAMPLE	PPM P	DESCRIPTION
BA018G	980	BA018 consisted of two layers a black peaty layer overlaid a grey silt clay. The control sample was from the sandstone gravels 0.50m c. N of BA018.
BA018 NATURAL	320	
BA019	1150	
BA021B	2170	
BA023D	1850	Base of fill BA023
BA023 CONTROL C	3580	0.20m below bottom of visible edge.
BA047B	1130	Middle of top layer.
BA047D	1220	Middle of lower layer.
BA047 CONTROL C	4180	0.20m below visible base of feature.
BA107B	3740	0.40m below top of BA107.
BA107M	5800	0.25m "
BA107T	3550	0.15m "
BA10[illegible]	2840	
BA101/1	3770	
BA102/2	4100	
BA103/3	4100	
BA104/4	2180	

Table 66 Total phosphate analysis : 1986 features, sample results

SAMPLE NO.	PPM	PO4	SAMPLE NO.	PPM	PO4
1A	2070	2130	34	1950	
1B	2210	2190	35	2690	
2	2940	2890	36	2860	
3	2850		37	2610	
4	3020	3030	38	2880	
5	2850		39	4300	
6	2160		40	2830	3080
7	2460		41	2720	
8	2900	2880	42	2030	2080
9	2420	2450	43	1980	
10	1630	1630	44	3160	
11	1330		45	1180	
12	1630		46	1580	1560
13	1840		47	1440	
14	1830		48	2070	
15	3540		49	2380	
16	2740	2840	50	1900	2130
17	1840		51	4730	
18	1960		52	2380	2430
19	1060	1220	53	4850	
20	1810		54	2830	
21	3850		55	2780	
22	1830		56	2720	
23	2550		57	2250	
24	2530		58	1640	1830
25	3720		59	1880	
26	2580	2540	60	1280	
27	3210		61	1700	
28	7840	8250	62	1100	
29	2550		63	880	830
30	1880	1880	64	1730	
31	2850		65	2720	2880
32	2180		66	4780	4800
33	2880	2810	67	2820	

Table 67 Total phosphate analysis : 1986 grid samples in trench BA, sample results

Comparing the set of samples from the grid and the samples from the natural soils (P20 to P38) using the Whitney Mann U test (Ebdon 1978) it can be shown that the two sets of samples are likely to be from different populations at the 0.001 significance level.

The Whitney Mann U test was also used against all those samples taken from within 17cm of suspected features and the rest of the samples from the grid. Thr null hypothesis could be rejected at the 0.05 significance level. This would he expected if we consider the features to be areas of concentrated human activity within the settlement as a whole.

The south east corner of the grid area was thought possibly to have overlain part of an early structure. A Whitney Mann U test was carried out on the twelve samples from this area and the rest of the grid samples. The Null hypothesis could be rejected at the 0.05 significance level suggesting that the samples from around this area do come from a separate population to those from the rest of the grid. This may support the possibility that this area was associated with a structure.

Conclusion

Analysis of the phosphate content of soils on and around the site was carried out. The results demonstrated that the soils within the area of the site exhibited enhanced phosphate levels compared to the phosphate content of the natural soils around the site.

Further to this the soils from the site taken from within 17cm of suspected features exhibited enhanced phosphate content (when treated as a population) compared to the other soil samples taken from within the site. However, soil phosphate levels alone were not capable of diagnosing between soils from individual features and the other soils of the occupation area. Preliminary work suggested that some features retained high phosphate content whereas other features had lost phosphate to the underlying natural.

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Report on Geomorphological Investigations Carried Out in Support of the Excavation at Kinloch, Rhum.

