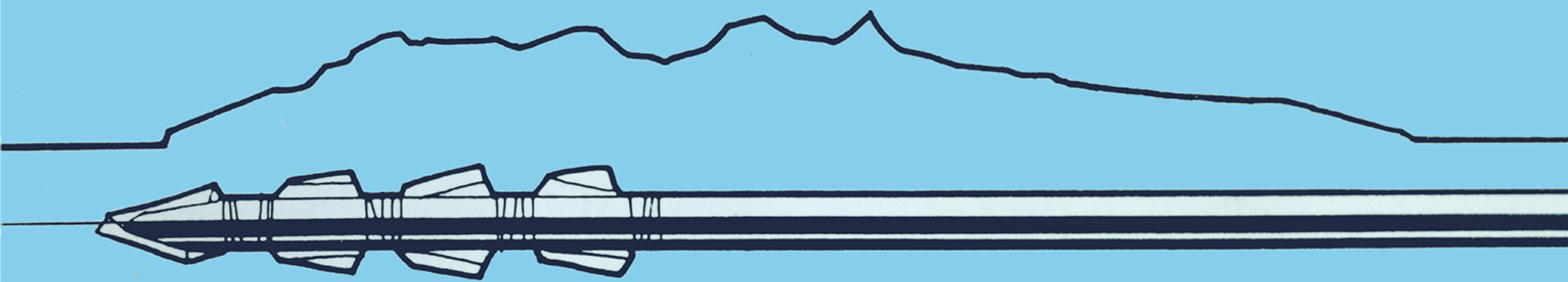
Rhum

Mesolithic and Later Sites at Kinloch, Excavations 1984–86

Caroline R Wickham-Jones

ISBN: 978-0-903903-07-3 (paperback) • 978-1-908332-29-5 (PDF)



RHUM

MESOLITHIC AND LATER SITES AT KINLOCH

EXCAVATIONS 1984–86

CR WICKHAM-JONES

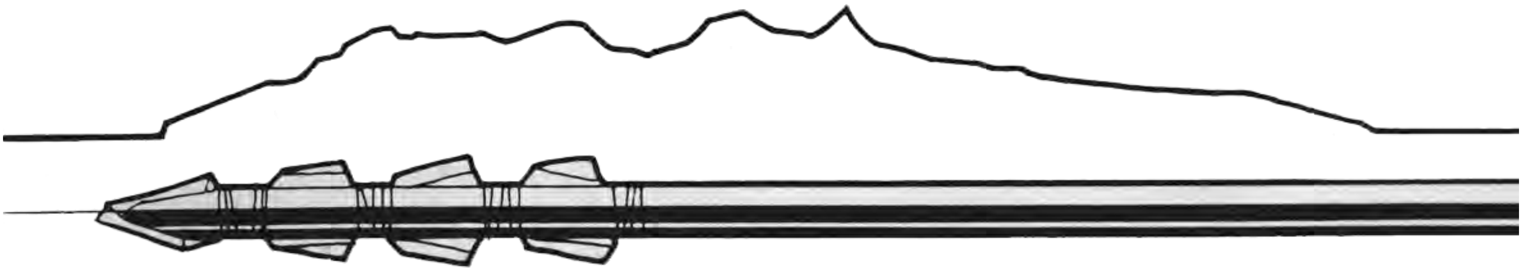
SOCIETY OF ANTIQUARIES OF SCOTLAND MONOGRAPH SERIES NUMBER 7

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

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 AND OTHERS

ILLUSTRATION

M O'NEIL AND J TERRY WITH A BRABY AND J HOLM

SOCIETY OF ANTIQUARIES OF SCOTLAND EDINBURGH 1990

MONOGRAPH SERIES NUMBER 7

SOCIETY OF ANTIQUARIES OF SCOTLAND

MONOGRAPH SERIES

EDITOR ALEXANDRA SHEPHERD

This volume is published with the aid of a generous grant from the Historic Buildings and Monuments Directorate of the Scottish Development Department.
The Society would also like to thank

The Mark Fitch Fund
The Nature Conservancy Council
and the Russell Trust

for grants towards publication
The frontispiece is published with the aid of a grant from
Highland Regional Council
British Libra ry Cataloguing in Publication Data
Wickham-Jones, C.R.

Rhum: mesolithic and later sites at Kinloch: excavations 1984-1986.
(Society of Antiquaries of Scotland monograph series.
ISSN 0263-3191; V.7).
l. Scotland. Highland Region. Rhum. Prehistoric antiquities.
Archaeological investigation
I. Title II. Series

ISBN 0-903903-07-5
Produced by Alan Sutton Publishing Limited, Stroud, Glos.

PREVIOUS VOLUMES

Number l
CL CURLE
Pictish and Norse finds from the Brough of Birsay 1934-74 (1982)

ISBN 0 903903 01 6

Number 2
JC MURRAY Excavations in the Medieval burgh of Aberdeen 1973-81 (1982)

ISBN 0 903903 02 4

Number 3
H FAIRHURST Excavations at Crosskirk Broch, Caithness (1984)

ISBN 0 903903 03 2

Number 4
JR HUNTER
Rescue excavations on the Brough of Birsay 1974-82 (1986)

ISBN 0 903903 04 0

Number 5
P HOLDSWORTH
Excavations in the medieval burgh of Perth 1979-1981 (1987)

ISBN 0 903903 05 9

Number 6
JA STONES (ED) Three Scottish Carmelite friaries: Excavations at Aberdeen, Linlithgow and Perth 1980-86

ISBN 0 903903 06 7

CONTENTS

ACKNOWLEDGEMENTS

As in any archaeological project of this type, this work is the result of the co-operation of many people and acknowledgement must be paid to all.

Those who volunteered to provide labour and expertise on site are too numerous to mention individually, but they worked long and hard, often under adverse weather conditions. All played an important role including the site assistants: A Barlow, P Bellamy, K Callander, M Kemp, VJ McLellan, and the assistant supervisors: N Sharples and D Pollock, as well as the cooks: M Braithwaite, B Ogilvy Wedderburn and L Sinclair. In addition, N Cartwright worked tirelessly to provide technical support. Together they provided the data for this volume.

Attention was drawn to the site by R Mclvor of Rhum. He notified the field surveyors of the Royal Commission on the Ancient and Historic Monuments of Scotland who contacted the author. The Nature Conservancy Council readily gave permission for the excavations, and NCC staff have provided much advice and expertise throughout the excavations. B Watt and M Grant provided transport to and from the island for an odd assortment of people and equipment. The inhabitants of Rhum put up with the archaeological intrusion with great patience and provided both encouragement and much help throughout all the seasons of fieldwork. In particular, thanks are due to L Johnston and C Eatough, the NCC wardens, and to R Jewell who put up with much disturbance to keep the equipment running and who spent many hours off-loading supplies, even on occasion ferrying an injured volunteer to the mainland. In addition, the Hon F Guinness and Dr T Clutton-Brock allowed access to sites within their research area, and J Love has readily shared his wide knowledge of the history of Rhum.

The work of post excavation analysis and writing up has been made much easier by the facilities of the Artifact Research Unit, provided by the Royal Museum of Scotland in Edinburgh. Especial acknowledgment must be paid to Dr DV Clarke who has overall responsibility for the Unit, and who has always been a stimulating critic of the project. The Unit housed many members of the project whilst they were engaged in the routine processing work, in particular R Blakemore, N Cameron, B Evans-Hughes, S McCartan, C MaCartney, N Pawson and D Reed. Other specialists are all listed at the front of the volume and all are owed great thanks for their expertise. Thanks are also owed to I Larner and to D Moyes of the RMS who provided much photographic assistance. Facilities for the photocopying of material throughout the preparation of the report were kindly arranged with RCAHMS, through the offices of Mr J Dunbar and Miss K Cruft. B Finlayson and A MacSween helped with the final preparation of text. The work of editing a text such as this is not to be lightly undertaken and Mrs A Shepherd must be thanked for her help and encouragement to the author.

Finances and equipment were predominantly supplied by the Historic Buildings and Monuments (Scottish Development Department). From their staff, Dr N Fojut and Mr P Ashmore must be singled out for thanks as they both coordinated practical help and provided guidance throughout the project. Throughout the seasons of excavation, M Donaldson worked hard to ensure that all of the necessary equipment reached Rhum, even when last minute requests were forwarded. Further funding was provided by several sponsors, listed below. They must all be given thanks, for their help allowed the work of the project to be flexible. In this respect Mr G Wilkins, Ms A MacMillan, and the staff of both Glenfiddich and Tait & McLays must be especially thanked for advice and encouragement over the re-creation of the Rhum Brew.

Further afield, the project has benefited from the encouragement of the Highland Regional Archaeologist, R Gourlay. Computer facilities were procured with considerable help from

D Powlesland who adapted his own software and wrote further programs for the specific needs of the project. M Armour-Chelu examined the bone fragments. A Gibbard provided both encouragement and typing skills for the environmental analysis. Mr PR Ritchie kindly shared his knowledge of the use of bloodstone in prehistory. JR Kirby, C McLean, R Miket, P Musgrove, and S Watson all helped with the search for sites with bloodstone artifacts as did the staff of the Hunterian and Kelvingrove museums as well as those of the RMS. Dr A Livingstone identified the materials of the coarse stone tools. G Barclay, DV Clarke, A Foxon, AS Henshall and VJ McLellan commented on the pottery. C Page and N Jones commented upon the 'brew' interpretations. S Oxer, E Lunn, P Immirzi and R Beaver all helped with the underwater survey which was designed under the guidance of Dr NC Flemming. J Taffinder translated the lithic technological analysis from Swedish into English. Professor P Woodman has always provided great inspiration, and shared his interest in this little known period of Scottish prehistory.

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

LIST OF CONTRIBUTORS TO THE VOLUME

Sue Bellamy	Department of Geography, University of Hull – Palaeobotany.
Alan Braby	21 Woolmet Cresc, Edinburgh – Artist's impressions of the site.
Simon Butler	Department of Archaeology, University of Sheffield – Palaeobotany: undersea survey.
Ann Clarke	Artifact Research Unit, Royal Museum of Scotland, Edinburgh – Lithic analysis. – Coarse stone tool analysis. – The use of bloodstone on the west coast of Scotland.
Dr Gordon Cook Dr	Scottish Universities Research and Reactor Centre, East Kilbride – Radiocarbon determinations.
Donald Davidson	Department of Geography, University of Strathclyde – Soil sciences.
Dr Andrew Dugmore	Department of Geography, University of Edinburgh – Geochemical analysis of the pumice.
Dr Graham Durant	Hunterian Museum, Glasgow – Geology.
Dr Kevin Edwards	Department of Geography, University of Birmingham – Palaeobotany.
Bill Finlayson	Artifact Research Unit, Royal Museum of Scotland, Edinburgh –Lithic materials analysis.
Dr Daffydd Griffiths	Institute of Archaeology, London –Geology.
Dr Ken Hirons	Department of Geography, University of Birmingham –Palaeobotany and soil chemistry.
Jenny Holm	Department of Archaeology, University of Uppsala – Illustrations: lithic technology.
David Jordan	English Heritage, Savile Row, London – Soil Sciences.
Mary Kemp	Artifact Research Unit, Royal Museum of Scotland, Edinburgh – Pottery analysis.
Simon Lee	Whithorn Trust, Whithorn, Dumfries and Galloway – Soil phosphate survey. – Geophysical survey.
Dr Barbara Maher Sinead McCartan	Department of Archaeology, University College, Cork – Lithic analysis.
Rod McCullagh	Archaeological Operations and Conservation, Historic Buildings and Monuments Directorate, Edinburgh – Macrobotanical analysis.
Dr Brian Moffat	SHARP, 36 Hawthornvale, Edinburgh – Palaeobotany. – Residue analysis.

Marion O'Neil	Artifact Research Unit, Royal Museum of Scotland, Edinburgh - Illustrations: artifacts.
Neil Oliver	Artifact Research Unit, Royal Museum of Scotland, Edinburgh - Lithic analysis.
Romola Parish	Department of Archaeology, University of Durham -Palaeobotany.
Anthony Pollard	Department of Archaeology, University of Glasgow − Documentary search.
Dave Pollock	Whithorn Trust, Whithorn, Dumfries and Galloway − Stratigraphical analysis.
Alan Radley	Artifact Research Unit, Royal Museum of Scotland, Edinburgh − The results of wet sieving.
Dr Elaine Scott	Scottish Universities Research and Reactor Centre, East Kilbride − Radiocarbon determinations.
Dr Donald Sutherland	Placer Analysis, 2 London Street, Edinburgh − Geomorphology.
John Terry	Artifact Research Unit, Royal Museum of Scotland, Edinburgh − Stratigraphical analysis. − Illustrations: site plans, figures and tables.
Dr Dave Watson	British Geological Survey, Edinburgh − Geophysical survey.
Peter Zetterlund	Department of Archaeology, University of Uppsala − Lithic technological analysis.

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

SPONSORS OF THE EXCAVATION PROJECT

Historic Buildings and Monuments (Scottish Development
Department) Royal Museum of Scotland
Nature Conservancy Council
Russell Trust
Robert Kiln Charitable Trust
Society of Antiquaries of Scotland
William Grant & Sons Ltd
Lloyds Bank Fund for Independent Archaeologists
The Jubilee Trust
Highland Regional Council
Holman, Foxcroft & Jackson
Lochaber Local History Society
Fearann Eilean Iarmain
George Morton Ltd
Savacentre (Edinburgh)

ILLUSTRATIONS

Frontispiece: A selection of the debris from the site at Kinloch illustrating the variety of raw material used.

Ian Larner's photographs are reproduced here by kind permission of the Trustees of the National Museums of Scotland.

TABLES

MICROFICHE SECTION: CONTENTS

NB: The microfiche section is available at https:/doi.org/10.9750/9781908332295

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

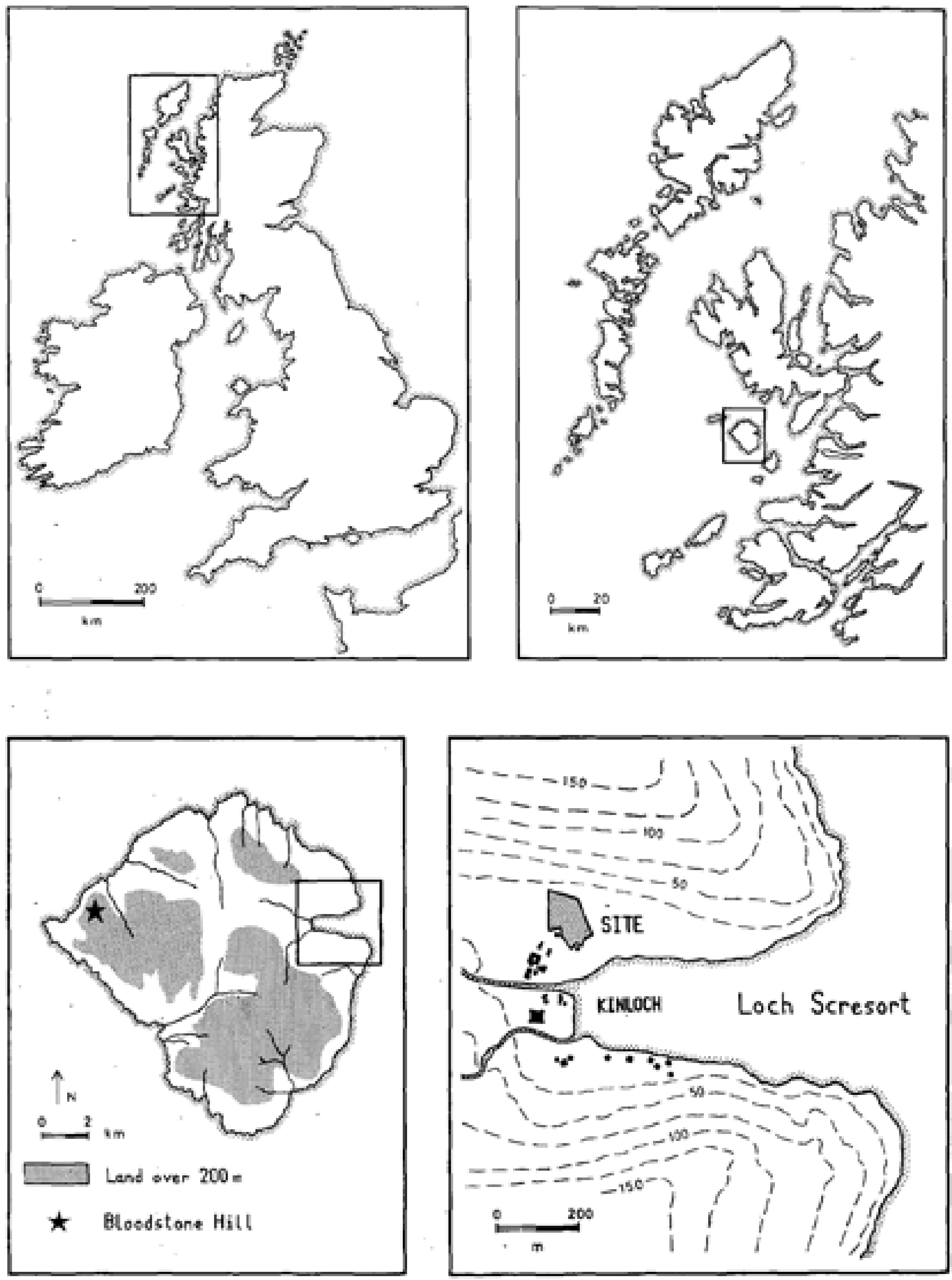
Although the original name of the island is 'Rum', the modern version 'Rhum' is used throughout this volume. This is the form in which the island now appears on most maps and gazetteers.

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.

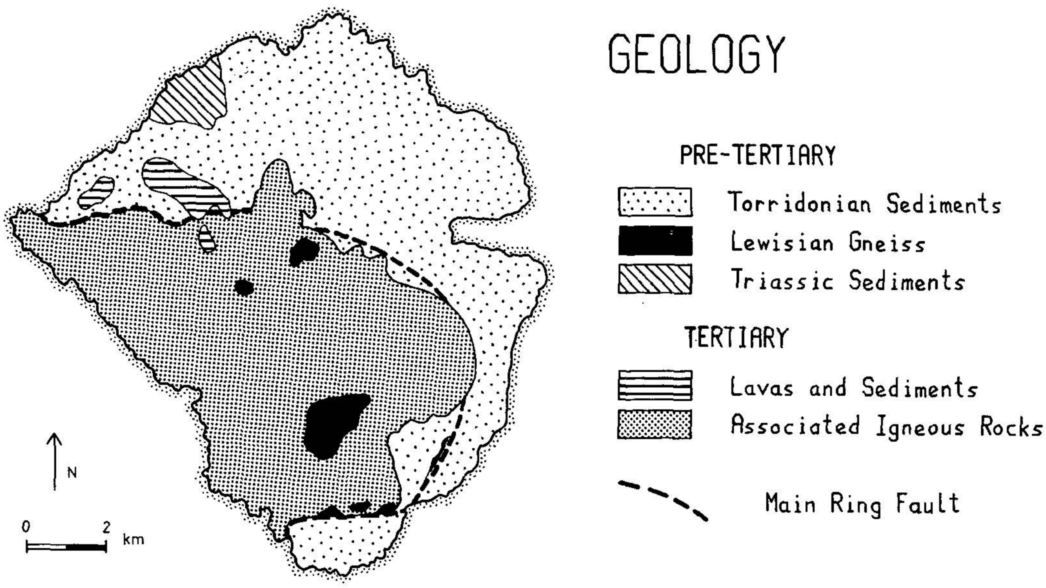
The geomorphology is described in detail in Chapter 12. Since the Tertiary period considerable erosion has reduced the original volcano to its roots, resulting in the ring of sharp peaks in the south of the island. To the north, the Torridonian sandstones are now tilted to the north-west and have weathered 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.

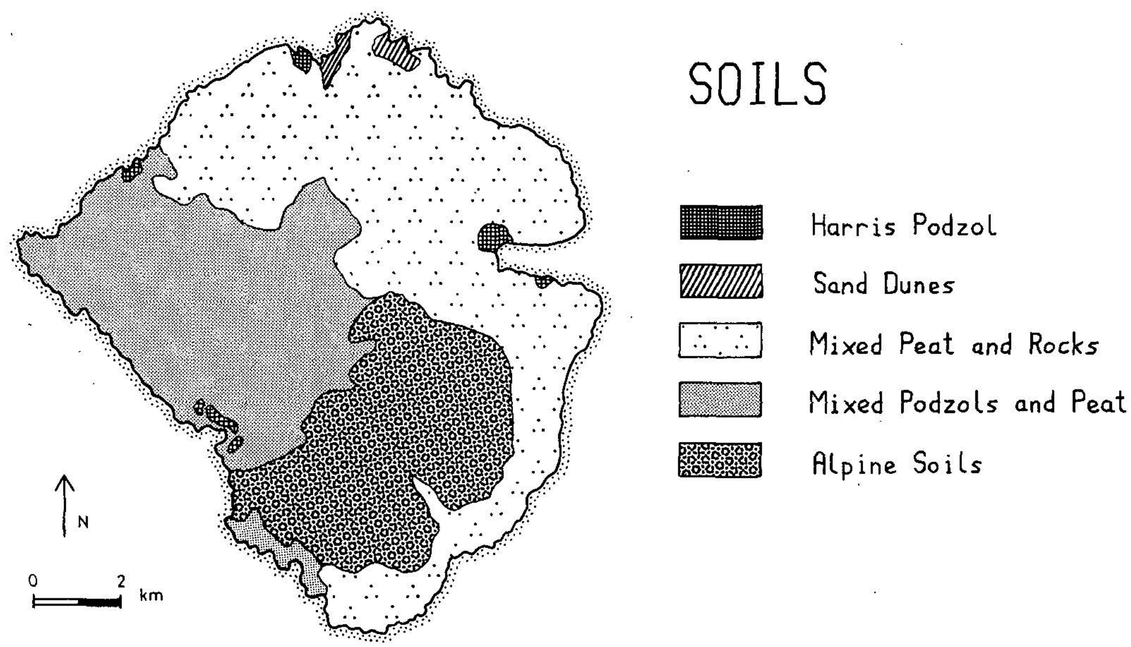
Much of Rhum is covered by wet heath and blanket bog dominated by heather, but there are areas of grassland, particularly in the better drained parts and on the more developed soils (Ill 2c). On the high peaks herb-rich grassland has developed in association with colonies of Manx shearwaters. Limestone 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

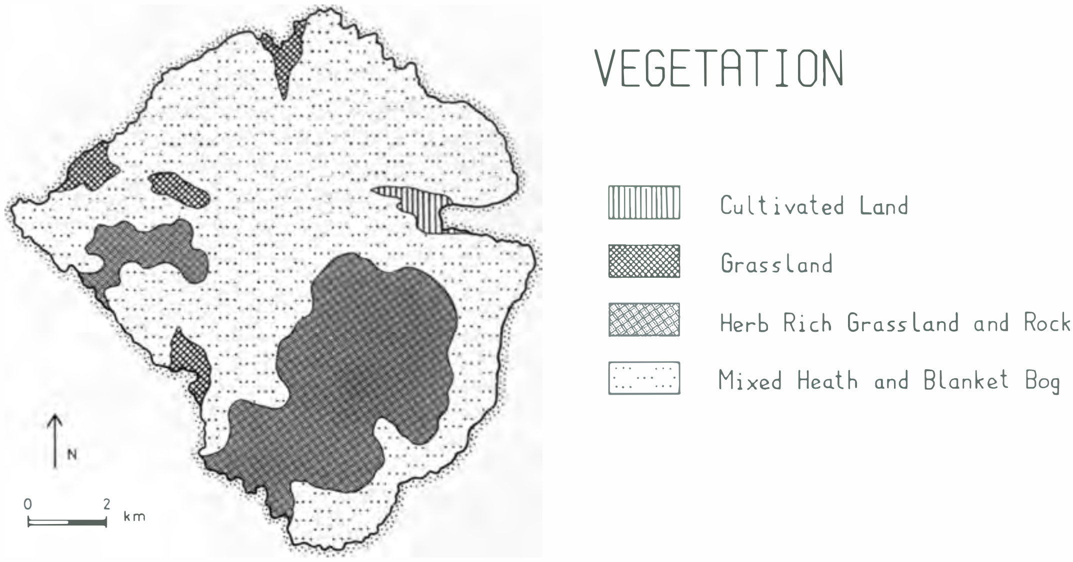


ILL 2: Rhum:

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 JII 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

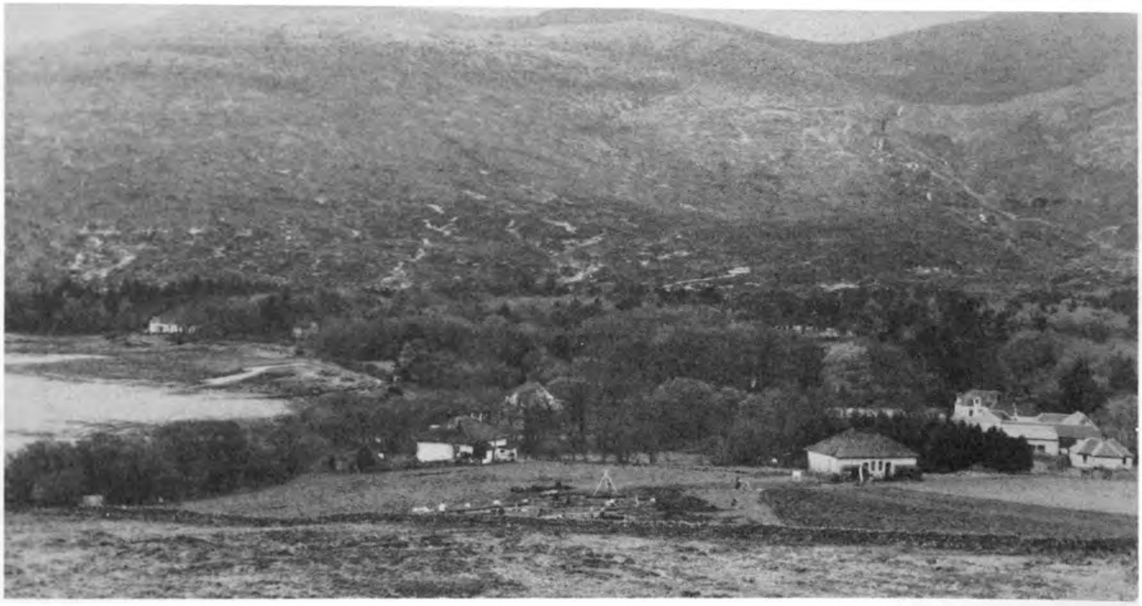
INTRODUCTION

The excavated site of Kinloch is situated on the east coast of Rhum (M 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

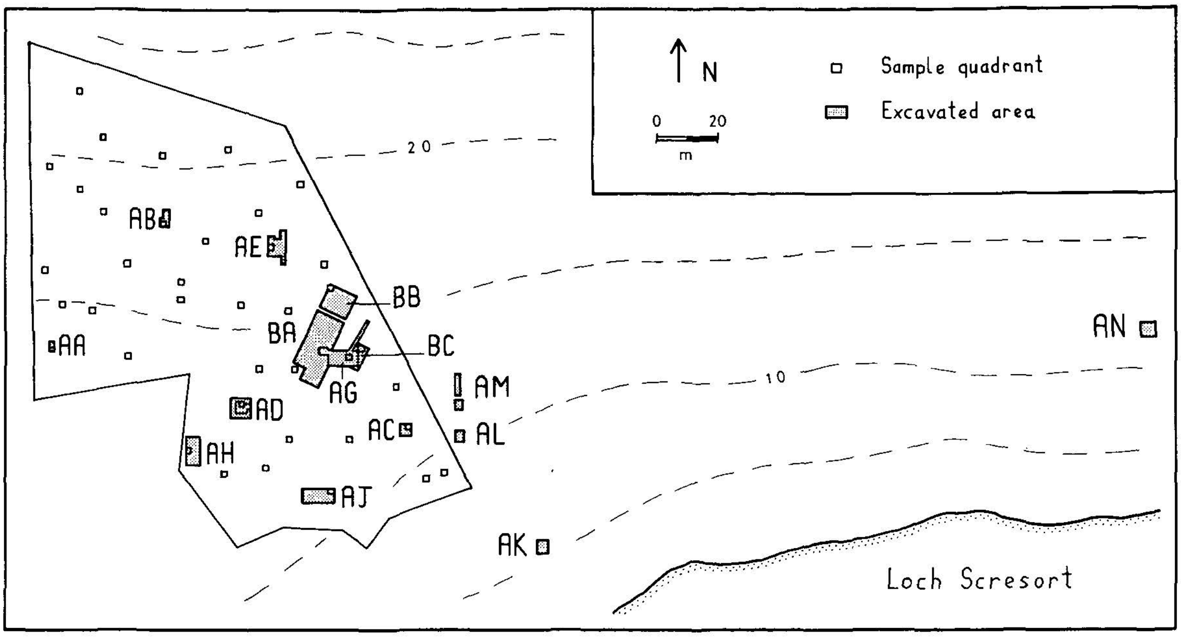
METHODS

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 ingle-metre-squares. Each square was excavated sepa-rately by shovelling out the ploughsoil down to the under-lying 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 matenal was removed and catalogued. In this way it was possible to relay information about the finds promptly into the excav• ation strategy. Comparison of the two sieving methods showed that wet sieving was more efficient, indeed essent-ial, 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

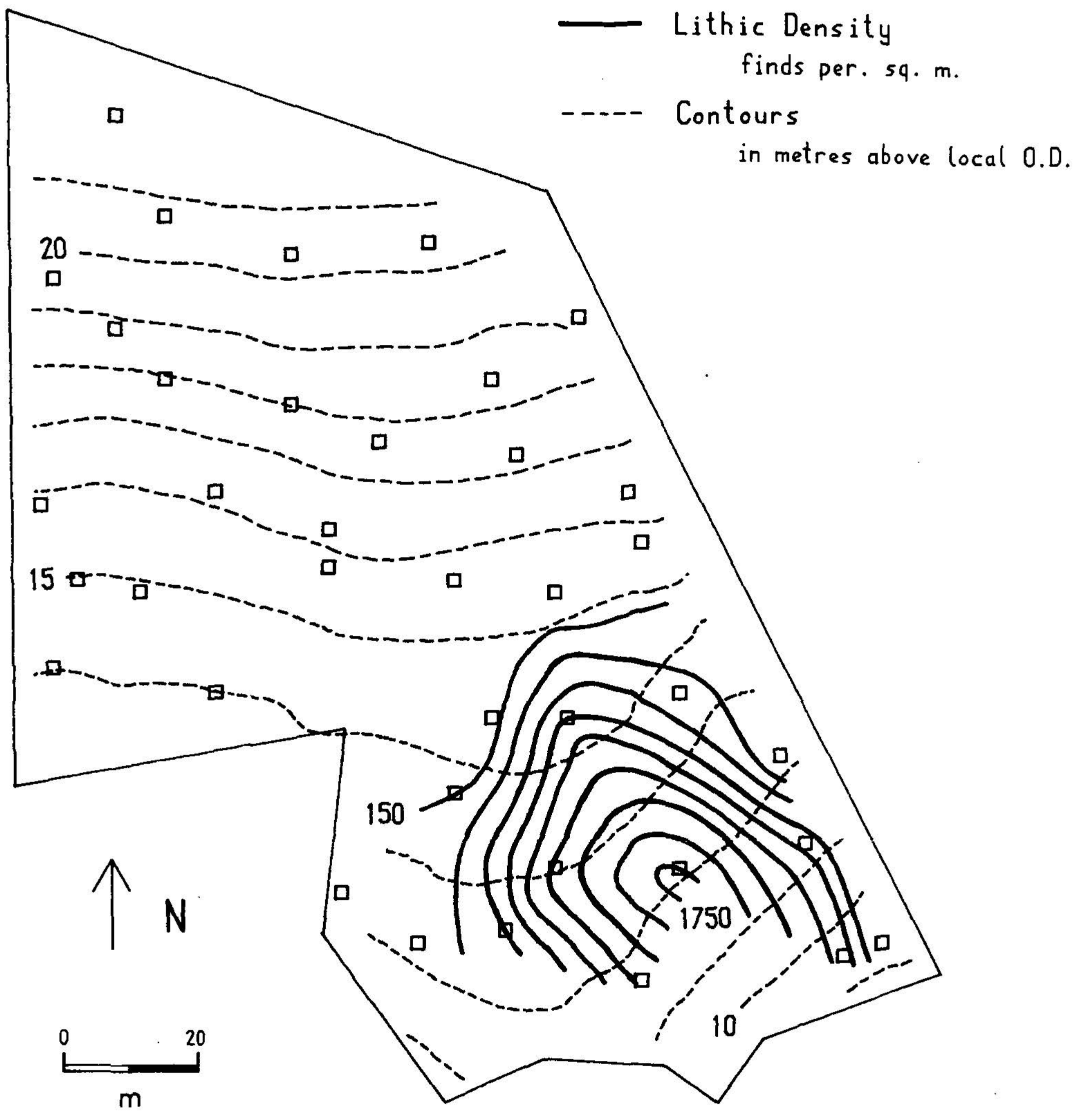
Archaeological features did survive in association with the lithic scatter, and carbonised material sufficient for two radiocarbon determinations was collected from one of them (Pit AD 5). Outside the lithic scatter, all the features examined were either natural or recent. The area of prehistoric remains 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: locations 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 ome 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

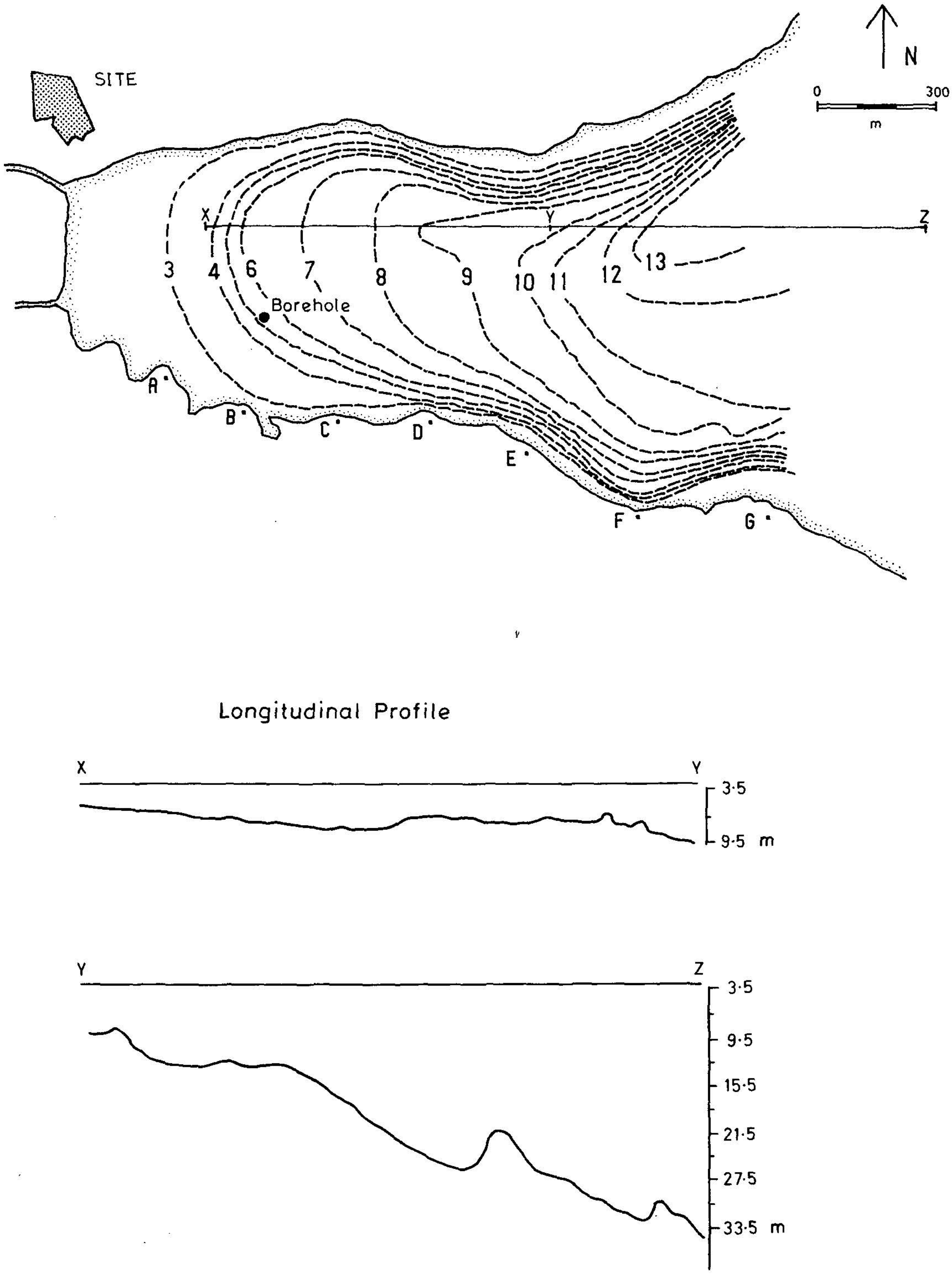
Loch Scresort is fed by a number of freshwater streams and it is open to the sea to the E; consequently its sedimentation consists both of material washed from the surrounding land and of material brought in by seawater. It is therefore possible that the stratified deposits within the loch may contain 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 expres ed in metre below Rhum L.D. Diver observation along each transect was used to de cribe 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) sample 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)

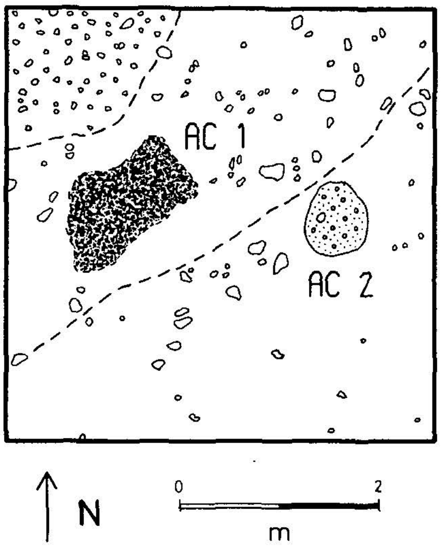
A banded feature appeared to run NE-SW across the original quadrat. Excavation revealed this to be part of a complex of amorphous colour and textural changes within the subsoil matrix. These were natural and related to the reworking of the glacial till. On the surface of the till lay a patch of charcoal (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

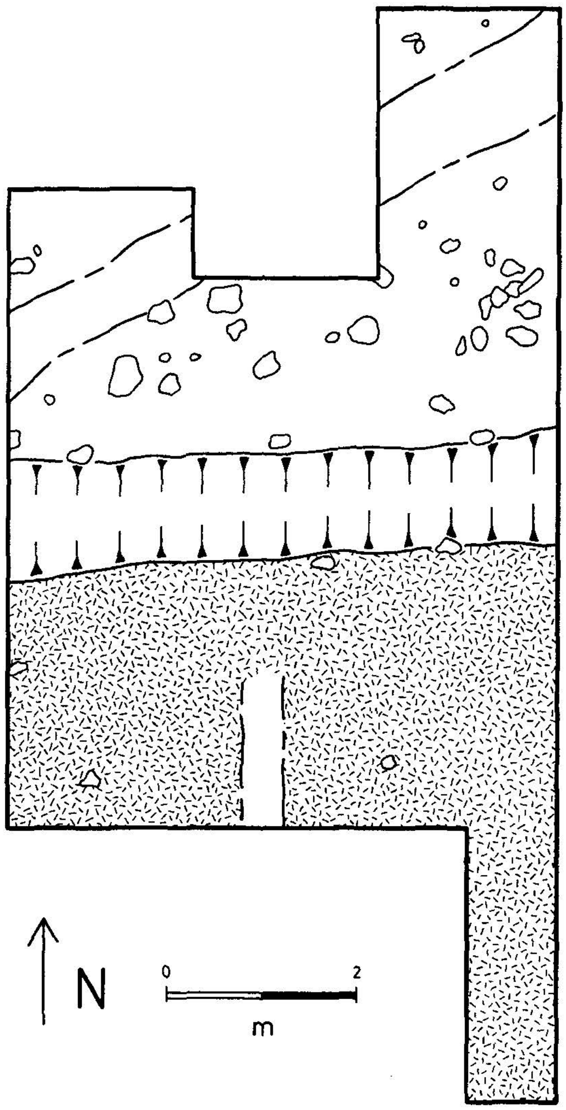
During excavation of the sample quadrat one of the metre squares was overdug to reveal a charcoal rich soil containing a large number of flaked lithics. Excavation revealed this to be part of a complex of intercutting pits and hollows. All contained large amounts of artifactual material, including hammerstones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

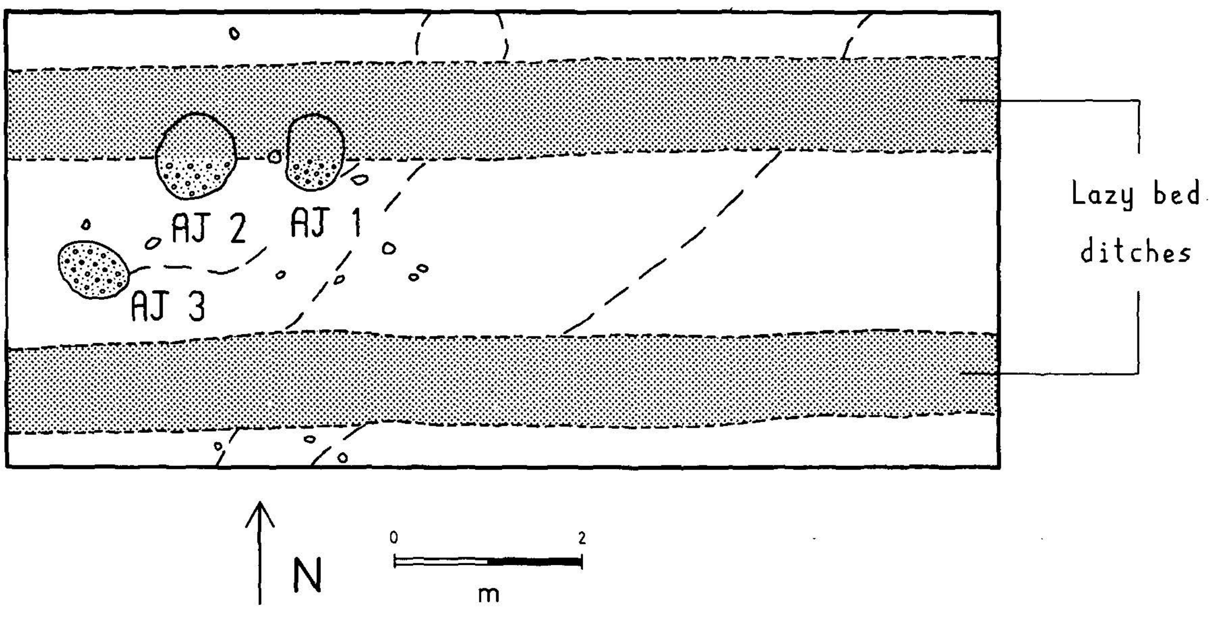
DISCUSSION: THE NATURE OF THE SITE

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

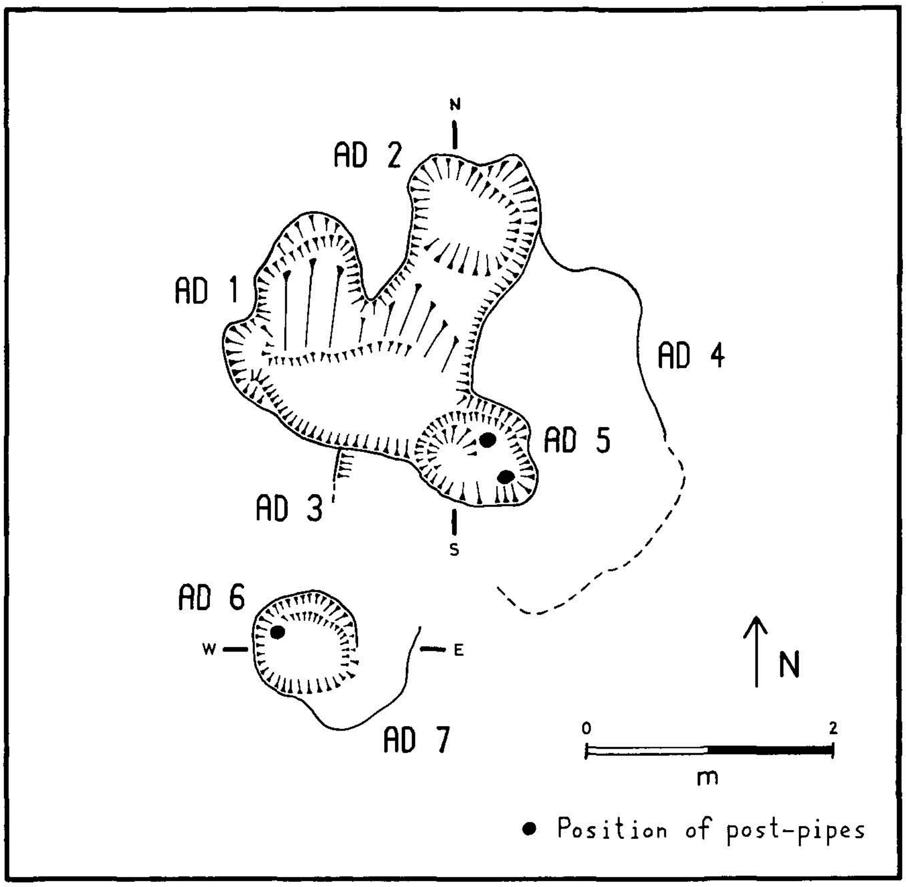
The artifacts consisted primarily of a large assemblage of flaked lithics. From the sampling of the ploughsoil 28,838 pieces were recovered. Much of this was knapping debris, but there were also many regular flakes, together with a significant number of blades, many microliths, and a few other retouched 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).

