MESOLITHIC SETTLEMENT IN THE NORTH SEA BASIN

A Case Study from Howick, North-East England

Edited by
Clive Waddington

MESOLITHIC SETTLEMENT IN THE NORTH SEA BASIN

A Case Study from Howick, North-East England

edited by

Clive Waddington

with contributions by

Geoff Bailey, Alex Bayliss, Alan Biggins, Ian Boomer, Christopher Bronk Ramsey, Ann Clarke, Jacqui Cotton, Derek Hamilton, Karen Hardy, Nicky Milner, Kristian Pedersen, Robert Shiel, Tony Stevenson and Illustrations by Ben Johnson and James Brightman

OXBOW BOOKS

Published by
Oxbow Books, Oxford, UK

ISBN 978 1 84217 246 9

A CIP record for this book is available from the British Library

This book is published with the aid of a grant from English Heritage.

English Heritage is now Historic England

Historic England

For Marjorie Deakin

Contents

List of Contributors

Geoff Bailey
University of York
Department of Archaeology
Kings Manor
York
YO1 7EP
UK

Alex Bayliss
English Heritage
1 Waterhouse Square
138-142 Holborn
London
EC1N 2ST
UK

Alan Biggins
Timescape Surveys
Northumbria
Main Road
Dinnington
Newcastle upon Tyne
NE13 7JW
UK

Ian Boomer
University of Birmingham
School of Geography
Edgbaston
Birmingham
B15 2TT
UK

Christopher Bronk Ramsey
Oxford Radiocarbon Accelerator Unit
Research Laboratory for Archaeology and the History of Art
6 Keble Road
Oxford
OX1 3QJ
UK

Ann Clark
Rockville Lodge
By Kingston
North Berwick
East Lothian
EH39 5JN
UK

Jacqui Cotton
Environment Agency
Rivers House
21 Park Square South
Leeds
LS27 2QG
UK

Derek Hamilton
English Heritage
1 Waterhouse Square
138-142 Holborn
London
EC1N 2ST
UK

Karen Hardy
The Old Toll
Kirkurd
Blyth Bridge
Peebleshire
EH46 7AH
UK

Ben Johnson
Archaeological Research Services Ltd
Baltic Business Centre
Saltmeadows Road
Gateshead
NE8 3DA
UK

Nicky Milner
University of York
Department of Archaeology
Kings Manor
York
YO1 7EP
UK

Kristian Pedersen
Archaeological Research Services Ltd
Baltic Business Centre
Saltmeadows Road
Gateshead
NE8 3DA
UK

ROBERT SHIEL
School of Agriculture, Food and Rural Development
King George VI Building
Newcastle University
Newcastle upon Tyne
NE1 7RU
UK

TONY STEVENSON
Newcastle University
School of Geography
Daysh Building
Newcastle upon Tyne
NE1 7RU
UK

CLIVE WADDINGTON
Archaeological Research Services Ltd
Angel House
Portland Square
Bakewell
Derbyshire
DE45 1HB
UK

Acknowledgements

The work carried out at Howick and the subsequent analysis of the data has been a genuine delight to undertake, providing, during its course, an enjoyable experience for many. The project has involved people from all walks of life ranging from professional archaeologists and students to volunteers, teachers, the media, retired people and schoolchildren. In all, over 250 people took part in the fieldwork and it is estimated that the excavations were visited by around 3000 people. It was a great pleasure to work with so many people, all of whom added greatly to the project whether by way of on-site work, enthusiasm or general support. I am indebted to the landowner, Lord Howick, who gave permission for the work to take place and for his support and encouragement throughout. However, a special mention is due to the farmer, Mr. Thompson, who helped in virtually all aspects of the fieldwork and was a generous host, particularly for all those who camped on the farm for 13 weeks. It is with pleasure that thanks is given to them and for all the additional help that included, amongst other things, arranging for taking aerial photographs from a helicopter and for a boat ride to see the site from its seaward side. It is also a pleasure to acknowledge the co-operation and assistance from the other people of the Howick-Craster area, who were involved in the project and made us most welcome.