DG SUTHERLAND

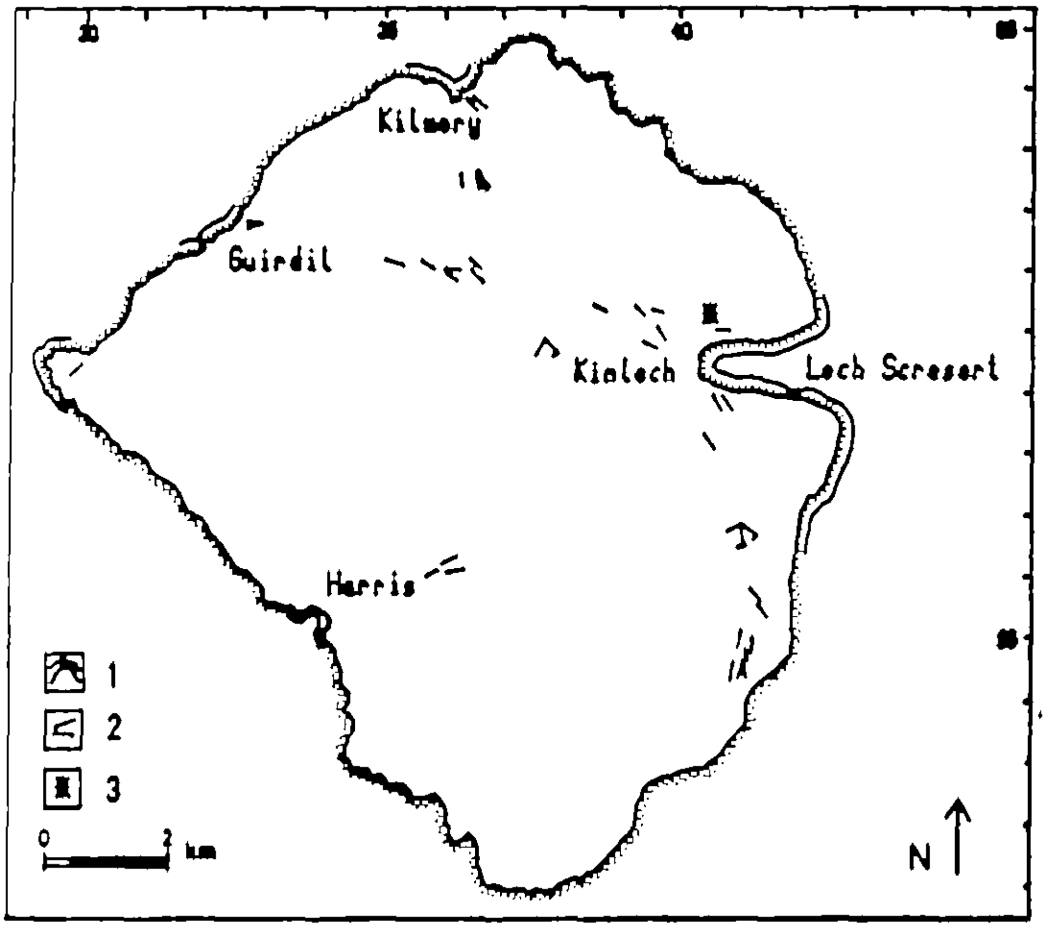
Introduction and Objectives

During 1984, archaeological excavations were carried out at Kinloch, Rhum which established Mesolithic occupation of that area from as early as c.8500 BP. The site is situated between c.11 and 15m above local O.D., but its relationship to Flandrian sea levels was unknown. Sea level during the period of occupation of the site and subsequently is of importance (a) as a factor in the local environment and (b) as a potential factor i disturbance of the site by marine transgression after its abandoment.

The principal objective of the work reported here was therefore to study the history of sea-level change around the coast of Rhum and to relate this to the Kinloch site. A second objective was to study the sediment forming the undersoil of the site in order to understand its genesis. In addition, factors relating to the natural transport of bloodstone from Bloodstone Hill and its incorporation in the beach at Guirdil were also examined.

Work Carried Out

Following examination of the whole of Rhum on aerial photographs at a scale of c. 1:27,000 and a review of the relevant literature, a 10-day programme of field work from 6th to 16th



1. Stretches of coastline mapped at 1:10,000
2. Striations mapped during this study; older striations tail marked.
   The striations indicate dominant ice-flow from east-west, Lastglaciation.
3. Archaeological Site

ILL 117 : Geomorphological work on Rhum 1985

April 1985 was carried out. Those stretches of coastline and lower portions of adjacent valleys that seemed likely to preserve evidence of former sea-level changes were mapped at a scale of 1:10,000 (Ill 117). During this mapping, in addition to landforms and sediments resulting from sea-level changes, features relating to glaciation or post-glacial processes were also recorded. The mapping was supplemented by shallow hand bores to a maximum depth of 3m to investigate the sediments at the head of Loch Scresort (10 bores) and in the lower part of the Kilmory Glen (8 bores) together with a number of other bores through peat around Kinloch.

Subsequent to mapping, all clear raised shoreline features around Loch Scresort, at Harris and at Guirdil were accurately levelled on closed traverses using a Koshiba semi-automatic level.

Sedimentological investigations were also carried out both in the field and subsequently in the laboratory on samples from the substrate of the archaeological site.

Sea Level Change

Introduction:

Certain aspects of the raised shorelines around the coasts of Rhum have been described in the literature (Harker 1908, McCann and Richards 1969, Peacock 1976). These accounts have concentrated mainly on the rock-cut shorelines and Lateglacial depositional features and have only mentioned briefly marine landforms and sediments that were presumed to date from the poor development of Flandrian shorelines, the paucity of river terraces graded to these and the considerable thickness of peat and fine-grained sediment accumulated in the lower reaches of Kilmory Glen. The low total sediment supply to the coasts of Rhum seems attributable to the lack of extensive (easily-eroded) glacial deposits. The numerous short streams that drain the island also result in such sediment as is transported being dispersed around the coast rather than concentrated in particular areas. Much of the material in Flandrian raised shorelines, as in the present beaches, therefore appears to be of very local derivation or reworked from earlier periods of sediment supply (i.e. the Lateglacial period, c.13,000-10,000 BP).

Exposure varies very greatly around the coast of Rhum. The bays at Harris and Guirdil on the south and west coasts have maximum fetches of well in excess of 150km, whilst Kilmory on the north coast has a maximum fetch of c.75km. The head of Loch Scresort near the archaeological site is the most sheltered stretch of coast on the island with a maximum fetch of 25km to the east-south-east, itself a direction of relatively low frequency of strong winds. Exposure is the principal control on the altitude to which waves are liable to move sediment along a particular shoreline and hence local variation due to this factor must be anticipated around the Rhum coast.

The coastal profile of Rhum is typically very steep with cliffs, rising in places to over 300m, around all but a few stretches of coast. These cliffs are fronted by various rock platform remnants that pre-date the Flandrian indicating the cliffs to be fossil (McCann and Richards 1969) and hence, despite their impressive appearance, supplying very little sediment to the coast. The steep nature of the coastal profile, even in many embayments, precludes extensive development of depositional marine landforms.