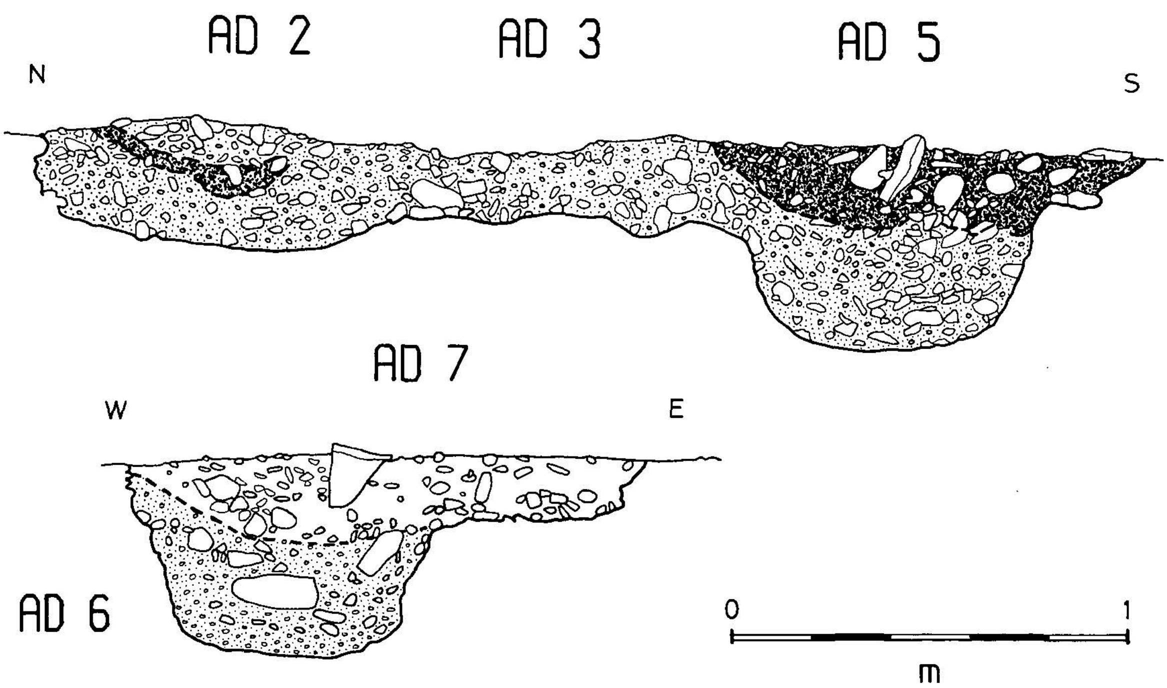
The artifacts demonstrated the existence of a late mesolithic site, with some indication from the leaf-shaped points that activity had continued into the neolithic. Excavation of the features supported this. All the prehistoric features examined could be parallelled on mesolithic sites elsewhere (Woodman 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.

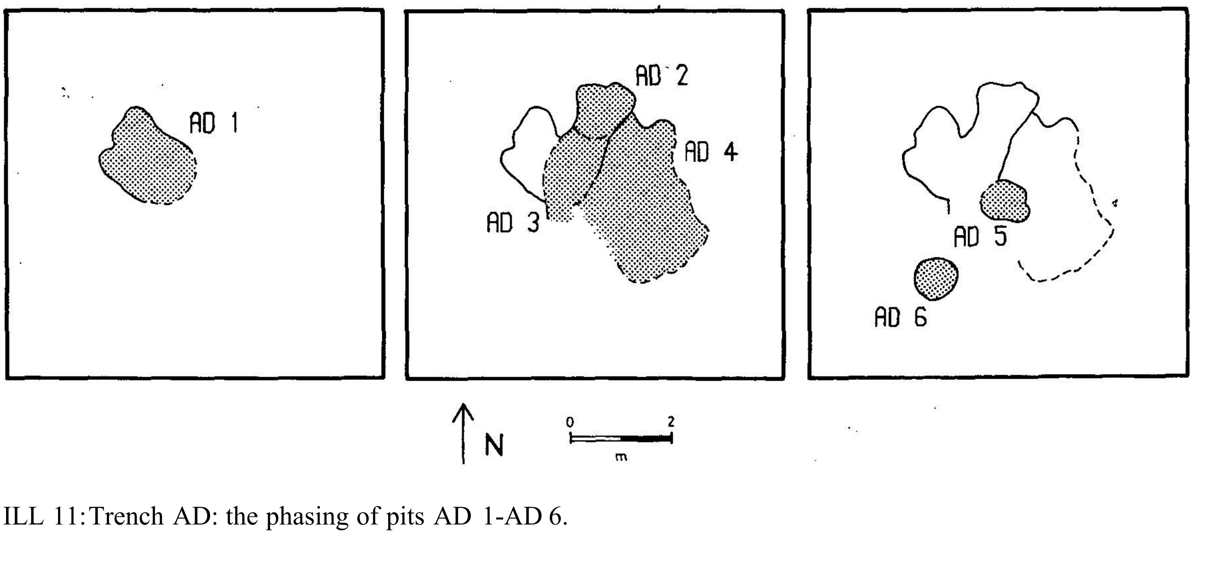
TRENCH AD (Ill 10)

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).

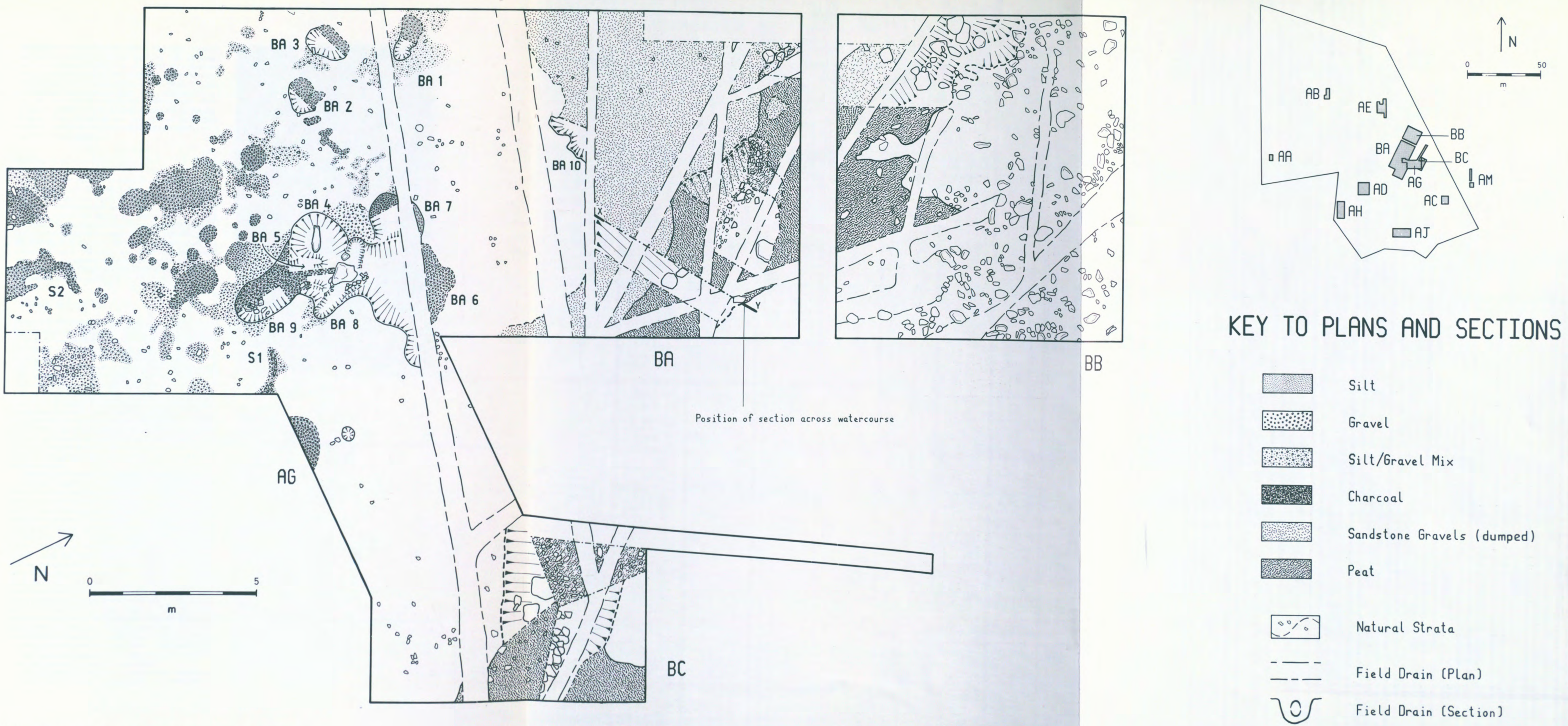
Sometime after the backfilling of AD 1 another shallow hollow (AD 4) was formed together with two small pits (AD 2 and AD 3). AD 4 was largely obliterated by AD 2 and AD 3, but it survived towards the E side of the complex. The relationship between these three features was unclear, but it is likely that 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 eems 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.

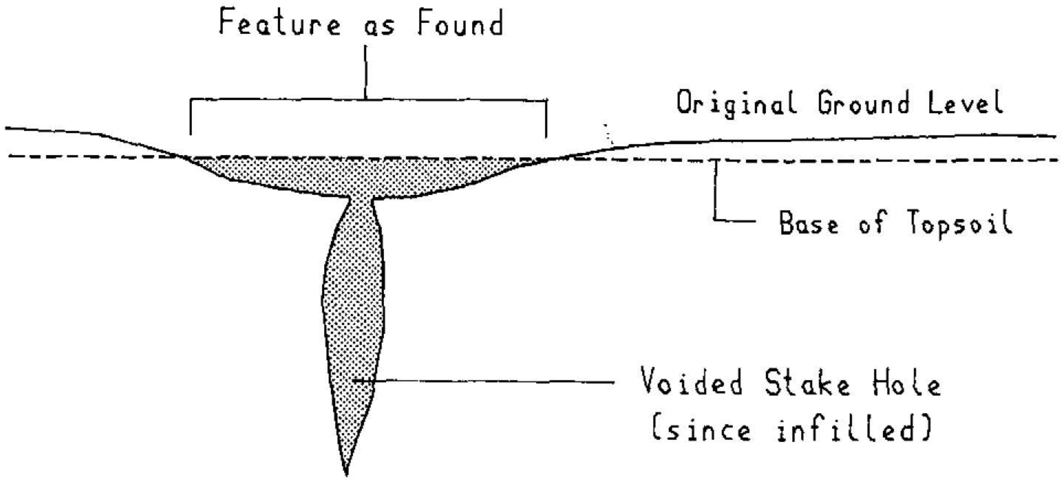
Towards the W edge of the trench lay a group of features (BA 1, BA 2 and BA 3). Two (BA 1 and BA 2) were shallow hollows containing the usual dark fill with carbonised hazel-nut shell and some lithic material. The larger (BA 1) also contained several fragments of broken stone slabs. These occurred in 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 activi-ties, but the reconstruction of this sequence proved diffi-cult 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 I: 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 stakchole.

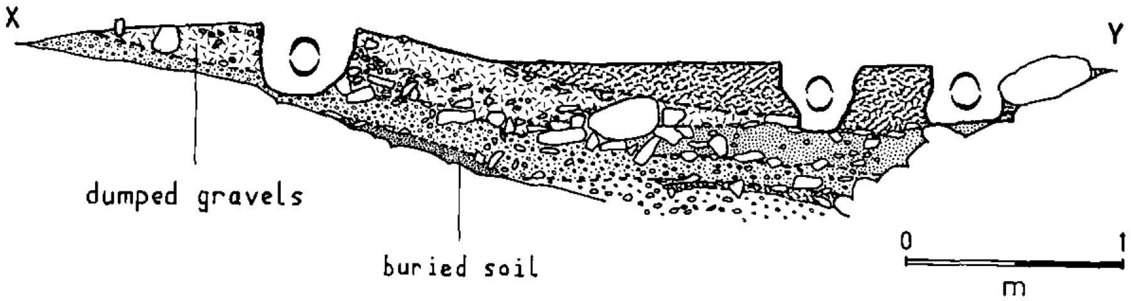
blocks were aligned with the adjoining foundation slot (S1), and it is possible that the two features originally supported part of a timber structure. The relationship of BA 9 with the rest of the complex was not explored.

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).

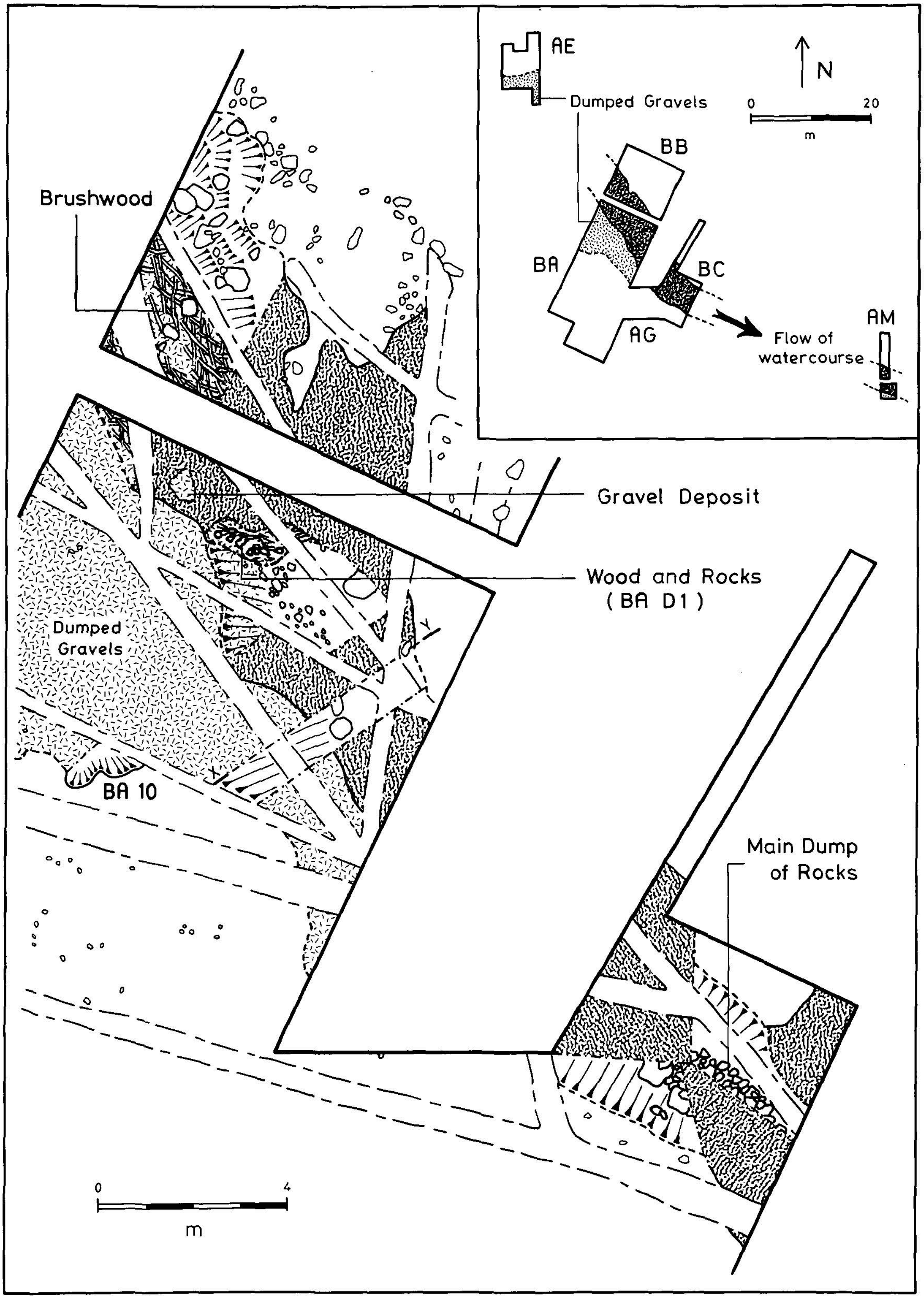
The N end of Trench BA abutted the defunct watercourse which today is a wet flush (Ill 15). One shallow hollow (BA 10) was uncovered immediately to the S of the watercourse and this hollow was subsequently dated to the mesolithic period (7880±70 BP, GU–2147); it contained the usual dark fill with much 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 111 16 for the location of the section, For key see 111 12.



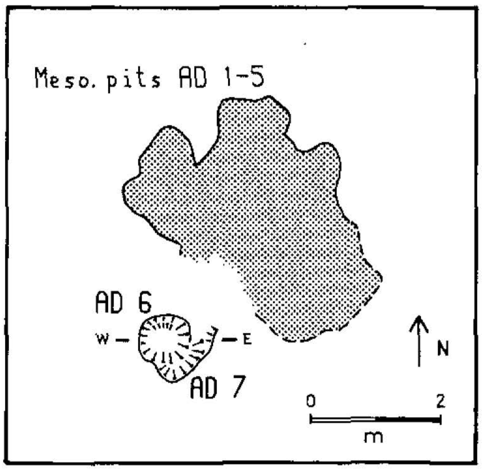
ILL 16: The watercourse: excavated features. For key see Ill 12.

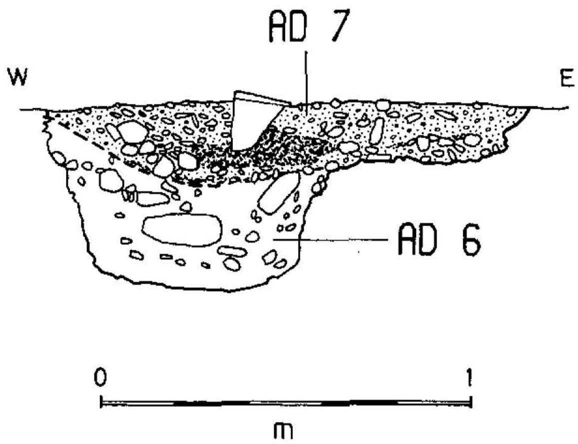
ILL 17: Brushwood deposits in the watercourse: from the N.

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.





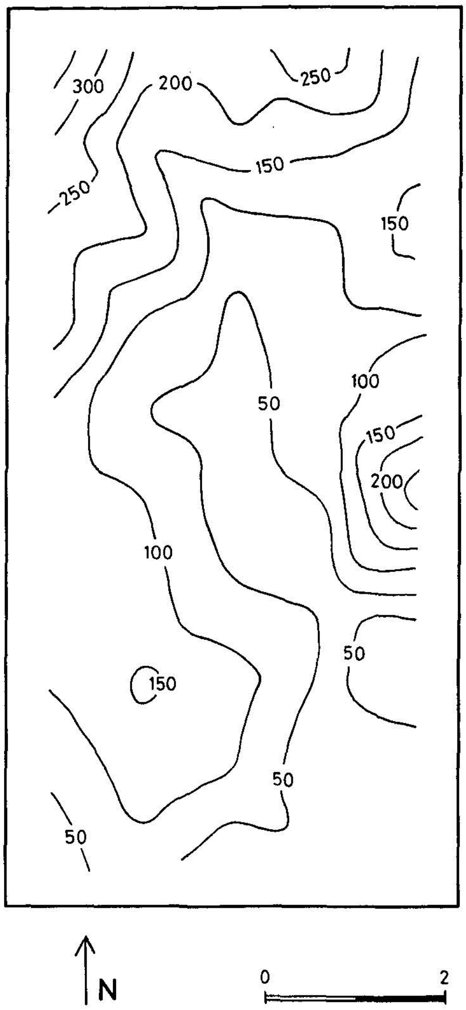
ILL 18: Trench AD: features AD 6-AD 7. For key see Ill 12.

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.

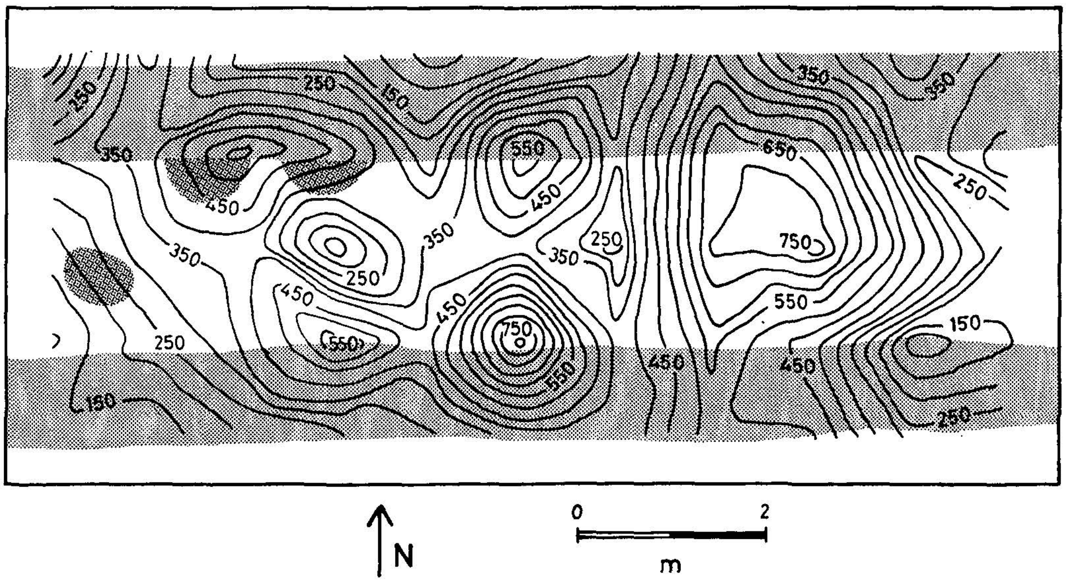
The gravel dumps, therefore, post-date the mesolithic occupation of the site and they seem to pre-date the later activity on site. This later activity is predominantly related to human interference in, and around, the burn in the third millennium BC. Although it is possible that the dumps do relate to 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.

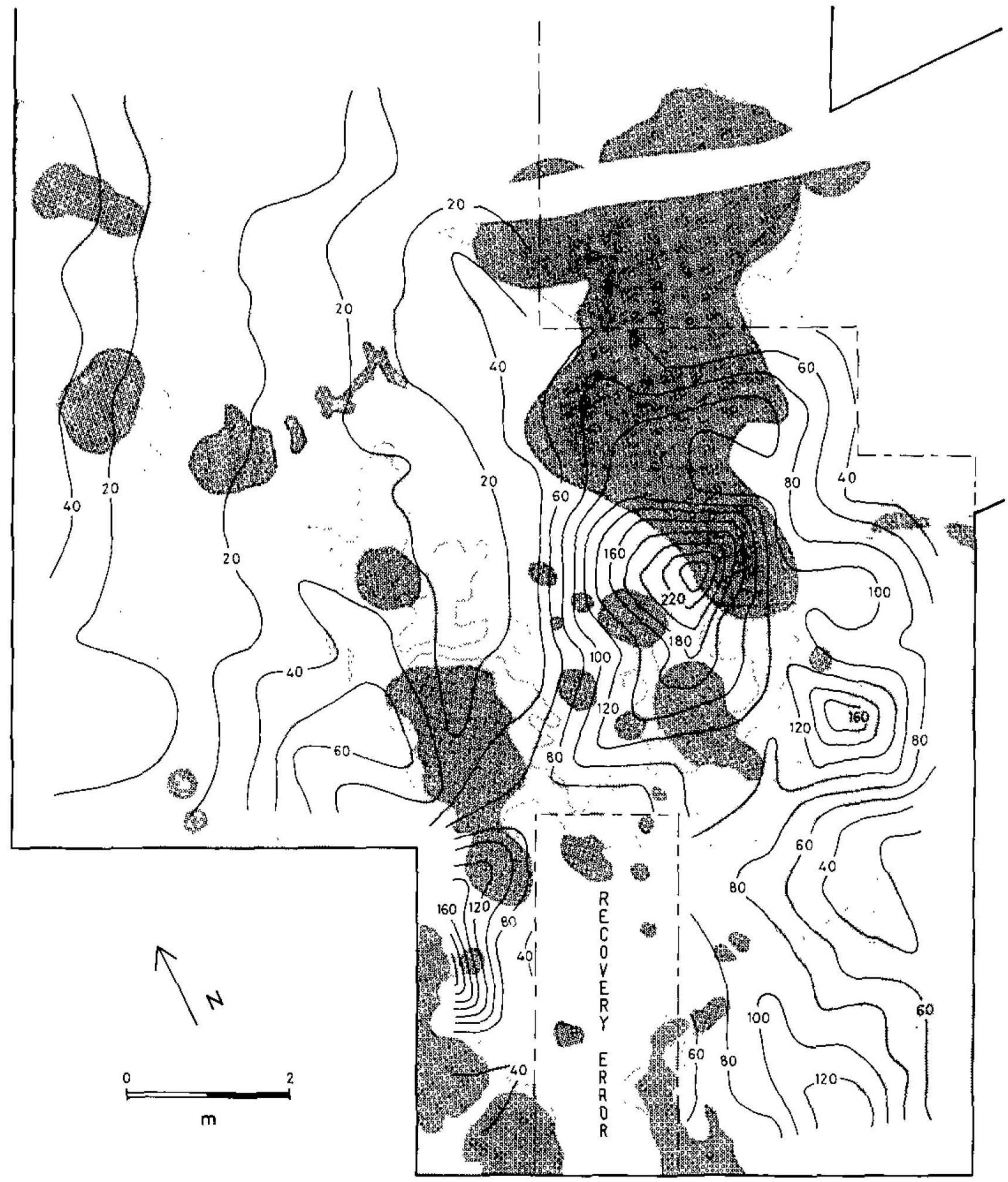
Further gravel deposits were discovered upstream in Trench AE. During excavation it was not possible to interpret these deposits because the trench was too small, but they are similar to the gravel dumps of Trench BA, and they lie clearly along the line of the S bank of the watercourse (Ill 16).



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.



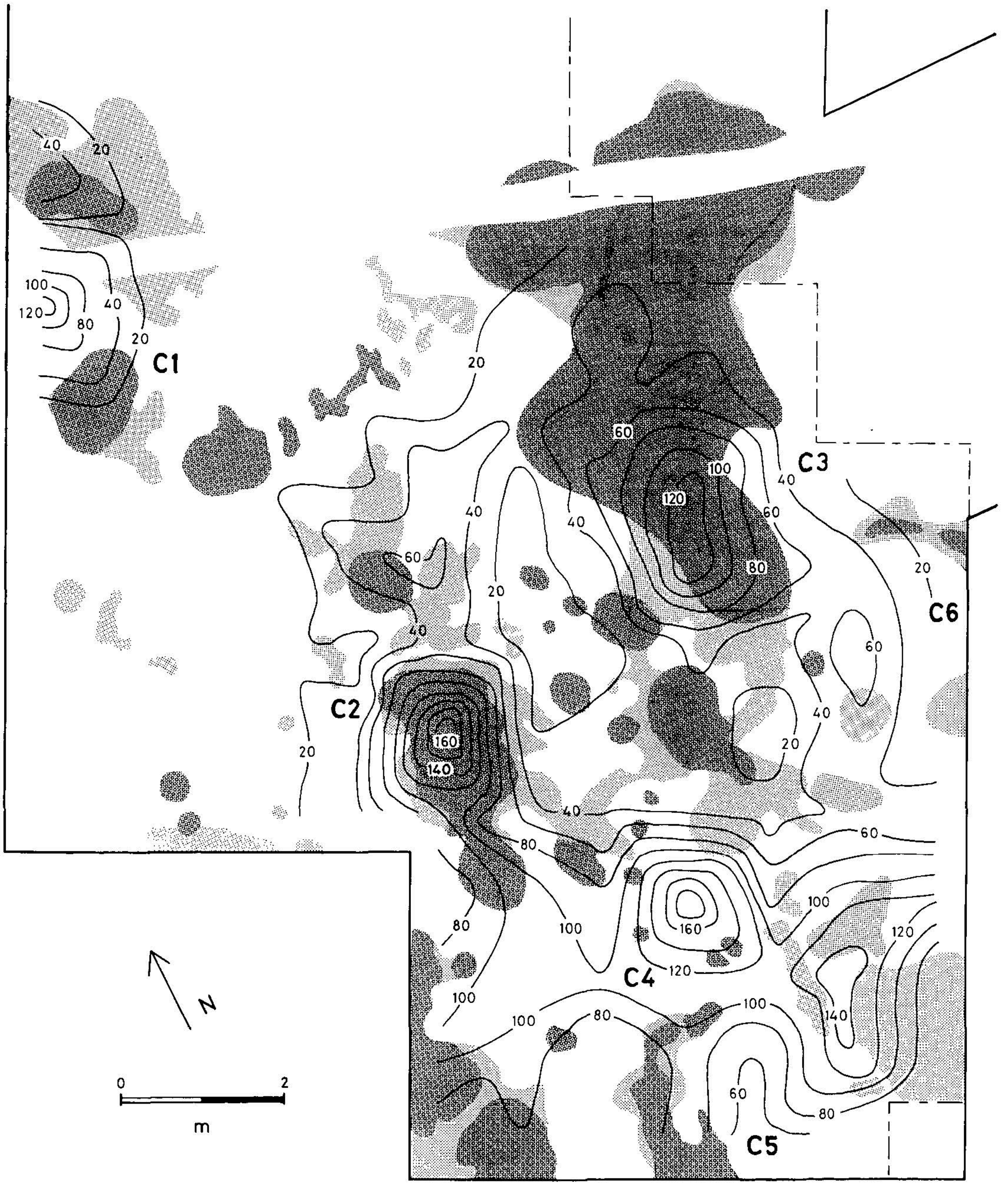
ILL 20: Trench AJ: the density of lithic material in the ploughsoil. Contours at intervals of 50 finds per sq m. Surviving contexts are stippled.



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

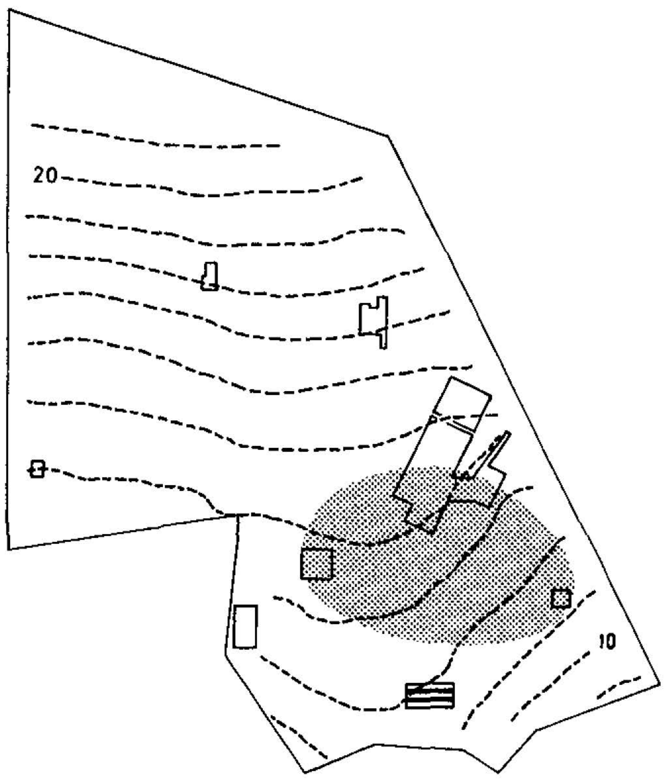
Contour maps of the lithic density per metre square within the ploughsoil of each trench have been drawn up. These show specific concentrations of material surviving within each trench, which could be compared to the positions of the remaining features. In general, the ploughsoil concentrations overlay 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



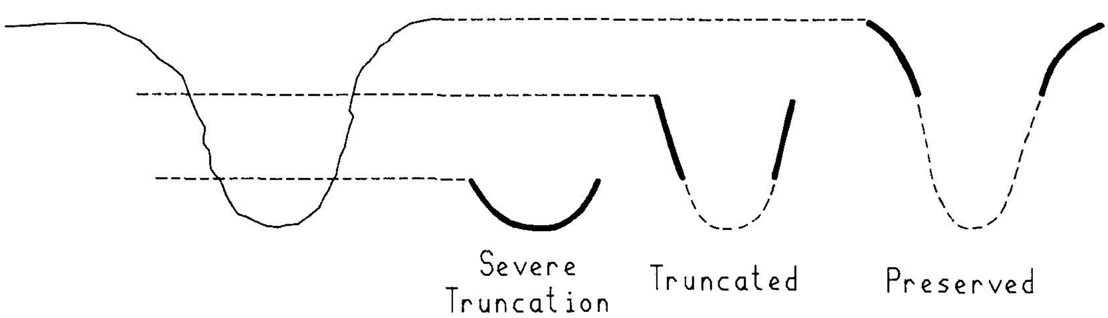
ILL 23: The conditions of preservation across the site.

the difference that the pattern in Ill 21 is less well defined. The three main concentrations of material outlined in Ill 22 (Cl–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 (Sl) (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

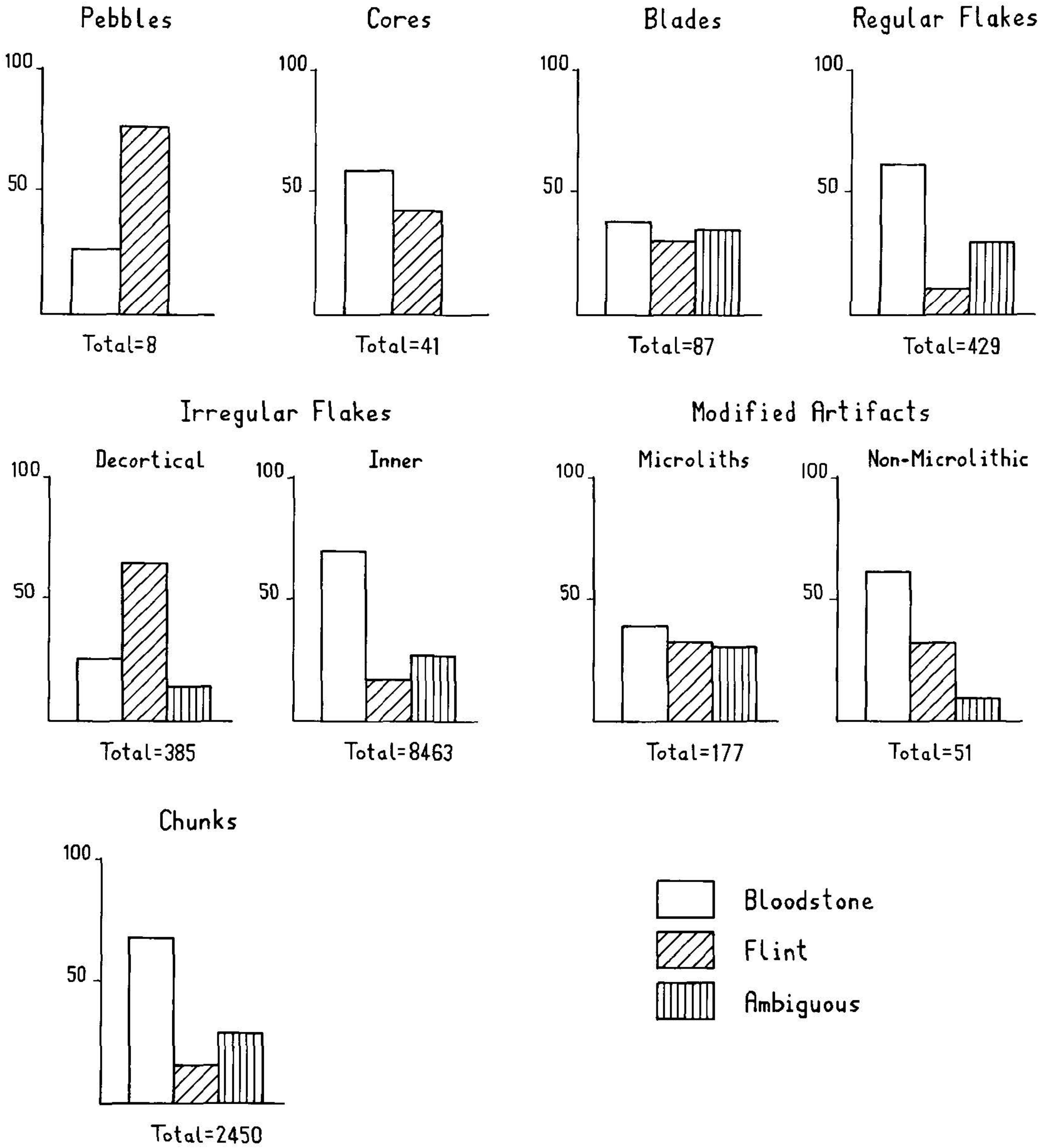
All the material from the 1984 wet-sieved sample-quadrats was classified into raw material categories. This comprised a total of 12,091 pieces of which 137 were neither flint nor bloodstone. Illustration 25 presents a breakdown of this sample by material. From this it is clear that the majority of the 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.