The erosion of lithics at Howick was first brought to my attention by Jim Hutchinson, a member of the Northumberland Archaeology Group, who brought a collection of flint material from the site to an artefacts day school being held by the then Centre for Lifelong Learning of the University of Newcastle. Although Mesolithic flints had previously been reported from the erosion scar by John Davies who referred to it in his 1983 publication, no work had been carried out there and it is thanks to their observant discoveries that the site was able to be recognised and recorded.

The project was funded through the generous support of the Heritage Lottery Fund, English Heritage and the University of Newcastle to whom I am most grateful and who should be recognised for acting quickly to help record an eroding site. Thanks is also due to the Society of Antiquaries of Newcastle upon Tyne and Northumberland County Council Archaeology Section who provided the funding for the initial radiocarbon dates. The BBC selected the site for inclusion in its high-profile 'Ancestors' and 'Coast' series and supported the project throughout and I am most grateful to them for this. The BBC kindly funded the building of the first 'reconstruction' at Milfield and the team of Sophie Robinson, Bucy McDonald and Julian Richards deserve special mention for their help and enthusiasm on the project. Forest Enterprise and Durham Wildlife Trust generously supported the project by donating the timber and grass for the reconstruction. The Air Sea Rescue team based at RAF Boulmer very kindly allowed myself and the BBC crew on board a Sea King helicopter in order to photograph the site and I am most grateful to them for this. Steve Speake and Richard Young of Tyne and Wear Museums Service kindly made available the results of an unpublished evaluation excavation on the nearby Cushatt Wood rectilinear enclosure as well as information on the excavations carried out at Low Hauxley.

The specialist input to this research has been considerable with all the work being undertaken notably swiftly which has allowed for its rapid publication. Thanks is extended to all those who contributed both in the field and in post-excavation analyses. In particular Alan Biggins of Timescape Surveys who undertook two phases of geophysical survey providing the first survey free of charge when the project had only limited funds available. The adroit assistance of Johnny Shipley, Alex Green, Aimee Lawrence and Dave Henderson during both phases of the geophysical survey is gratefully acknowledged. Alex Bayliss of English Heritage has done an outstanding job on the radiocarbon dating programme, producing an unrivalled and elegant chronological sequence for a British Mesolithic site and it was a delight to work with her on this. Ian Boomer from the Department of Geography at the University of Newcastle is owed a considerable debt of thanks for the sediment coring and analysis and pulling together the environmental components of the project, and for his generous help in completing the excavation when resources and time were stretched. Robert Shiel and Tony Stevenson kindly assisted with the soil and sediment analyses respectively and I am grateful to them for this. Jacqueline Cotton did a splendid job identifying and counting the plant macrofossils while Ann Clarke made a valuable contribution with the analysis of the coarse stone tools. I would like to thank Dr Lyall Anderson, Department of Geology and Zoology, National Museum of Scotland for the identification of the limestone cobbles and Dr Alison Sheridan, Department of Archaeology, National Museum of Scotland for facilitating the geological identification.

Karen Hardy and Robert Shiel have contributed a very interesting and informative analysis of residues and use-wear on a sample of the stone tools and this important work demonstrates the potential of residue analysis for future stone tool studies. With regard to this work, thanks are due to Kristian Pedersen for making the experimental tools and to Kristian, Andy Bates, Brian Murray and Victoria Chase for helping out with the experiments. Oliver Craig is to be thanked for his illuminating observations and David Manning is thanked for advice on the analysis of the residues and comments on the draft text. The SEM microscope was housed in the Department of Geology and Geophysics, University of Edinburgh and Nicola Cayzer and John Craven are thanked for the training and support they provided.

Peter Forrester of the Design Desk took some excellent photographs and produced the handsome information panels and leaflet that can be seen at Craster Tourist Information Centre. Dave Hall kindly produced a series of excellent artistic impressions of the site for use on the panels and interpretive literature, and again put in far more time on this work than could have been expected and I am indebted to him for this. Jo Catling did an excellent job in devising the schools pack and, together with Will Graham, Kristian Pedersen, Nicky Milner, Geoff Bailey, Ian Boomer and myself, undertook a series of school visits explaining aspects of hunter-gatherer life and the past environment to Key Stage 2 classes.