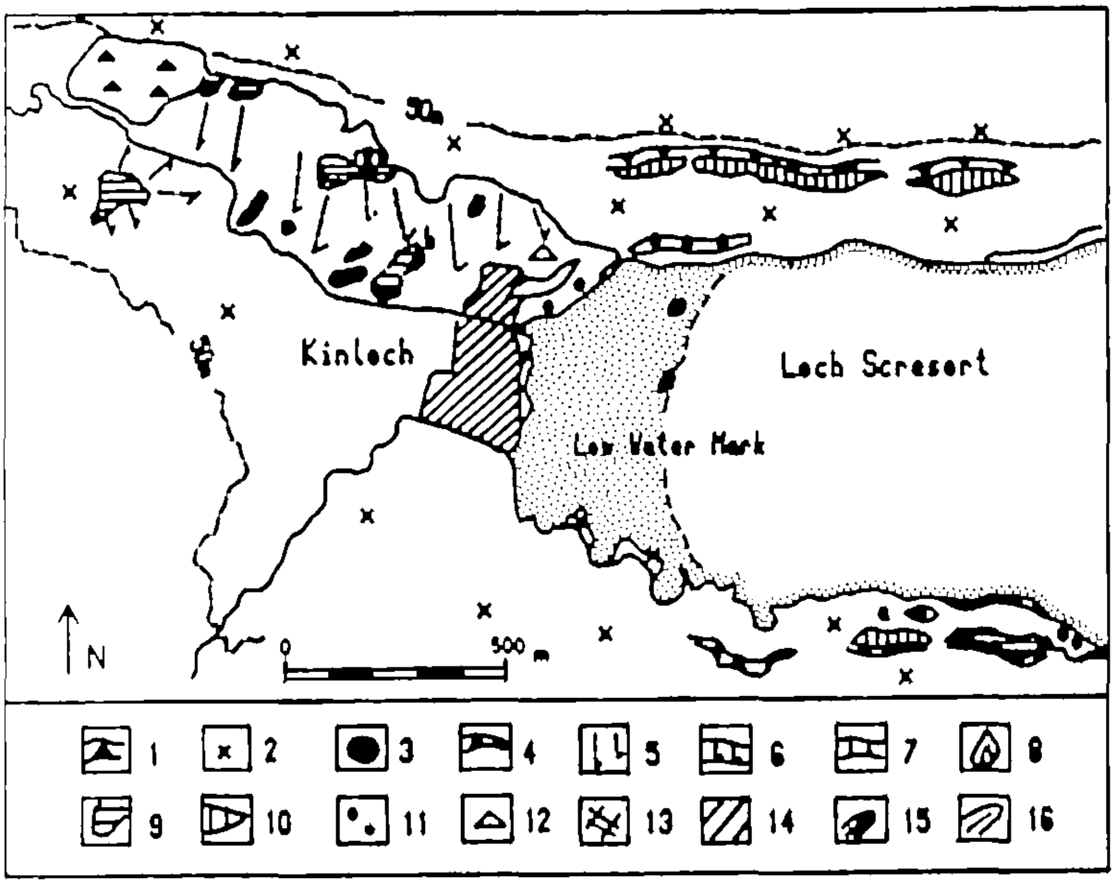
The offshore profile is also generally steep uround Rhum, the only exception being in Loch Scresort. A shallow offshore profile results in the reduction of wave energy prior to its reaching the shore. Hence on Rhum this factor operates in sympathy with fetch in emphasising the sheltered nature of Loch Scresort, particularly its head around Kinloch, and the exposed nature of Harris and Guirdil.

In summary, the local factors affecting the development and altitude of shoreline features are not conducive to widespread formation of depositional land forms. There is also likely to be considerable local variation, from bay to bay, in the altitude at which given processes are effective. Loch Scresort has by far the most sheltered coastline on the island. As is discussed later, at the maximum of the Main Postglacial Transgression the lower part of Kilmory Glen would have been an even more protected brackish/marine embayment. Insofar as Mesolithic settlement was influenced by the sheltered nature of Loch Scresort, then in the middle Flandrian the lower portion of Kilmory Glen may also have offered an attractive environment.

Field Evidence of Former Sea Levels:

A geomorphological map of the area around Loch Scresort is shown in (Ill 118).The highest marine features, formed at the time of deglaciation, are found within Glen Kinloch where depositional terraces, fronting a large drift mound, have an altitude of c.35m local O.D. During the fall in sea level subsequent to the formation of these features a further depositional terrace was formed in the mouth of Glen Kinloch at an altitude of c.24m local O.D. A major rock-cut platform and degraded cliffline occurs along the north of Loch Scresort and on the south side of the loch by its mouth. This was surveyed near the head of the loch where it has an altitude of c.32m O.D. The age of this and similar rock platforms which are found widely around the coast of Rhum is unknown: they may be older than the last regional glaciation.

The remaining evidence relating to sea-level change around Loch Scresort is considered to be of Flandrian age and to have been formed at the maximum of, or following, the Main Postglacial Transgression. No evidence has been found in the area around Loch Scresort to establish the transgressional nature of these marine landforms and sediments. However, evidence for such a transgression probably exists in Kilmory Glen where a line of eight boreholes proved a widespread minerogenic layer with peat above and below at an altitude of around 10m. This site deserves further detailed investigation. Furthermore, the Main Postglacial



1. Sharp break of slope in bedrock. 2. General bedrock exposure.
3. Limited bedrock exposure. 4. Sharp break of slope in drift. 5. Moderate drift slope.
6. Steep drift slope. 7. Talus. 8. Alluvial fan. 9. Terrace in drift.
10. Rock platform. 11. Beach gravel spreads. 12. Large accumulation of glacial sediments.
13. Infilled peaty basin. 14. Man-made ground. 15. End moraine. 16. Shingle ridge.

ILL 118 : Geomorphological map of the head of Loch Scresort and the lower part of Kinloch Glen