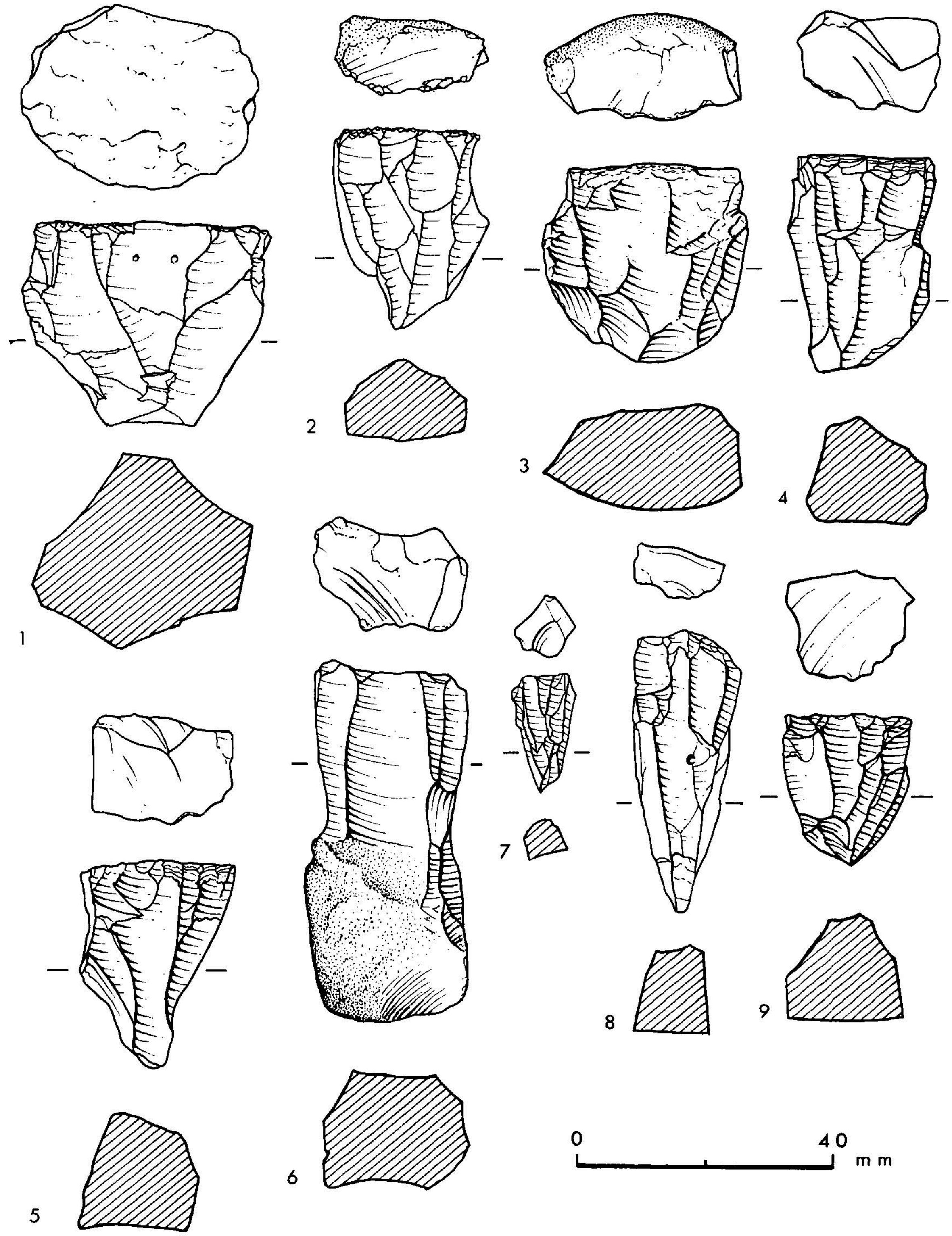
23 Modified Pieces are artifacts that have been modified after primary reduction by the use of secondary technology. At Kinloch this was always done by retouching. The individual types of modified piece found at Kinloch are fully described in Chapter 7.

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. (Image by Marion O'Neil)

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

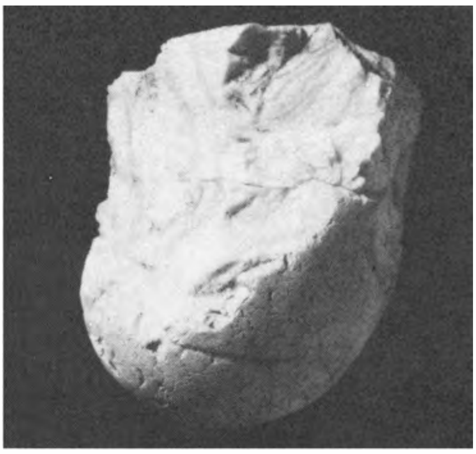
Table 2: The total lithic assemblage: composition by type and material.

PEBBLES

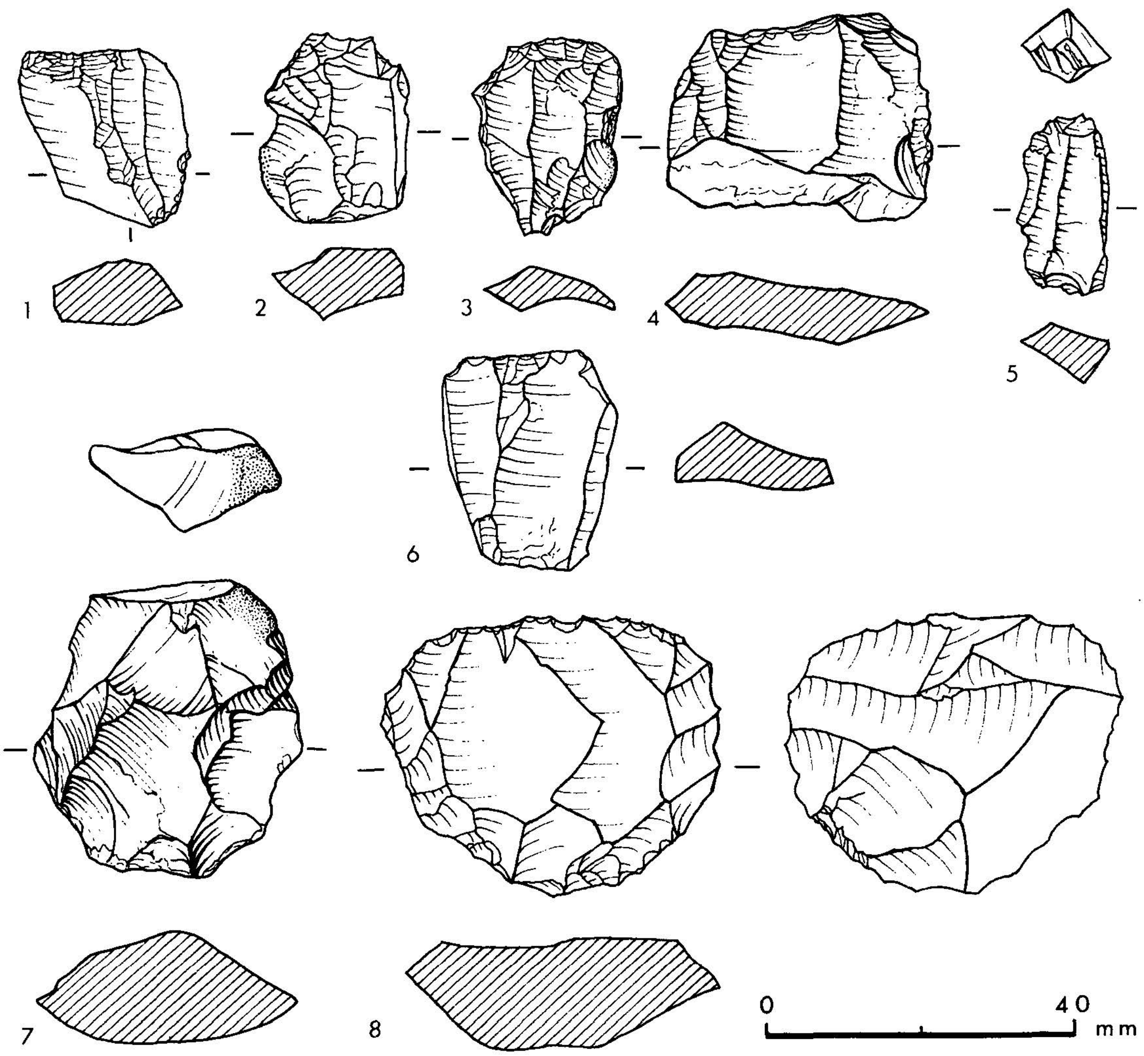
The 120 pebbles represent less than 1% of the total assemblage. The majority are of chalcedony (82%), while the remainder are of quartz or agate; all are small. In many cases one or two flakes have been removed from the pebbles, and thus they may represent raw material that was never utilised.

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: I (Photograph - I Larner).



ILL 28: The lithic assemblage, cores: 1-6 bipolar cores: 7-8 disc cores. (Image by Marion O'Neil)

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)

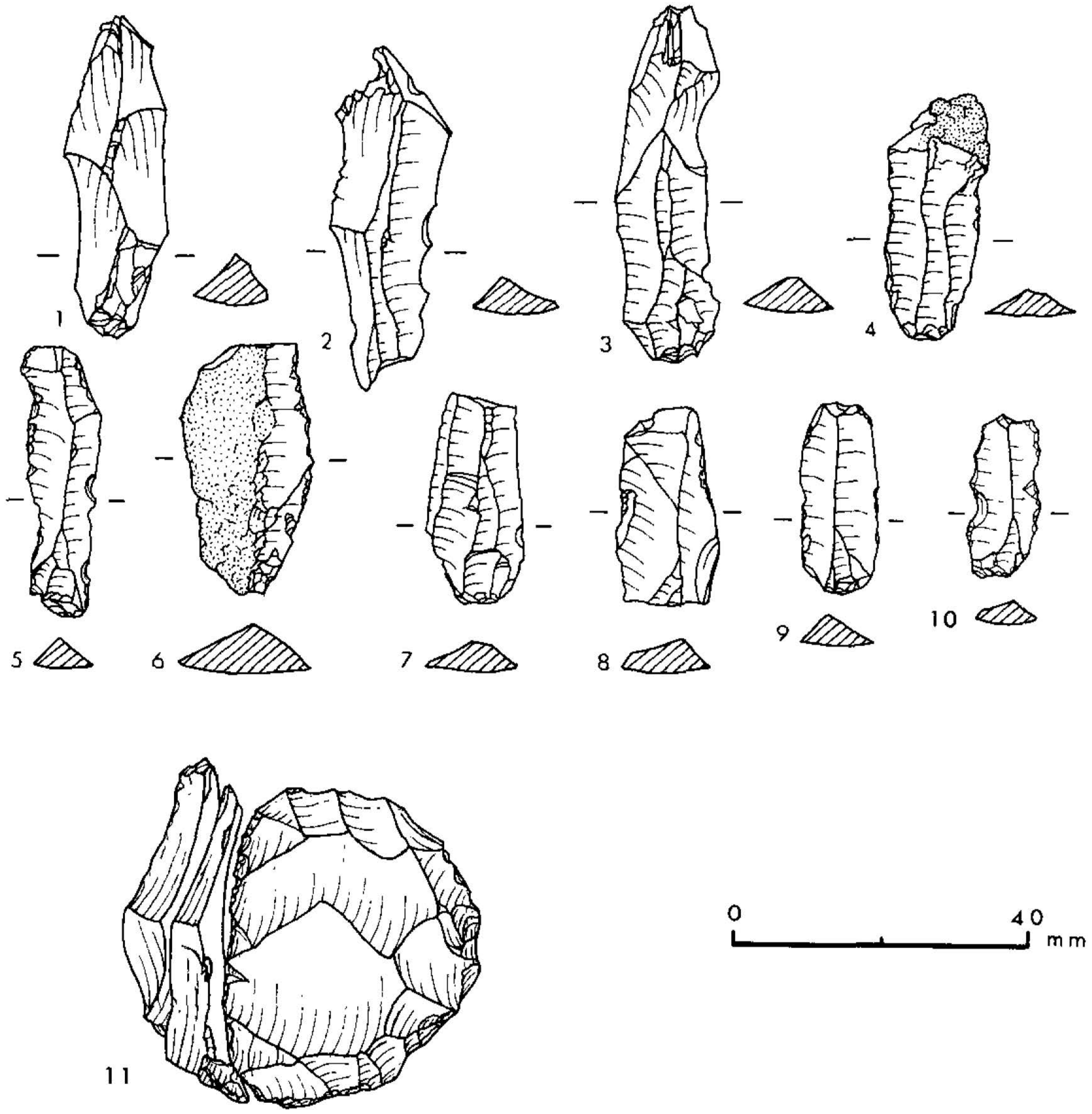
There are 2575 blades, 2% of the assemblage. With the exception of three quartz blades, all are of chalcedony. 96% are inner; there are 88 secondary blades and 3 are primary; only 8 crested blades were recovered. It would seem that the nodules could readily be flaked into blade cores without recourse 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 I and 2 to core 26.8. (Image by Marion O'Neil)

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 sub-divided 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

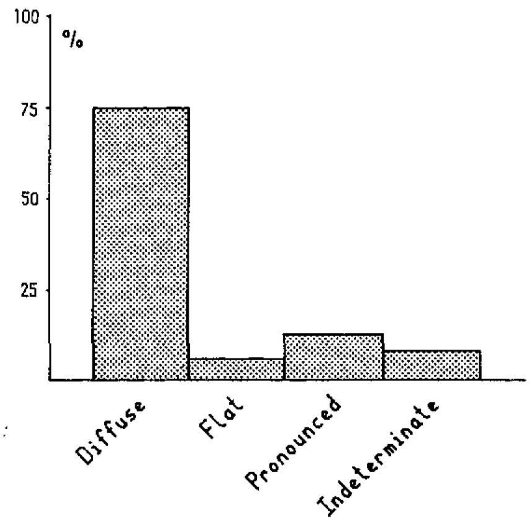
Only the flint and bloodstone artifacts were examined.

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 B.rtifacts used for technological analysis.



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

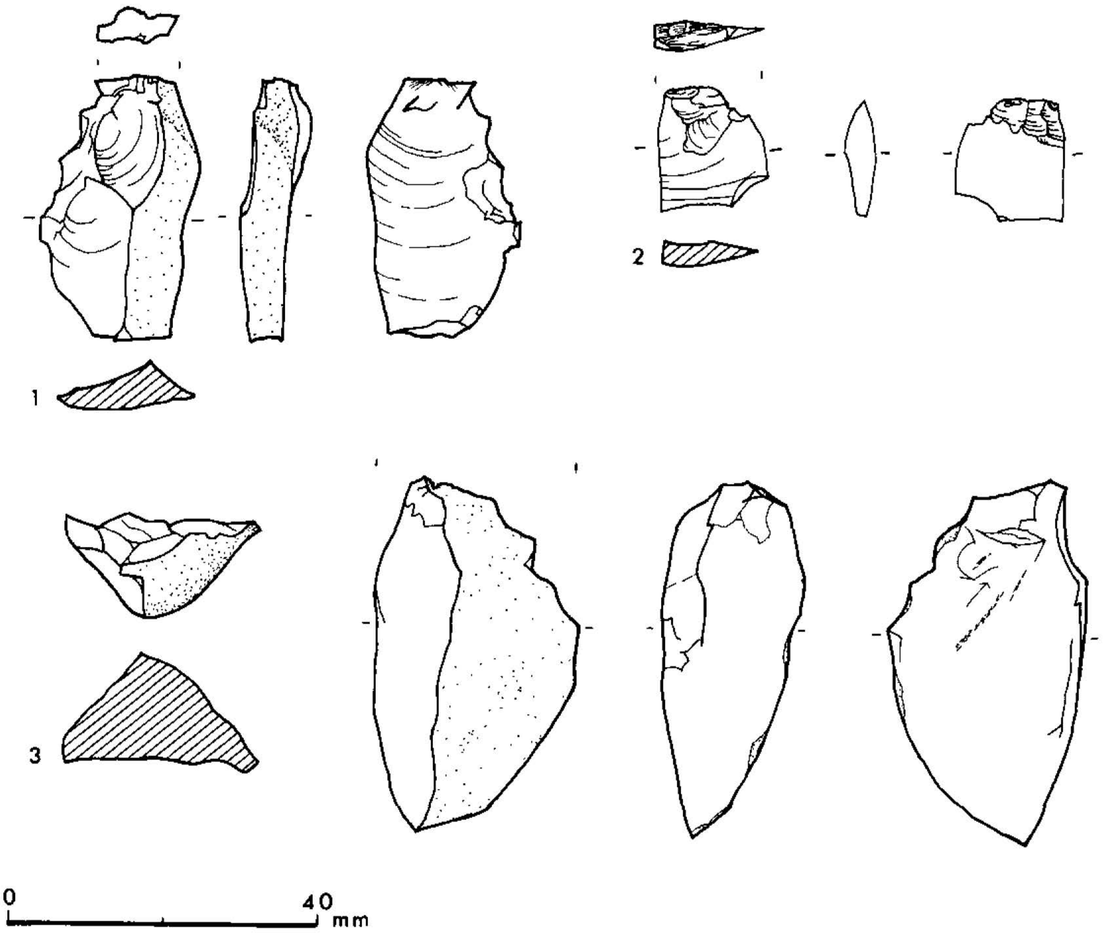
from the analysis. This comprised 27% of the blades; 31% of the sampled regular flakes; 4% of the cores; and 11% of the microliths, and it included all pieces of ambiguous material (Chapter 4). The condition of the retouched artifacts posed a problem as there were only fourteen in total, six of which 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.

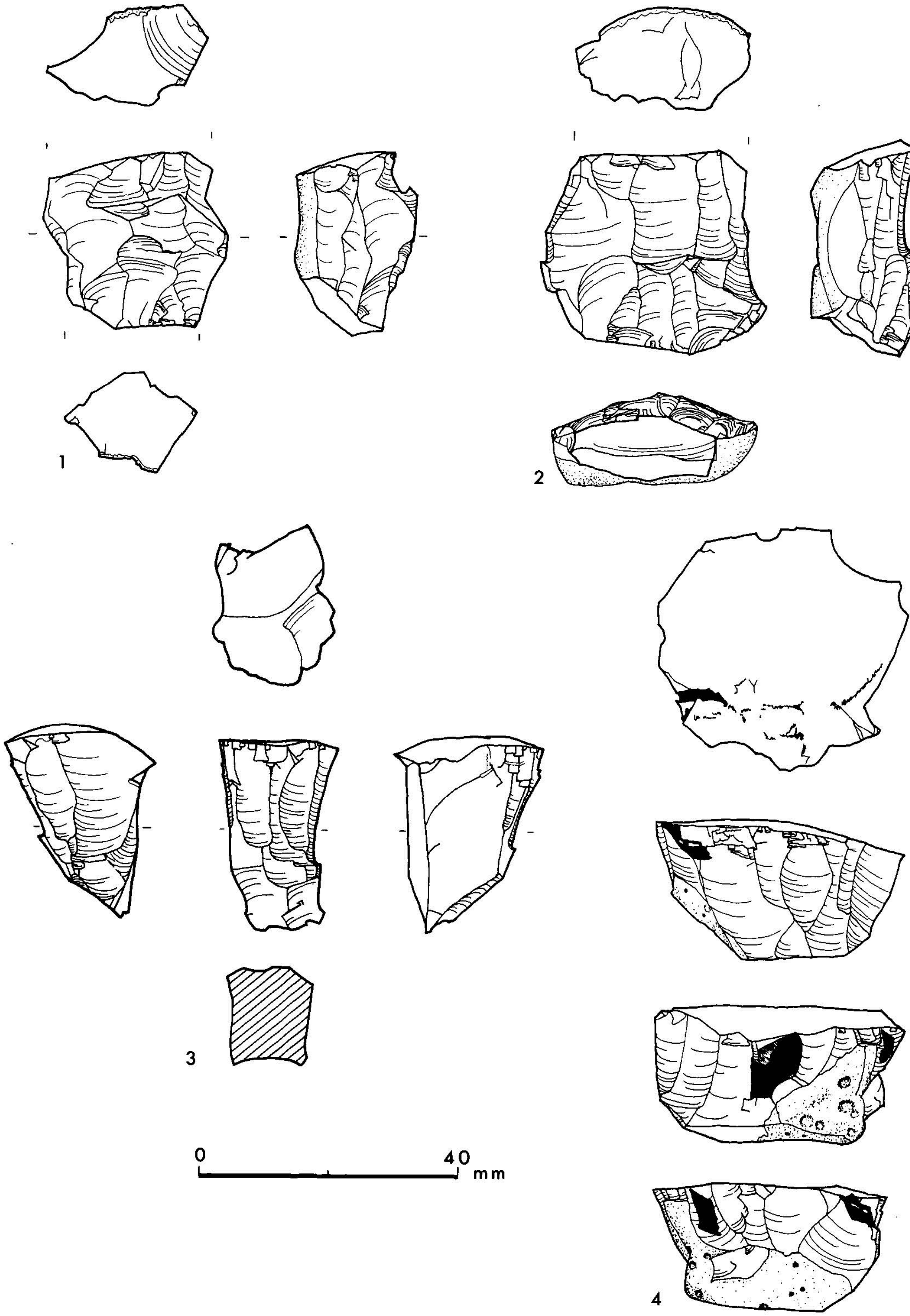
Of these, the first two are more or less impossible to register in any lithic assemblage. The ring cracks to be seen on 13 pieces in the sample may reflect increased force, but they do not correlate with a particular bulb type and so they are hard to interpret. The structure of the material is of more 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



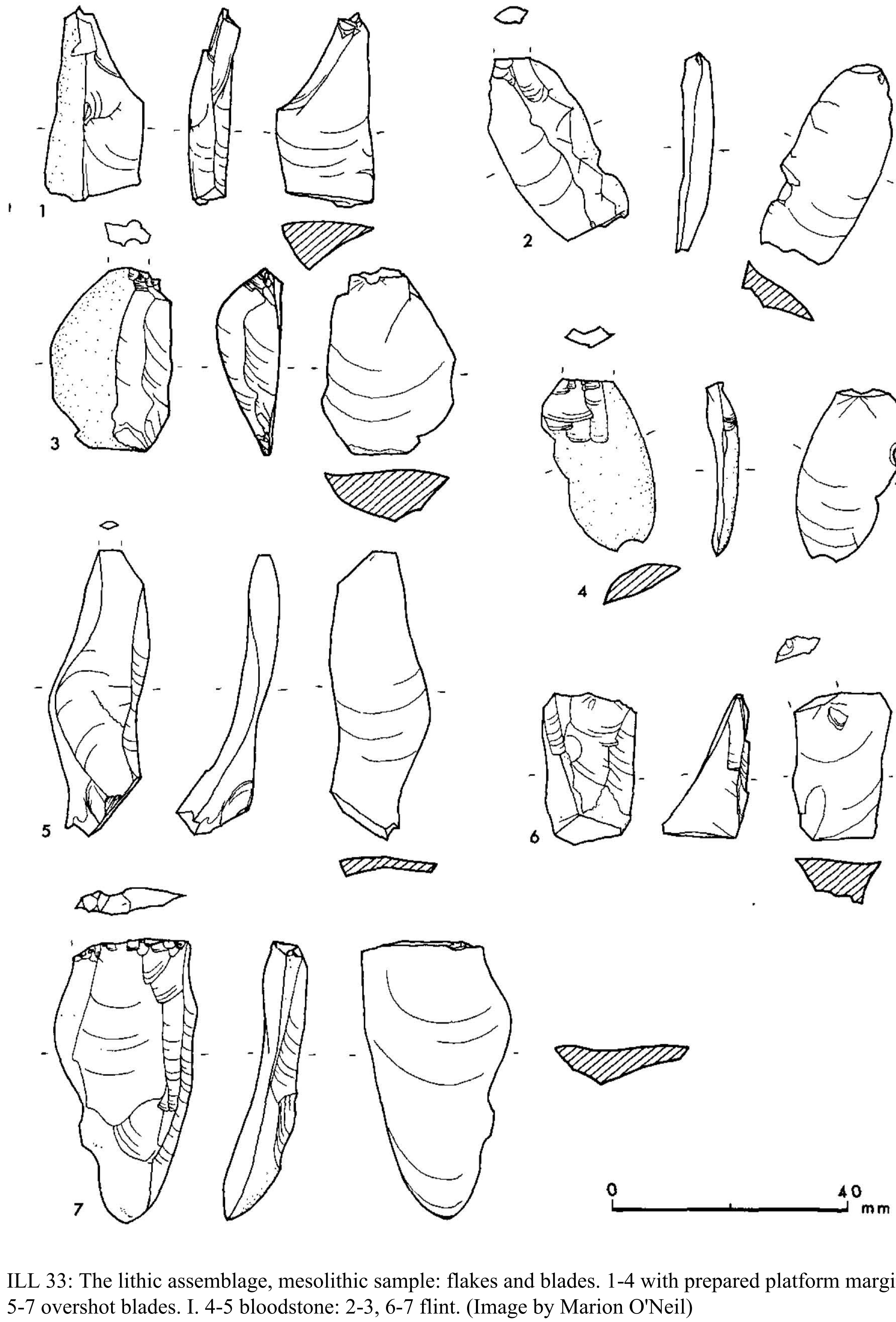
ILL 31: The lithic assemblage, mesolithic sample: flakes. 1 platform edge preparation: 2-3high speed fractures. 1 & 3 bloodstone: 2 flint. (Image by Marion O'Neil)

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.

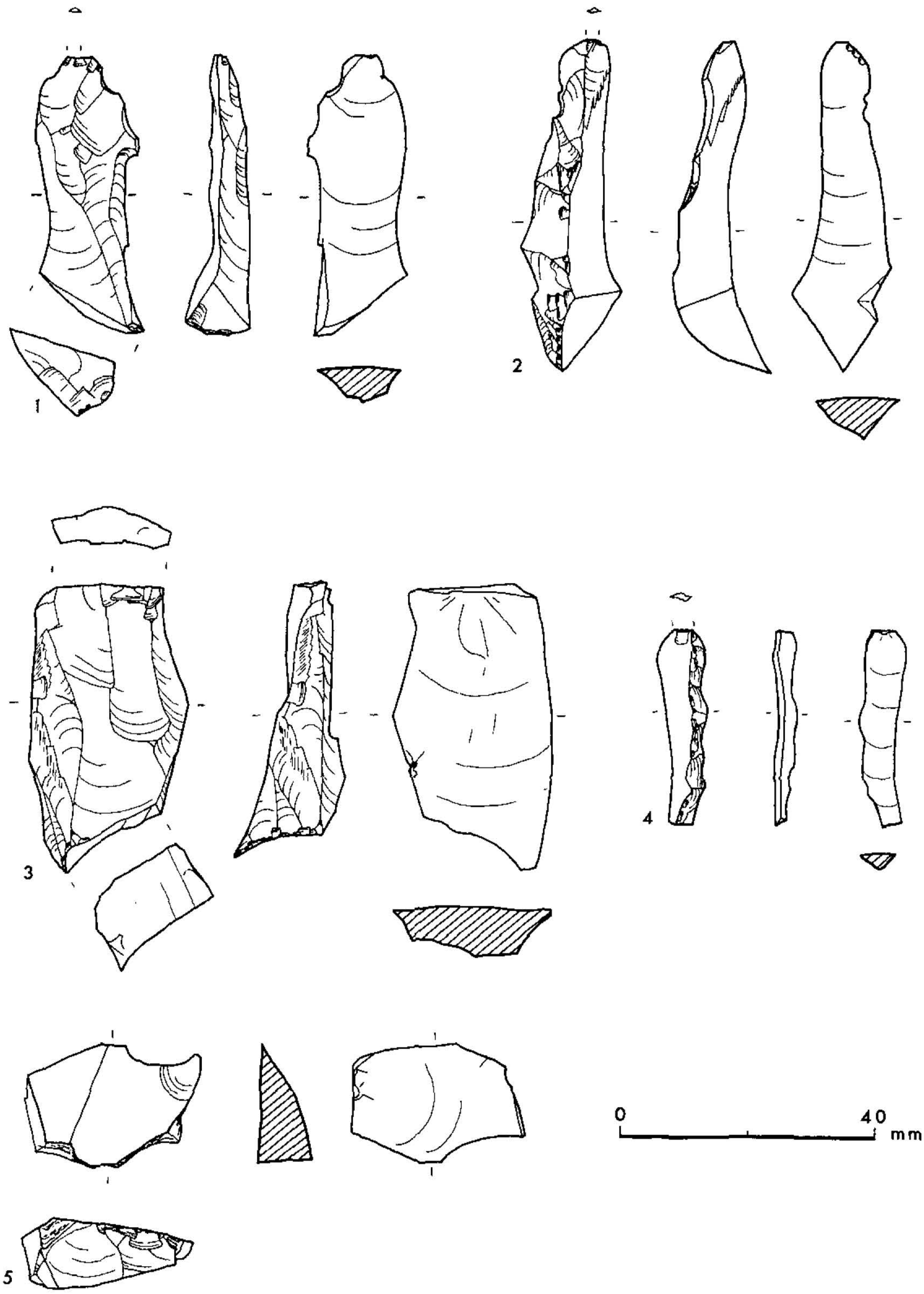
Soft percussion may be direct or indirect (in contrast to hard percussion, which is almost always direct), and it is difficult to determine whether a soft baton was used as a percussor (whether direct, or indirect in combination with a punch), or as a pressure tool. At Kinloch the morphology of the platform 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



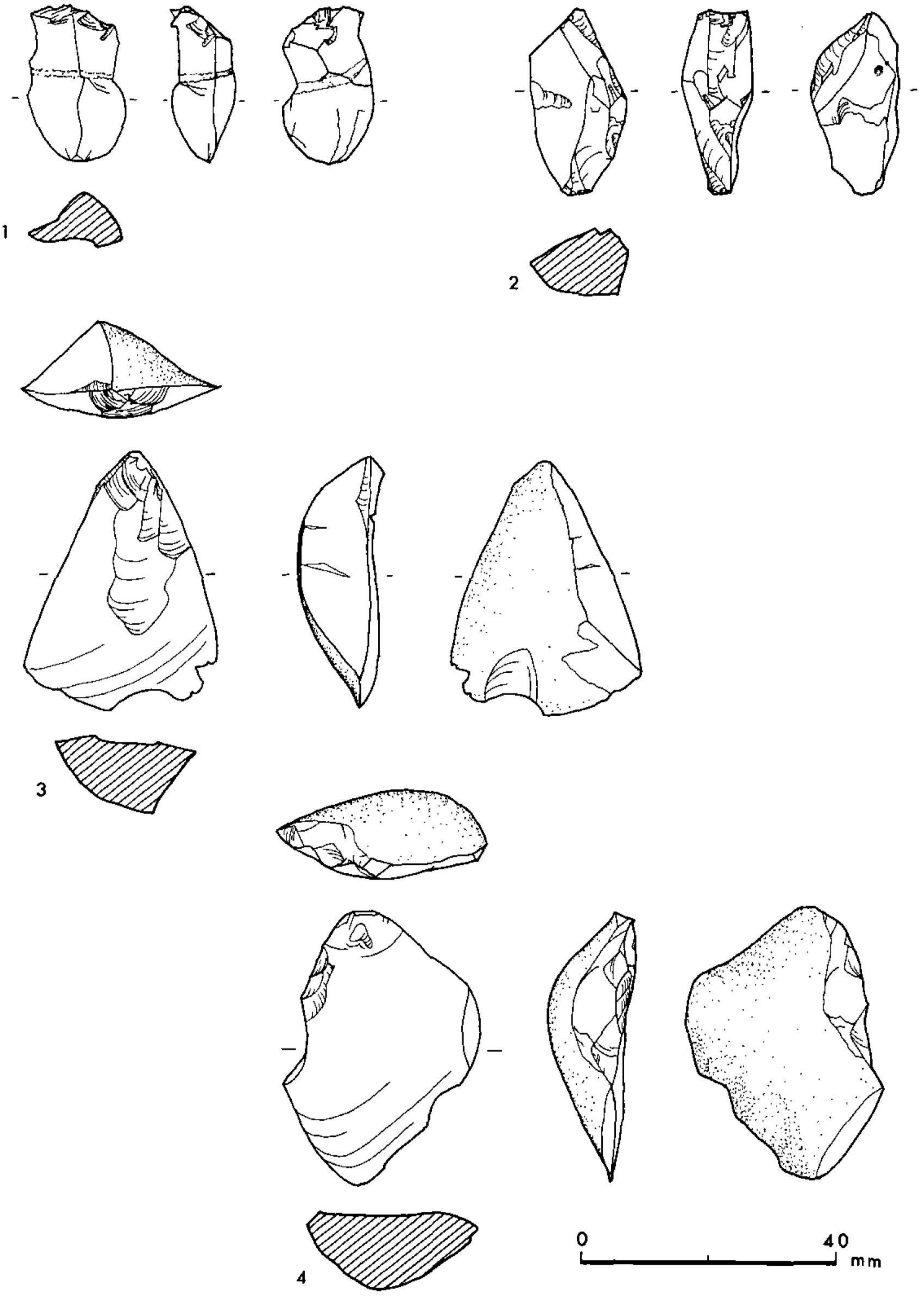
ILL 32: The lithic assemblage, mesolithic sample: platform cores. 1-2 double platformed cores: 3-4 conical platform cores. 4 bloodstone: 1-3 flint. (Image by Marion O'Neil)



ILL 33: The lithic assemblage, mesolithic sample: flakes and blades. 1-4 with prepared platform margin: 5-7 overshot blades. I. 4-5 bloodstone: 2-3, 6-7 flint. (Image by Marion O'Neil)



ILL 34: The lithic assemblage, mesolithic sample: flakes and blades. I & 3 removals with two platforms: 2 & 4 crested blades: 5 platform rejuvenation flake. 1 & 3 bloodstone: 2, 4-5 flint. (Image by Marion O'Neil)



ILL 35: The lithic assemblage, mesolithic sample: cores and flakes. 1-2 bipolar cores; 3-4 flakes with cortex platforms. t-3 bloodstone; 4 flint. (Image by Marion O'Neil)

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.

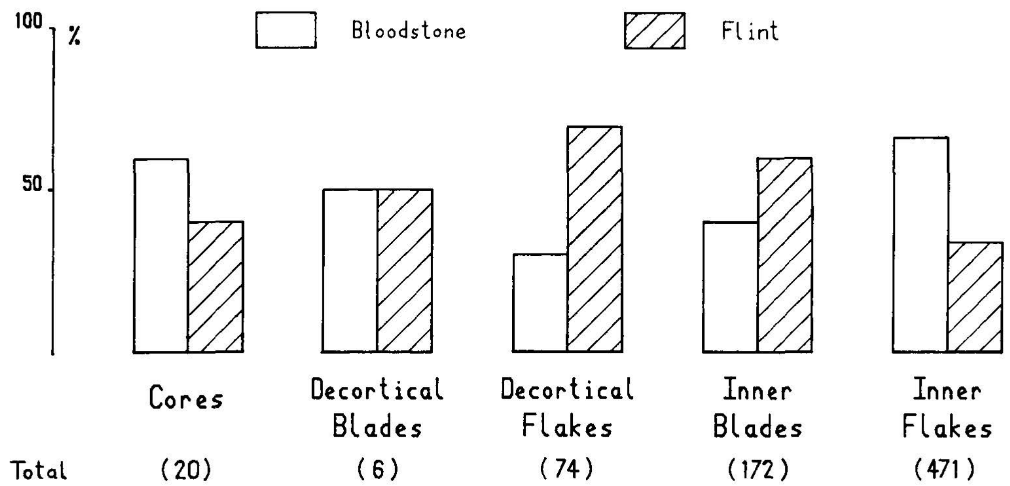
Both bloodstone and flint, were available on Rhum as beach nodules of varying quality (Chapter 4). The relationship between the two materials may be summarised as follows: the quality of flint was high, but the nodules were small; bloodstone was available in larger nodules, but they were generally of 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.

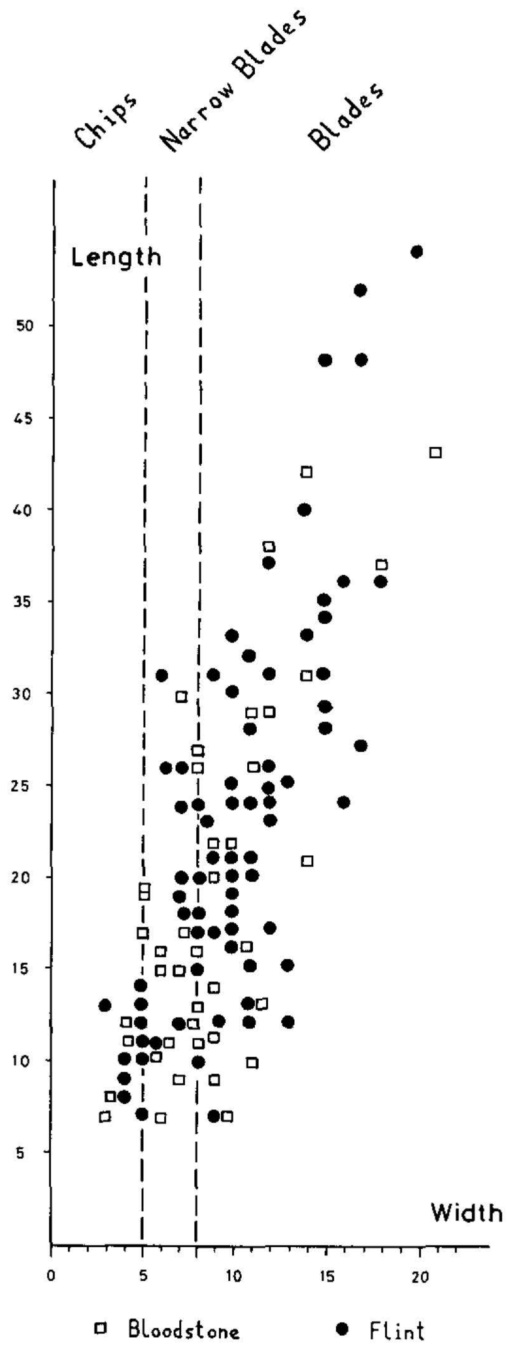
OVERSHOT FLAKES AND BLADES

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

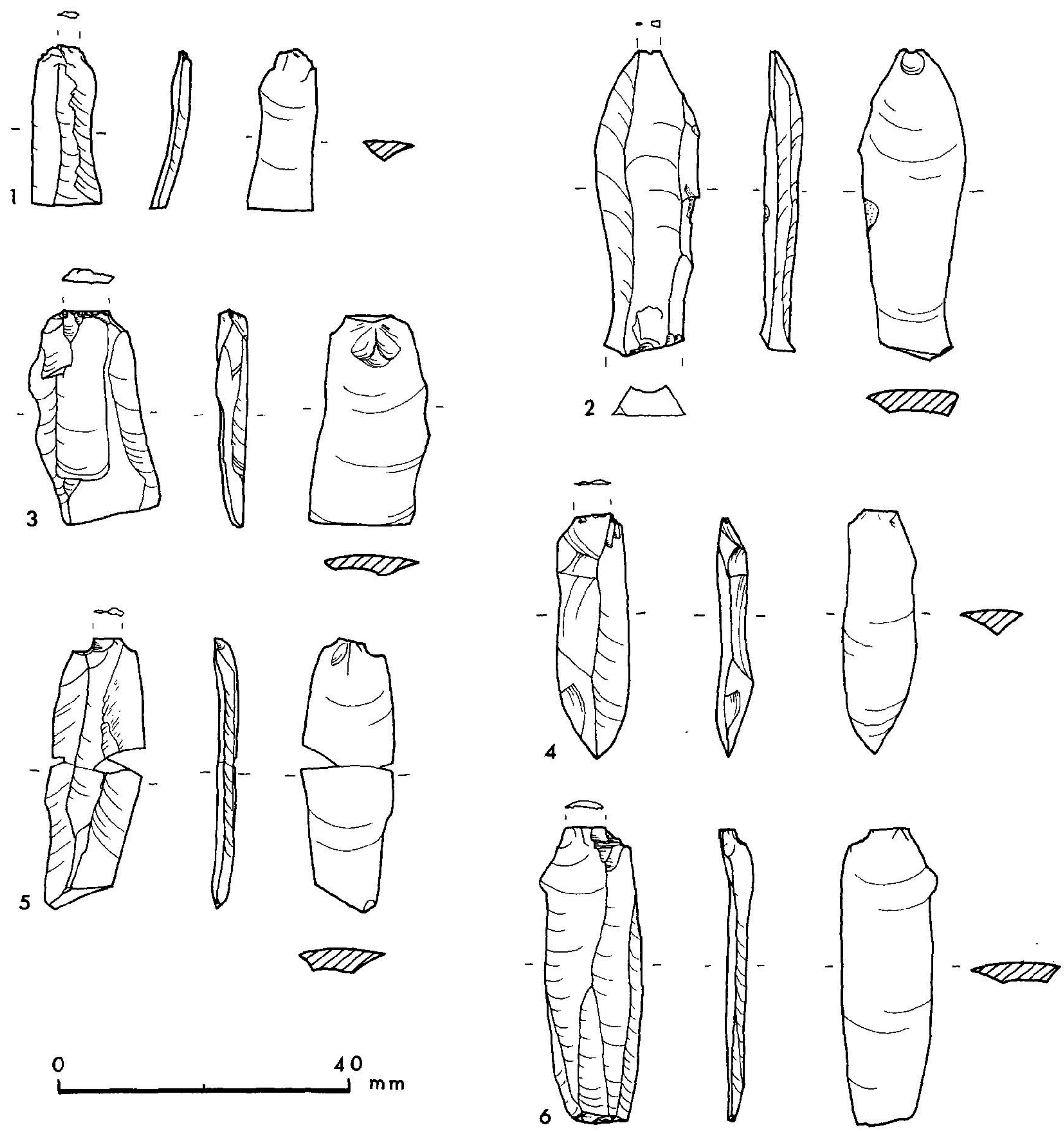
There are two crested blades, both of flint (Ill 34. 2 & 4). They were used to prepare ridges down the side of a core to guide blade production. Neither is a true crested blade (on which the ridge is formed by alternating flakes). Both have been produced to straighten a natural pre-existing ridge. One 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 t)'pes. 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. (Image by Marion O'Neil)

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):