English Heritage has been immensely supportive of this work and deserve special mention for their help. In particular Kate Wilson, the regional Inspector, helped with securing support for the project, while project management was undertaken by Jonathan Last who helped keep the project running smoothly. Jacqui Huntley provided support and advice with regard to plants and macrofossils and Alex Bayliss and Derek Hamilton have made an important contribution with the dating mentioned above. I am also grateful to Chris Scull in Archaeological Commissions who made the completion of the analytical work and the publication of this volume possible.

The professional supervisory staff who worked on the site during both seasons of fieldwork conducted themselves with exceptional competence and diligence and I remain indebted to them for making the fieldwork such a success, both in terms of recording the archaeology and in training and supervising the cohorts of volunteers. It is therefore with the greatest pleasure that I extend my thanks to Richard Chatterton, Will Graham, Claire Henderson, Benjamin Johnson, Eleanor Johnson and Kristian Pedersen. Additional professional assistance was provided by Claire Carey, Gavin Davies, Jo Goodhall, Helena Gray, Bryan Murray and Richard Smalley. Stuart Winthrope fastidiously supervised the flotation tank, putting several tons of sediment through a 2mm mesh as well as helping with the excavations and treating us all to his irrepressible humour. Timothy Sandiford endured endless torment in a dark barn drying out flots with two hairdryers and, although succumbing to bouts of cabin fever, his stoic persistence allowed the flots to be analysed in record time. During the first season of work Clifford Jones and Ken Stone provided help with catering, logistics and all round entertainment and I am very grateful to them for this. During the second season of work James Whitford organised all cooking and catering for up to 50 people per day. Together with James Brightman this pair of redoubtable troubadours propelled morale to new highs with their musical talents. Benjamin Johnson and James Brightman deserve special thanks for their excellent illustrations and patience in the face of repeated requests for alterations to figures. Their dependable help throughout the entire project is also gratefully acknowledged. Kristian Pedersen, the project officer, worked above and beyond the call of duty in carrying out a range of tasks including setting up the project website (www. ncl.ac.uk/howick) and organising an international conference on the Mesolithic of the North Sea Basin at the University of Newcastle. The proceedings of this meeting are published separately by Oxbow Books. I would also like to thank my project co-directors Geoff Bailey and Nicky Milner who helped from the beginning with the organisation of the project, fieldwork and specialist analyses of the faunal remains, as well as dealing with media interviews and publications and their input to this volume.

I am grateful to Jonathan Last for his editorial work at English Heritage and to the anonymous referees who gave their time to reading the text and improving the book through useful and detailed comment. Andrew David, also at English Heritage, kindly undertook editorial work on the geophysical chapter at a time when the chapter's author was diagnosed with a sudden and serious illness. Roger Jacobi kindly assisted with the identification of some chipped stone tools and Sönke Hartz kindly drew my attention to the evidence for the hazelnut roasting at Duvensee. I must extend a special thank you to Myra Wilkinson van Hoek, of Fine Line Archaeological Language Services, who kindly undertook the copy editing of this volume in remarkably quick time. Finally, the team at Oxbow Books deserve a special thanks for their patience and support in bringing this volume to publication.

Summary

The first indication of a Mesolithic site at Howick was noticed on separate occasions by two amateur archaeologists who each discovered flints eroding from the cliff edge. Subsequently a small test pit, together with geophysical survey, confirmed the presence of undisturbed Mesolithic deposits below the ploughzone. After an excavation season in 2000 to evaluate the deposits, a full-scale excavation was mounted in 2002 to record, in full, all archaeological remains that were in danger of further erosion.