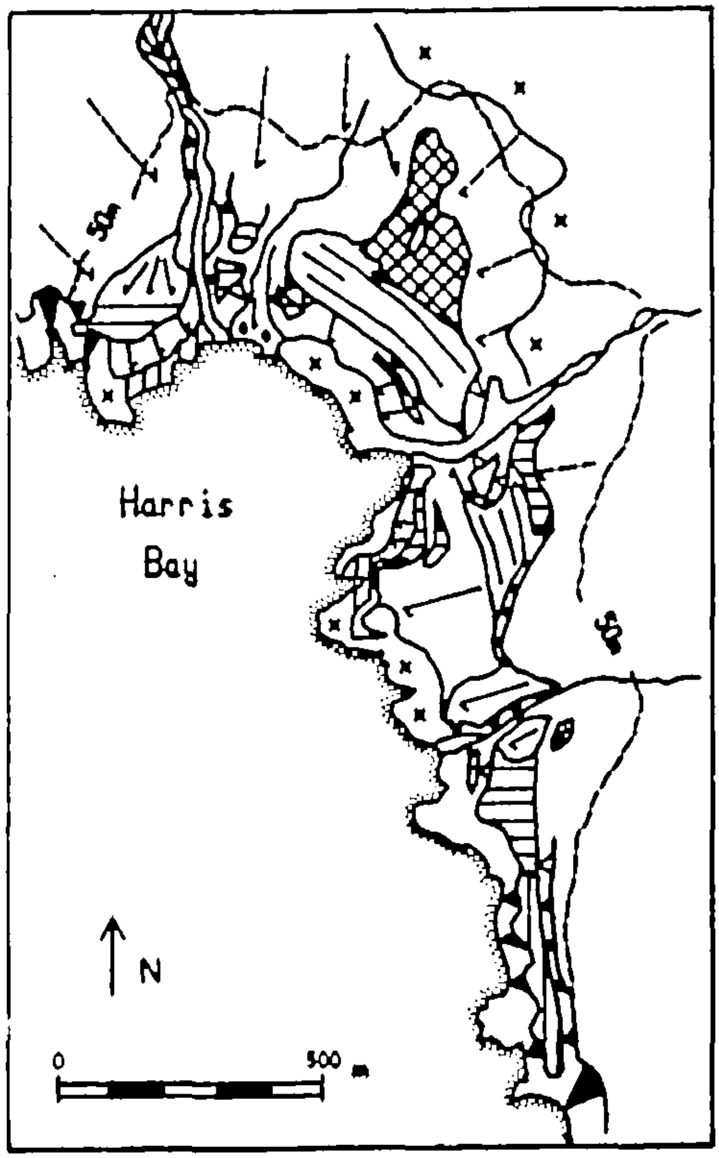
Transgression has been established at a sufficiently large number of localities around the Scottish coast to make it certain as an element in the sea-level history of Rhum. The sea-level changes established elsewhere in Scotland indicate an early Flandrian regression minimum at between 8000 and 8500 BP. followed by the Main Postglacial Transgression which culminated in the formation of the Main Postglacial Shoreline at around 6500-7000 BP.

Ten boreholes were drilled in the intertidal sediment at the head of Loch Scresort in a search for any early Flandrian peats that may have formed during the early Flandrian regression and been preseved because of the low energy environment and low sediment budget at the loch head. No peat was found, however, just a c.50cm surface layer of medium to coarse shelly sand overlying grey shelly silty fine sand in most bores. This lower deposit is thought to be the finer-grained offshore sediments deposited during the higher middle Flandrian sea levels. The drilling programme had to be curtailed because of tidal changes that restricted access to the lower part of the intertidal zone.

Around the margins of Loch Scresort, Flandrian beach gravels, where present, occur mainly as thin spreads resting on bedrock. On the south side of the Loch, however, a narrow depositional terrace exists at (a) in Ill 118.This has an altitude of 11.4m local O.D. and although this altitude may be influenced by the underlying rock structural bench, this provides a maximum altitude for the Main Postglacial Shoreline by Loch Scresort.

In the lower part of Kinloch Glen to the north of the river (b) in Ill 118, a peat-covered terrace was investigated. The sub-peat surface consists of grey sands and silts with a thin surface layer of gravel at an altitude of 8.9m local O.D. The base of the peat is characterised by abundant Phragmites macrofossils and, although no microfossil evidence is presently available on this section, it is thought that the minerogenic/peat transition is a seral contact from marine to freshwater conditions (but see Chapters 11 & 12 in text). A sample was removed for radiocarbon dating from the basal 2cm of the peat and it is anticipated that this sample should closely date the retreat of the sea from the maximum achieved at the peak of the Main Postglacial Transgression.

The evidence of former sea-level change at Harris and Guirdil is broadly similar to that for Loch Scresort. A geomorphological map of the coast around Harris is shown (Ill 119).The highest former marine features are the notable series of raised shingle ridges around the head of Harris Bay at an altitude of c.30m. Sea level fell following the formation of these ridges and beaches have been preserved at c.21m and c.17m, the former appearing as a more significant feature in the area of Harris Lodge for it coincides approximately with the level of a pre-existing rock platform that can be traced along much of the south/west coast of Rhum. All these raised shorelines predate the Flandrian.



ILL 119 : **Geomorphological map of Harris Bay**

The generally steep coastal slope around Harris Bay below the level of the high rock platform has restricted the development of Flandrian marine deposits. These are typically in the form of steep banks of gravel and only one such feature was surveyed, in the south/east of the bay. This had an altitude of c.8m, which, given the degree of exposure of the bay and the information from elsewhere on Rhum as to Flandrian sea levels, implies formation in the latter part of the Flandrian.

At Guirdil (Ill 122), there are only two depositional features that can be related directly to sea level. The higher, at an altitude of c.27.5m, relates to the period of deglaciation when a small valley glacier occupied Guirdil Glen. The lower feature is the raised beach on which the bothy stands. It represents the highest Flandrian shoreline and occurs at c.9.5m. Given the variation in coastal conditions and the likely effect of isostatic tilting, this figure for the uppermost sea level during the Flandrian is in agreement with the figures derived for Loch Scresort. More detailed discussion of the Guirdil area is included later.