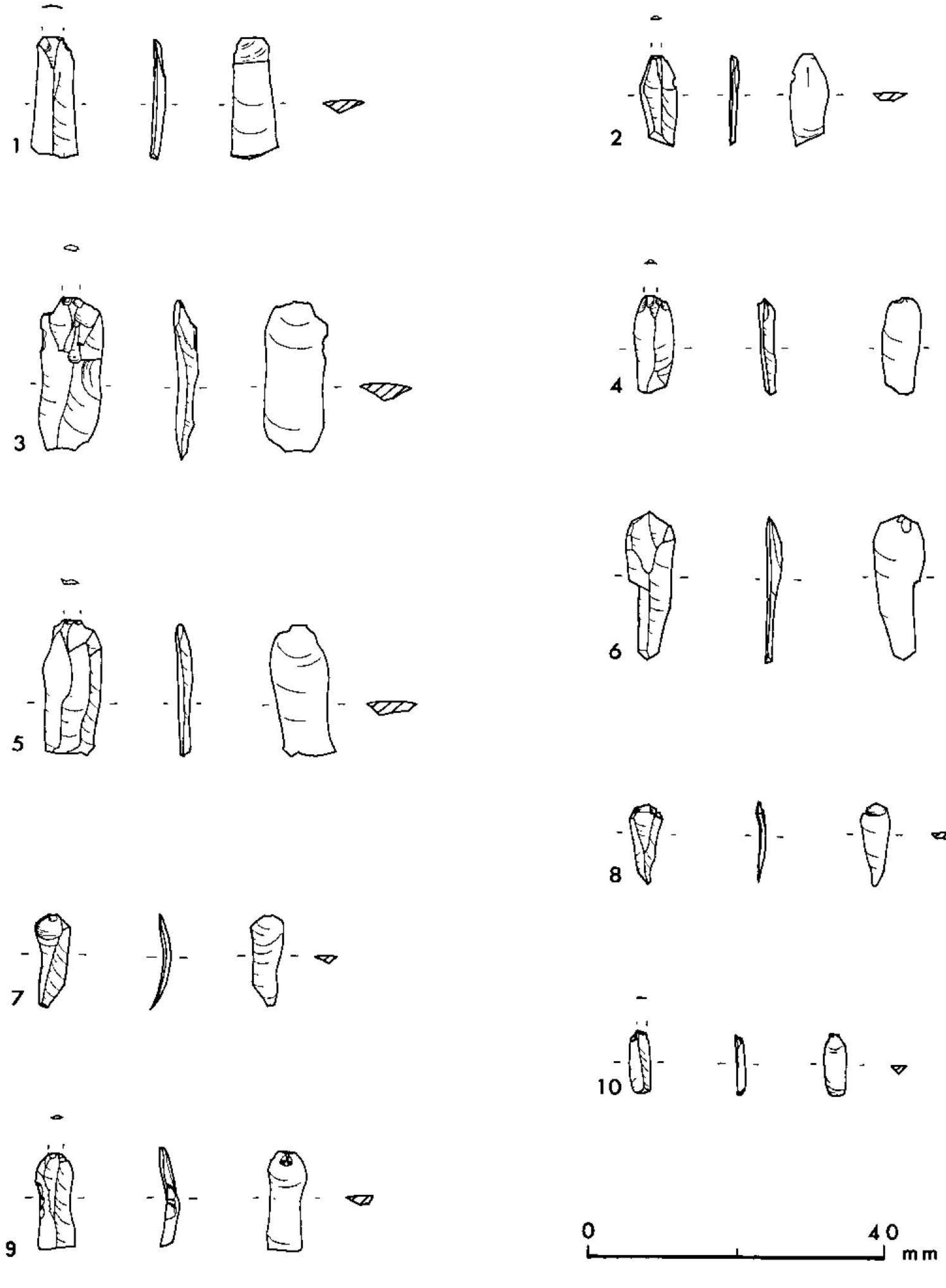
Blades are characterised by small elongated platforms (mean size 3mm × 1mm), careful platform preparation, platform isolation, parallelism, and low dorsal ridges. Most are straight, and the flaking angle varies between 70° and 80°. The size range of complete specimens is presented in Ill 37. There are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

2 Narrow Blades (Ill 39. 1–6):

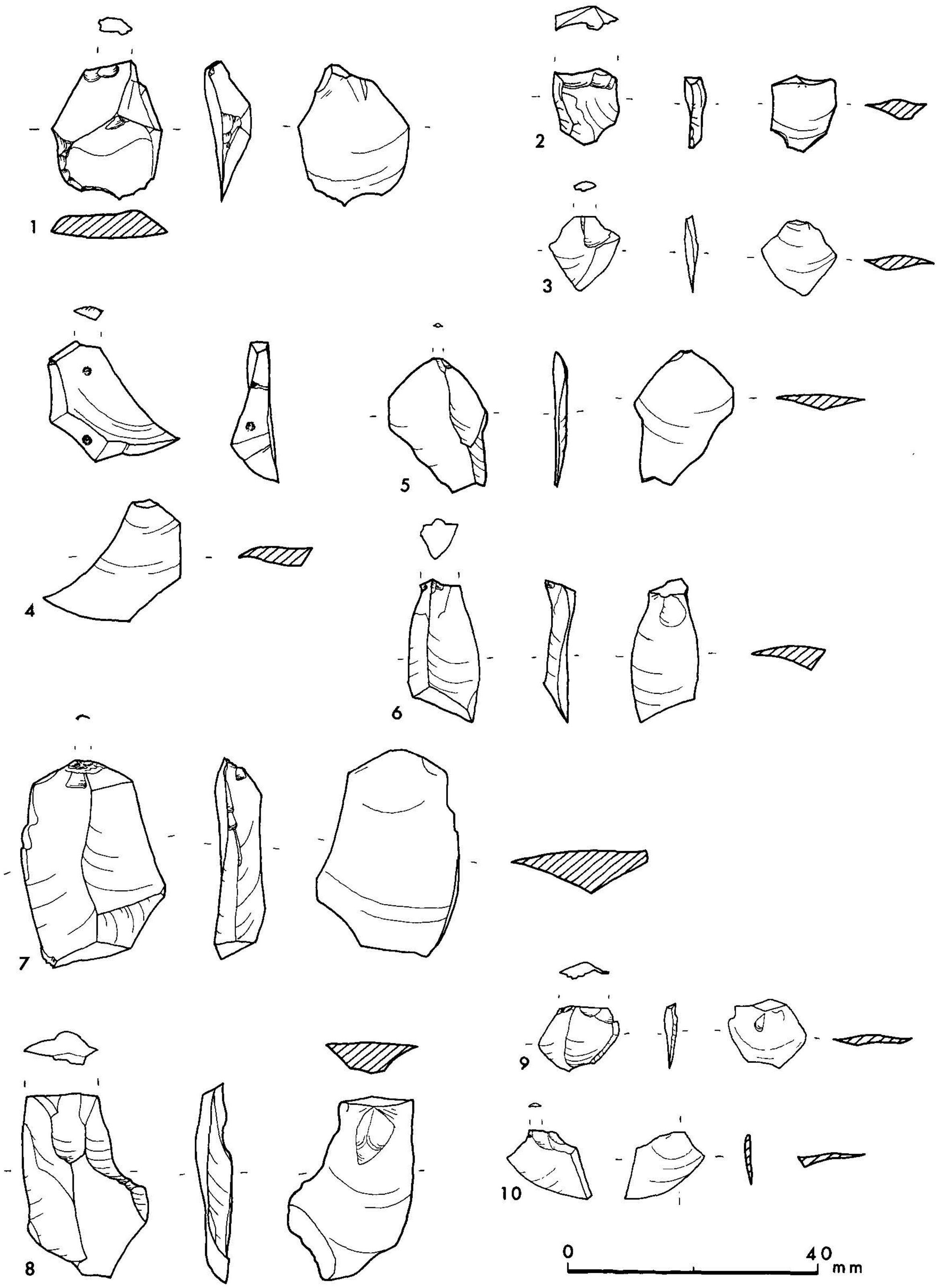
Narrow blades have the same morphological and technological properties as blades, though they tend to have fewer dorsal ridges. The size range is shown in Ill 37. There are more narrow blades of bloodstone than of flint in the sample.

3 Chips (Ill 39. 7–10)

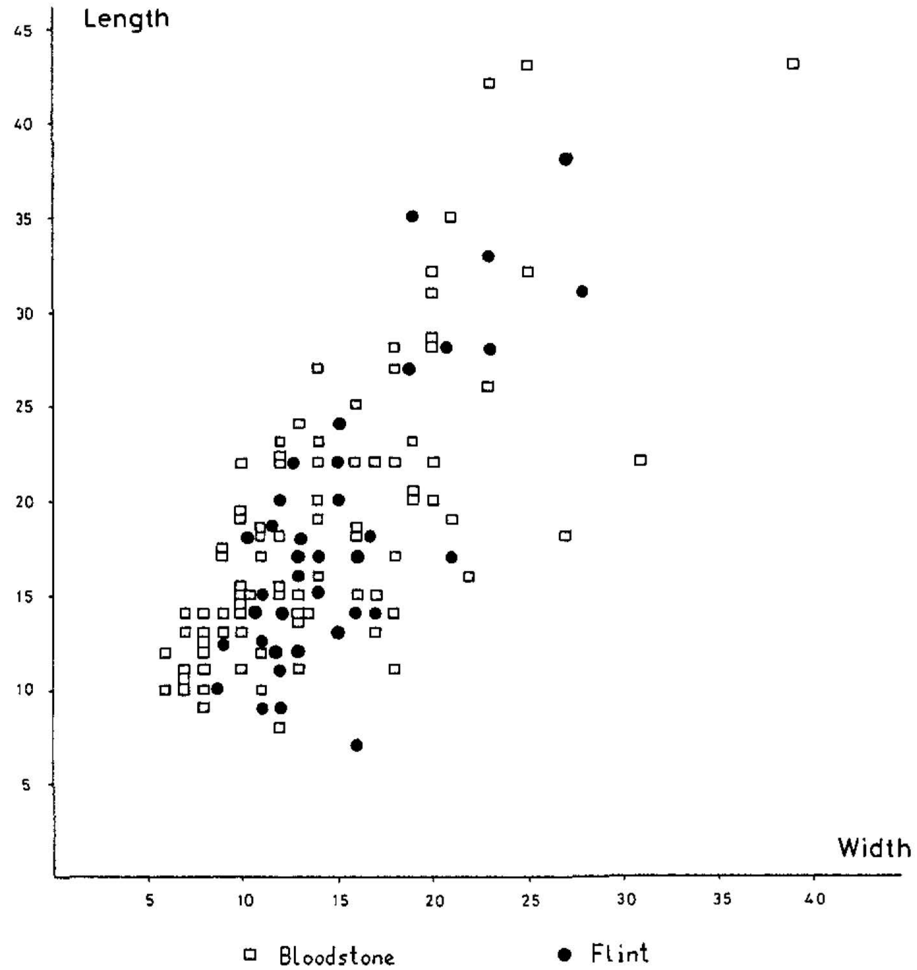
There are few chips. They exhibit the same characteristics as the other two groups, but are much smaller (Ill 37).



ILL 39: The lithic assemblage, mesolithic sample: narrow blades and chips. 1-6 narrow blades: 7-10 chips. I-3, 9-10 bloodstone: 4-8 flint. (Image by Marion O'Neil)



ILL 40: The lithic assemblage, mesolithic sample: flakes. 2-3, 5-6, 8 bloodstone: 1, 4, 7, 9-10 flint.
(Image by Marion O'Neil)



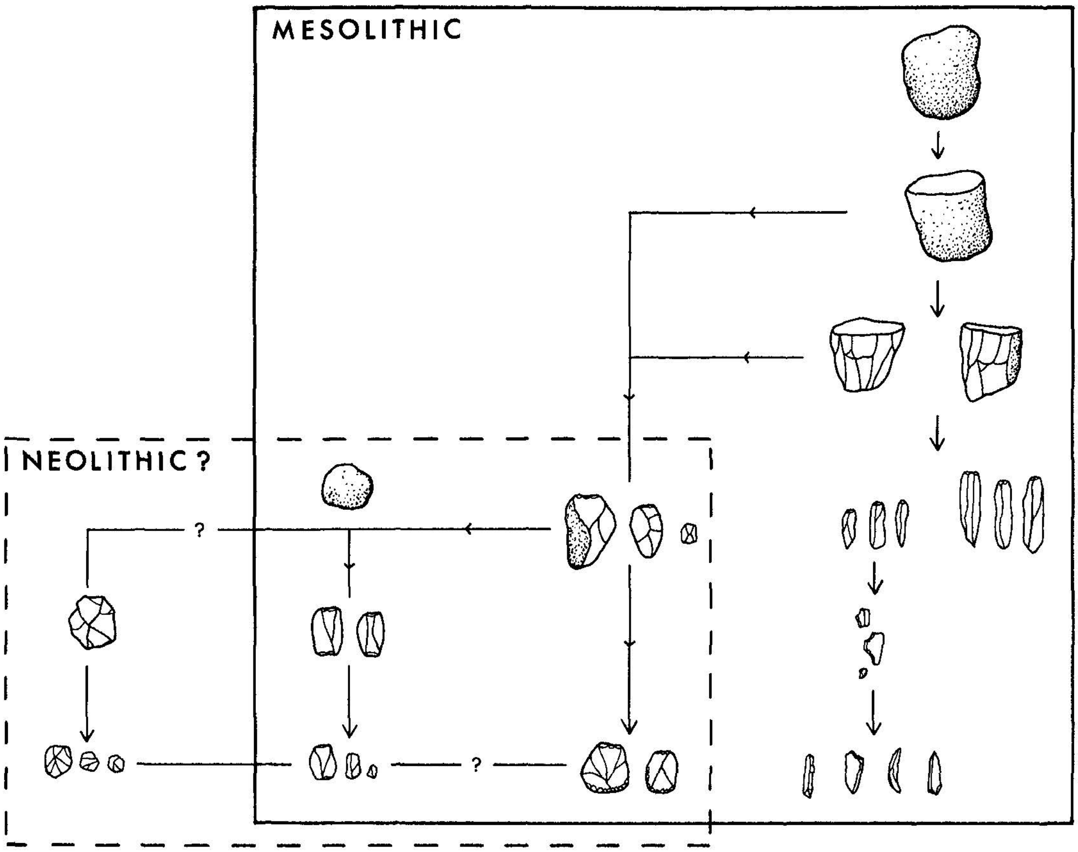
ILL 41: The lithic assemblage, mesolithic sample: complete inner flakes, length/width ratios. Dimensions in mm.

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).

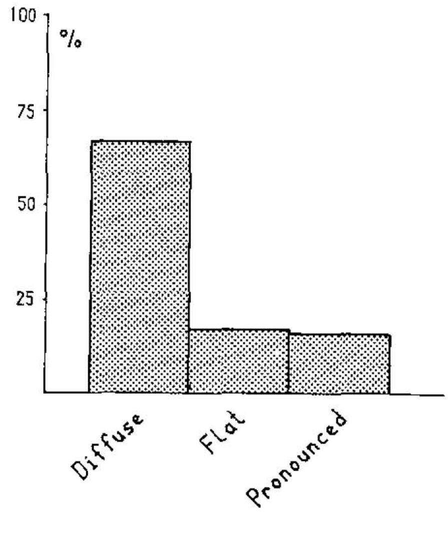
Although making flakes was not the primary goal of the knappers, there are many that would have been useful, and it is unlikely that these went to waste. Without further study it is impossible to identify those that were used unmodified. Some, however, were modified, eg most of the larger modified tools 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.

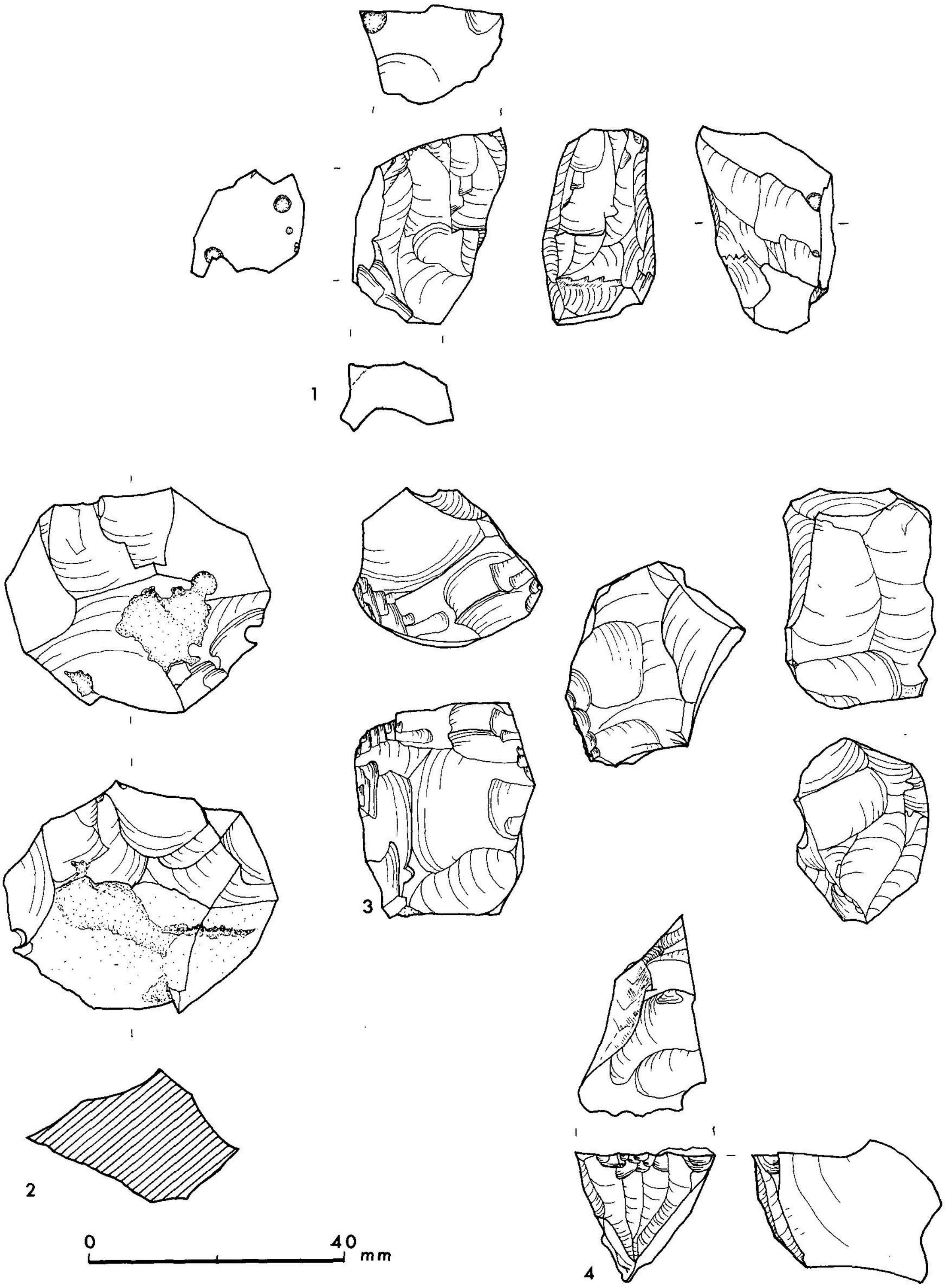


ILL 43: The lithic assemblage, mesolithic/neolithic sample: bulb types

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. (Image by Marion O'Neil)

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

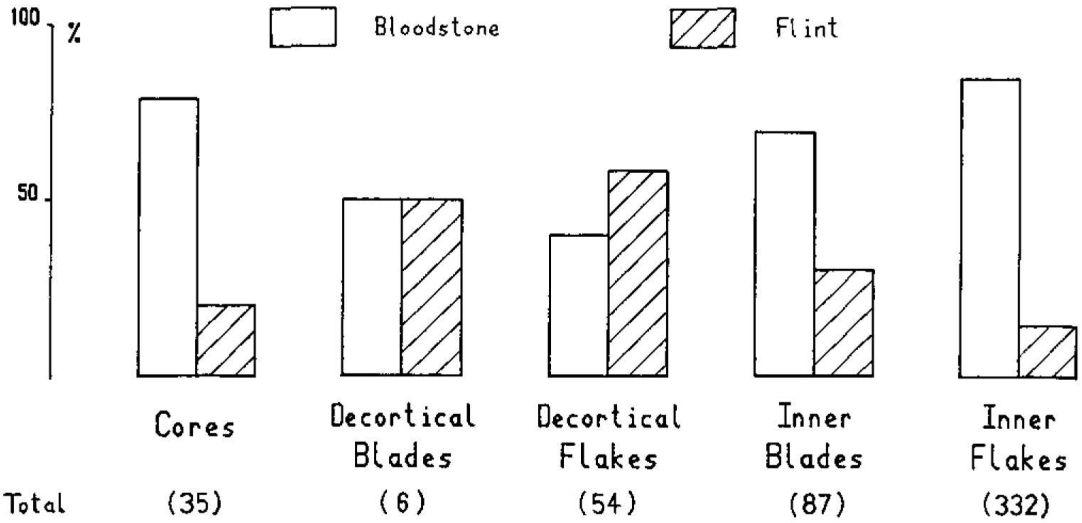
Types, Raw Material and Condition.

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)

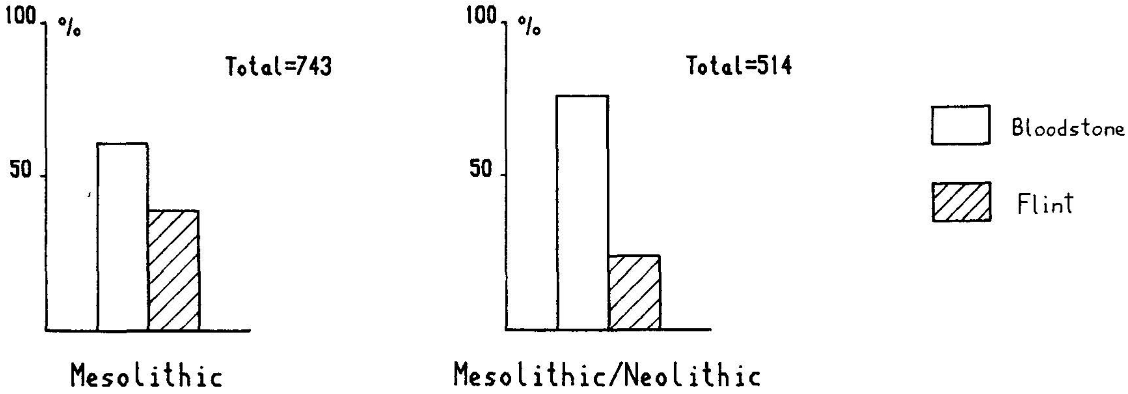
The features indicative of the methods used to apply force for the manufacture of flakes and blades were catalogued and analysed. As in the mesolithic sample, diffuse and flat bulbs were predominant (Ill 43), suggesting the use of soft percussion. This is supported by the other technological attributes. 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)

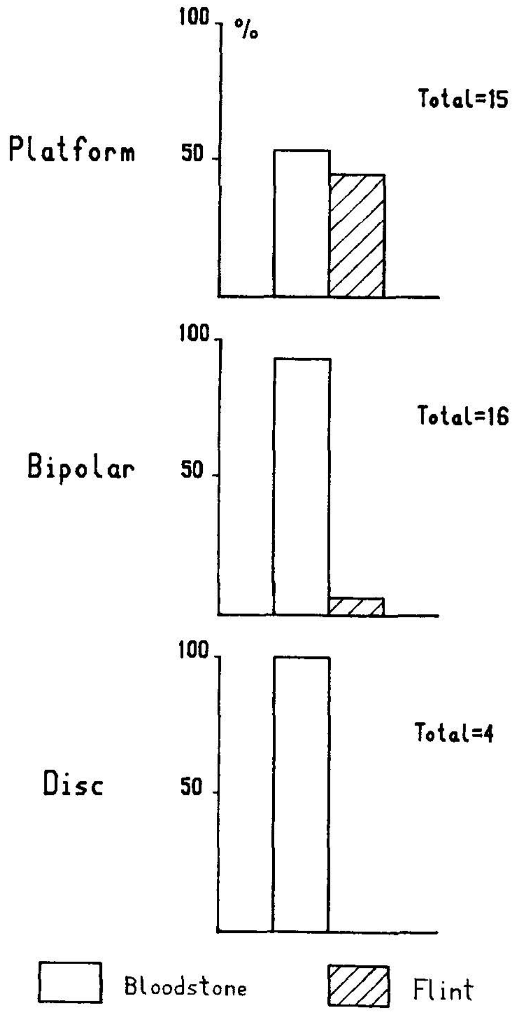
Flint.

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.

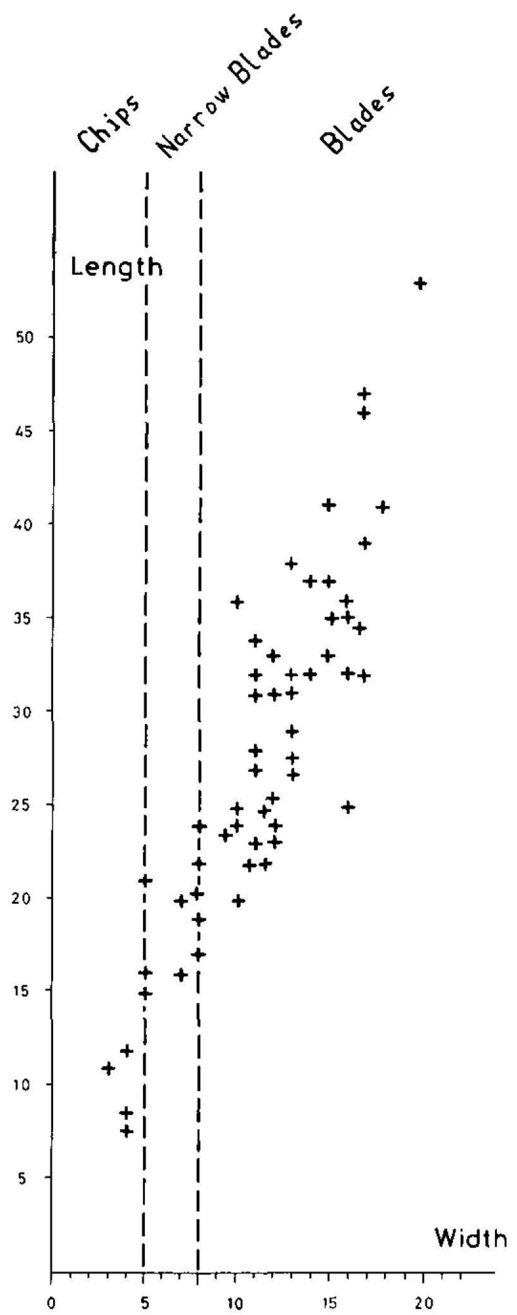
Bloodstone.

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.

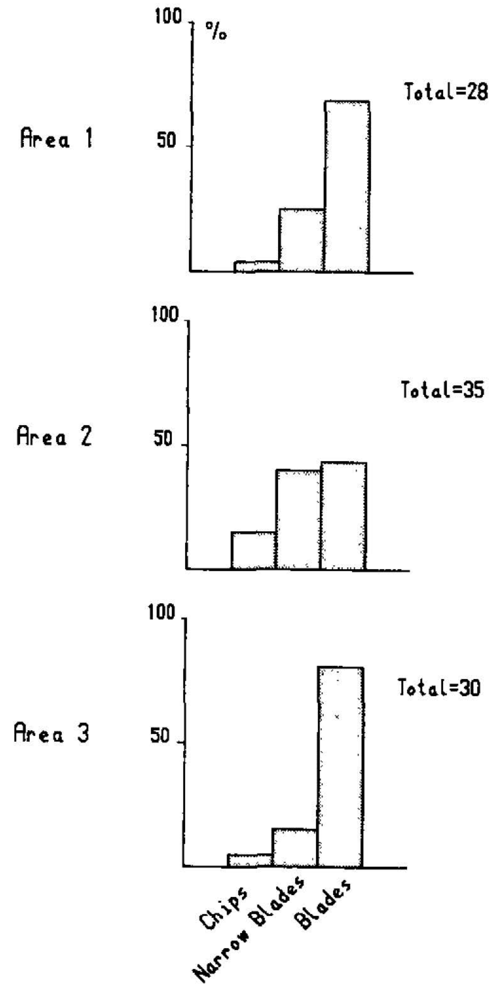
Four bloodstone disc cores, a type not found in the mesolithic contexts, were also identified (Ill 44. 1–3). They were used in the production of flakes by a quasi-bifacial method, each removal utilising the negative scar from the previous flake as a platform. This is a complex way to make flakes and 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

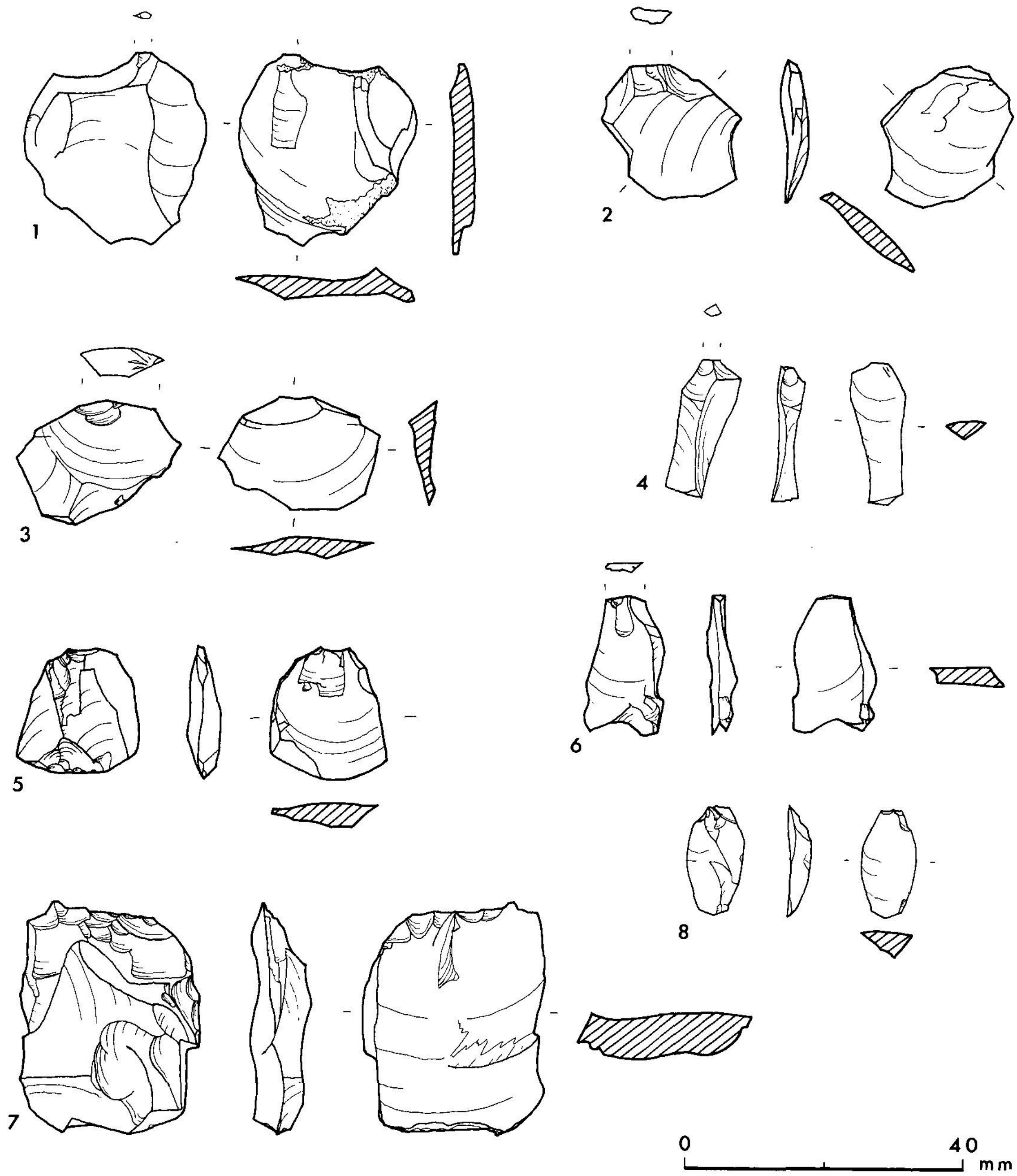
There are a few overshot flakes and blades; all present the same picture as those from Trench AD.

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

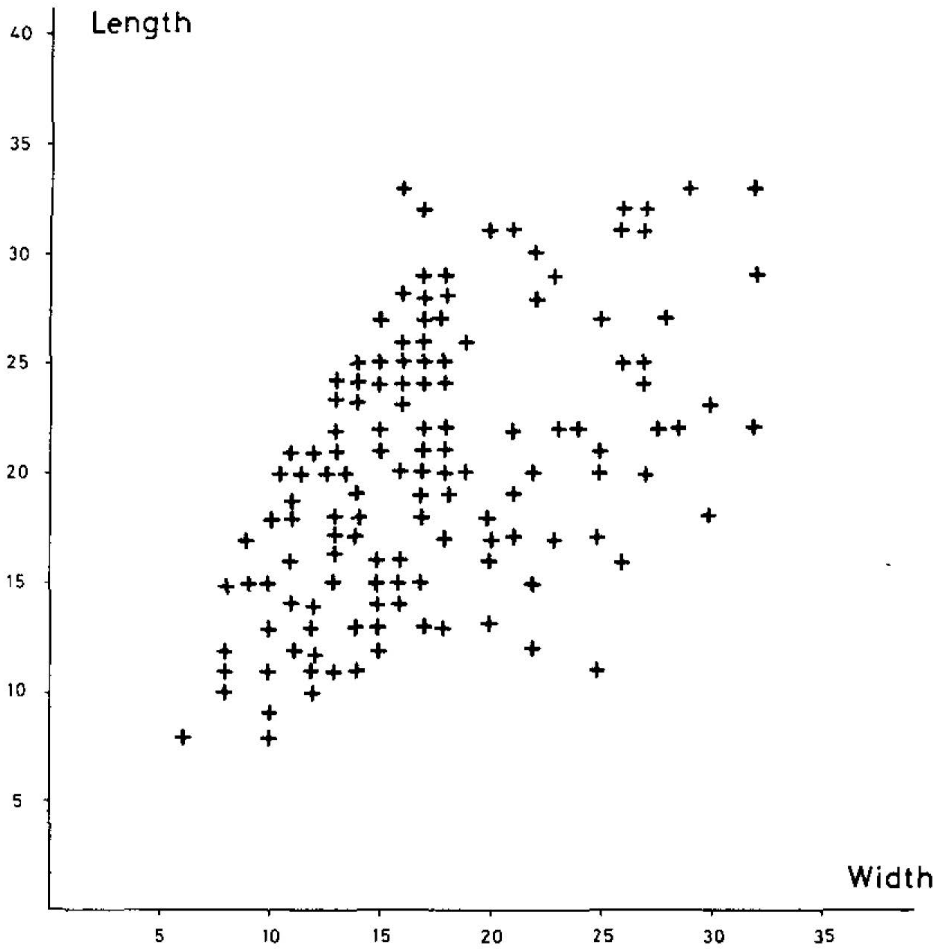


ILL 50: The lithic assemblage, mesolithic/neolithic sample: Flakes. 1-3 disc core flakes: 4-8 bipolar flakes. 1-4, 6-8 bloodstone: 5 flint. (Image by Marion O'Neil)

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

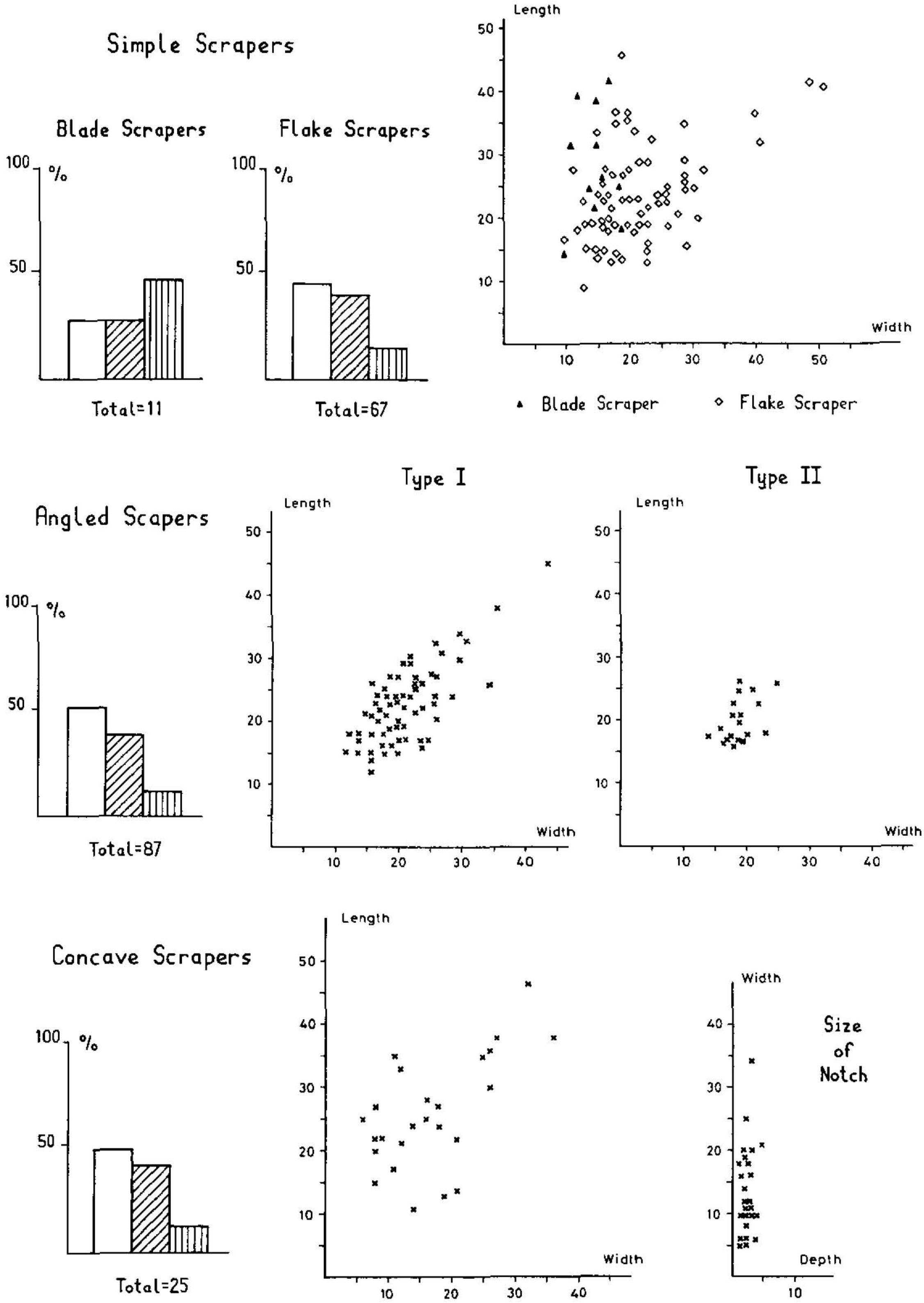
Scrapers have modification to produce a 'scraping edge'. A 'scraping edge' is unifacial; the retouch is shallow, regular and short, and runs steeply up from the edge of the piece at an angle of between 55°–95°. Various sub-types exist.

SIMPLE SCRAPERS

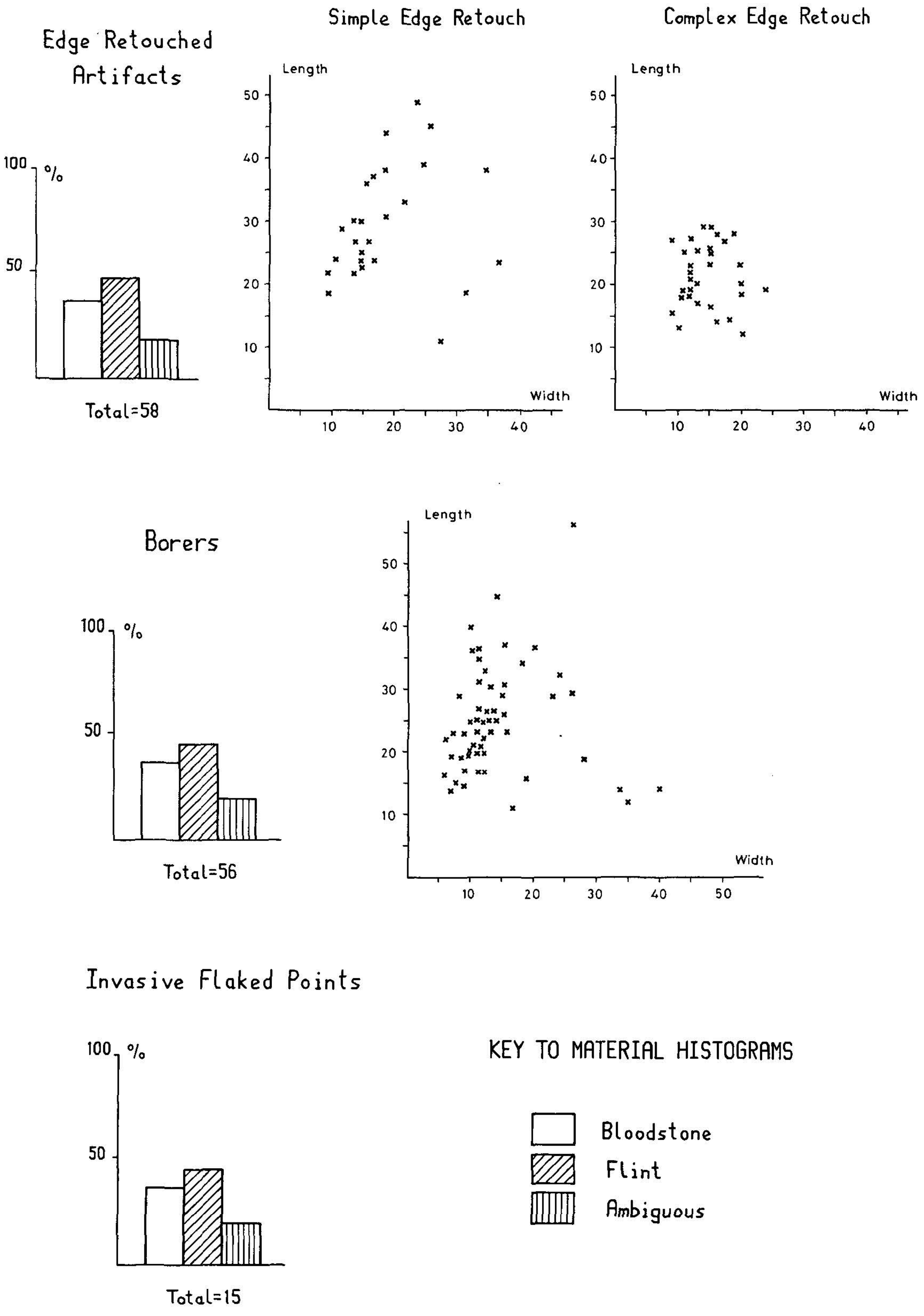
Simple scrapers have a single 'scraping edge'.