The archaeological remains at Howick consist of a Mesolithic hut site and an Early Bronze Age cist cemetery located on a modern cliff edge overlooking a small estuary. This volume is devoted solely to the reporting and interpretation of the Mesolithic remains while the Bronze Age material is reported separately as a journal article (Waddington *et al.* 2005), as is the full Holocene environmental sequence obtained from the sediment core (Boomer *et al*. 2007). Few Mesolithic hut sites have been discovered in the British Isles whereas in other regions, such as southern Scandinavia, hut sites belonging to this period are more common. The relative lack of sites in Britain may be explained by a combination of reasons including, most notably, the differential effects of sea level change and site survival in different areas, the lack of large open area excavations in coastal areas of the UK, less focus in recent years on the Mesolithic period amongst the British archaeological research community compared to their counterparts in Scandinavia, and perhaps a failure to recognise such sites when they have been revealed during previous excavations and field evaluations. It is exciting to note that within months of completing the Howick excavations, an almost identical site was excavated 80km to the north at East Barns near Dunbar, which also lies on the North Sea coast (Gooder 2007). Together with the previously known sites of Mount Sandel and Broomhill, these four hut sites provide the least ambiguous evidence for settlements in the British and Irish Mesolithic to date.

Three huts had been constructed on the Howick site, all on the same footprint, with no evidence to indicate a gap between these occupations. This was confirmed by the radiocarbon dates, which suggest these different phases followed on continuously one to another. Whether the site was occupied on a seasonal basis or as a permanent residence remains open to question, and this will no doubt form one of the key outstanding questions relating to this site. A fourth phase of very short-lived occupation was identified by the radiocarbon dating programme, occurring after the hut had been abandoned and probably representing a transitory use of the hollow for an overnight camp. The residues from the Howick site have been subjected to a comprehensive radiocarbon dating programme and the results have been statistically modelled using a Bayesian approach to produce a singularly well-understood chronological sequence. The initial construction of the site took place around 7850 cal BC and abandonment took place in the years around 7650 cal BC.

The remains inside the hut were all consistent with its use as a habitation site. These consisted of a central arrangement of hearths that contained burnt animal bones and masses of charred hazelnut shell fragments, activity areas represented by the distribution of stone artefacts, and the presence of a hazelnut roasting pit indicative of strategies associated with food storage. Although the primary function of the hut was undoubtedly as a dwelling structure this does not mean to say that aspects of residential life did not include ritualised behaviour. Indeed it is unlikely that domestic and ritual life was separated out by Stone Age hunter-gatherer groups, who are more likely to have incorporated 'ritual' into all aspects of life. However, it is important to stress that there was no obvious physical indication of ritualised behaviour within the excavated deposits and that no finds present on the site could be construed as being specially placed deposits or of intrinsic ritual significance. Neither was there any sign of burial or the disposal of human remains. In this way the hut site was no different from those at Mount Sandel, Broomhill and East Barns, which produced remarkably similar remains to those from Howick.

The lithic material from Howick is the most accurately dated assemblage from any British Mesolithic site and is a classic example of a narrow-blade industry associated with the micro-triangle techno-complex, with scalene triangles the most common form of microlith. Typically for Britain, these sites date from around 7500 cal BC but the Howick dates indicate an earlier start for this type of industry in the centuries immediately after 8000 cal BC. More recent dates from East Barns accord directly with the earliest of the Howick dates. Still earlier dates have recently been acquired for a micro-triangle site at Cramond near Edinburgh, which now provide the earliest dates so far for this industry in Britain at around 8400 cal BC. This raises interesting questions over the origin and spread of this type of technology, its relationship with North European industries, as well as the overlap with what are traditionally termed 'Earlier Mesolithic' artefact industries in southern England.

The chipped stone assemblage from Howick is all made from locally occurring beach pebble flint and this fits into the wider pattern of localised raw material acquisition by groups elsewhere in North-East England. A wide variety of tool types is present from within the hut, reflecting the diverse activities that appear to have taken place there. Evidence for task diversity is further attested by the presence of a large bevelled pebble tool assemblage, huge quantities of charred hazelnut shells, some ochre fragments and the presence of a range of animals.

The Howick site lies in an ecotonal setting with access to a remarkably resource-rich catchment. With such a wide range of resources on offer on a year-round basis, the site is interpreted as a base camp-type settlement that was used by the same group and their descendants over a period of several generations lasting for somewhere in the region of 200 years. The size of the hut indicates its use by a family-sized group. There was no surviving evidence for any more than one structure on the site at any one time, although land on the seaward side of the site has been lost through erosion and this land could have contained such evidence. The fieldwalking evidence suggests that other Mesolithic settlement foci existed nearby, all in easy reach of the freshwater stream, which could suggest the presence of other similar structures nearby. This provides an impression of family groups occupying sturdy conical-shaped huts separated by several hundred metres, but all with easy access to freshwater and the shore, and easy access to each other. No midden site was found at Howick and this is almost certainly due to the erosion of the contemporary Mesolithic shoreline and the effects of the Main Post-Glacial Marine Transgression, which would have removed and/or drowned any midden deposits near to the 8th millennium cal BC shore.