Conclusions

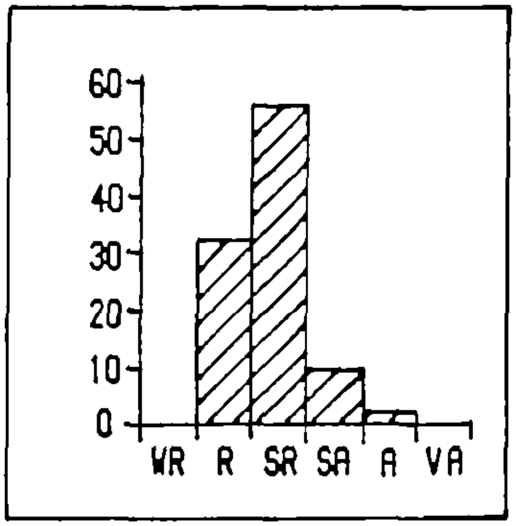
In conclusion, the available evidence suggests that the maximum altitude achieved by the sea during the middle Flandrian may be placed at approximately 10-11m local O.D. around Loch Scresort. This event was very probably preceded by a period of lower sea level and, by comparison with other areas in Scotland the time of lowest sea level approximately coincided with the earliest period of occupation of the Kinloch site. The local sea level at this time is, however, undetermined. In eastern Scotland where the Main Postglacial Shoreline (allowing for differences in datum) is at approximately the same altitude as around Loch Scresort, the early Flandrian regression appears to have approached or dropped below present sea level. At the time of earliest occupation of the Kinloch site, therefore, sea level could have been close to or perhaps below present sea level.

The subsequent rise of sea level during Main Postglacial Transgression did not reach such an altitude that would have disrupted the area excavated. That the occupation site has been traced to a lowest altitude that broadly coincides with the uppermost Flandrian sea level may suggest, however, that lower portions of the site have been destroyed during the transgression.

At the time of the Main Postglacial Shoreline the lower reaches of Kilmory Glen were occupied by the sea or by a brackish inlet. This may have provided an attractive sheltered environment for mesolithic man.

Sediment Analysis from the Substrate of the Kinloch Site

A particular problem related to the archaeological excavation was the nature of the sediment on which the Mesolithic settlement had been established. As can be seen (Ill 118), there is only a



WR: well rounded　R: rounded
SR: sub-rounded　SA: sub-angular
A: angular　VA: very angular

ILL 120: Trench AJ. Clast roundness

0.00-0.25	m	Topsoil. Grey-black organic rich sand with pebbles scattered throughout.
0.25-0.55	m	Organic rich medium-fine sand with more abundant pebbles and cobbles than above. Abundant rootlets and iron staining. Very compact.
0.55-0.75	m	Very compact clast-supported cobbles with coarse sand and small gravel matrix. Iron staining and rootlet penetration.
0.75-0.80	m	Very compact reddish-brown clast supported cobbles with medium sand matrix. Reduced iron staining.
0.80-1.10	m	Very compact reddish-brown clast supported cobbles and small boulders. Matrix small gravel to medium-coarse sand. Some iron staining. Some clasts weak and partly rotted.
1.10	m	Base of pit.

Table 68 Trench AJ: stratigraphy

limited area of sediment-covered ground around the head of Loch Scresort. The largest such area is on the north side of the head of the loch where the excavations were located. A short distance to the east of the site the sediment thins out against a Torridonian bedrock rise whilst to the west bedrock outcrops in a number of areas suggesting that the sediment itself is relatively thin. A small fossil possibly marine-cut cliff occurs immediately south of the site. This has a maximum relief of c.3m, implying that in this area the body of sediment has at least this thickness. In order to investigate this sediment more closely and to confirm the base of the site, a trench (AJ) was dug towards the lower end of the site. It had a surface altitude of 11.8m local O.D. The stratigraphy is shown in table 88.

The sediment analysis described below was carried out on the lowermost 30cm of the pit as this would be the least disturbed by surface activity (the archaeological material occurred in the topmost c.55cm) and soil-forming processes.

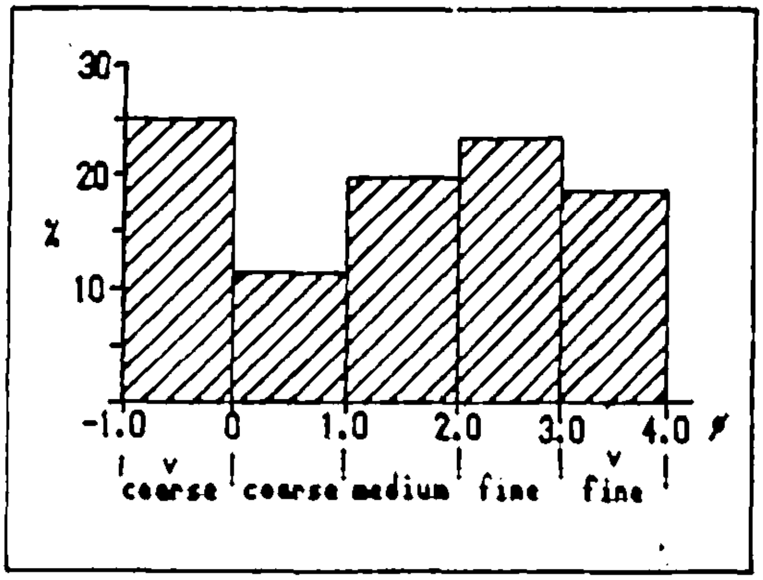
Clast form. Fifty clasts, the long axes of which were greater than 4cm, were measured for the long (a), intermediate (b) and short (c) axes. The mean [a+b]/2c ratio was 2.04 and the mean c/a ratio was 0.46.

Roundness. The roundness of the same 50 clasts was assessed on a six-point scale extending from well-round to very angular. The results are shown in Ill 120 from which it can be seen that the modal class is sub-round with rounded clasts being the most frequent.

Lithology. The lithology of the same 50 clasts was also classified. The dominant lithology was Torridon Sandstone (44%). Of particular interest were Schistose and Mesozoic sedimentary lithologies (12.5%) that do not crop out on Rhum. The remainder of the clasts were various igneous lithologies. These are likely to have been derived from Rhum although some, particularly basalts and dolerites, could have come from outwith the island.