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.

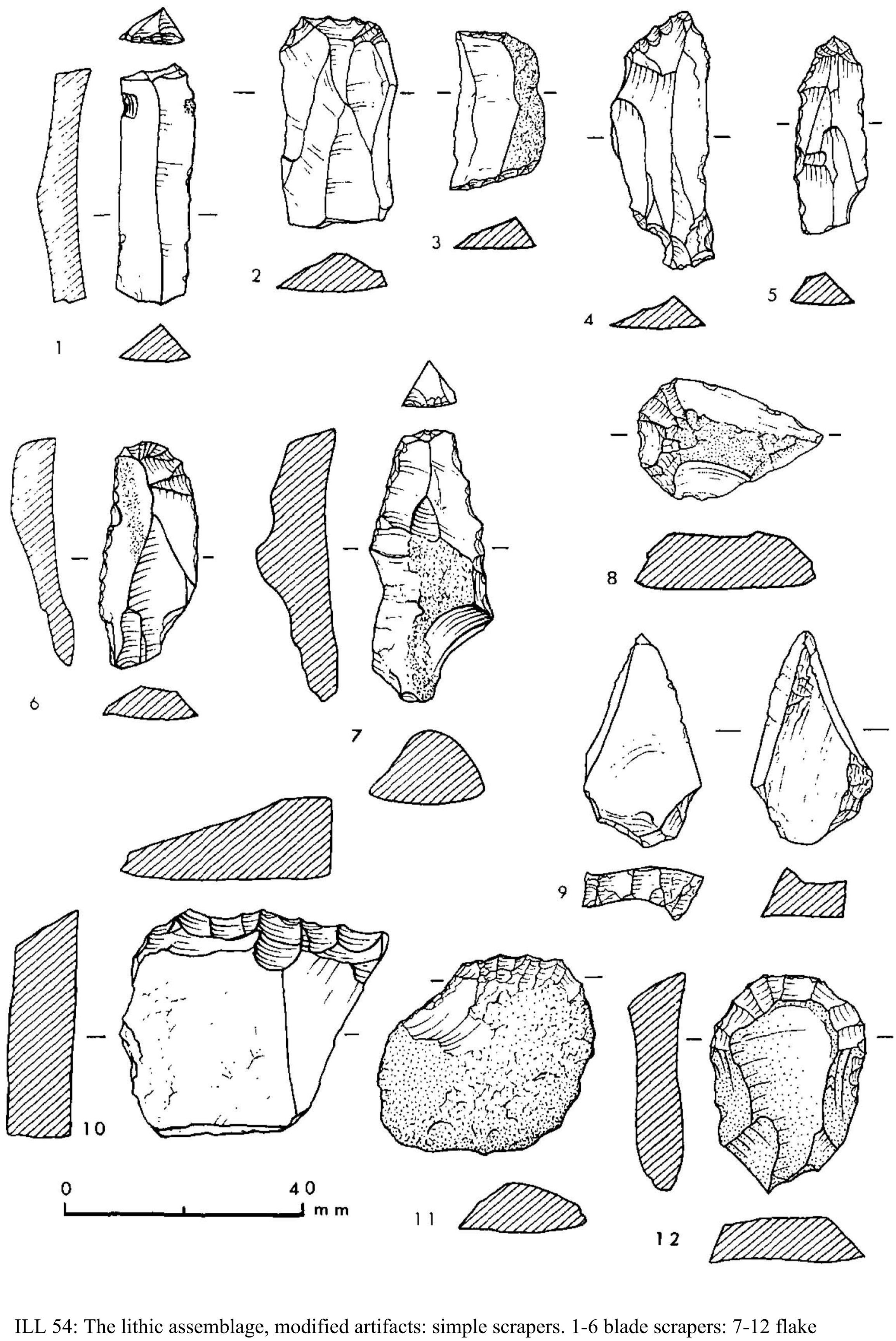
Simple scrapers may be sub-divided by the type of blank into blade scrapers and flake scrapers.



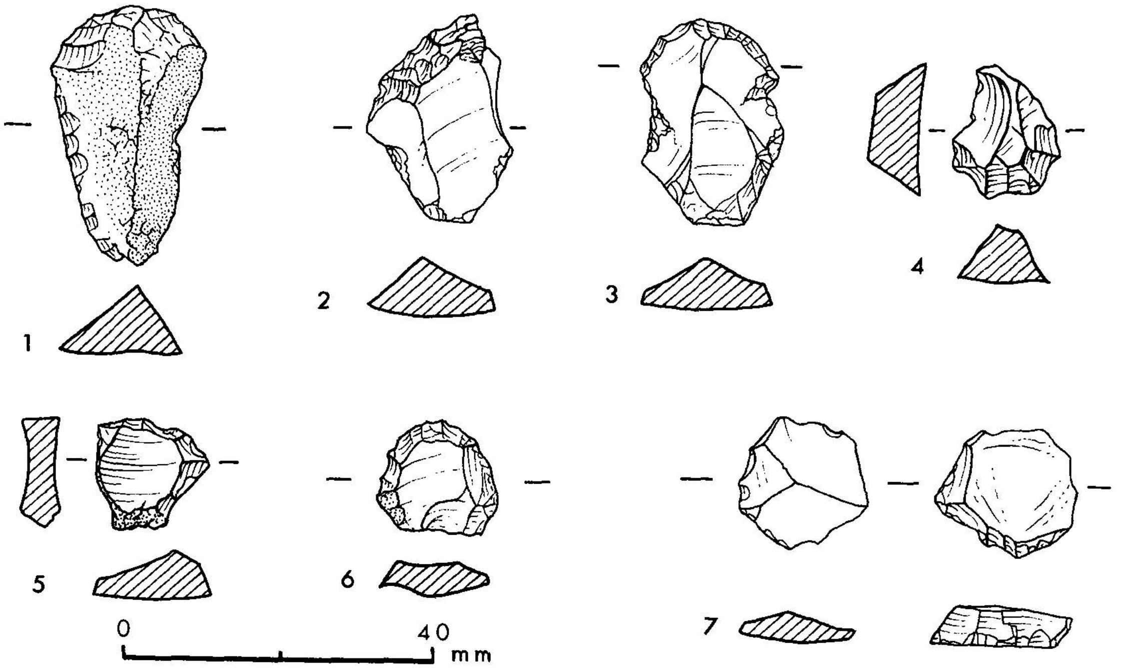
ILL 52: The lithic assemblage, modified artifacts by type, material and dimensions (mm).



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: l-3, 5, 7, 12 abraded. (Image by Marion O'Neil)



ILL 55: The lithic assemblage, modified artifacts: simple (flake) scrapers (4-7 horizontally truncated). 2, 4, 7 bloodstone: 1 & 5 flint: 3 & 6 abraded. (Image by Marion O'Neil)

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.

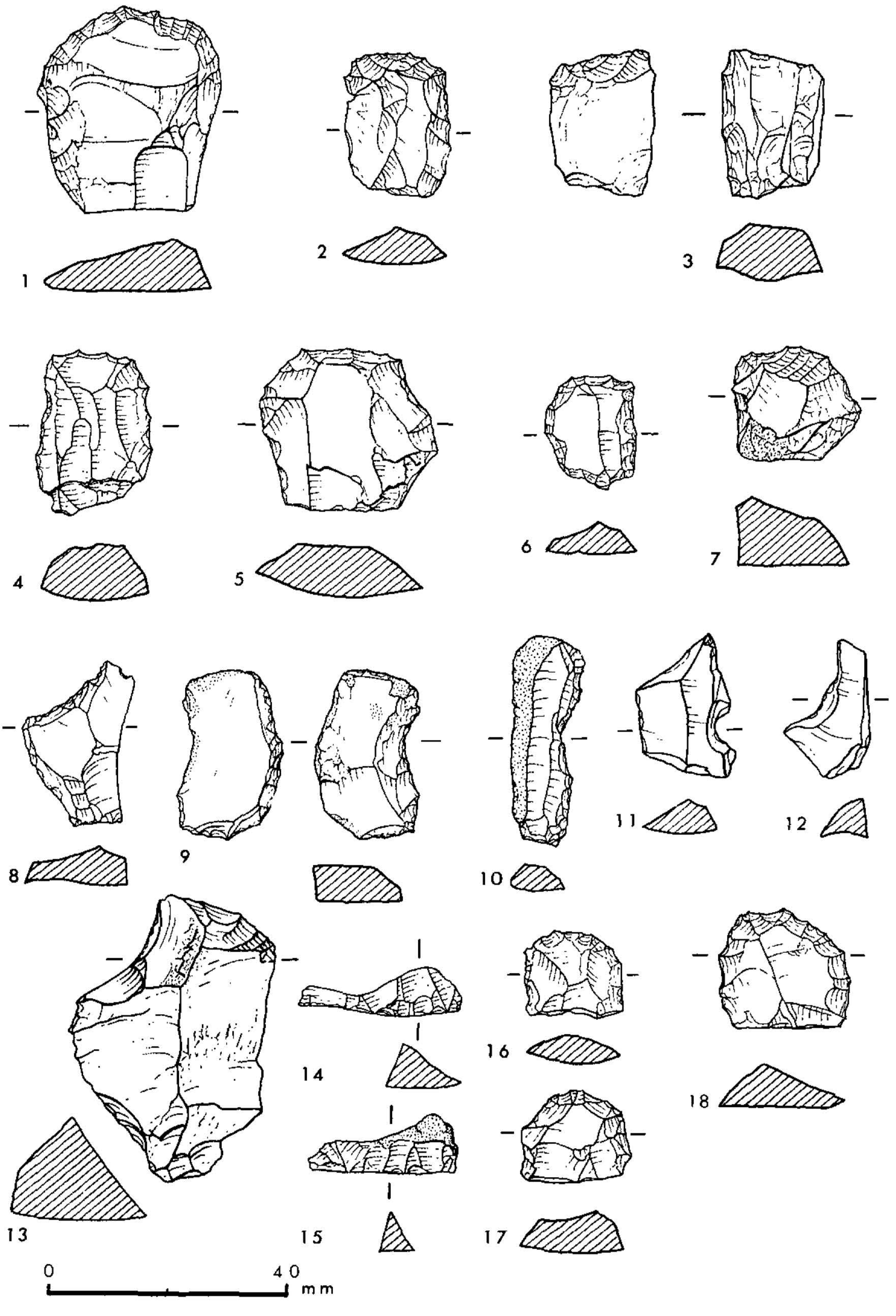
Angled Scrapers II (Ills 52; 56. 4–7)

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: l-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. (Image by Marion O'Neil)

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

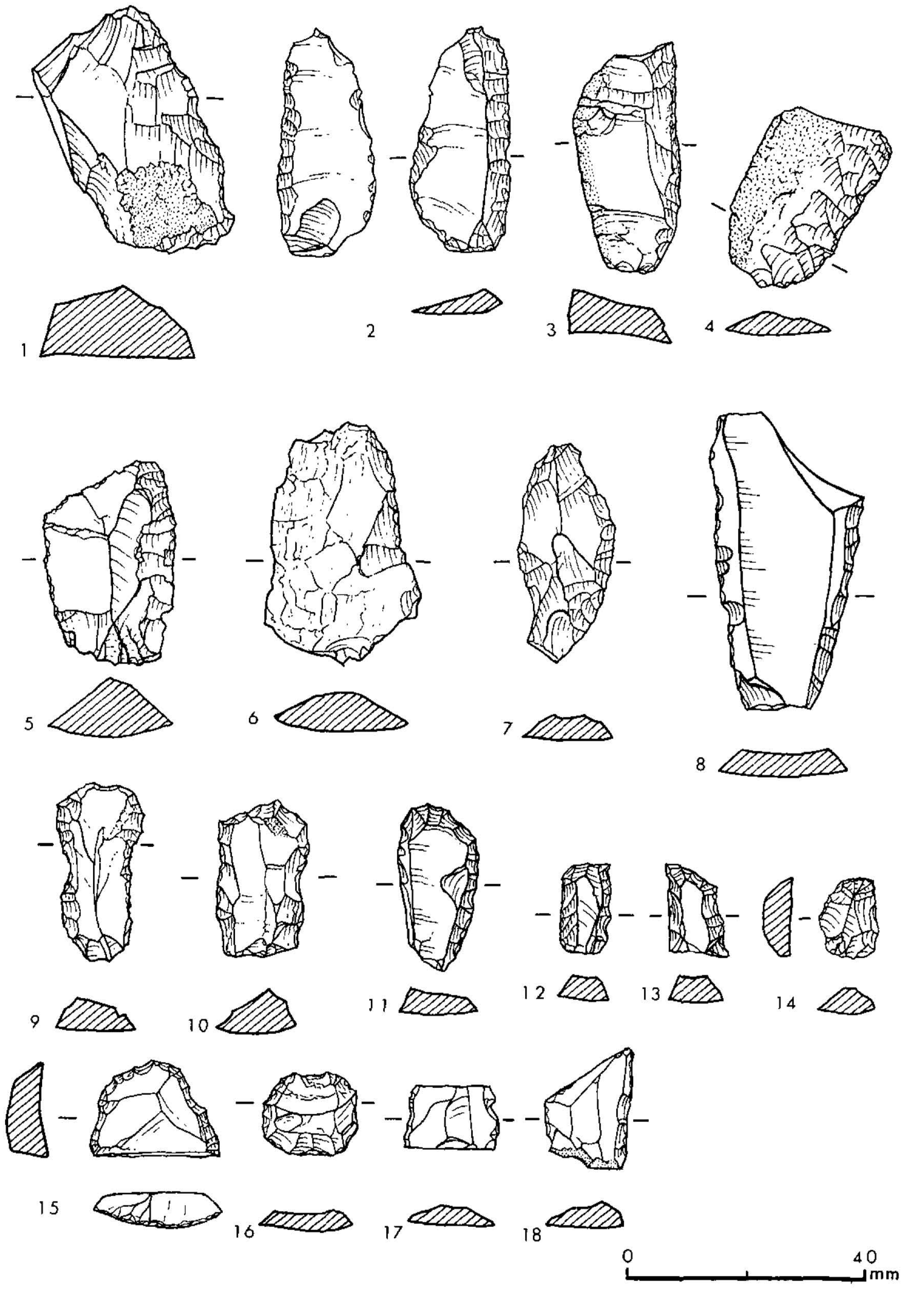
Broken edge retouched artifacts have a length of edge modified as above, but the artifact has been broken so that the original morphology can be longer be ascertained.

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

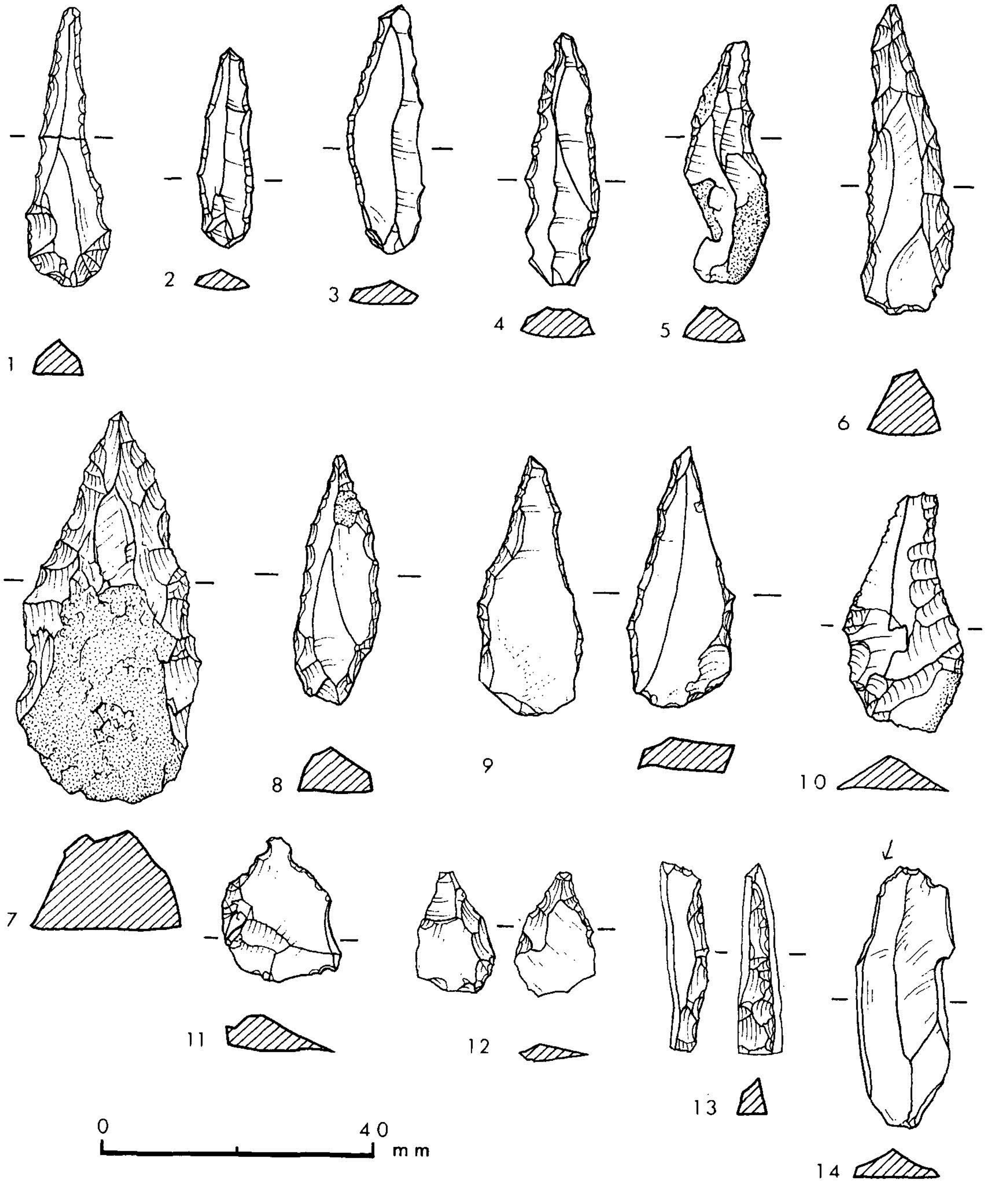
RETOUCHED BLADE SEGMENTS (Ill 57. 17–18)

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. (Image by Marion O'Neil)

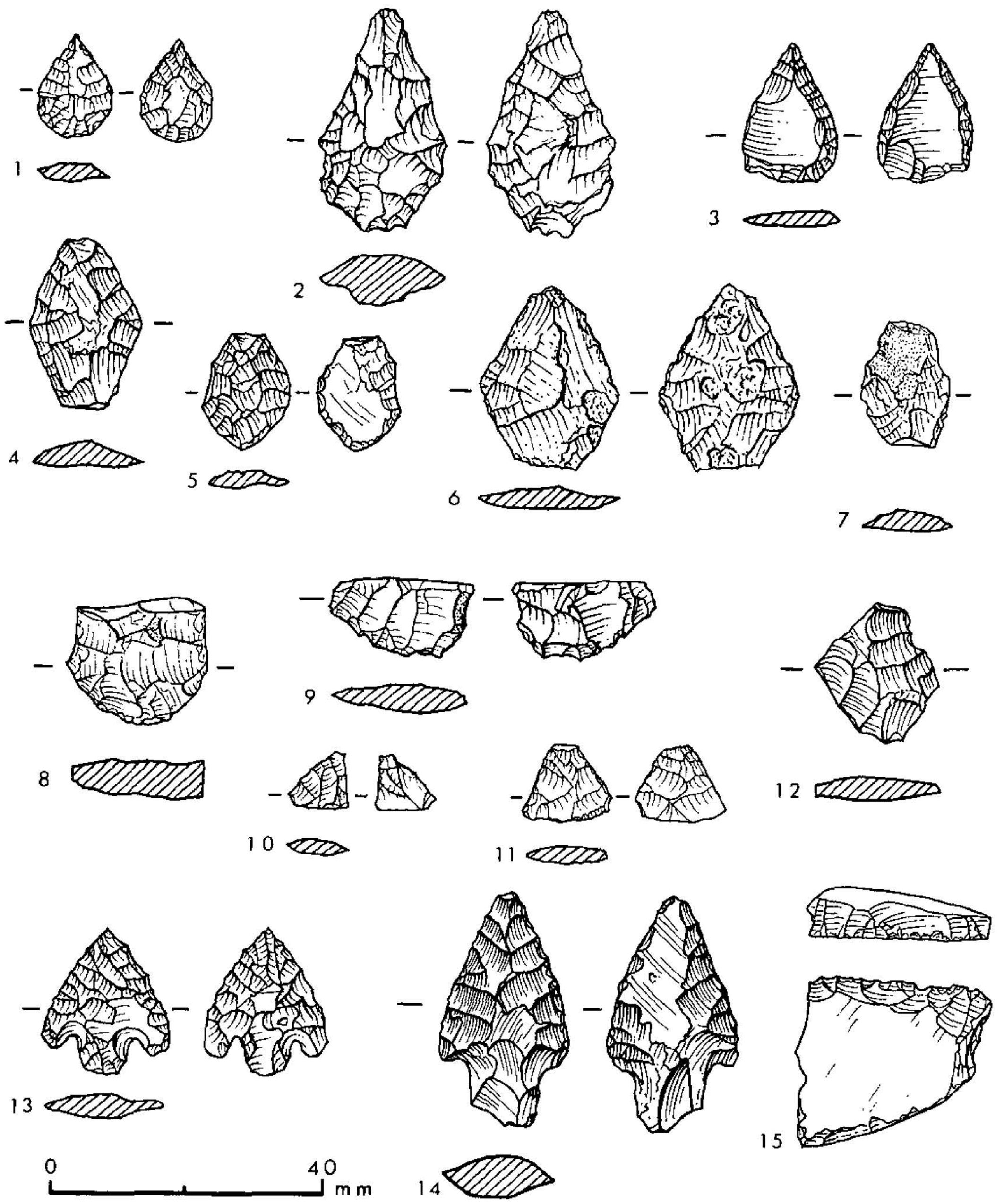


ILL 58: The lithic assemblage, modified artifacts: 1-12 borers: 13 burin spall: 14 burin: 6, 8, 10-14 bloodstone: 1-3, 7, 9, flint: 4-5 abraded. (Image by Marion O'Neil)

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. (Image by Marion O'Neil)

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.

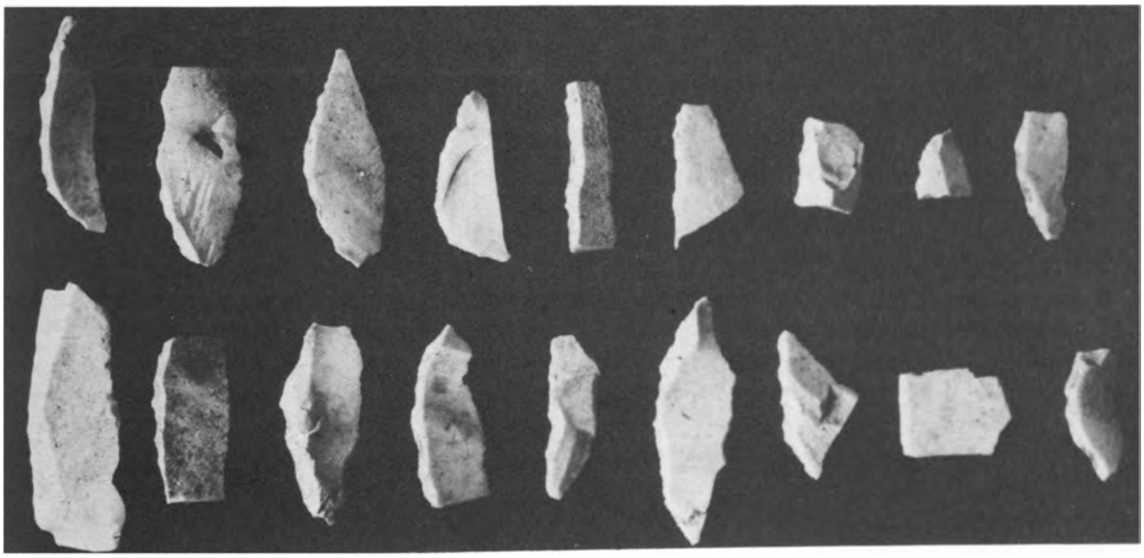
GUNFLINT (Ill 59. 15)

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.

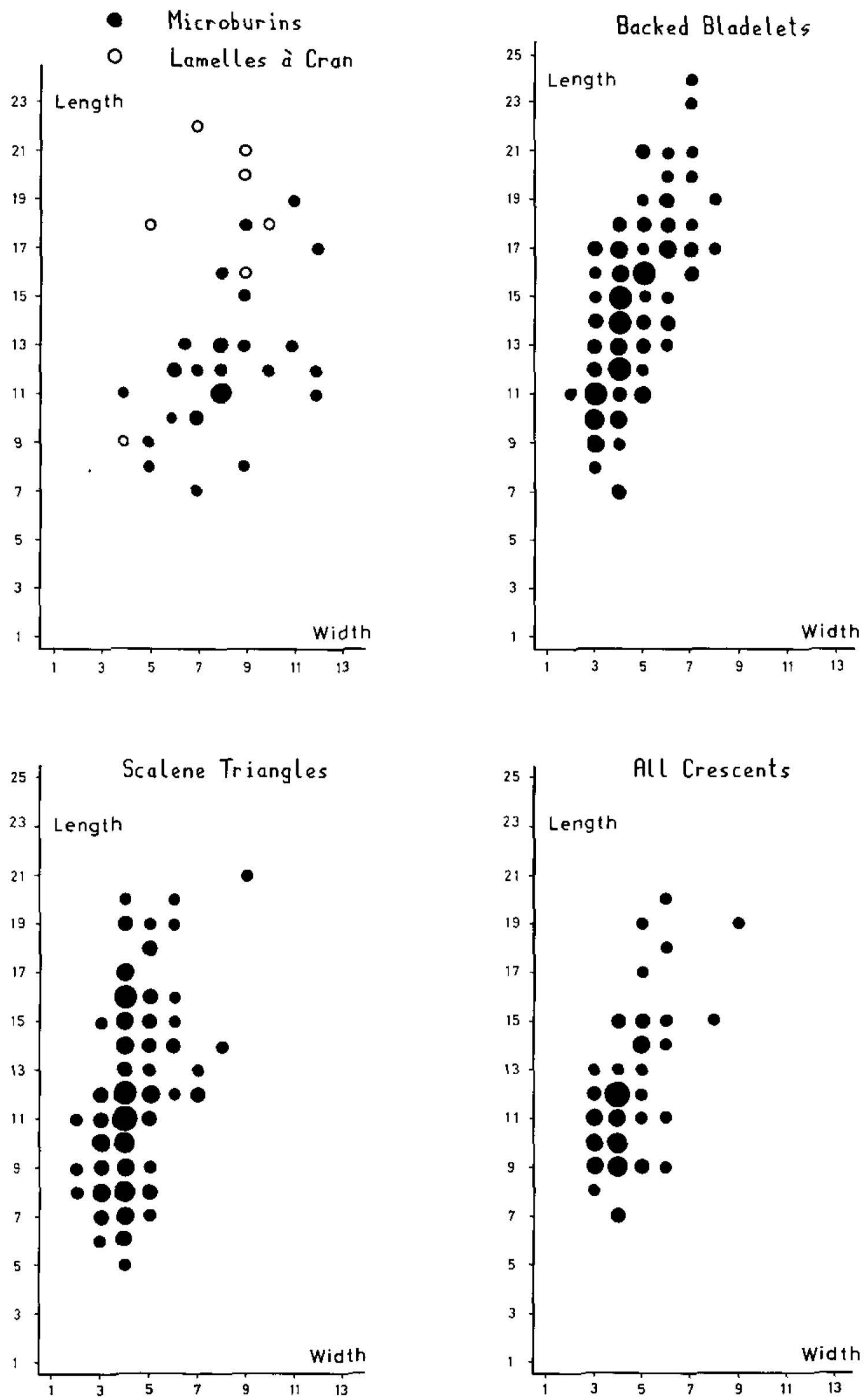
MICROLITHS (Ills. 60–64)

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.

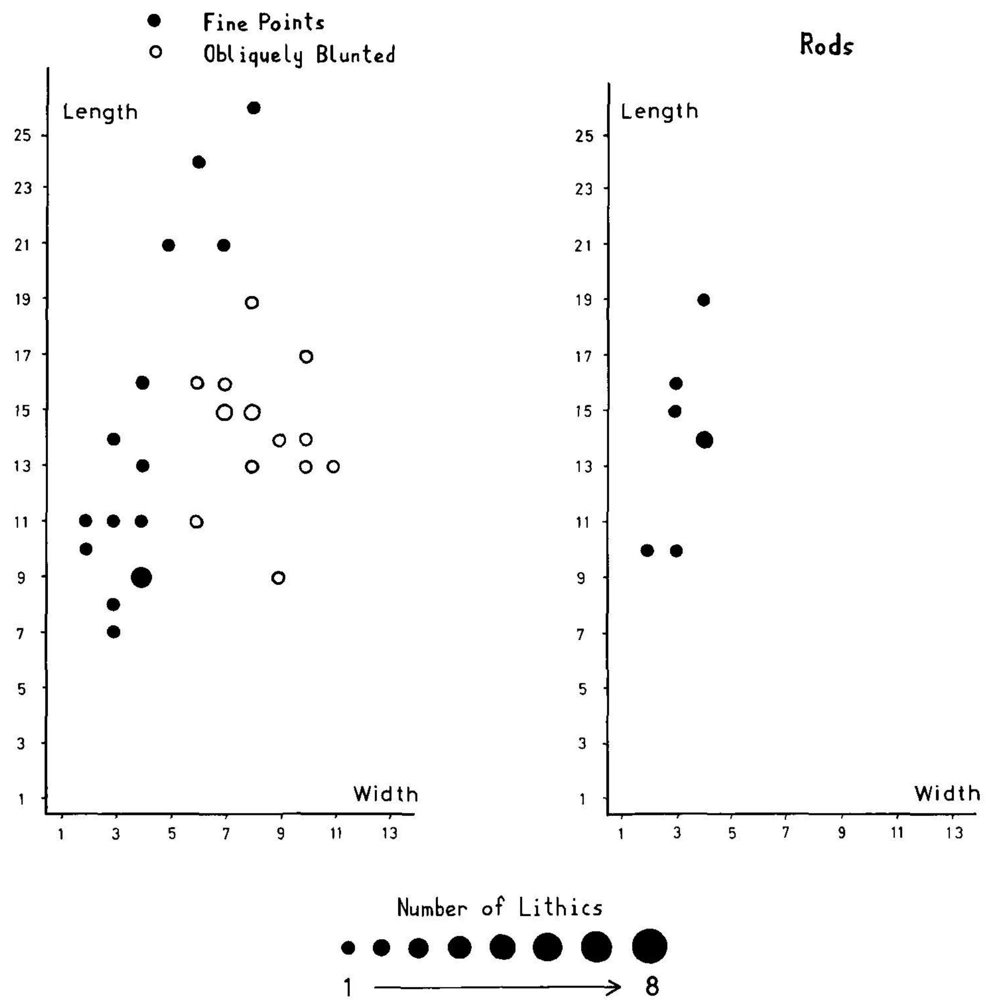
The assemblage contained 1,155 microliths. They were



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).

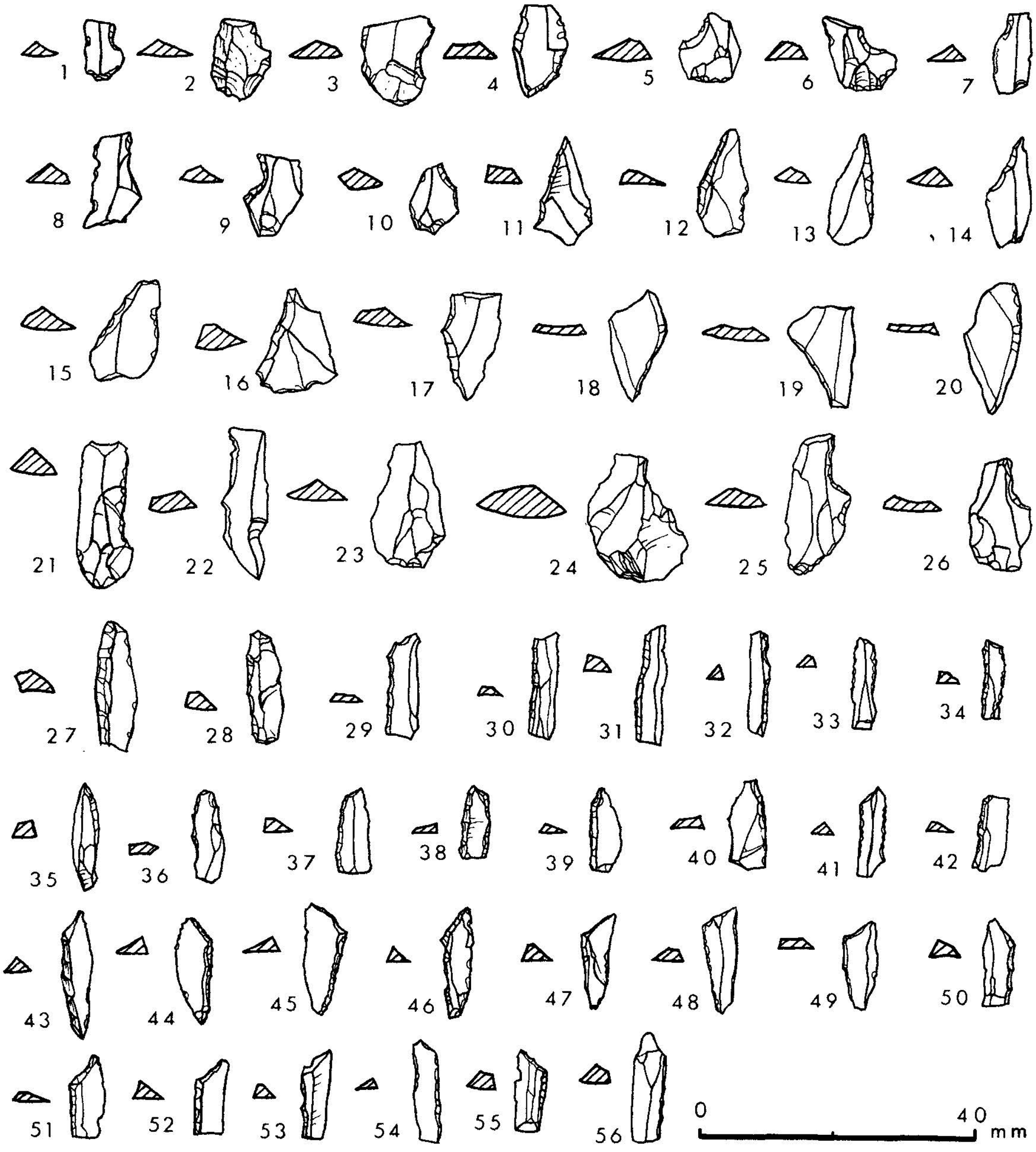
manufactured on blades of distinctive size (narrow blades; Chapter 6) in both bloodstone and flint. Many were abraded and their surfaces were altered to the extent that it was difficult to distinguish the material of which they were made, but flint was apparently preferred (as with all artifacts based 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. (Image by Marion O'Neil)

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.