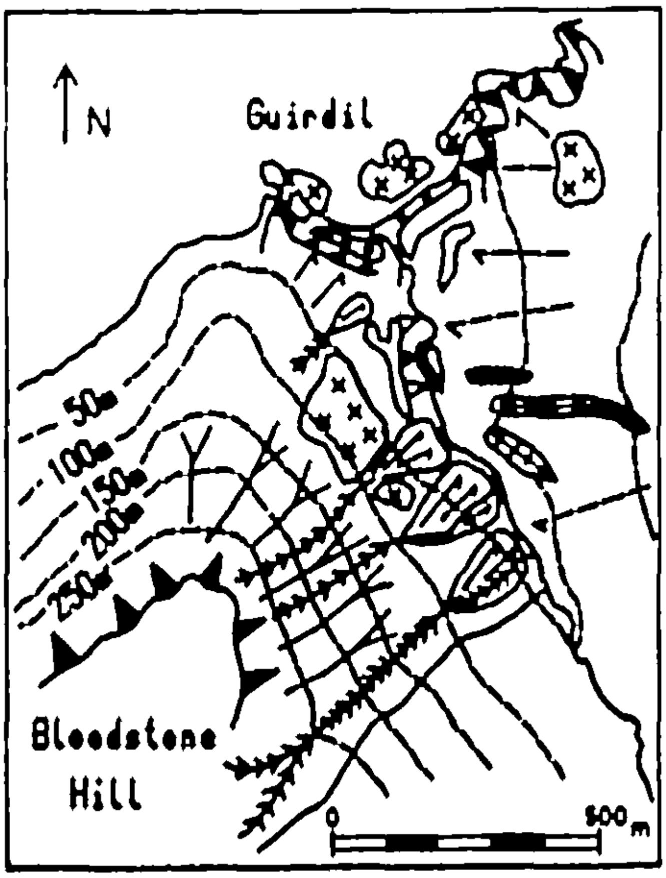
Matrix particle size distribution. A matrix sample was removed and dry sieved in the laboratory at 0.5 intervals between -1.0 (2mm) and 4.0 (0.063mm). The graphic mean diameter of the matrix was 1.93 (0.282mm) but it was poorly sorted (˜ = 1.45 ; 0.388mm). The silt and clay (i.e. <4.0) percentage was c.10.5% and the sand fraction had two modes: a larger one of very coarse sand (-1.0 to 0 ; c.25% of the sand fraction) and a smaller one of fine sand (2.0 to 3.0 ; c.23.5% of the sand fraction) (Ill 121).

Interpretation The observations in the field and the sediment analysis indicate that the deposit is unstratified poorly-sorted clast-supported sediment. The matrix is primarily a coarse sand, particularly when consideration is given to the likelihood of downwashing in the soil profile of fine sand, silt and clay. This may be the explanation of the secondary mode in the fine sand fraction. The lithology of the clasts, with the significant



Sand-size fraction of matrix of sediment from excavated site substrate.

ILL 121 : Trench AJ. Matrix particle size distribution



ILL 122: Geomorphological map of Guirdil

environmental changes in this area as they relate to the liberation of bloodstone and its incorporation in the local sediments, particularly the Guirdil beaches.

During ice-sheet deglaciation, a glacier occupied the greater part of Glen Guirdil, its terminus being marked by one large and two small moraines on the eastern side of the glen. This ice marginal position is related by a terrace on the west side of the glen to a sea level of about 27m. The glacial deposits are composed dominantly of Torridonian material with subsidiary fine-grained igneous rocks and a few granophre clasts derived from the head of the valley. As most of the material carried by the glacier would have been transported down valley, it is unlikely that any significant concentration of bloodstone would be found in these glacial deposits and, by extension, in the raised shoreline deposits derived from them.

The eastern flanks of Bloodstone Hill are mauked in their middle portion by an extensive, vegetated taluc. As this Talus derives much of its material from the area of outcrop of the bloodstone, its development is fundamental in the transport of bloodstone to the local beaches. The talus must have started to form on deglaciation but at this time there is unlikely to have been significant transfer of bloodstone to the beaches because (i) the talus had to build up, thus trapping freshly eroded bloodstone, and (ii) sea level would have been falling rapidly at this time and the Guirdil Burn would have been eroding into and mainly transporting the glacial deposits in the bottom of the glen.

Both the rate of production of the talus and the fall of sea level are likely to have diminished during the Lateglacial Interstadial but during the subsequent Loch Lomond Stadial (c. 11,000-10,000 BP) there was a marked environmental change towards more severe climatic conditions. Small glaciers built up again in the corries of Rhum and periglacial processes were very active (Ballantine and Wain-Hobson, 1980). This is likely to have been the period of most rapid frost-riving of the free faces on Bloodstone Hill and the talus probably achieved its present dimensions during this period.

The talus is developed on a bedrock slope that is stepped in sympathy with the structure of the underlying Torridonian Sandstone. A larger bedrock step towards the base of the talus produced an area of rock outcrop and below this a series of large alluvial fans/debris cones. These are likely to have been principally constructed during the Loch Lomond Stadial: one of them is clearly inactive today as the gully cuts through it and hence sediment by-passes it, whilst there are also relict gullies on the face of the talus.

The gullies have derived debris from the talus, the bedrock faces above and from the underlying bedrock into which the larger gullies are incised. They have delivered poorly sorted sediments, via the alluvial fans, to the Guirdil Burn. During the

Loch Lomond Stadial, it is likely, on the basis of analogy with other areas of Scotland, that this was a period of stillstand of sea level or even slight transgression. This would have the effect of trapping the sediment from the Guirdil Burn in Guirdil Bay and also diminishing the amount of downcutting in the glacial deposits in Guirdil Glen. Given therefore, (i) the likely increase in activity on the slopes of Bloodstone Hill, (ii) the likely reduction in supply of material from the glacial deposits, and (iii) sea-level changes that favoured increased retention of sediment in Guirdil Bay, it seems probable that the Loch Lomond Stadial was the time when there first occurred a significant component of bloodstone in the Guirdil beaches. The exact altitude of the sea at that time is unknown: by extrapolation from elsewhere on the west coast of Scotland it may be presumed to have been slightly below present sea level.

The start of the Flandrian is likely to have been characterised by falling sea levels (reaching a low at around 8500 BP) and, with climatic amelioration and vegetation development, increasing slope stability. At this period there is likely to have been a marked decline in the addition of new bloodstone to the talus on Bloodstone Hill but continued gully activity (some gullies being active in present conditions) and possible erosion of the lower parts of the alluvial fans due to a lower base level are likely to have ensured a continuing, albeit reduced, supply of bloodstone to the beaches.

After c.8500 BP the Main Postglacial Transgression occurred subsequent to which the sequence of raised shingle deposits in Guirdil Bay were deposited. Slope activity during the middle and late Flandrian is unlikely to have been greater than that of today and hence supply of sediment to the beaches rather low. It is thought that much of the material in the raised and present beaches has been reworked from that supplied during the Loch Lomond Stadial and early Flandrian.

Reworking of the beach sediments may be of some relevance to the quality of bloodstone available for collection from the beach. The bloodstone has a variable content of vesicles and it may be presumed that those pieces of bloodstone with a high proportion of vesicles would be mechanically weaker and hence more readily destroyed in the high-energy beach environment. If this is correct, then the bloodstone on the beach would not only be the most readily located source of bloodstone but would also be of a naturally selected higher quality than that occurring on the talus.

In summary, on the basis of the landforms in the Guirdil/Bloodstone Hill area and knowledge of the likely environmental and sea-level changes since deglaciation, it is suggested that the period of most abundant 'production' of bloodstone fragments was during the Loch Lomond Stadial. Further, the time of greatest transport of bloodstone to the beaches was likely to have been during the Stadial and the very early

Flandrian. During most of the Flandrian fresh release of bloodstone fragments from the bedrock is likely to have been rather low and the main part of the bloodstone in the present and raised beaches formed after c.6500-7000 BP is thought to have been reworked earlier material. This reworking probably has had the effect of destroying (i.e. reducing to small size) bloodstone fragments that had a high content of vesicles and leaving behind more coherent and mechanically sounder bloodstone. Finally, this reconstruction is rather qualitative but a detailed study could quantify the processes operating.

Conclusions

The conclusions to the work carried out may be summarised as follows.

1. At the time of earliest occupation of the Kinloch site, sea level is likely to have been at or slightly below its present level. The sea, however, would have been close enough to the site to have been a relevent factor in its choice as an occupation area.

2. The subsequent rise of sea level during the Main Postglacial Transgression did not attain such an altitude that the area of the excavation was directly affected. However, the coincidence in altitude between the lowermost part of the site and the uppermost level reached by the Flandrian sea suggests that lower portions of the site may have been reworked or destroyed during the

transgression.

3. At the time of the Main Postglacial Shoreline, the lower part of Kilmory Glen would have been a marine or brackish embayment that might have provided an attractive environment for Mesolithic occupation.

4. The site at Kinloch is underlain by sediment interpreted as a stoney till the upper part of which has been reworked, probably during the Lateglacial fall in sea level, at which time, at least briefly, the area of the site would have been subject to littoral processes.

5. The most probable time for natural release of bloodstone from Bloodstone Hill and incorporation into the Guirdil beaches is during the Loch Lomond Stadial and the early Flandrian. Most of the bloodstone found in the Flandrian raised beaches and the present beach at Guirdil probably reached the coast during the above period. Subsequent reworking in the high energy beach environment has probably lead to destruction of bloodstone with a high content of vesicles and a consequent increase in the proportion of better quality bloodstone in the beaches.

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Pumice on Rhum: Geochemical analyses and interpretation

A Dugmore

Introduction

In 1972 Richard Binns drew attention to the presence of drifted pumice horizons in Holocene strandlines in the British Isles, Norway and Svalbard, and noted several related occurences upon archaeological sites. Recent work in the Hebrides by archaeologists from the SDD/HBM and the University of Sheffield has located a number of midden sites in which pieces of pumice are frequent. These sites lie in the machair of North and South Uist, facing the open Atlantic. Similar pumice has also been recovered during SDD/HBM excavations at Kebister on the Shetland Islands. The realisation that these occurences could be used to define important isochronous marker horizons within Scottish later prehistory has led to the detailed study of this material (Dugmore *et al*, in prep). The analysis of pumice recovered from the excavations on Rhum should be considered in this wider context.

The analyses

Samples of three pieces of pumaceous material were analysed to determine both major and trace element abundances. The material was prepared by the author and X-Ray flourescence analyses were performed at the Grant Institute of Geology, University of Edinburgh. In their original state all of the samples floated in fresh water.

Sample A was sub-rounded in shape, brown, and weighed 13.7g. Given the reference number AG128 5594 it was recovered from a Neolithic context.

Sample B was angular and irregular in shape, light grey in colour and superficially weathered; it weighed 9.6g and given the reference number BA00052 it was recovered from a Mesolithic context.

Sample C was similar in appearance to sample B, but despite its rough, irregular surface the piece was approximately spherical and it weighed 8.2g. The piece was one of three recovered from a Mesolithic context and described as AD00182.

The results of the XRF analyses are given in tables 69 and 70.