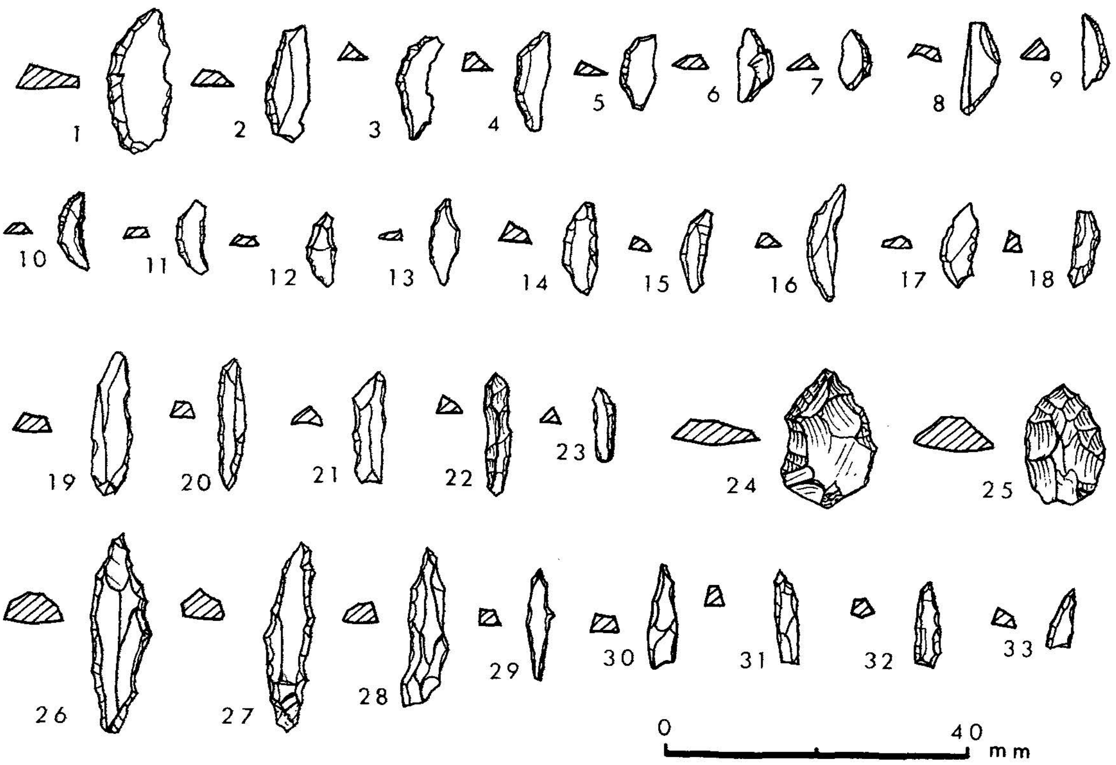
LAMELLES À CRAN (Ills 61; 63. 21–26)

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. (Image by Marion O'Neil)

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; they are shorter than
both size and shape, but in general with a greater variety of 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 [illegible] Flakes	Irregular [illegible] Flakes	Quartz	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:

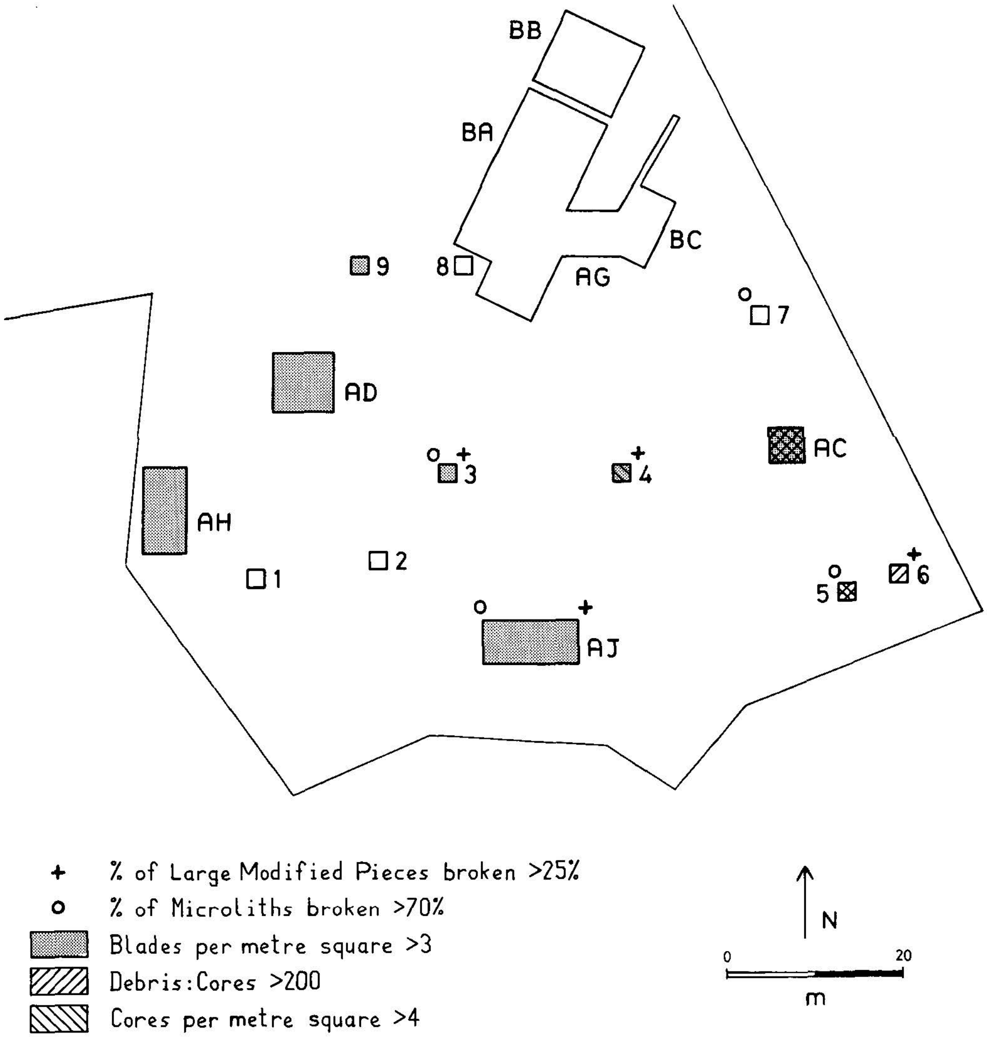
Deposits resulting from tool manufacture.
These should contain high quantities of debitage, as well as many cores and large numbers of regular flakes (it is likely that regular flakes were a by-product of the manufacture of blades at Kinloch, Chapter 6). If the knapping was *in situ*, or if the waste 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

Sample Sq.	Flakes/Cores	Microliths/m2	Cores/m2	Blades/m2
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

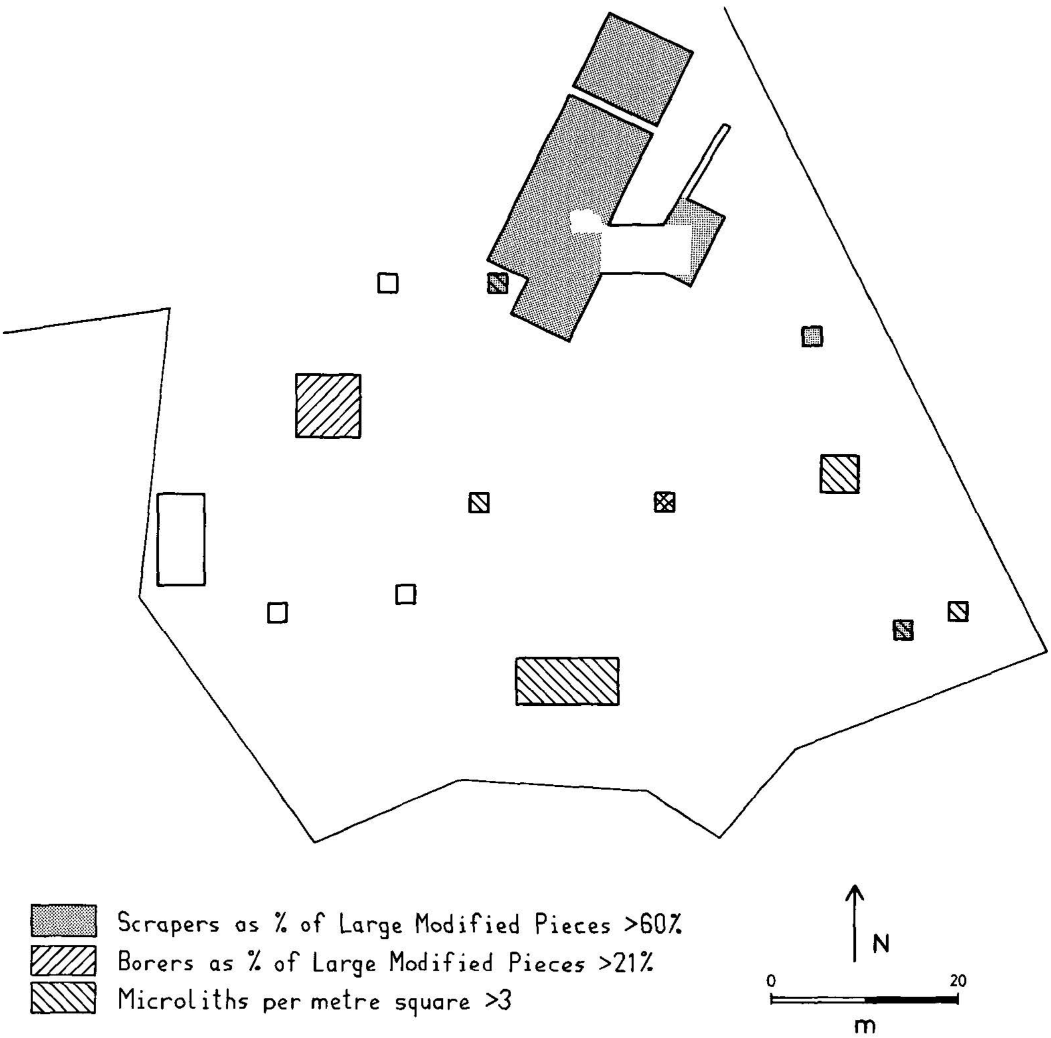
The spatial analysis was based on visual observation, the nature of the site and excavation was such that statistical analysis could not be applied (Whallon Jr 1978). Initially, the absolute quantities of the different artifact types in separate trenches were examined. This revealed some differentiation, 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

	Scrapers %	Borers %	Edge Retouched %	Miscellaneous %	Invasive %	Retouched Blade Segments %	Scraper Resharpening %	Retouched Flakes %	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

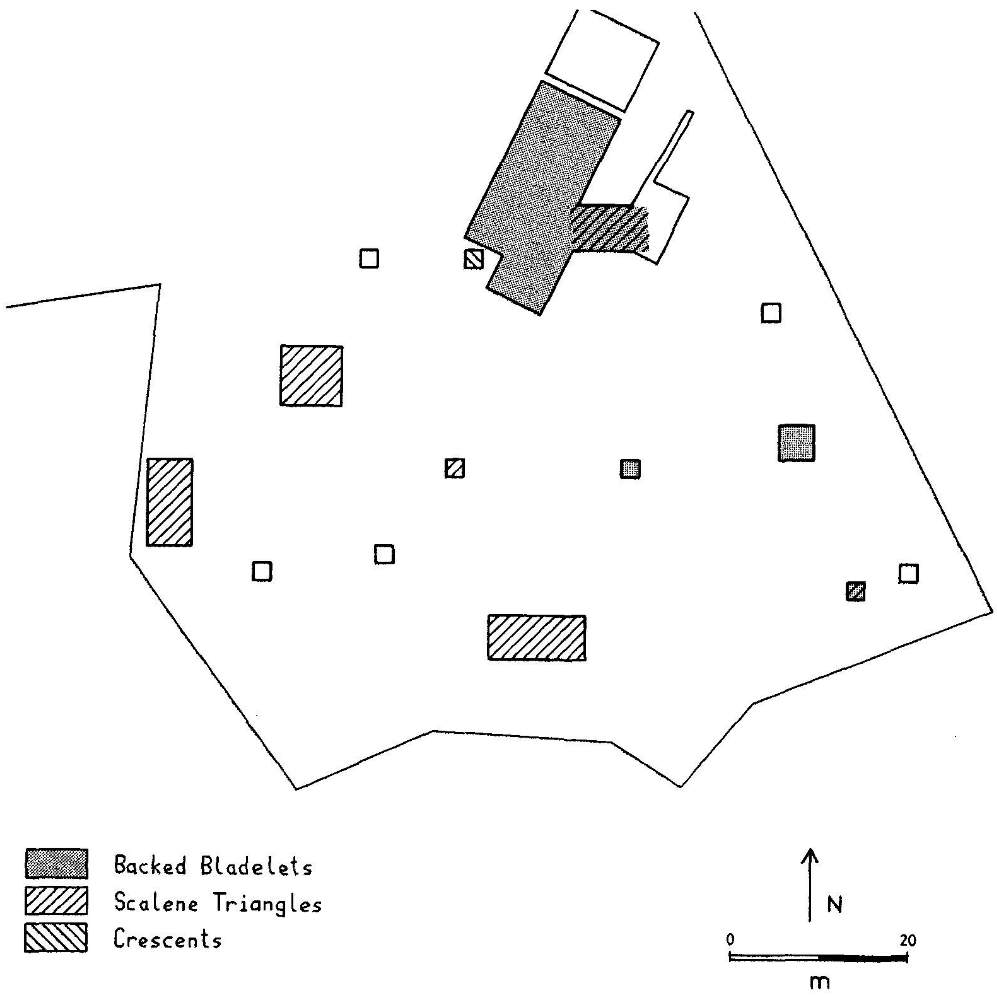
Trench AD (Tab 14) The mesolithic pits within the AD complex cut into each other, and they had probably filled relatively rapidly, consequently it was difficult to separate the contents of the individual pits. As might be expected, the larger and most recent pits had larger assemblages, whilst Pits AD 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



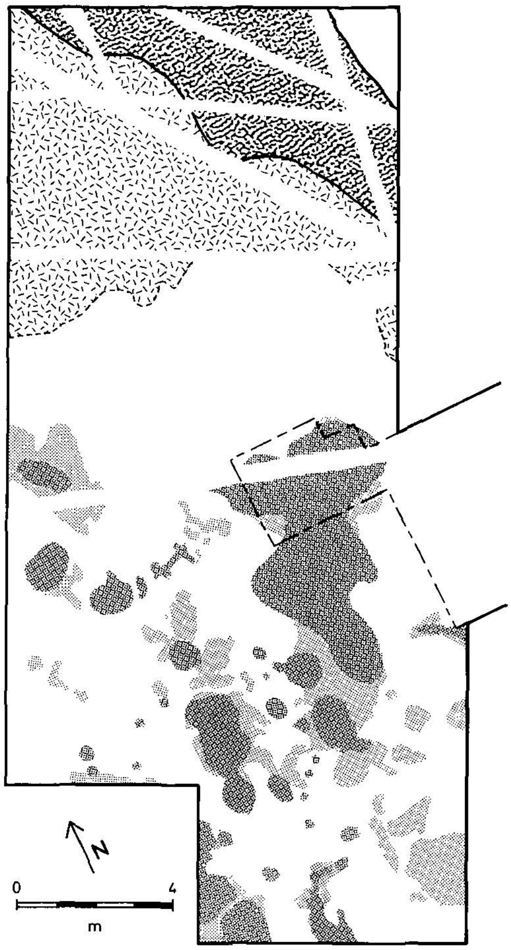
ILL 67: Artifact distribution across the site: dominant microliths.

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.

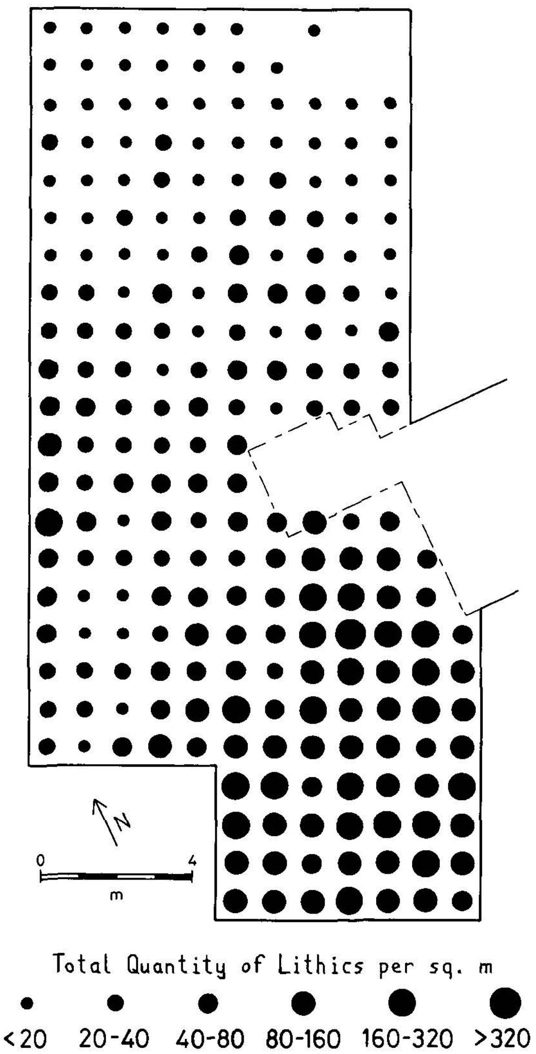
The knapping debris was concentrated in the S, but it still dominated the assemblage from Trench BA, and in this trench discrete concentrations could be highlighted. In some cases, the absence of cores associated with concentrations of knapping debris is cause for surprise, but work done elsewhere has 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



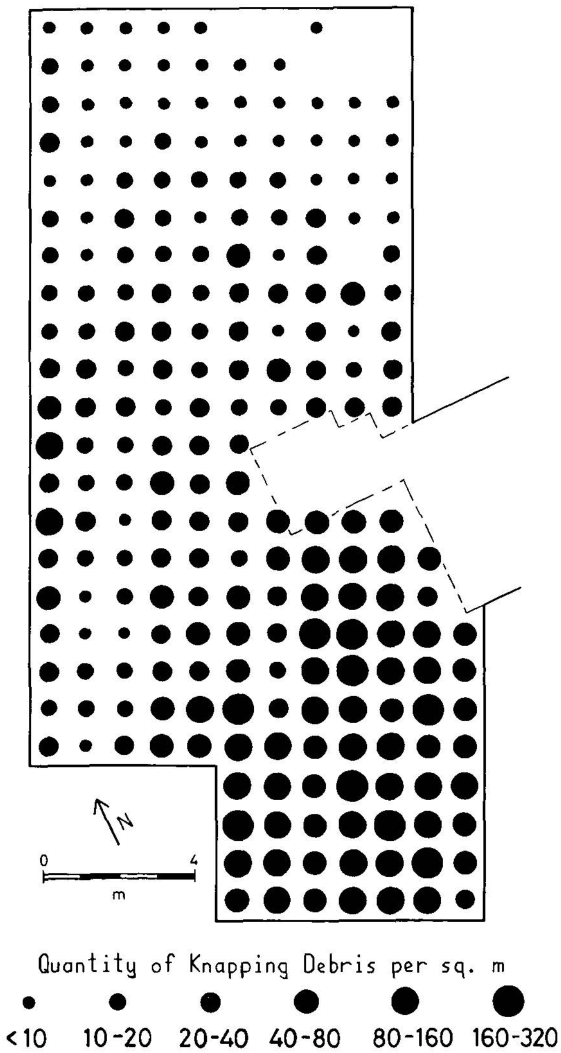
ILL 68: Trench BA: features.

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

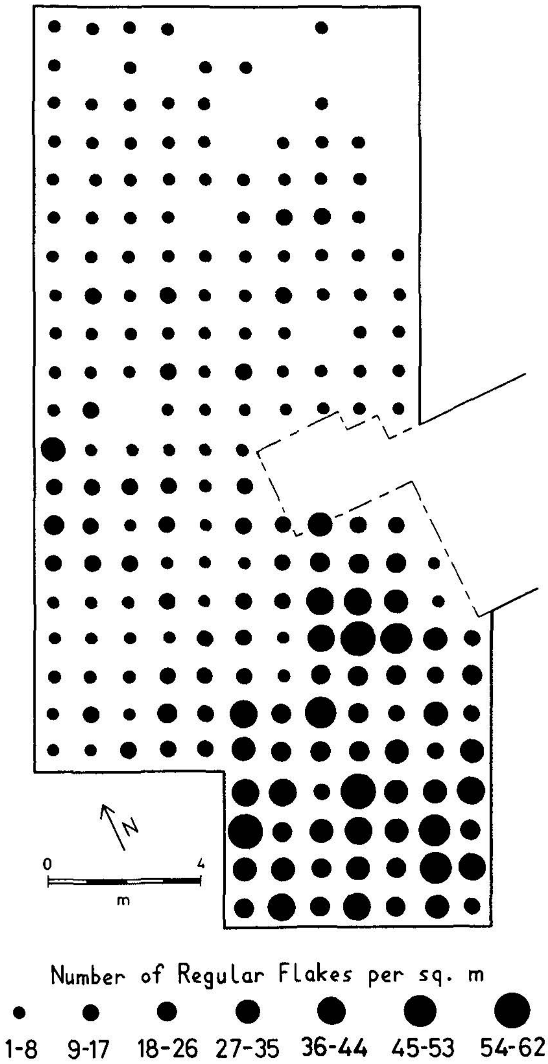
Trench BA yielded few modified artifacts, and there was little spatial variation across the trench. Microliths were not common at all, in either the features or the ploughsoil (though it is notable that the majority of the crescents from the site came from this trench); they were most abundant in the 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).



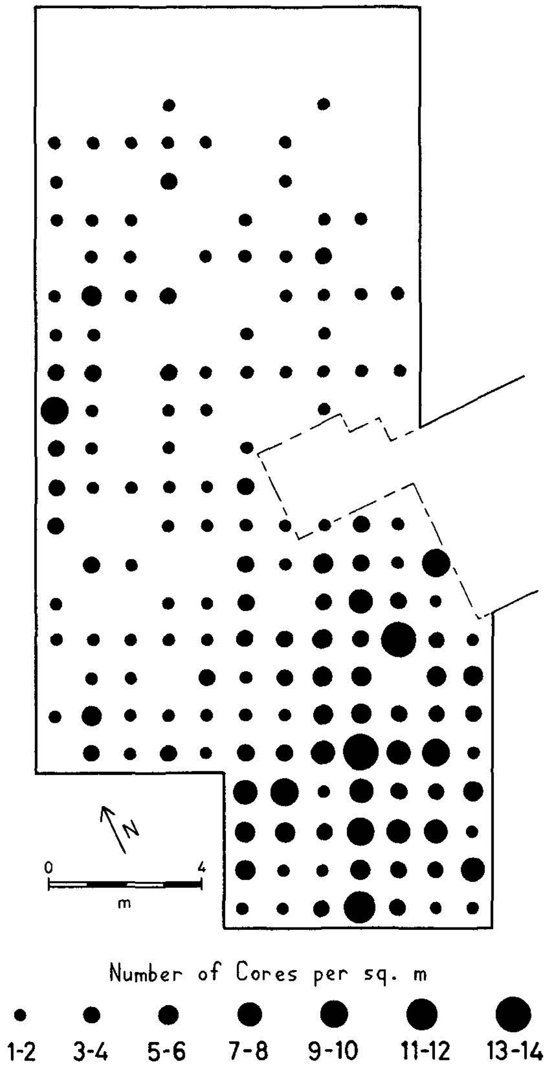
ILL 69: Trench BA: distribution of the total lithic assemblage.



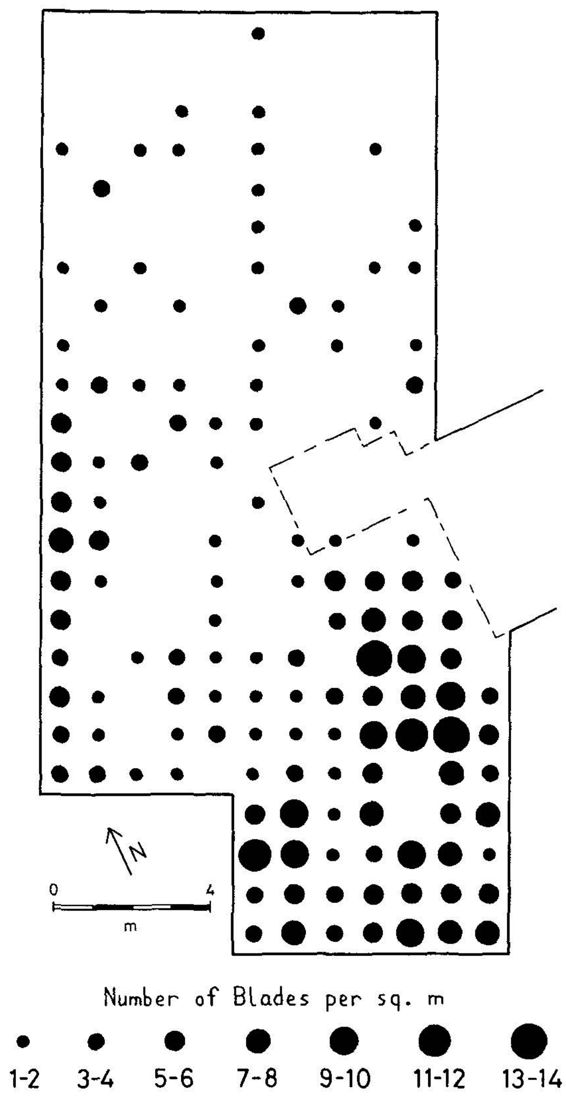
ILL 70: Trench BA: the distribution of knapping debris.



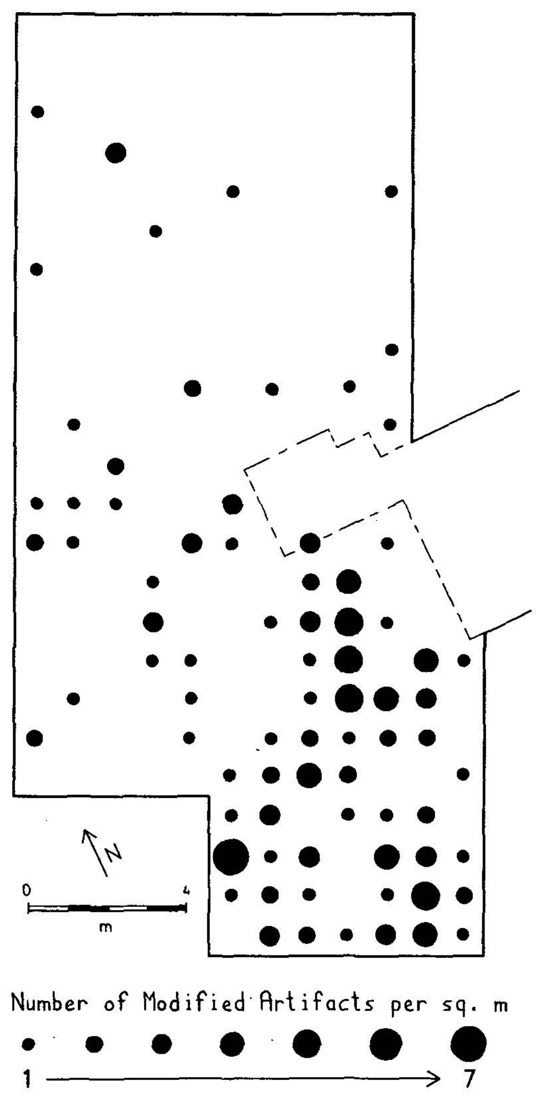
ILL 71: Trench BA: the distribution of regular flakes.



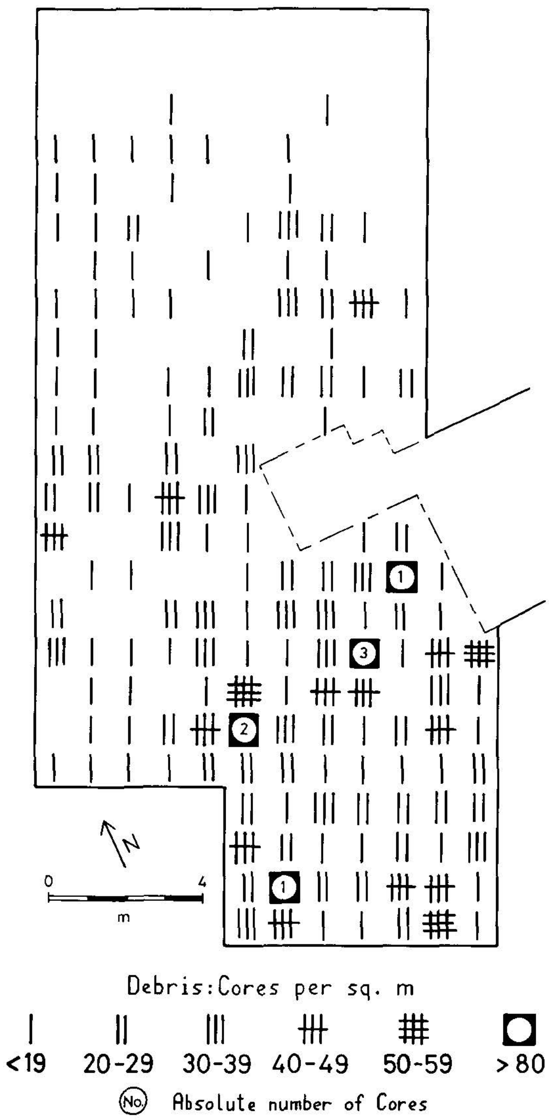
ILL 72: Trench BA: the distribution of cores.



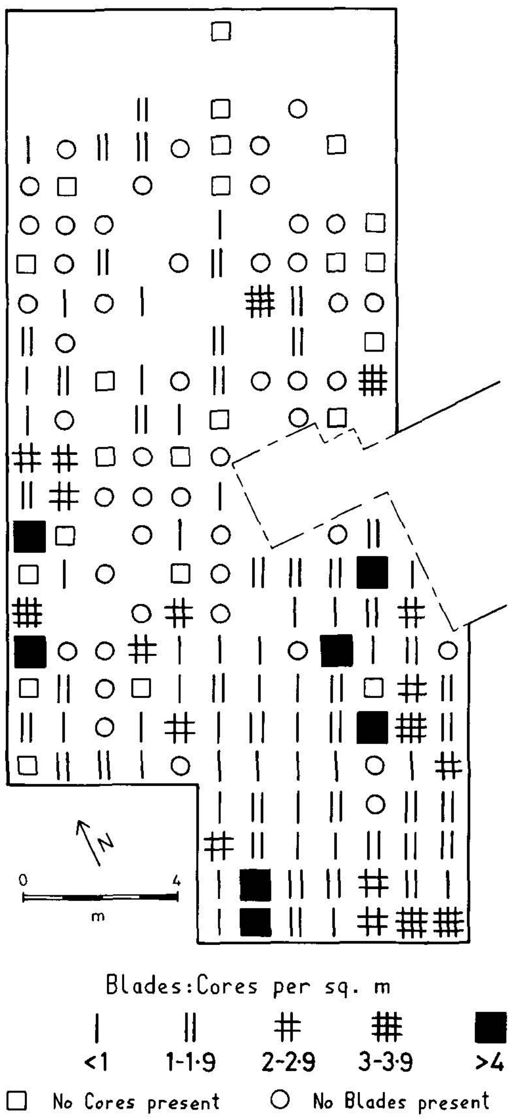
ILL 73: Trench BA: the distribution of blades.



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 Grav. %	Inverse Points %	Double Edge Crescent %	Others %	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	Inverse 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 (Fragments – Obliquely Blunted) | Non-Microlithic (Scrapers – Burins)

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

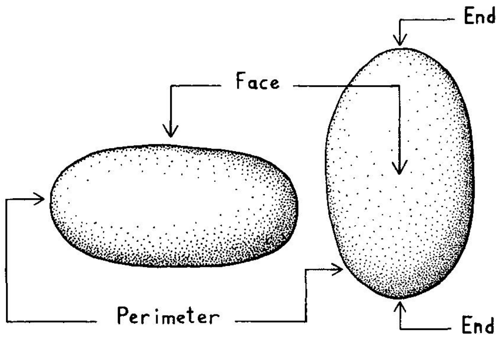
9.1 COARSE STONE TOOLS A CLARKE

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.

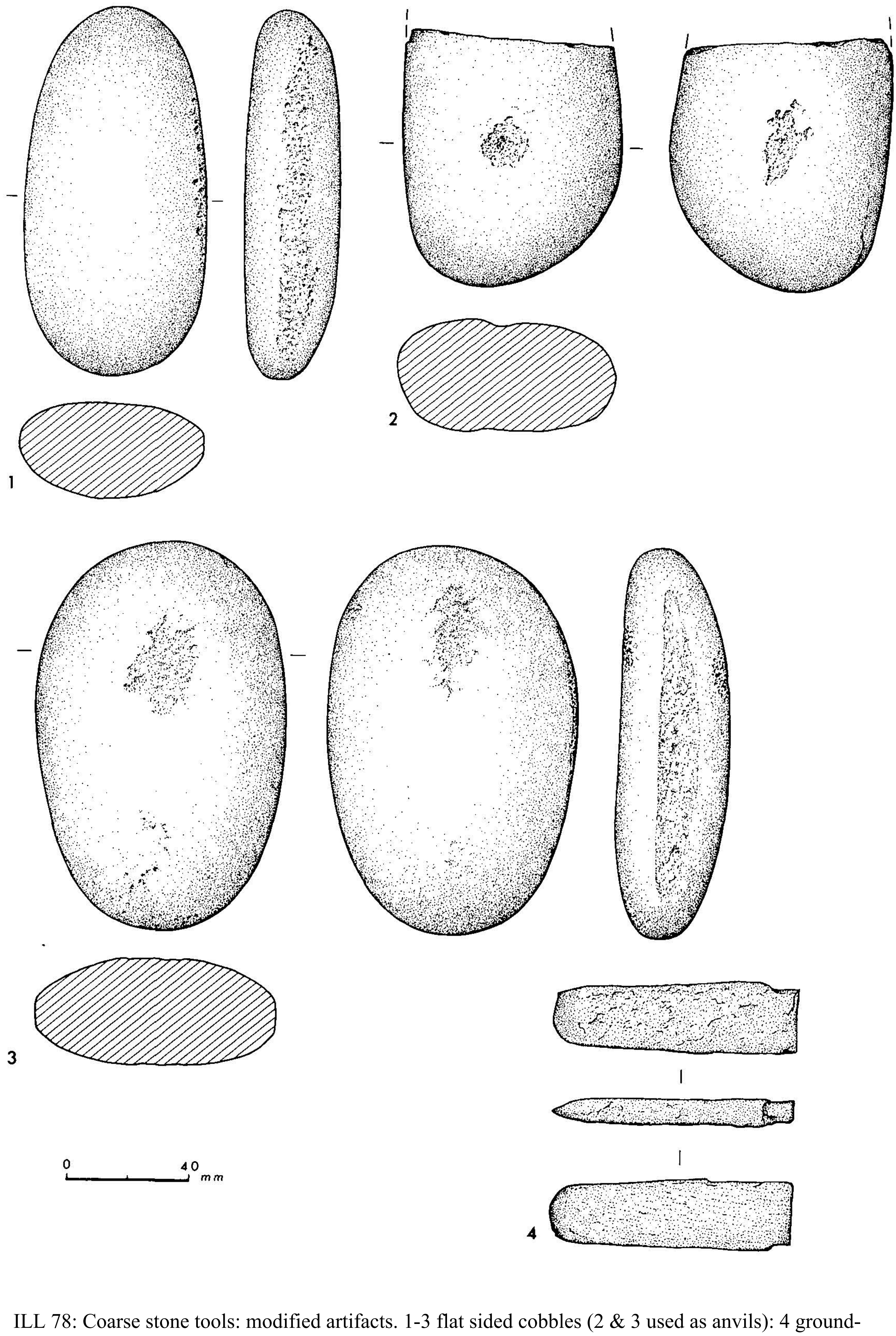
The other four modified artifacts are all oval sandstone cobbles. They vary in grain size from a coarse grit to a fine grain; all are of similar size and shape, and all have a flat cross-section. The two long sides of each cobble have been pecked flat, and possibly finished with grinding (Ill 78. 1–3). 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	-	2		
Anvils	2	2	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. (Image by Marion O'Neil)

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: I. (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.

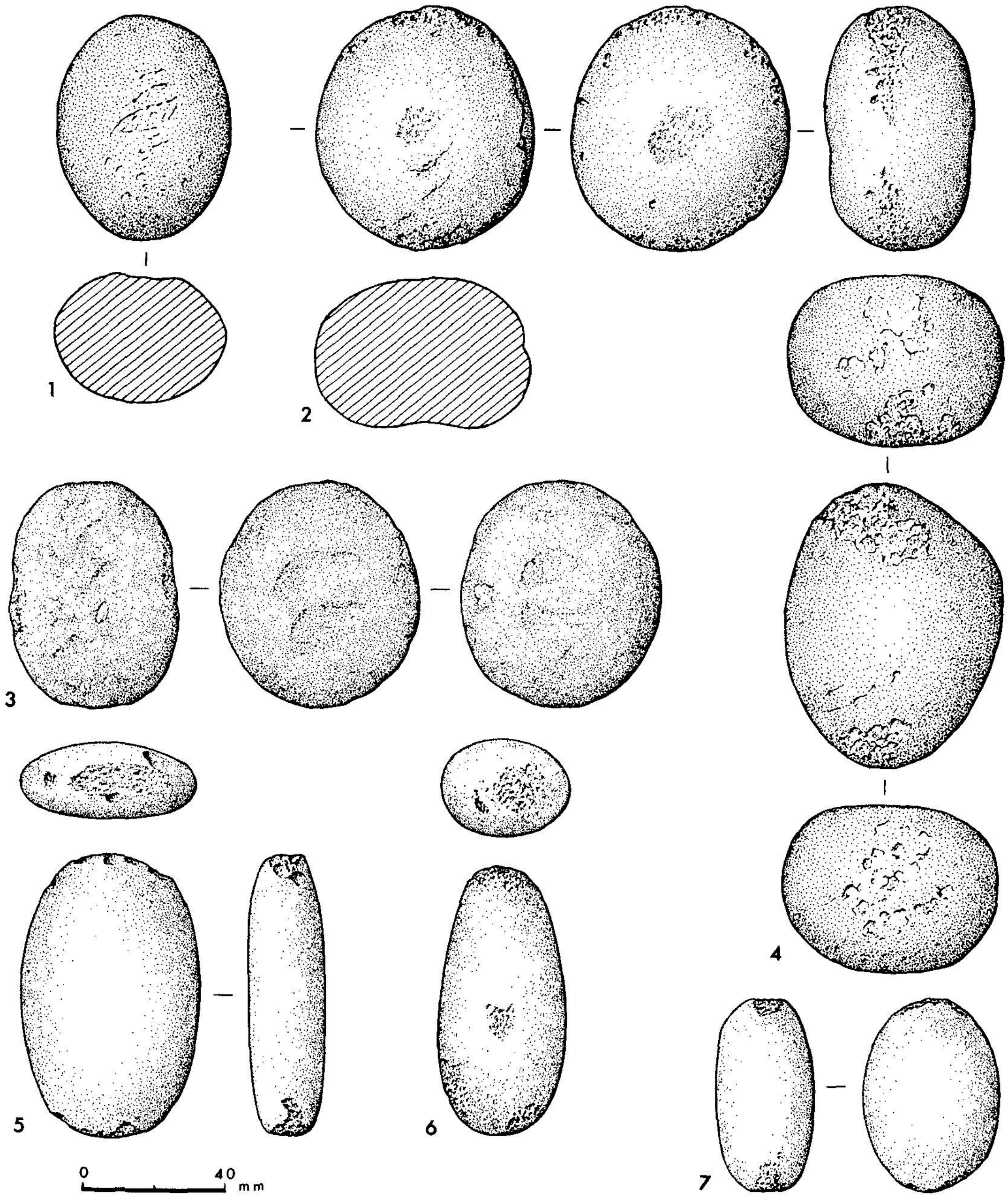
ANVILS (Ill 78. 2–3)

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

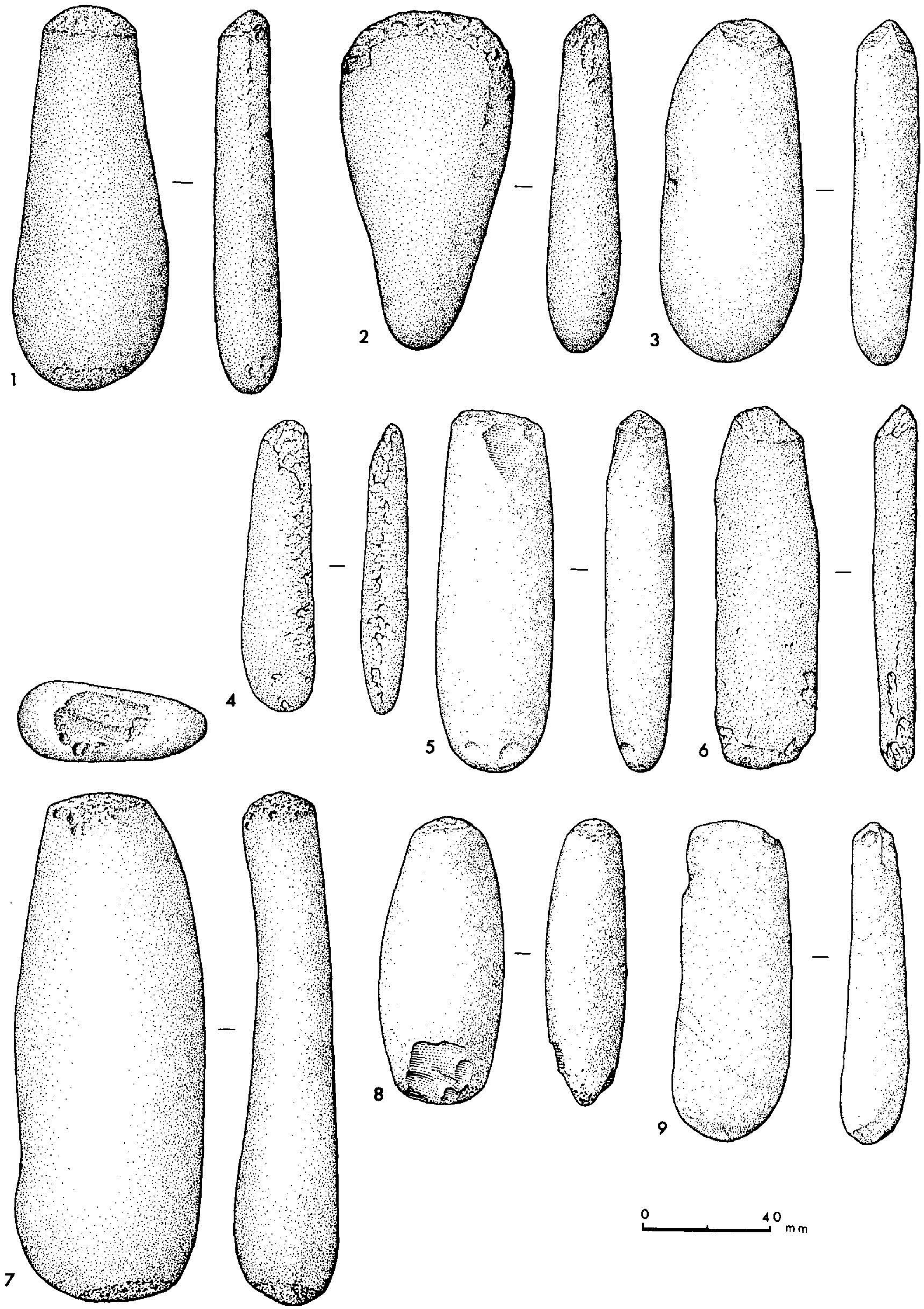


ILL 80: Coarse stone tools: hammerstones. 1-3 rounded hammerstones: 4 plain hammerstone: 5-7 faceted hammerstones. (Image by Marion O'Neil)

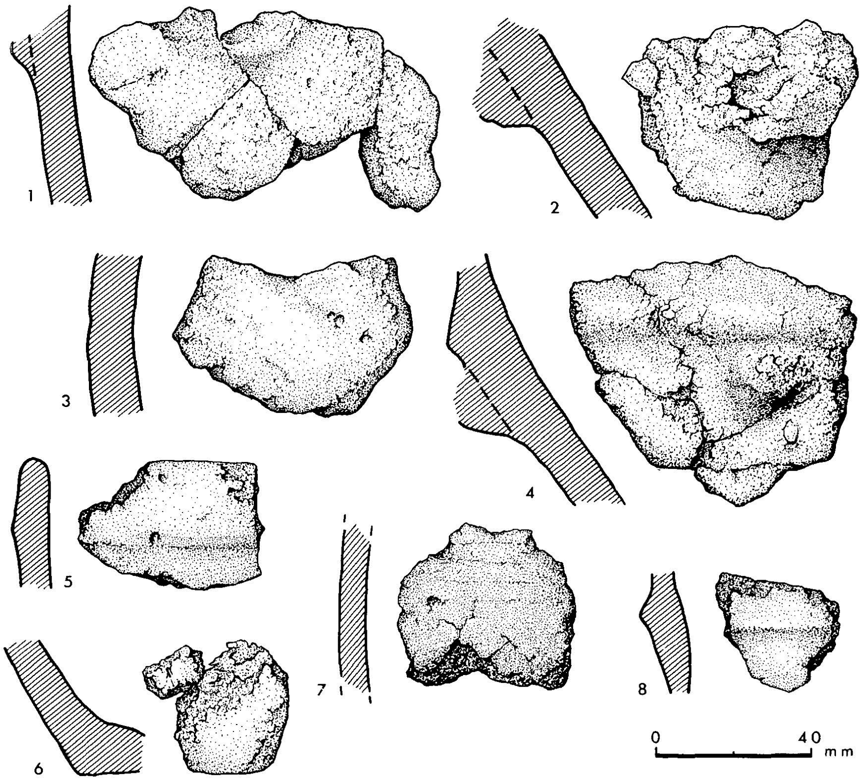
hammerstones. The blanks for the faceted hammerstones were generally smaller than those used for the other tools, but they were also more diverse in shape. Plain hammerstones were based on cobble blanks of diverse size and shape and, as noted above, many may simply be little used artifacts from the other 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. (Image by Marion O'Neil)



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).

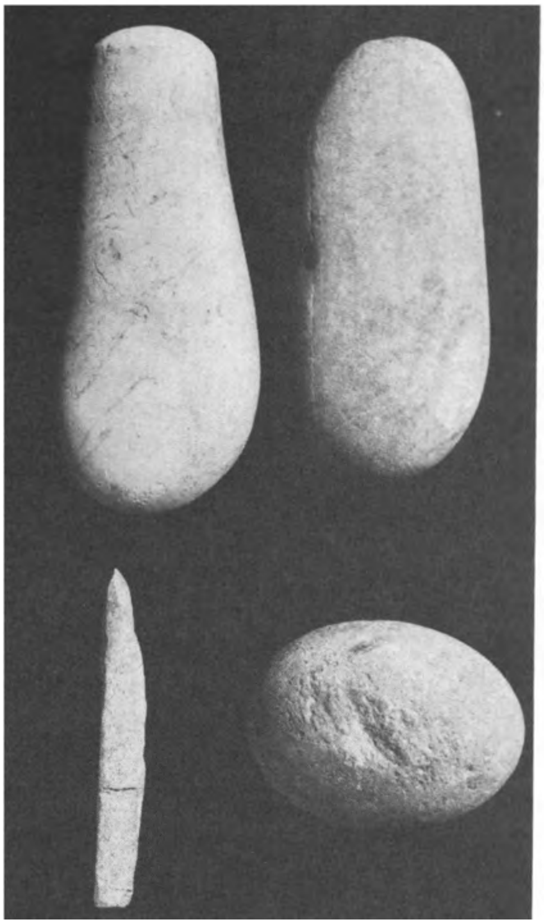
There are no clear associations between the different types of coarse stone tools. Despite their possible mutual use in the process of bipolar reduction, anvils and rounded hammerstones do not occur together. The single associated group (in the top of Pit AD 5) comprises predominantly one tool type (bevelled 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

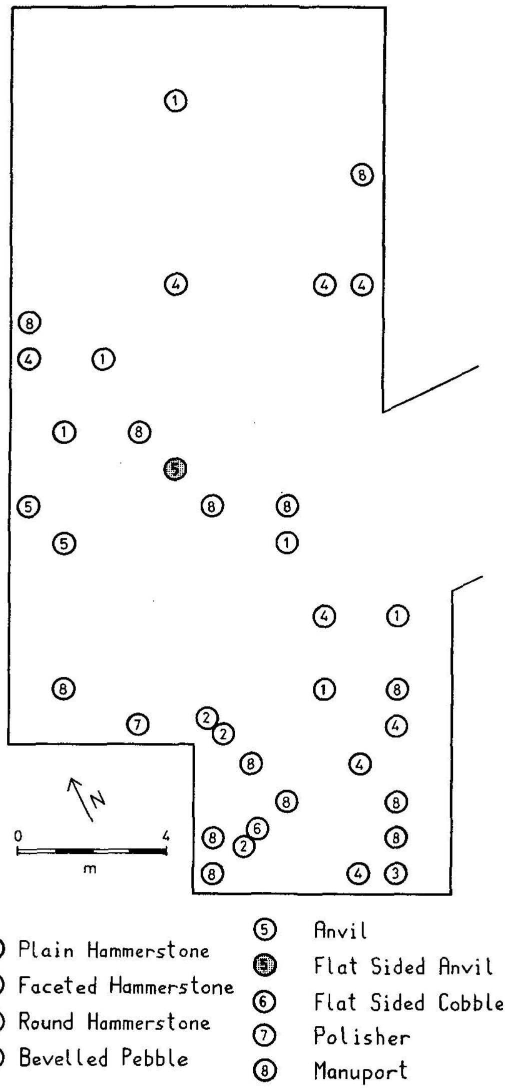
Hammerstones are difficult to date as their functions, and the wear produced, are not usually period specific. At Kinloch hammerstones occur in both mesolithic and later contexts.

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	·
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.

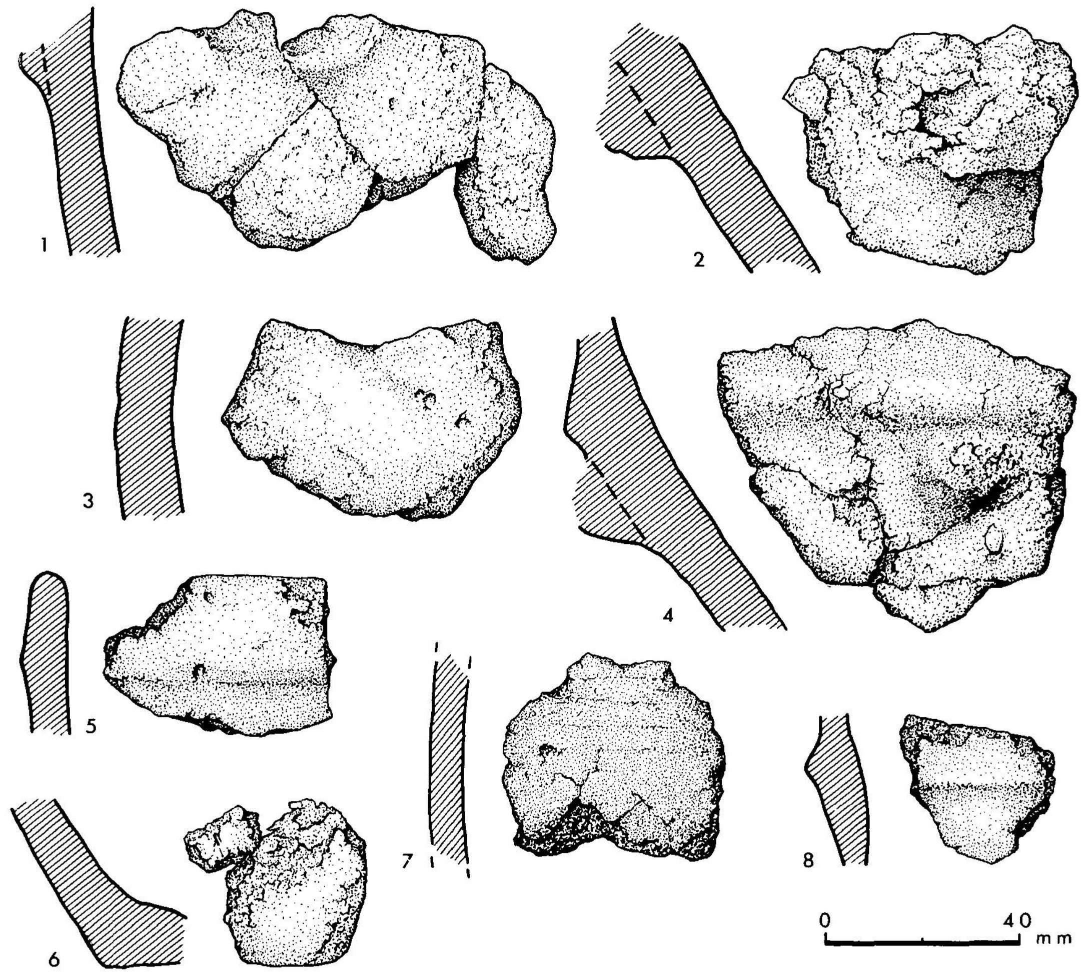
FORM AND FABRIC

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).



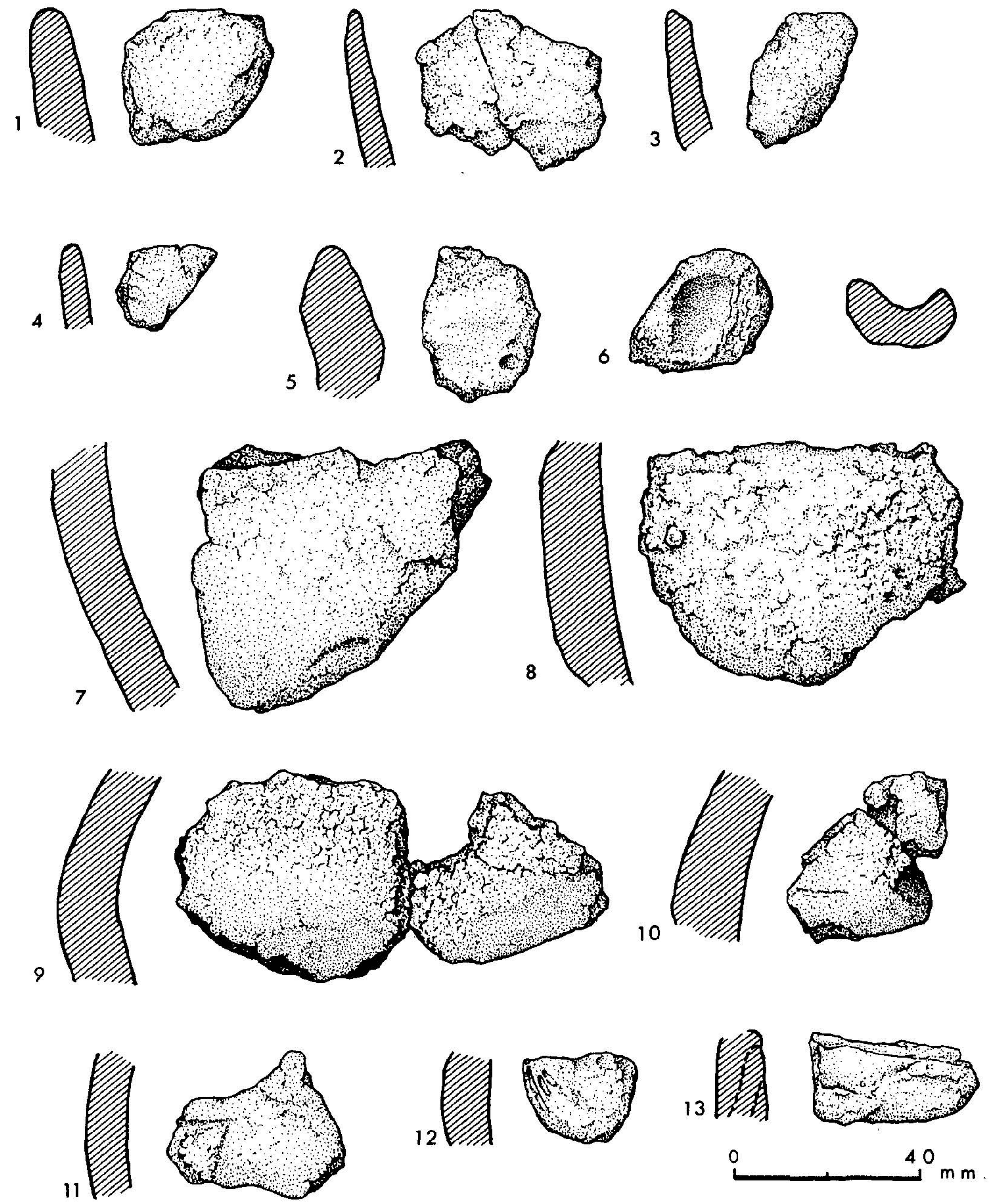
ILL 86: Pottery: 1 prepared edge for lug; 2 broken base of lug; 3 shoulder; 4 carinated shoulder above a broken lug; 5 rim with cordon; 6 base sherd; 7 burnished sherd; 8 sherd with carination. (Image by Marion O'Neil)

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. (Image by Marion O'Neil)

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

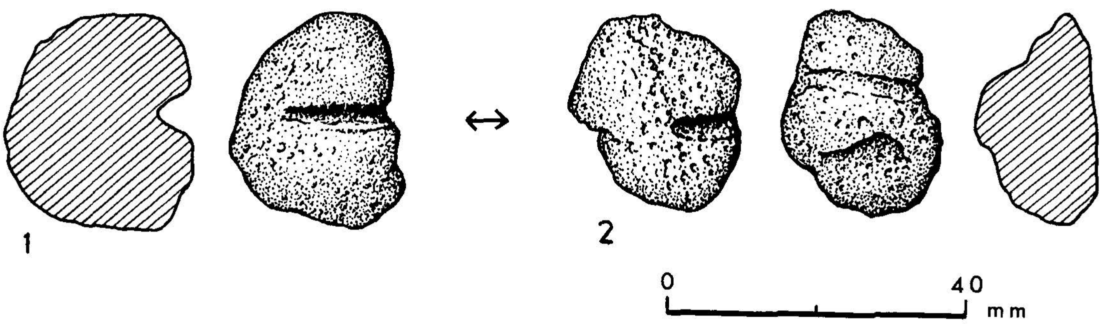
Exact parallels for the assemblage are difficult to cite. The few individual traits and forms which can be identified fit most comfortably into a middle neolithic context. The fabrics are like those of other Hebridean wares (Henshall 1972, 152–4), in the case of the 'corky ware' (fabric 4b), parallels 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. (Image by Marion O'Neil)

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	×	
Buried Soil	0.42 g			
Watercourse	0.99 g			×

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

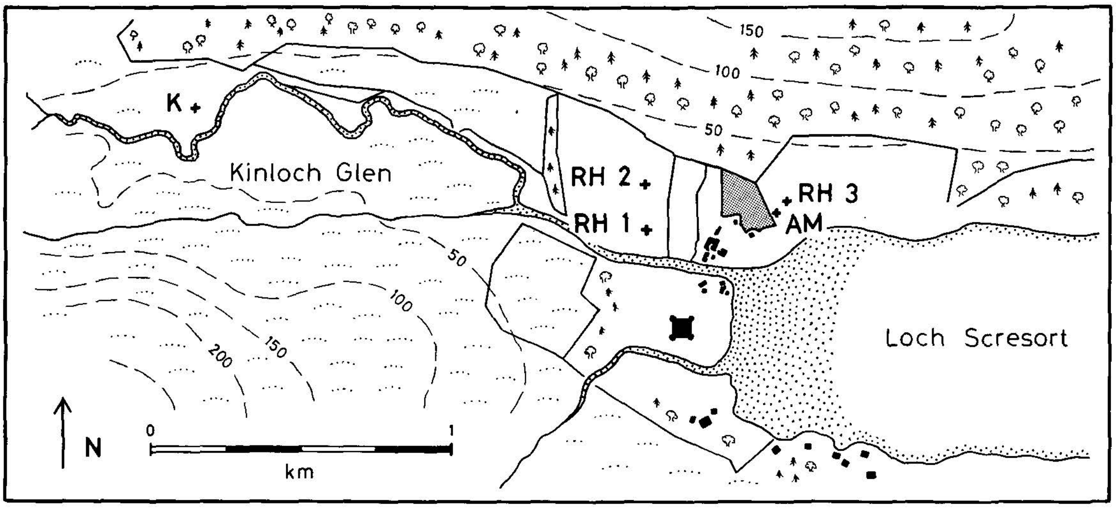
VEGETATION

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. RHl-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).

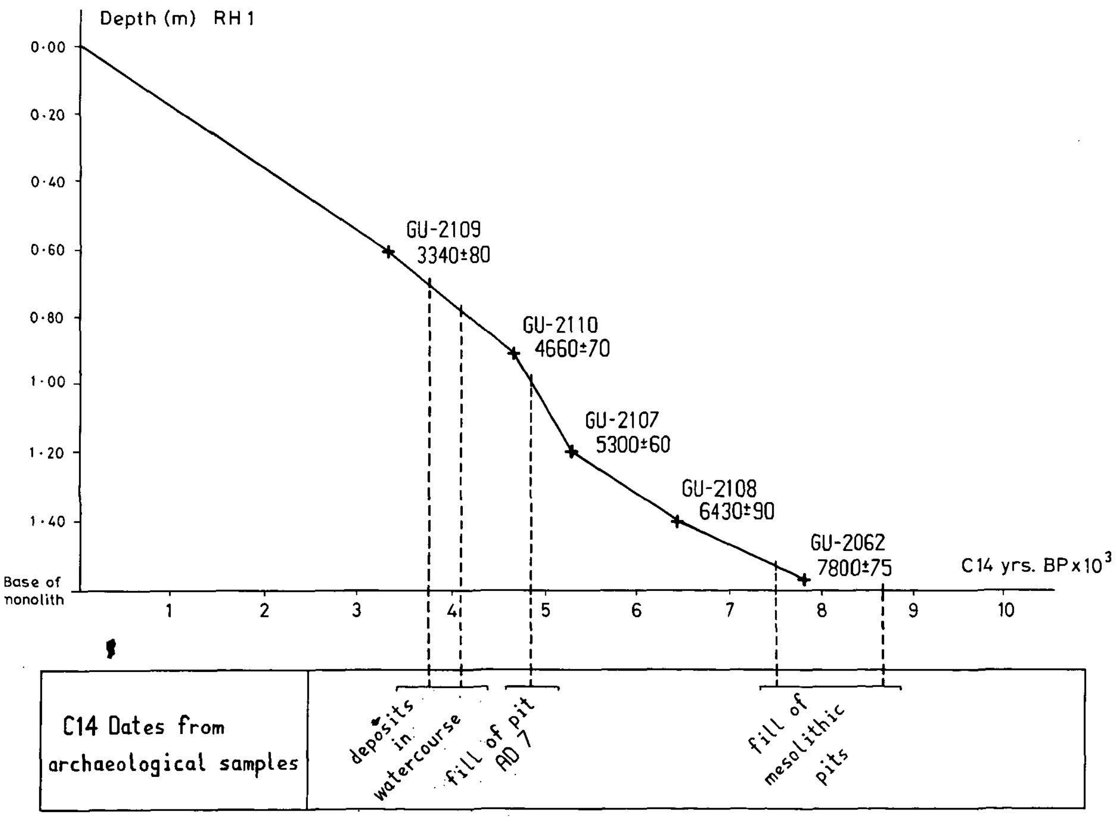
SOILS

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 O 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.

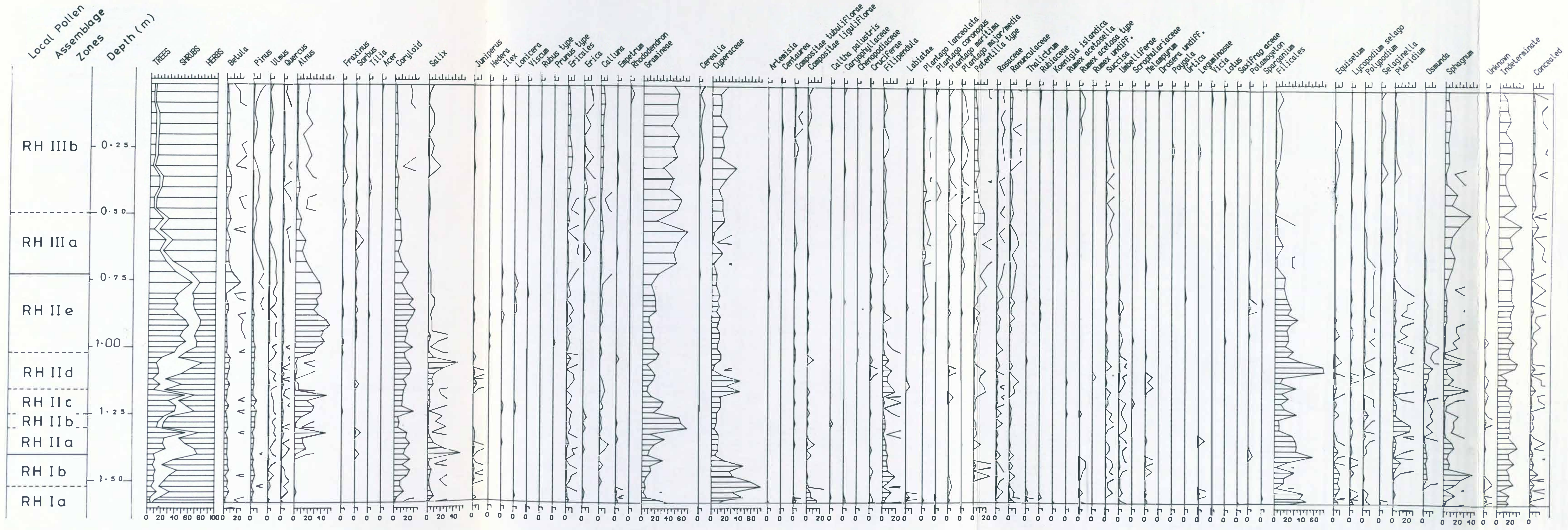
A combination of evidence suggests that the vegetation of the mire surface at the Farm Fields site was disturbed by fire at times throughout this zone (*cf* Bohncke 1988), and this disturbance could have contributed to the establishment of alder in the next zone (McVean 1956a). It is not possible, on 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.

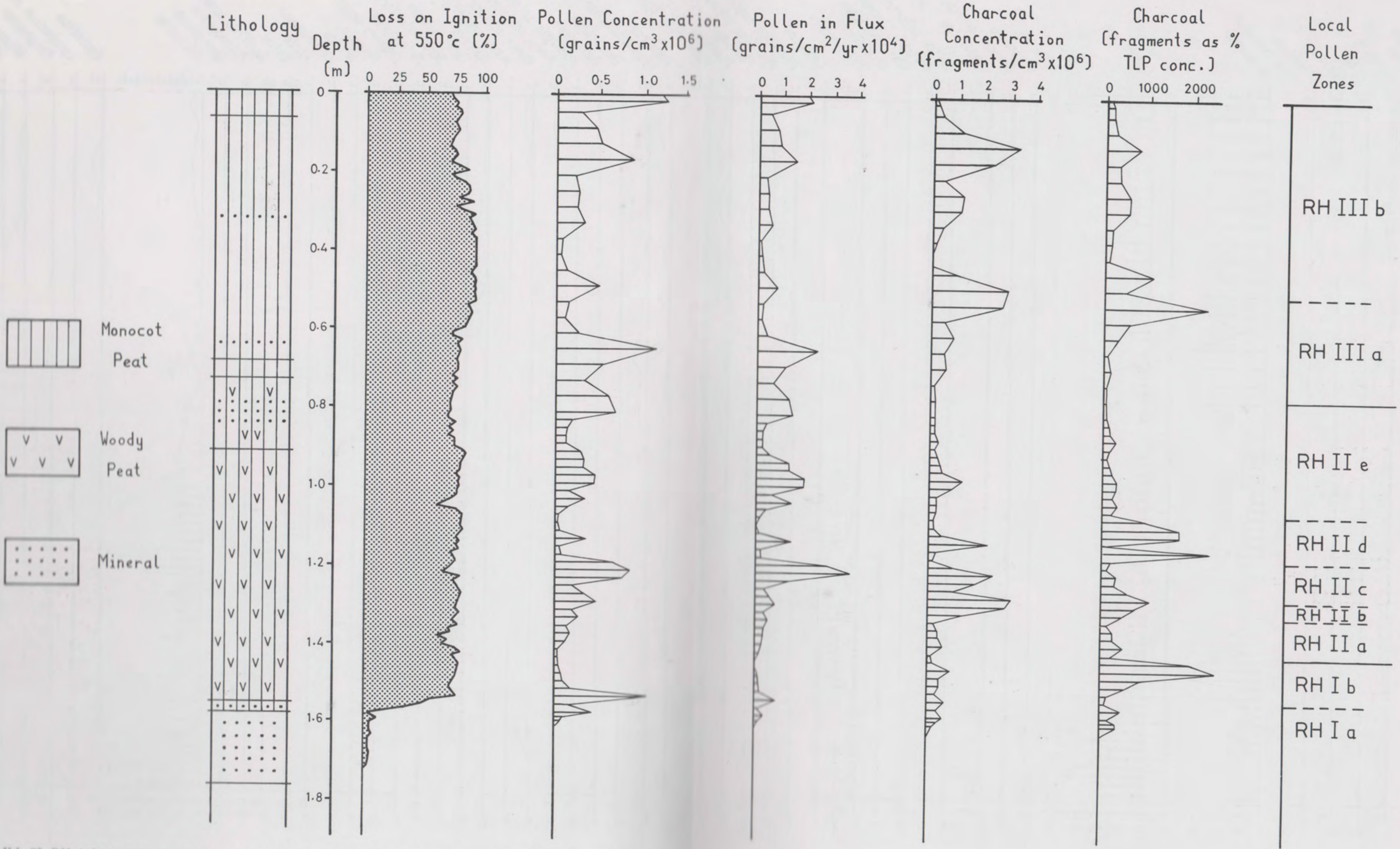
Zone II starts at the rise in alder pollen (6500 BP) and ends just after the beginning of the major decline of both alder and hazel/myrtle (pollen of hazel and bog myrtle is difficult to distinguish and is given the composite name Coryloid), pollen at the Farm Fields site. It encompasses zone RHII at 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.

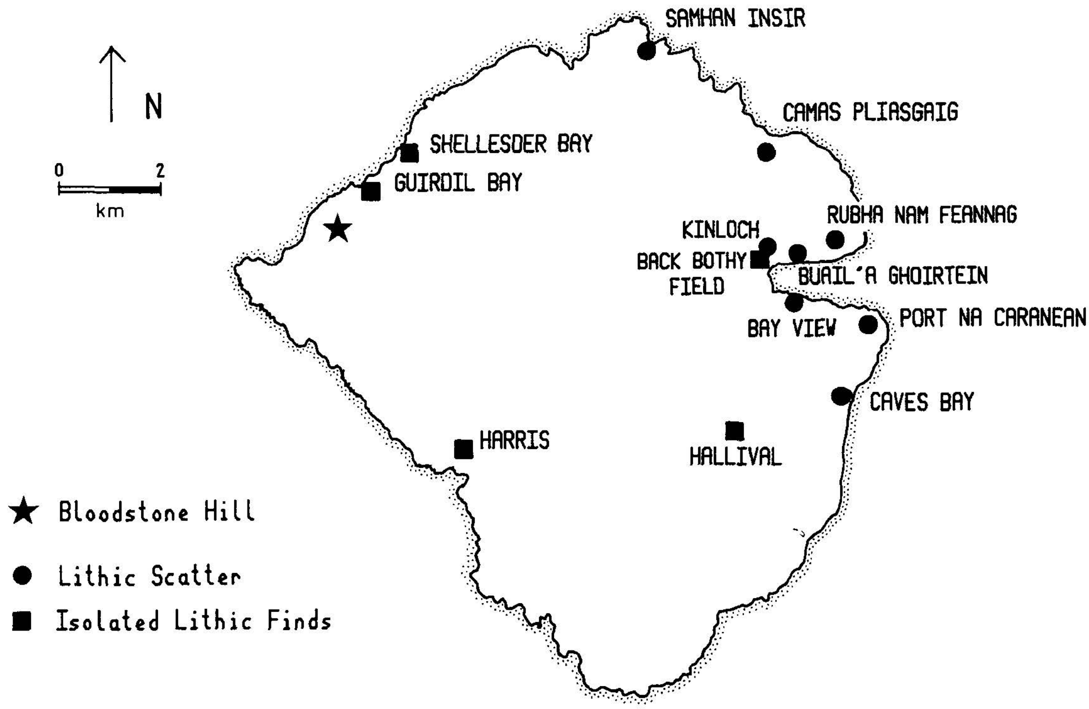
The evidence suggests that there has been little modification, due to natural processes, to the area of the site since occupation. The soil profiles preserve relict periglacial features, suggesting little total erosion, while at breaks of slope there is little build-up of slope-washed material. Thus 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

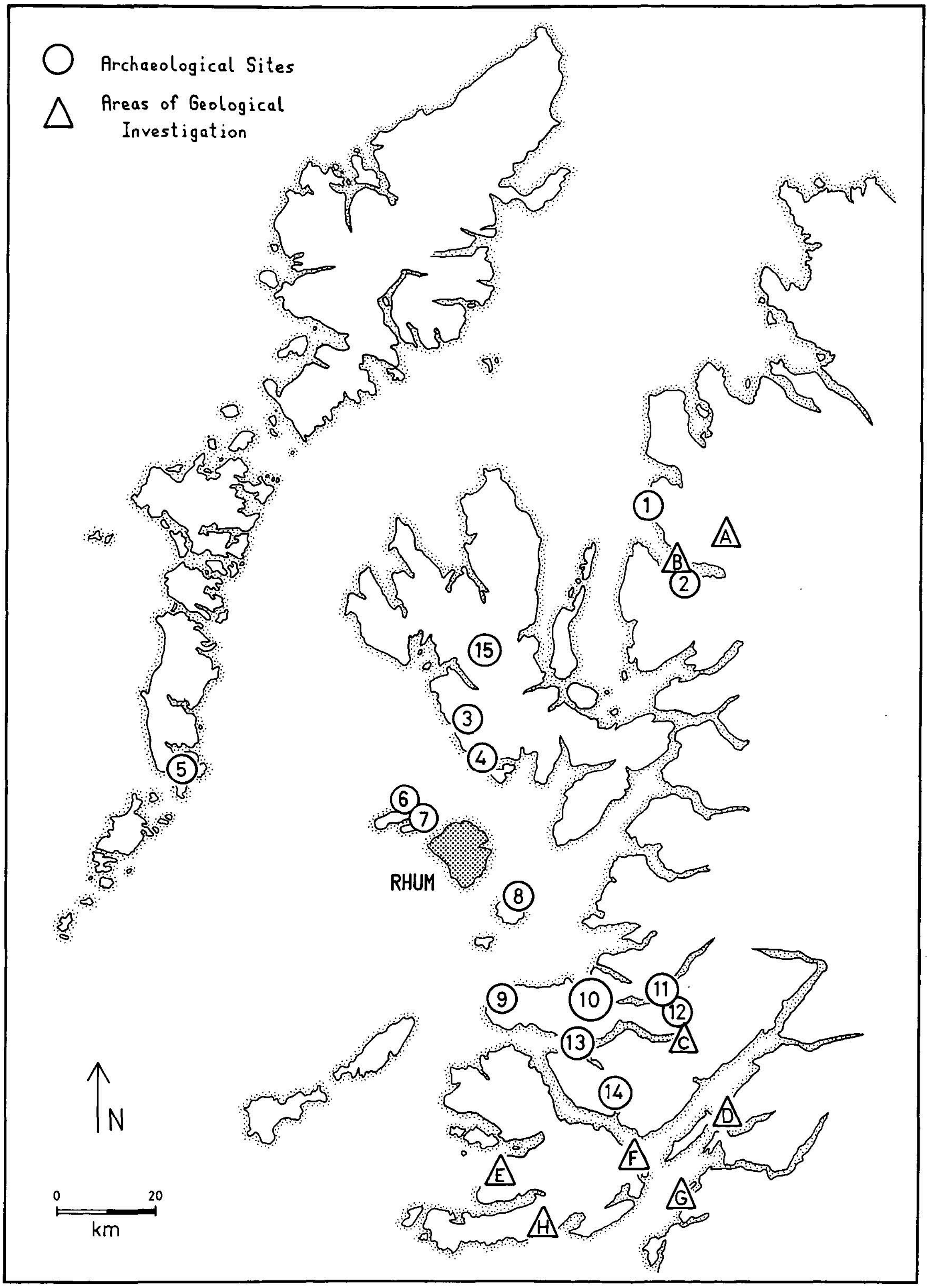
The peat cover of Rhum has sealed much of the prehistoric land surface, and prehistoric sites were only found in areas of natural erosion or artificial disturbance. Ploughing, in particular, both for forestry and crop cultivation, has resulted in the discovery of five of the sites (Clarke mf, 1:E6–E9). 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, 1934a)
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 élement 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 T = 1356	Bloodstone	37		97.2		2.7	8
	Flint	35		97.1		2.8	] 4
	Mudstone	197	1.0	97.4	0.5	1.0	
	Quartz	1087	1.2	97.1	1.2	0.4	
(2) Shieldaig T = 6001	Bloodstone	68		86.7		13.2	3
	Flint	655	3.6	90.9	1.0	4.2	] 17
	Chalcedony	8		87.5		12.5	
	Quartz	5270	0.6	96.4	2.2	0.6	
(5) Glendale T = 62	Bloodstone	7		57.0		42.8	0
	Flint	52	1.9	86.5		11.5	
	Quartz	2		100.0			] 32
	Sandstone	1		100.0			
(8) Eigg 1 T = 100	Bloodstone	5		100.0			0
	Flint	71		85.9		14.0	
	Agate	22	13.6	86.3			] 30
	Pitchstone	2		100.0			
(13) Risga T = 14080	Bloodstone	67	16.4	79.0		4.4	1
	Rest	14013	2.1	91.6		6.4	?
(12) Allt Lochan na Caraidh T = 77	Bloodstone	5		100.0			20
	Flint	45	2.2	93.3	2.2	2.2	] 12
	Chalcedony	27		100.0			
(10) Arivegaig T = 41	Bloodstone	3		100.0			0
	Flint	38		97.3		2.6	23
(10) Cul na Croise T = 336	Bloodstone	12	8.3	91.6			0
	Flint	60	3.3	91.6		5.0	
	Chalcedony	142		100.0			] 13
	Quartz	122		100.0			
(10) Kentra T = 128	Bloodstone	8	25.0	62.5		12.5	12
	Flint	52		88.4		11.4	
	Chalcedony	68		100.0			] 38
(10) Bruach na Maorach T = 35	Bloodstone	1		100.0			0
	Flint	24		95.8		4.1	
	Quartz	10	20.0	80.0			] 5
(11) Polloch T = 143	Bloodstone	6		100.0			0
	Flint	126	2.3	94.3		3.1	
	Chalcedony	11		100.0			] 19
(14) Acharn T = 843	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	
	Pitchstone	1			100.0		] 13
	Mudstone	4		100.0			
	Quartz	9	11.1	88.8			
(10) Drymen Sands T = 85	Bloodstone	6		66.6		33.3	0
	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.

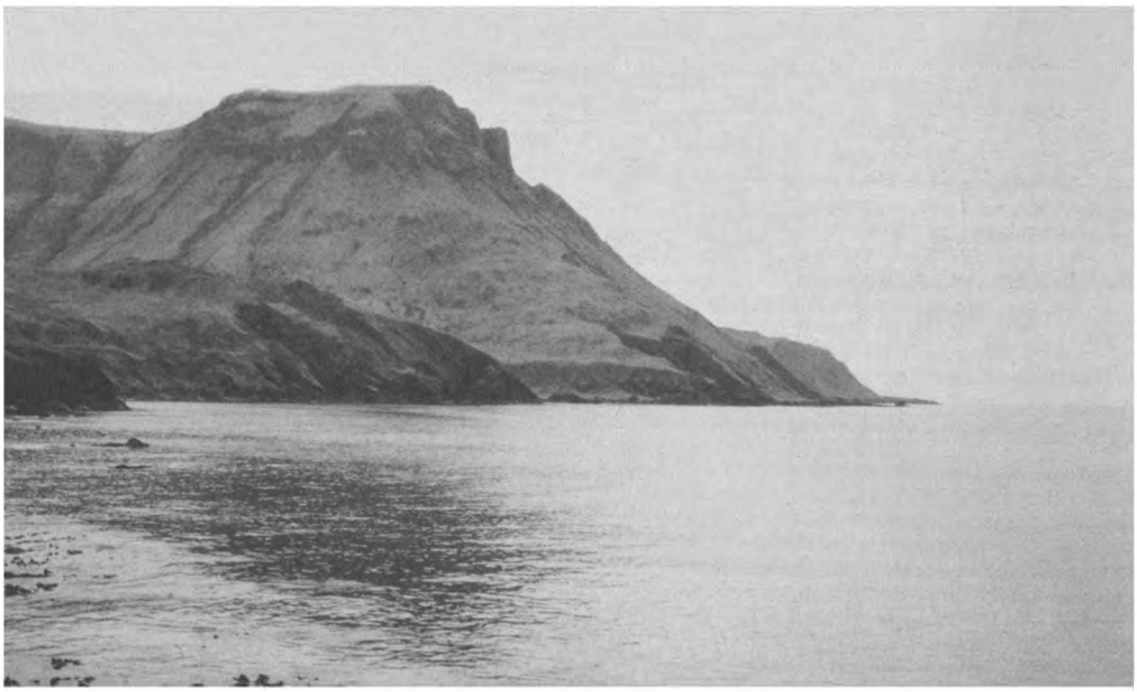
sites (Acharn and Eigg 1), there are also small quantities of pitchstone and these pose a problem. Pitchstone from Arran is known to occur in archaeological assemblages across Scotland (Thorpe and Thorpe 1984), but there are pitchstone outcrops on Eigg. The pitchstone artifacts from these two sites were 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.

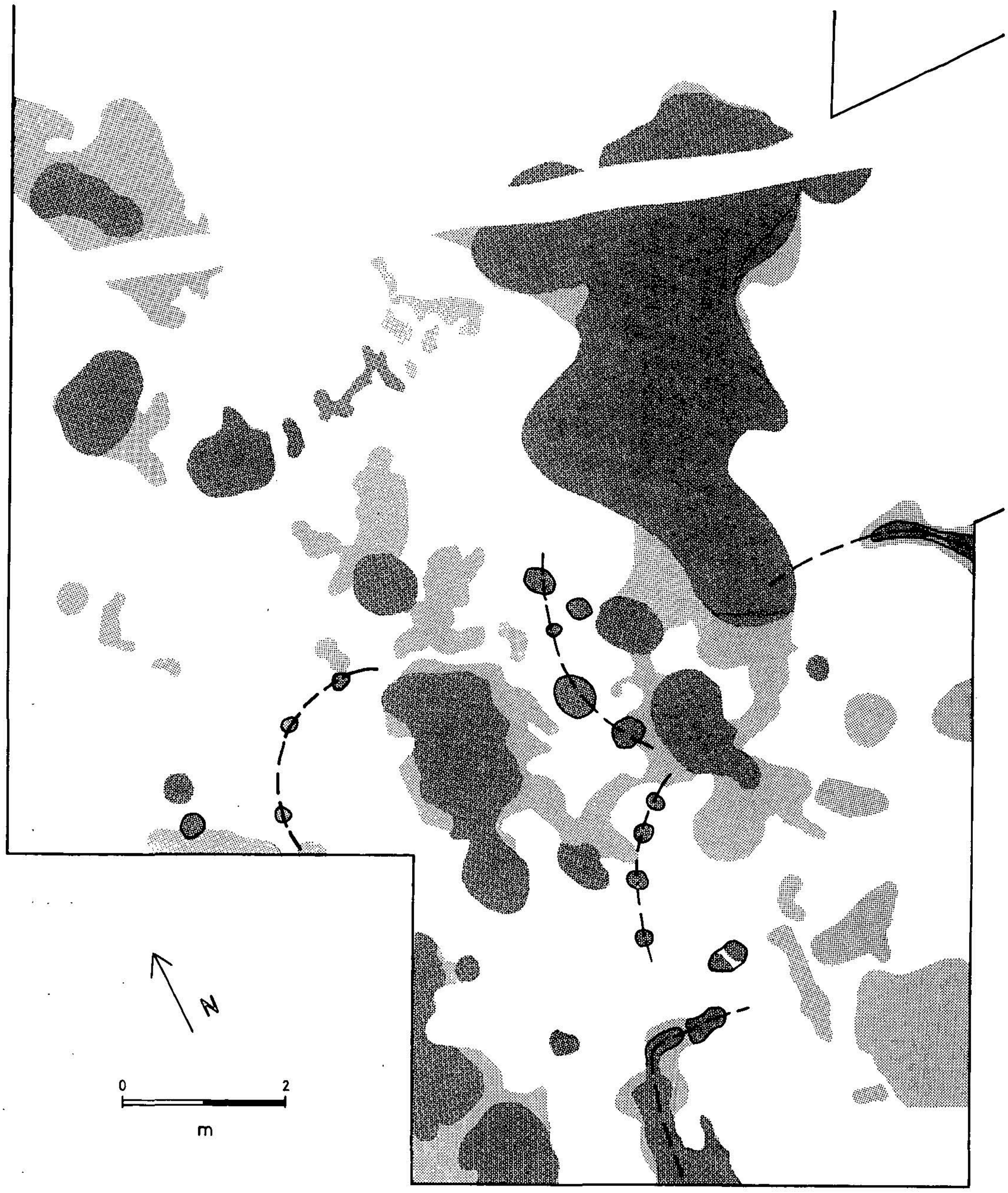
KINLOCH IN THE MESOLITHIC

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.

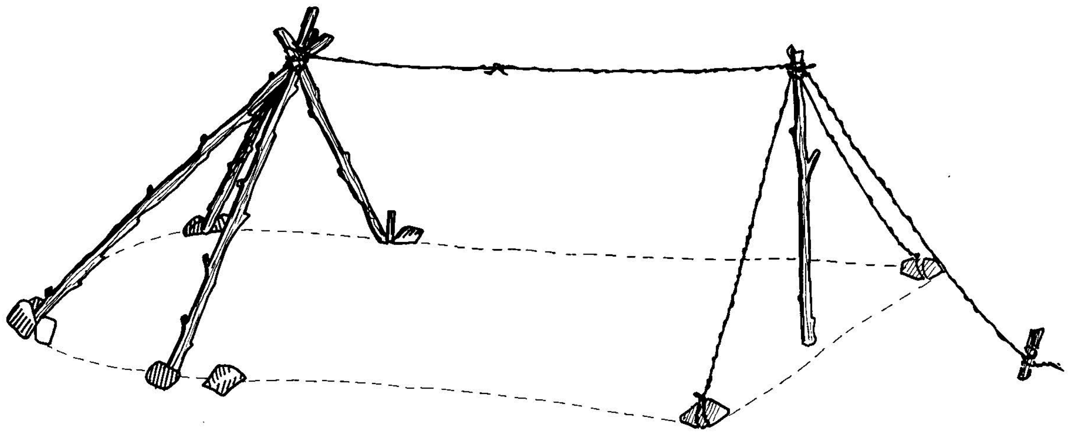
Many functional explanations have been proposed to account for the presence of pits and hollows. These include rubbish disposal, raw material extraction, storage, and cooking. In addition, pits and hollows have been interpreted as dwellings, though it has been noted that the presence of 'pit-dwellings' 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.