Conclusions

A comparison of the Rhum data with published sources leads to the following conclusions:

1. Sample A is volcanic and probably Icelandic in origin (cf. Binns 1972, Mangerud et al 1984); comparison with data from post-Mesolithic excavations in the Outer Hebrides and Shetland combined with Icelandic source data suggests that all this Scottish material is from a single volcanic source in Iceland. It is possible that this pumice was produced during a single

ELEMENT	SAMPLES A	B	C
SiO_2	64.76	79.32	83.00
Al_2O_3	14.21	8.63	5.77
FeO	6.19	2.50	3.04
MgO	1.23	0.67	0.96
CaO	3.18	0.72	0.33
Na_2O	4.82	1.70	0.05
K_2O	2.58	3.01	2.62
TiO_2	1.23	0.64	0.44
MnO	0.18	0.02	0.02
P_2O_5	0.33	0.08	0.10
TOTAL	98.71%	97.28%	96.31%

Table 69 Pumice samples : major element abundances determined by XRF

eruption c. 2700 14C years bp (Dugmore *et al* in prep).

2. Samples B and C are most unlikely to be volcanic in origin; perhaps they are grains of a heat altered sandstone (table 71). The likely origin of this material may be determined from thin section analysis.

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ELEMENT	SAMPLES A	B	C
V	19.3	103.3	117.4
Ba	575.6	511.1	419.9
Sc	9.3	7.7	6.3
La	82.0	24.2	21.1
Nd	85.1	21.6	19.2
Ce	185.0	54.1	47.7
Cr	5.4	97.0	79.1
Ni	5.5	11.0	50.6
Cu	0.2	-2.2	4.1
Zn	161.5	73.0	28.1
Pb	8.2	8.4	8.8
Th	9.8	8.7	6.6
Rb	56.3	79.4	59.9
Sr	313.8	168.4	95.6
Y	74.8	12.9	11.7
Zr	782.2	510.8	331.1
Nb	93.1	10.4	9.2

Table 70 Pumice samples : trace element abundance determined by XRF (ppm)

SAMPLE B

CIPW NORM (WT%)

QUARTZ	56.64	CORUNDUM	1.50	ORTHOCLASE	10.29
ALBITE	14.77	ANORTHITE	3.18	HYPERSTHENE	3.15
MAGNETITE	1.04	ILMENITE	1.25	APATITE	0.19

SAMPLE C

CIPW NORM (WT%)

QUARTZ	72.67	CORUNDUM	2.60	ORTHOCLASE	16.09
ALBITE	0.41	ANORTHITE	1.04	HYPERSTHENE	4.01
MAGNETITE	1.27	ILMENITE	0.06	APATITE	0.25

Table 71 Pumice samples : composition of samples B and C

RADIOCARBON DETERMINATIONS: PROCEDURAL RESUMÉ

GT COOK & EM SCOTT

PRETREATMENT

Pretreatment procedures were generally standard. During the chemical removal of potential contaminants from the carbonised hazel-nut shell a double alkali treatment (2% w/v potassium hydroxide, <KOH>) was employed following an initial hot 1 molar hydrochloric acid (1M HCl) treatment. After the second KOH pretreatment a final hot 1M HCl treatment was carried out. Subsequently, the carbonised shell was filtered, washed with distilled water and dried at 80°C. Wood samples were finely chopped (to approximately matchstick sized pieces) and subject to successive boilings in 2M KOH. Finally, cellulose was produced by extraction with a sodium chlorite/hydrochloric acid solution. Again the samples were filtered, washed with distilled water and dried at 80°C. For peat samples the second (and subsequent) humic acid fractions were regarded as being the most reliable. Following extraction of the acid soluble fulvic acid fraction with hot 1M HCl the residual material was extracted with cold 1% KOH to remove the first humic acid fraction (alkali soluble). The residual material from this extraction was then heated with a further aliquot of 1% KOH. The humic acid containing solution was then filtered, washed and dried ready for sample combustion.

SAMPLE SYNTHESIS

Liquid scintillation counting of benzene is the technique employed for measurement of the residual C-14 activity at Glasgow. Combustion of samples to carbon dioxide (CO_2) was achieved using a combustion bomb filled to 2 bar pressure with CO_2 free oxygen. As a second stage lithium carbide was produced by the reaction of the CO_2 with molten lithium. On cooling, acetylene was generated by the addition of distilled water to the lithium carbide. Finally, high purity benzene was synthesised by cyclotrimerisation of the acetylene at 100-120 °C using a chromium based catalyst. Isotopic fractionation corrections were applied via mass spectrometric measurement of the C-12/C-13 ratio on combustion derived CO_2. Background (C-14 free) samples were derived from the synthesis of benzene from calcium carbide and anthracite, as well as from commercially purchased scintillation grade benzene. Wet oxidation by acidified potassium permanganate solution was used for the preparation of CO_2 from the NBS Oxalic Acid Standard. Subsequent synthesis to benzene was as previously described.

BENZENE VIALLING

The counting geometry consists of 4.5g benzene (accurately weighed to four decimal places) and 0.95g of scintillant solution (12g/l butyl-PBD + 8g/l bis-MSB in toluene). Samples of less than 4.5g were made up to constant weight using scintillation gradient benzene. Borosilicate sealable ampoules were used in preference to screw cap vials as they do not suffer from the disadvantage of weight loss due to evaporation that is encountered with screw cap vials. Prior to counting, the upper half of all ampoules were masked to a standard height with matt black paint to help reduce photomultiplier cross-talk and thereby reduce background count rates.

QUENCHING

A series of approximately 40 ampoules containing C-14 spiked benzene and varying amounts of acetone as a quenching agent were vialled and sealed as per the sample benzenes in order to produce a plot of counting efficienct as a function of impurity level. The External Standard ratio was used as a measure of the quenching.

COUNTING

All scintillation counters were heavily discriminated against tritium (<1%) resulting in C-14 counting efficiencies of aprroximately 70%. Quasi-simultaneous batch counting was employed with each sample undergoing two consecutive 40 minute counts, each with a short count of the external standard to produce the quenching indicator. Normally, each batch consists of four C-14 free benzenes (backgrounds), four NBS Oxalic Acid Standards, approximately twelve samples and two C-14 spiked standards to measure constancy of efficiency. Each sample was counted for a minimum of 2000 minutes.