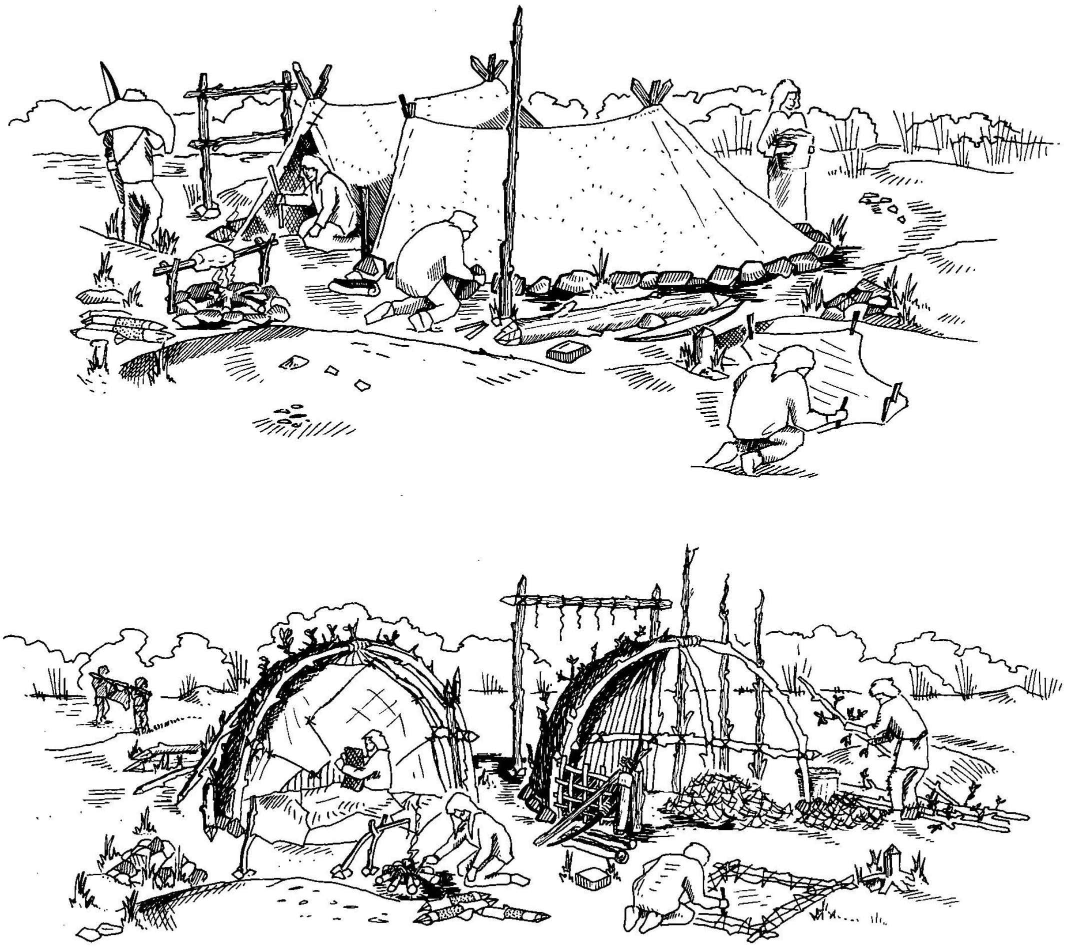
The uncertainties of interpreting the functions of the pits and hollows at Kinloch are exacerbated by the homogeneity of the fills. In most areas post-depositional processes have obliterated any internal stratigraphy, so that any sequences of filling are no longer apparent. Furthermore, the acidity of 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.

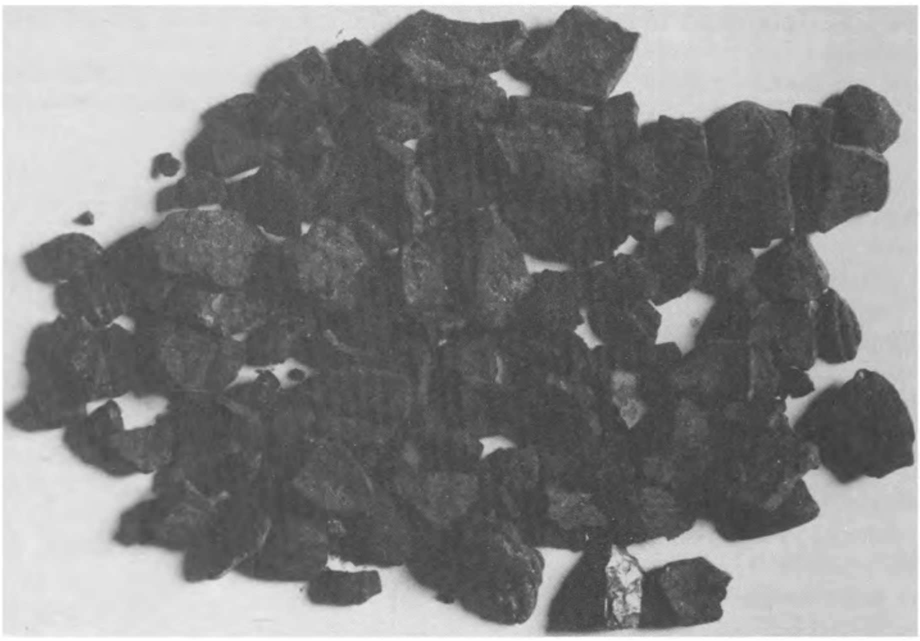
There was no analysis of the individual tasks for which tools were used. However, several tool types were recognised and, despite the problems of emic and etic classification in prehistory (Knutsson 1988b, 11–6), it is likely that they fulfilled a range of functions. Detailed consideration of function 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 vagaries 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.

REFERENCES

Andersen, JM 1976 'An ignition method for determination of total phosphorus in lake sediments', *Water Research*, 10 (1976), 329–31.

Andrews, MA, Gilbertson, DD, Kent, M & Mellars, PA 1985 'Biometric studies of morphological variation in the intertidal gastropod', *J Biogeogr*, 12 (1985), 71–87.

Ball, ME 1983 'Native woodlands of the Inner Hebrides', *Proc Roy Soc Edinburgh*, 83b (1983), 319–39.

Ball, ME 1987 'Botany, woodland and forestry', *in* Clutton-Brock & Ball 1987, 43–62.

Ballantyne, CK & Wain-Hobson, T 1980 'The Loch Lomond Advance on the island of Rhum', *Scot J Geol*, 16 (1980), 1–10.

Bang-Andersen, S 1985 'Utgravd – tapt – gjenfunnet. Analyse av steinartefakttapet ved bopladsundersøkelser', *AmS-Skrifter*, 11 (1985), 5–23.

Bang-Andersen, S 1987 'Surveying the Mesolithic of the Norwegian Highlands – a case study on test pits as a method of site discovery and delimination', *in* Rowley-Conwy *et al* 1987, 33–45.

Bang-Andersen, S forthcoming 'Mesolithic adaptions in the southern Norwegian Highlands', *in* Bonsall, C (ed), 1989, *The Mesolithic in Europe, Pap Third Int Symp, Edinburgh 1985* Edinburgh, 338–50.

Behm, JA 1983 'Flake concentrations: distinguishing between flintworking activity areas and secondary deposits', *Lithic Technol* 12 (1)(1983), 9–16.

Behre, K-E (ed) 1986 *Anthropogenic Indicators in Pollen Diagrams*, Rotterdam.

Bennet, KD 1984 'The post-glacial history of *Pinus sylvestris* in the British Isles', *Quat Sci Rev* 3 (1984), 133–55.

Beonas, B 1978 'Acid pressure decomposition for interference free AA analysis', *Spectroscopy*, 2 ser, 2 (1978), 48–51.

Betts, A 1978 'An experiment to examine some effects of agricultural implements on flints: its results and implications', *Bull Inst Archaeol Univ London*, 15 (1978), 241.

Beuminghoff, WS 1962 'Calculation of pollen and spore density in sediments by addition of exotic pollen in known quantities', *Pollen Spores*, 4 (1962), 332–3.

Binford, LR 1983 *In Pursuit of the Past, decoding the archaeological record*. New York.

Binns, RE 1972a 'Pumice on postglacial strandlines in prehistoric sites in the British Isles', *Scot J Geol*, 8 (1972), 105–14.

Binns, RE 1972b 'Composition and derivation of pumice on postglacial strandlines in northern Europe and the western Arctic', *Bull Geol Soc Amer*, 83 (1972), 2303–24.

Binns, RE 1972c 'Flandrian strandline chronology for the British Isles and correlation of some European postglacial strandlines', *Nature*, 235 (1972), 206–10.

Birks, HH 1975 'Studies in the vegetational history of Scotland. IV. Pine stumps in Scottish blanket peats', *Phil Trans Roy Soc London*, B270 (1975), 181.

Birks, HJB 1973 *Past and present vegetation of the Isle of Skye, a palaeoecological study*. London.

Birks, HJB 1977 'The Flandrian forest history of Scotland: a preliminary systhesis', *in* Shotton, FW (ed), *British Quaternary Studies*, 119–35, Oxford.

Birks, HJB 1980 *Quaternary Vegetational History of West Scotland*. Cambridge. (= Excursion guide, Fifth Int Palynological Conf)

Birks, HJB 1987 'The past and present vegetation of Oronsay and Colonsay and adjacent areas', *in* Mellars 1987, 71–7.

Birks, HJB & Madsen, BJ 1979 'Flandrian forest history of little Loch Roag, Isle of Lewis, Scotland', *J Ecol*, 67 (1979), 825–42.

Birks, HJB & Williams, W 1983 'Late Quaternary vegetational history of the Inner Hebrides', *Proc Roy Soc Edinburgh*, 83 (1983), 269–92.

Birse, EL & Robertson, L 1970 *Assessment of Climatic Conditions in Scotland. 2, Based on Exposure and Accumulated Frost*, Aberdeen. (= *Soil Surv Scot*)

Blankholm, HP 1987 'Maglemosian hutfloors: an analysis of the dwelling unit, social unit and intra-site behavioural patterns in early Mesolithic Southern Scandinavia', *in* Rowley-Conwy *et al* 1987, 102–20.

Blower, JG, Cook, LM & Bishop, JA 1981 *Estimating the size of animal populations*. London.

Bohncke, SJP 1981 'Pollen analysis of the Lochan Mor section', *in* Barber, JW 'Excavations on Iona 1979', *Proc Soc Antiq Scot*, 111 (1981), 368–70.

Bohncke, SJP 1983 'The pollen analysis of deposits in a food vessel from the Henge Monument at North Mains', *in* Barclay, G 'Sites of the third millennium bc to the first millennium ad at North Mains, Strathallan, Perthshire', *Proc Soc Antiq Scot*, 113 (1983), 178–80.

Bohncke, SJP 1988 'Vegetation and habitation history of the Callanish area, Isle of Lewis, Scotland,' *in* Birks, HH, Birks, HJB, Kaland, PE & Moe, D, (eds) 1988, *The Cultural Landscape – Past, Present and Future*, Cambridge, 445–61.

Bond, JM & Hunter, JR 1987 'Flax-growing in Orkney from the Norse period to the 18th century', *Proc Soc Antiq Scot*, 117 (1987), 175–81.

Bonnichsen, R 1977 *Models for deriving cultural information from stone tools*. Ottawa. (= *Nat Mus Man Mercury Ser, Archaeol Surv Canada*, 60)

Bonsall, C 1981 'The coastal factor in the Mesolithic settlement of North-west England', *in* Gramsch 1981, 451–72.

Bordaz, J 1970 *Tools of the Old and New Stone Age.* Newton Abbot.

Bordes, F & Gaussen, J 1970 *Un fonde de tente magdalénien près de Mussidan (Dordogne)*. Köln. (= Frühe Menschheit Und Umwelt, 1)

Bradshaw, RHW & Browne, P 1987 'Changing patterns in the post-glacial distribution of *Pinus Sylvestris* in Ireland', *J Biogeogr*, 14 (1987), 237–48.

Brinch-Petersen, E 1966 'Klosterlund – Sønder Hadsund – Bollund', *Acta Archaeol*, 37 (1966), 77–185.

Broadbent, N 1979 *Coastal resources and settlement stability, a critical study of a Mesolithic site complex in Northern Sweden*. Uppsala. (= *Aun*, 3)

Cahen, D 1987 'Refitting stone artifacts: why bother?' *in* Sieveking & Newcomer 1987, 1–10.

Callahan, E 1987 *An Evaluation of the lithic technology in Middle Sweden during the Mesolithic and Neolithic*. Uppsala. (= *Aun* 8)

Chambers, EG 1964 *Statistical calculation for beginners*. Cambridge.

Cherry, JF, Gamble, C & Shennan, S (eds) 1978 *Sampling in contemporary British archaeology*. Oxford. (= *Brit Archaeol Rep*, 50).

Clapham, AR, Tutin, TG & Warburg, EF 1962 *Flora of the British Isles*, 2 ed. Cambridge.

Clark, DL 1976 'Mesolithic Europe: the economic basis', *in* Sieveking *et al* 1976, 449–81.

Clark, JE 1986 'Another look at small debitage and microdebitage', *Lithic Technol*, 15 (1) (1986), 21–33.

Clarke, DV 1978 'Excavation and volunteers: a cautionary tale', *World Archaeol*, 10 (1)(1978), 63–70.

Clarke, PA forthcoming 'Corse Law, Carnwath, Lanarkshire: a lithic scatter', *Proc Soc Antiq Scot*, 119' (1989).

Clegg, JK 1977 'The four dimensions of artifact variation', *in* Wright 1977, 60–6.

Clutton-Brock, TH & Ball, ME 1987 *Rhum: the natural history of an island*. Edinburgh.

Coles, JM 1971 'The early settlement of Scotland: excavations at Morton, Fife', *Proc Prehist Soc*, 37 (1971), 284–366.

Coles, JM 1983 'Morton Revisited', *in* O'Connor, A & Clarke, DV (eds) *From the Stone Age to the 'Forty-five*, Edinburgh, 9–18.

Coles, JM & Orme, BJ (eds) 1985 *Somerset Levels Papers*, 11

Cook, SF & Heizer, RF 1965 *Studies on the chemical analysis of archaeological sites.* Berkley, (= *Univ California Publ* Archaeol, 2)
Cook, SF & Heizer, RF 1968 'Relationships among houses, settlement areas, and population in aboriginal California', *in* Chang, KC (ed) *Settlement Archaeology*, Palo Alto, 79–116.
Coope, GR 1985 'Coleoptera analysis', *in* Berglund, BE (ed) *Handbook of Holocene palaeo-ecology and palaeohydrology*, Chichester, 703–13.
Crosby, E 1977 'An Archaeologically oriented classification of ethnographic material culture', *in* Wright 1977, 83–96.
Currie, A & Murray, C 1983 'Flora and vegetation of the Inner Hebrides', *Proc Roy Soc Edinburgh*, 83b (1983), 293–319.
D & E, 1983 *Discovery and Excavation in Scotland*, 1983.
Dackombe, RV & Gardiner, V 1983 *Geomorphological Field Manual.* London.
Dawson, AG 1984 'Quaternary sea-level changes in western Scotland', *Quat Sci Rev*, 3 (1984), 345–68.
Dickson, JH 1978 'Bronze Age Mead', *Antiquity*, 52 (1978), 108–13.
Dugmore, AJ, Buckland, PC, Barber, J, Hillam, J & Larsen, G in prep 'Hebridean pumice and the dating of the bronze age eruption of Santorini'.
Ebdon, D 1978 *Statistics in Geography*. Oxford.
Edwards, KJ, Hamond, FW, & Simms, A 1983 'The medieval settlement of Newcastle Lyons: an interdisciplinary approach', *Proc Roy Ir Acad*, 83C (1983), 351–76.
Edwards, KJ & Hirons, KR 1982 'A date of blanket peat initiation and spread – a problem in research design', *Quat Newsl*, 36 (1982), 32–7.
Edwards, KJ & Ralston, I 1985 'Postglacial hunter-gatherers and vegetational history in Scotland', *Proc Soc Antiq Scot*, 114 (1984), 15–34.
Emeleus, CH 1987 'The Rhum Volcano', *in* Clutton-Brock & Ball 1987, 11–26.
Erdtman, G, Berglund, B & Praglowski, B 1961 *An Introduction to a Scandinavian Pollen Flora*, vol 2, Stockholm.
Faegre, T 1979 *Tents, architecture of the nomads*. London.
Faegri, K & Iversen, J 1975 *Textbook of Pollen Analysis*. Oxford.
Ferreira, REC 1967 *Community Descriptions in Field Survey of Vegetation Map of the Isle of Rhum.* Unpubl typescript, Nature Conservancy Council.
Finlayson, BL 1975 'Measurement of the organic content of suspended sediments at low concentrations', *Brit Geomorphol Res Group, Tech Bull*, 17 (1975), 21–26.
Fischer, A, Grønnow, B, Jønsson, JH, Nielsen, FO & Petersen, C 1979 *Stenalder-eksperimenter i Lejre: bopladsernes indretning*. Copenhagen. (= *Working pap Nat Mus Denmark*, 8)
Fitzpatrick, EA 1956 'An indurated soil horizon formed by permafrost', *J Soil Sci*, 7 (1956), 248–54.
Fitzpatrick, EA 1980 *Soil Micromorphology Manual*. London.
Fladmark, KR 1982 'Microdebitage analysis: initial considerations', *J Archaeol Sci*, 9 (1982), 205–20.
Flenley, JR & Pearson, MC 1967 'Pollen analysis of a peat from the island of Canna (Inner Hebrides)', *New Phytol*, 66 (1967), 299–306.
Ford, DC 1976 *The vegetational history of the Isle of Rhum in the Inner Hebrides*. Unpubl BSc thesis, Univ Hull.
Forsberg, LL 1985 *Site variability and settlement patterns*. Umea. (= *Archaeol Envir*, 5)
Fraser, J 1983 *Traditional Scottish dyes and how to make them*.
Gendel, PA 1986 *Mesolithic social territories in Northwestern Europe*. Oxford. (= *Brit Archaeol Rep Int Ser*, S218)
Gendel, PA 1987 'Socio-stylistic analysis of lithic artifacts from the Mesolithic of Northwestern Europe', *in* Rowley-Conwy *et al* 1987, 65–81.
Gennard, D 1985 'Observations on the evidence for flax growth in Ireland provided by pollen analysis', *Cicaea*, 3 (3) (1985), 195–62.
Godwin, H 1975 *The History of the British Flora: a Factual Basis for Phytogeography*. Cambridge.

Göransson, H 1987 *'Neolithic man and the forest environment around Alvastra pile dwelling'*. Stockholm. (= *Theses pap North-European Archaeol*, 20)

Graham, C 1986 *A pollen core from Glen Shellesder, Isle of Rhum*. Unpubl MSc thesis, Univ Leeds.

Gramsch, B (ed) 1981 *Mesolithikum in Europa. 2, Internationales Symposium Potsdam 3–8 April 1978 Bericht*. Potsdam. (= *Veröffentlichungen des Museums für Ur-und Frühgeschichte Potsdam*, 14/15. Berlin)

Gray, AF 1960 'A collection of stone artifacts from Redpoint, Loch Torridon, Ross-shire', *Proc Soc Antiq Scot*, 93 (1959–60), 236–7.

Green, FHW & Harding, RJ 1983 'Climate of the Inner Hebrides', *Proc Roy Soc Edinburgh*, 83b(1983), 121–40.

Green, HS 1980 *The Flint arrowheads of the British Isles*, 2 vols. Oxford. (= *Brit Archaeol Rep*, 75)

Griffiths, DR, Seeley, NJ, Chandra, H & Symons, MCR 1983 'ESR dating of heated chert', *PACT*, 9 (1983), 399–409.

Griffiths, DR, Bergman, CA, Clayton, CJ, Ohnuma, K, Robins, GU & Seeley, NJ 1987 'Experimental investigation of the heat treatment of flint', *in* Sieveking & Newcomer 1987, 43–52.

Griffiths, DR & Woodman, PC 1987 'Cretaceous chert sourcing in NE Ireland: preliminary results', *in* Sieveking & Newcomer 1987, 249–52.

Gron, O 1983 'Social behaviour and settlement structure. Preliminary results of a distribution analysis on sites of the Maglemose culture', *J Danish Archaeol*, 2 (1983), 32–42.

Hamond, FW 1985 'Chemical analysis of soils', *in* Woodman 1985a, 83–98.

Harker, A 1908 'The geology of the small Isles of Inverness-shire (Rum, Canna, Eigg, Muck, etc)', *Mem Geol Surv Gt Brit Scot* (= a description of Sheet 60 Scotland)

Hayden, B 1977 'Stone tool function in the Western Desert', *in* Wright 1977, 178–88.

Hayden, B 1980 'Confusion in the bipolar world: bashed pebbles and splintered pieces', *Lithic Technol*, 9 (1)(1980), 2–7.

Hedges, M 1978 *Sheildaig – A burial cairn: an interim report*. Unpublished.

Henshall, AS 1963 *The Chambered Tombs of Scotland*, vol 1. Edinburgh.

Henshall, AS 1972 *The Chambered Tombs of Scotland*, vol 2. Edinburgh.

Hesse, PR 1971 *A textbook of soil chemical analysis*. London.

Hietala, H (ed) 1984 *Intrasite spatial analysis in archaeology*. Cambridge.

Holm, L forthcoming 'Manufacture of stone artifacts in north Sweden – a presentation of stone assemblages in the Caledonian Chain', *in* Larsson, TB & Lundmark, H (eds) *Approaches to Swedish Prehistory*. Oxford. (= Brit Archaeol Rep Int Ser).

Huyge, D & Vermeersch, PM 1982 'Late Mesolithic settlement at Weelde – Paardsdrank', *in* Vermeersch 1982, 115–209.

Iversen, J 1964 'Retrogressive vegetational succession in the postglacial', *J Ecol*, 52 (1964), 59–70.

Jackson, ML 1958 *Soil Chemical Analysis*. London.

Jacobi, RM 1976 'Britain inside and outside Mesolithic Europe', *Proc Prehist Soc*, 42 (1976), 67–84.

Jacobi, RM 1979 'Early Flandrian hunters in the South-west', *in* Maxfield, VA (ed) *Prehistoric Dartmoor in its context*, *Devon Archaeol Soc* 37, 48–93.

Jacobi, RM 1987 'Misanthropic miscellany: musings on British early Flandrian archaeology and other flights of fancy', *in* Rowley-Conwy *et al* 1987, 163–68.

Jane, FW 1970 *The Structure of Wood*, 2 ed. London.

Jardine, WG 1982 'Sea level changes in Scotland during the last 18,000 years', *Proc Geologists Ass*, 93 (1982), 25–41.

Jessen, K & Helbaek, H 1944 *Cereals in Great Britain and Ireland in Prehistoric and Early Historic Times*. Det Kongelige Danske Videnskabernes Selskab. *Biologiske Skrifter*, 3. Copenhagen.

Jowsey, PC 1966 'An improved peat sampler', *New Phytol*, 65 (1966), 245–8.

Kinnes, IA 1985 'Circumstance not context: the Neolithic of Scotland as seen from outside', *Proc Soc Antiq Scot*, 115 (1985), 15–57.

Knudson, R 1979 'Inference and imposition in lithic analysis', *in* Hayden (ed) *Lithic use-wear analysis*, London, 269–81.

Knutsson, K 1981 'Innovation och produktutveckling. Aspekter på spåntekniken i Boreal/ Atlantisk tid i Skåne', *Kontaktstencil*, 20 (1981), Umeå.

Knutsson, K 1988a *Making and using stone tools*. Uppsala. (= *Aun*, 11)

Knutsson, K 1988b *Patterns of tool use, scanning electron microscopy of experimental quartz tools*. Uppsala. (= *Aun*, 10)

Kobayashi, H 1975 'The experimental study of bipolar flakes', *in* Swanson, EH (ed) *Lithic technology. Making and using stone tools*, The Hague, 115–27.

Lacaille, AD 1954 *The Stone Age in Scotland*. London.

Lamb, HH 1982 *Climate, history and the modern world*. London.

Lauwers, R & Vermeersch, PM 1982 'Un site du Mésolithique ancien à Neerharen – De Kip', *in* Vermeersch 1982, 18–54.

Leroi Gourhan, A & Brezillon, M 1972 *Fouilles de Pincevent Essai d'analyse ethnographique d'un habitat Magdalénien (La Section 36)*. Paris. (= *Supplément à Gallia Préhistoire*, 7)

Levitan, B 1982 *Excavations at West Hill Uley: 1979, the sieving and sampling programme*. Bristol. (= *Western Archaeol Trust, Occas Pap*, 10)

Lindsay Scott, W 1932 'Rudh' an Dunain Chambered Cairn, Skye', *Proc Soc Antiq Scot*, 66 (1931–32), 183–213.

Lindsay Scott, W 1934a 'External Features of Rudh' an Dunain Chambered Cairn', *Proc Soc Antiq Scot*, 68 (1933–34), 194–99.

Lindsay Scott, W 1934b 'Excavations of Rudh' an Dunain Cave, Skye', *Proc Soc Antiq Scot*, 68 (1933–34), 200–23.

Love, JA 1983 *The Isle of Rhum, a short history*.

Love, JA 1987 'Rhum's human history', *in* Clutton-Brock & Ball 1987, 27–42.

Lowe, JJ & Walker, MJC 1986 'Flandrian environmental history of the Isle of Mull, Scotland. I. Pollen-stratigraphic evidence and radiocarbon dates from Glen More, south-central Mull', *New Phytol*, 99 (1986), 587–610.

MacDonnel, A 1910 *The closet of Sir Kenelm Digby Knight opened*. London.

McCann, SB & Richards, A 1969 'The coastal features of the Island of Rhum in the Inner Hebrides', *Scot J Geol*, 5 (1969), 15–25.

McCullagh, R forthcoming 'Excavations at Newton, Islay', *Glasgow Archaeol J*.

McIntosh, CJ 1986 *Palaeoecological investigations of early agriculture on the Isle of Arran and the Kintyre Peninsula*. Unpubl MSc thesis, Univ Birmingham.

McVean, DN 1956a 'Ecology of *alnus glutinosa* (L) Gaertn. VI Post-glacial history', *J Ecol*. 44 (1956), 331–3.

McVean, DN 1956b 'Ecology of *alnus glutinosa* (L) Gaertn. V Notes on some British alder populations', *J Ecol*, 44 (1956), 321–30.

McVean, DN 1964 'Pre-history and ecological history', *in* Burnett, HJ (ed) *The Vegetation of Scotland*, Edinburgh, 561–7.

McVean, DN & Ratcliffe, DA 1962 *Plant communities of the Scottish Highlands*. London. (= *Nature Conservancy Council Monogr* 1)

Madsen, B 1978 'Nyt fra Dyrholmen', *Lokalhistoriskforening for Sønderhald Komune Årsskrift*.

Madsen, B 1986 'Nogle taxonomiske og nomenklatoriske bemaerkninger til studiet af flintteknologi – eksperimentell og arkeologisk', *Fjölnir*, 5 (1) (1986), 3–28.

Magny, M 1982 'Atlantic and Sub-Boreal: dampness and dryness ?', *in* Harding, E A (ed) *Climatic Change in Later Prehistory*, Edinburgh, 33–43.

Mangerud, J, Lie, SE, Furness, HK Kristiansen, IL & Lomo, L 1984 'A younger dryas ash bed in W Norway, and its possible correlations with tephra in cores from the Norwegian Sea and the North Atlantic', *Quat Res*, 21 (1984), 85–104.

Mellars, PA 1976a 'Settlement patterns and industrial variability in the British Mesolithic', *in* Sieveking *et al* 1976, 375–99.

Mellars, PA 1976b 'Fire, ecology, animal populations and Man; a study of some ecological relationships in prehistory', *Proc Prehist Soc*, 42 (1976), 15–45.

Mellars, PA 1987 *Excavations on Oronsay, prehistoric human ecology on a small island*. Edinburgh.

Mellars, P (ed) 1978 *The Early Post-glacial settlement of Northern Europe, an ecological perspective*. London.

Mercer, J 1968 'Stone tools from a washing-limit deposit of the highest Post-glacial transgression, Lealt Bay, Isle of Jura', *Proc Soc Antiq Scot*, 100 (1967–68), 1–46.

Mercer, J 1971 'A Regression-time stone workers' camp, 33 ft OD, Lussa River, Isle of Jura', *Proc Soc Antiq Scot*, 103 (1970–71), 1–32.

Mercer, J 1974 'Glenbatrick Waterhole: a microlithic site on the Isle of Jura', *Proc Soc Antiq Scot*, 105 (1972–74), 9–32.

Mercer, J 1980 'Lussa Wood 1: the Late Glacial and Early Post Glacial occupation of Jura', *Proc Soc Antiq Scot*, 110 (1978–80), 1–32.

Moore, PD, & Webb, JA 1978 *An illustrated guide to pollen analysis*. London.

Morrison, A 1980 *Early man in Britain and Ireland*. London.

Mulholland, H 1970 'The Microlithic industries of the Tweed Valley', *Trans Dumfriesshire Galloway Natur Hist Antiq Soc*, 47 (1970), 81–110.

Murphy, J & Riley, JP 1962 'A modified single solution method for determination of phosphate in natural waters', *Anal Chimica Acta*, 27 (1962), 31–6.

Myers, A 1988 'Scotland inside and outside of the British Mainland Mesolithic a tale of chronology', *Scot Archaeol Rev*, 5 (1988), 23–30.

Nature Conservancy Council 1974 *Isle of Rhum National Nature Reserve*, reserve handbook.

Newcomer, MH & Karlin, C 1987 'Flint chips from Pincevent', *in* Sieveking & Newcomer 1987, 33–7.

Newell, RR 1981 'Mesolithic dwelling structures: fact and fantasy', *in* Gramsch 1981, 235–84.

Oliver, NP 1987 *The Kinloch lithic implement core assemblage. Catalogue and assessment of the value of core analysis to the study of prehistoric stone tool production industries*. Unpubl MA thesis, Univ Glasgow.

Payne, S 1972 'Partial recovery and sample bias: the results of some sieving experiments', *in* Higgs, ES (ed) *Papers in economic prehistory: studies by members and associates of the British Association major research project in the early history of agriculture*, Cambridge, 49–64.

Peacock, JD 1976 'Quaternary Features of Rhum, Inner Hebrides', *Quaternary Newsletter*, 20 (1976), 1–4.

Pélegrin, J 1982 'Approche expérimentale de la technique de production lamellaire d'Orville', *Studia Prehistorica Belgica*, 2 (1982), 149–58.

Pennington, W, Haworth, EY, Bonny, AP & Lishman, JP 1972 'Lake sediments in Northern Scotland', *Phil Trans Roy Soc London*, 264B (1972), 191–294.

Piggott, S & Powell, TGE 1949 'The excavation of three Neolithic chambered tombs in Galloway 1949', *Proc Soc Antiq Scot*, 83 (1948–49), 103–61.

Pilcher, JR 1974 'Botanical report on Dun Mor Vaul', *in* MacKie, E *Dun Mor Vaul: an Iron Age Broch on Tiree*, Glasgow, appendix G, 204–9.

Pitts, MW 1978a 'Towards an understanding of flint industries in Postglacial England', *Bull Inst Archaeol, Univ London*, 15 (1978), 179–97.

Pitts, MW 1978b 'On the shape of waste flakes as an index of technological change in lithic industries', *J Archaeol Sci*, 5 (1978), 17–37.

Pitts, MW & Jacobi, RM 1979 'Some aspects of change in flaked stone industries of the mesolithic and neolithic in southern Britain', *J Archaeol Sci*, 6 (1979), 163–77.

Price, RJ 1983 *Scotland's environment during the last 30,000 years*. Edinburgh.

Price, TD 1978 'Mesolithic settlement systems in the Netherlands', *in* Mellars 1978, 81–113.

Proudfoot, B 1976 'The analysis and interpretation of soil phosphorus in archaeological contexts', *in* Davidson, DA & Shackley, ML (eds) *Geoarchaeology: earth science and the past*, London, 93–113.

Provan, DMJ 1971 'Soil phosphate analysis as a tool in archaeology', *Norwegian Archaeol Rev*, 4 (1971), 37–50.

Ragg, JM & Boggie, R 1958 *The soils of Rhum*. Aberdeen. (Unpubl report, Macaulay Inst Soil Research)

Ratcliffe, DA 1977 *Highland Flora*. Inverness.

RCAHMS 1983 Royal Commission on the Ancient and Historical Monuments of Scotland *Rhum, Lochaber District, Highland Region*. Edinburgh. (= *Archaeol Sites Monuments Scot*, 20)

Richards, JD (ed) nd *Computer usage in British archaeology; report of the joint IFA/RCHME working party on computer usage*. Birmingham. (= *Inst Fld Archaeol Occas Pap* 1)

Riches, D 1982 *Northern nomadic hunter gatherers*. London.

Ritchie, JNG, Thornber, I, Lynch, F & Marshall, D 1975 'Small Cairns in Argyll: some recent work', *Proc Soc Antiq Scot*, 106 (1974–5), 15–38.

Ritchie, PR 1968 'The Stone implement trade in third millennium Scotland', *in* Coles, JM & Simpson, DDA (eds) *Studies in Ancient Europe: essays presented to Stuart Piggott*, Leicester, 117–36.

Roberts, AJ 1987 'Late Mesolithic occupation of the Cornish coast at Gwithian: preliminary results', *in* Rowley-Conwy *et al* 1987, 131–7.

Robinson, DA 1983 'Possible Mesolithic activity in the west of Arran: evidence from peat deposits', *Glasgow Archaeol J*, 10 (1983), 1–6.

Rowley-Conwy, P, Zvelebil, M & Blankholm, HP (eds) 1987 *Mesolithic Northwest Europe: recent trends*. Sheffield.

Rymer, L 1974 *The palaeoecology and historical ecology of the parish of North Knapdale, Argyllshire*. Unpubl PhD thesis, Univ Cambridge.

Schiffer, MB 1976 *Behavioural archaeology*. New York.

Schweingruber, FH 1978 *Microscopic wood anatomy*. Birmensdorf.

Scott, EM, Harkness, DD, Aitchison, TC, Baxter, MS & Cook, GT forthcoming 'An interim progress report on stages 1 and 2 of the international collaborative programme', *Radiocarbon*, 31, in press.

Simmons, IG & Innes, JB 1981 'Tree remains in a North York Moors peat profile', *Nature*, 294 (1981), 76–8.

Simmons, IG & Innes, JB 1987 'Mid-Holocene adaptations and later Mesolithic forest disturbance in northern England', *J Archaeol Sci*, 14 (1987), 385–403.

Sissons, JB 1976 *The Geomorphology of the British Isles: Scotland*. London.

Sieveking, GdeG, Longworth, IH & Wilson, KE (eds) 1976 *Problems in economic and social archaeology*, London.

Sieveking, GdeG & Newcomer, MH (eds) 1987 *The human uses of flint and chert*. Cambridge. (= *Proc fourth int flint symposium, Brighton Polytechnic, 10–15 April 1983*)

Skar, B & Coulson, S 1986 'Evidence of behaviour from refitting – a case study', *Norwegian Archaeol Rev*, 19 (2) (1986), 90–102.

Skertchly, SBJ 1879 *On the manufacture of gun-flints, the methods of excavating for flint, the age of palaeolithic man, and the connexion between neolithic art and the gun-flint trade*. London. (= *Mem Geol Surv Engl & Wales*)

Smith, AG 1970 'The influence of Mesolithic and Neolithic man on British vegetation: a discussion', *in* Walker, D & West, RG (eds) *Studies in the Vegetational History of the British Isles. Essays in honour of Harry Godwin*, Cambridge, 81–96.

Sokoloff, VP & Carter, GF 1952 'Time and trace metals in archaeological sites', *Science*, 116 (1952), 1–5.

Spence, DHN, Allen, ED & Fraser, J 1979 'Macrophytic vegetation of fresh and brackish waters in and near the Loch Druidbeg National Nature Reserve, South Uist', *Proc Roy Soc Edinburgh*, 77b (1979), 307–29.

Stead, IM, Bourke, JB & Brothwell, D 1986 *Lindow Man, the Body in the Bog*. London.

Steven, HM & Carlisle, A 1959 *The native pinewoods of Scotland*. Edinburgh.

Stockmarr, J 1971 'Tablets with spores used in absolute pollen analysis', *Pollen and Spores*, 13 (1971), 615–21.

Stuiver, M & Polach, HA 1979 'Reporting of C14 dates', *Radiocarbon*, 19 (1979), 355–63.
Sutherland, DG 1981 *The Raised shorelines and deglaciation of the Loch Long / Loch Fyne area, Western Scotland*. Unpubl PhD thesis, Univ Edinburgh.
Sutherland, DG 1984 'The Quaternary landforms and deposits of Scotland and the neighbouring shelves: a review', *Quat Sci Rev*, 3 (1984), 157–254.
Swain, AM 1973 'A history of fire and vegetation in northeastern Minnesota as recorded in lake sediments', *Quat Res*, 3 (1973), 383–96.
Thorpe, ON & Thorpe, RS 1984 'The distribution and sources of archaeological pitchstone in Britain', *J Archaeol Sci*, 11 (1984), 1–31.
Thorsberg, K 1985 'Bipolar teknik i flinta. Några funderingar', *Fjölnir*, 4 (2).
Tixier, J, Inizian, ML & Roche, H 1980 *Préhistoire de la pierre taillée, 1 terminologie et technologie*. Valbonne.
Torrence, R 1986 *Production and exchange of stone tools: prehistoric obsidian in the Aegean*. Cambridge.
Vermeersch, PM (ed) 1982 *Contributions to the study of the Mesolithic of the Belgian Lowland*. Tervuren. (= *Studia Praehistorica Belgica*, 1)
Vermeulen, FHB 1953 'Control of the reproducibility and accuracy of routine analyses at the laboratory', *Plant Soil*, 4 (1953), 367–75.
Vorren, K-D 1986 'The impact of early agriculture on the vegetation of northern Norway – a discussion of anthropogenic indicators in biostratigraphical data', *in* Behre 1986, 1–18.
Vuorela, I 1986 'Palynological and historical evidence of slash and burn cultivation in south Finland', *in* Behre 1986, 53–64.
Walker, M 1973 *Archaeological excavation of a microlithic assemblage at Shieldaig, Wester Ross, Scotland. Preliminary Report*. Unpubl.
Walker, MJC 1984 'A pollen diagram from St Kilda, Outer Hebrides, Scotland', *New Phytol*, 97 (1984), 99–113.
Walker, MJC & Lowe, JJ 1985 'Flandrian environmental history of the Isle of Mull, Scotland. II Pollen analytical data from sites in western and northern Mull', *New Phytol*, 103 (1985), 417–36.
Walkley, A & Black, IA 1934 'An examination of the Degtorett method for determining soil organic matter, and a proposed modification of the chronic acid titration method', *Soil Sci*, 37 (1934), 29.
Welinder, S 1971 'Tidigpostglacialt Mesolithicum i Skåne', *Acta Archaeol Lundensia*, 8 (1971).
Werner, M 1974 'The occurrence of flintstones along the Swedish West coast', *Guni Rapport*, 7 (1974), 125–44.
Whallon, R 1978 'The spatial analysis of Mesolithic occupation floors: a reappraisal', *in* Mellars 1978, 27–35.
White, JP, Modjeska, N & Hipuya, I 1977 'Group definitions and mental templates, an ethnographic experiment', *in* Wright 1977, 380–90.
Wickham-Jones, CR 1986 'The procurement and use of stone for flaked tools in prehistoric Scotland', *Proc Soc Antiq Scot*, 116 (1985–6), 1–10.
Wickham-Jones, CR 1989 'Recent work on the island of Rhum, Scotland', *in* Bonsall, C (ed) *The Mesolithic in Europe. Papers presented at the Third International Symposium, Edinburgh 1985*. Edinburgh, 156–63.
Wickham-Jones, CR & Collins, GH 1978 'The sources of flint and chert in northern Britain', *Proc Soc Antiq Scot*, 109 (1977–8), 7–21.
Wickham-Jones, CR & Pollock, D 1985 'Excavations at Farm Fields, Kinloch, Rhum 1984–85: A preliminary report', *Glasgow Archaeol J*, 12 (1985), 19–29.
Wickham-Jones, CR & Sharples, N 1984 *An interim report on the excavations at Farm Fields, Kinloch, Rhum 1984*. Artifact Research Unit, Roy Mus Scot, Edinburgh. Unpublished.
Wiessner, P 1974 'A functional estimator of population from floor area', *Amer Antiq*, 39 (1974), 343–50.
Williams, W 1976 *The Flandrian vegetational history of the Isle of Skye and the Morar Peninsula*. Unpubl PhD thesis, Univ Cambridge.

Wilson, D 1863 *Prehistoric annals of Scotland*, 2 vols. London.

Woodman, PC 1978 *The Mesolithic in Ireland*. Oxford. (= *Brit Archaeol Rep*, 58)

Woodman, PC 1982 'Sampling strategies and problems of archaeological visibility', *Ulster J Archaeol*, 44 & 45 (1981–2), 179–84.

Woodman, PC 1984 'The early prehistory of Munster', *J Cork Hist Archaeol Soc*, 89 (1984), 1–11.

Woodman, PC 1985a *Excavations at Mount Sandel 1973–77*. Belfast.

Woodman, PC 1985b 'Mobility in the Mesolithic of Northwestern Europe: an alternative explanation', *in* Price, TD & Brown, J (eds) *Prehistoric hunter-gatherers the emergence of cultural complexity*, New York, 325–40.

Woodman, PC 1987 'Excavations at Cass ny Hawin, a Manx Mesolithic site and the position of the Manx microlithic industries', *Proc Prehist Soc*, 53 (1987), 1–22.

Woodman, PC forthcoming 'A review of the Scottish mesolithic: a plea for normality!', *Proc Soc Antiq Scot*, 119 (1989).

Wormell, P 1968 'Establishing woodland on the Isle of Rhum', *Scot Forestry*, 22 (3)(1968), 207–20.

Wright, RVS (ed) 1977 *Stone tools as cultural markers, change evolution and complexity*. Canberra. (= *Australian Inst Aboriginal Stud Prehist Material Culture Ser*, 12)

Yellen, JE 1977 *Archaeological approaches to the present*. New York.

Zvelebil, M, Moore, JA, Green, SW & Henson, D 1987 'Regional survey and analysis of lithic scatters: a case study from Southeast Ireland', *in* Rowley-Conwy *et al* 1987, 9–32.

INDEX