The Howick excavations have forced a rethink of the scale and nature of Mesolithic settlement in North-East England, as well as the relationship between this and other regions around the North Sea Basin. It has also demonstrated the potential of surviving deposits dating to this period as well as the type of residues and information that such sites can be expected to yield. Hopefully this work will help encourage further research into the Mesolithic of the region and its interactions with adjacent areas of upland, other North Sea Basin communities, as well as groups occupying the lands further north and south.

Résumé

Les premiers signes d'un site mésolithique à Howick furent remarqués séparément par deux archéologues amateurs, qui avaient chacun découvert des silex qui se détachaient de la paroi de la falaise sous l'effet de l'érosion. Par la suite, une petite tranchée de sondage, ainsi que la prospection géophysique confirmèrent la présence de dépôts mésolithiques non perturbés sous la zone labourée. Après une saison de fouilles en l'an 2000 pour évaluer les dépôts, des fouilles complètes furent entreprises en 2002 pour noter, dans leur intégralité, tous les restes archéologiques qui risquaient de s'éroder davantage.

Les restes archéologiques de Howick comprennent un site de huttes mésolithiques et une nécropole de cistes de l'Age du Bronze situés au bord d'une falaise moderne qui domine un petit estuaire. Ce volume se consacre exclusivement à la description et l'interprétation des restes mésolithiques; les restes de l'Age du Bronze sont décrits séparément dans un article d'une revue archéologique (Waddington *et al*. en cours de publication), de même que la séquence environnementale intégrale du Holocène obtenue par carottage des sédiments (Boomer *et al.* en cours de publication). Peu de sites de huttes mésolithiques ont été découverts dans les Iles Britanniques, alors que dans d'autres régions, comme par exemple le sud de la Scandinavie, les sites de huttes appartenant à cette période sont bien plus courants. Le manque relatif de ces sites en Grande-Bretagne s'explique peut-être par un ensemble de raisons, notamment, les effets différentiels du changement du niveau de la mer et la survie des sites à différents endroits, le manque de grandes surfaces de fouilles dans les zones côtières du Royaume-Uni, l'attention réduite portée à la période du Mésolithique ces dernières années par la communauté d'archéologues-chercheurs de Grande-Bretagne, contrairement à leurs homologues scandinaves, et peut-être le fait que de tels sites n'aient pas été reconnus en tant que tels au moment de leurs découvertes lors de fouilles et d'évaluations de terrain antérieures. Il est encourageant de noter que dans les mois qui suivirent l'achèvement des fouilles à Howick, un site presque identique fut mis au jour à 80km au nord de East Barns, à côté de Dunbar, qui se trouve également sur la côte de la Mer du Nord (Gooder en cours de publication). Considérés conjointement avec les sites déjà connus de Mount Sandel et Broomhill, ces quatre sites de huttes fournissent la preuve la moins ambiguë à ce jour d'établissements au Mésolithique en Grande-Bretagne et en Irlande.

Trois huttes avaient été construites sur le site de Howick, toutes sur le même emplacement, sans preuves qui indiqueraient une interruption entre ces occupations. Ceci fut confirmé par la datation par le radiocarbone, qui suggère que ces différentes phases s'enchaînèrent sans discontinuité. Le débat reste ouvert pour déterminer si le site était occupé de manière saisonnière ou comme lieu de résidence permanente, et cela formera sans aucun doute une des dernières questions clés liées à ce site. Une quatrième phase d'occupation très courte fut identifiée par le programme de datation par le radiocarbone : elle eut lieu après l'abandon de la hutte, et représente probablement une utilisation transitoire de la cuvette laissée par la hutte pour un campement d'une nuit. Les résidus provenant de Howick ont été soumis à un programme complet de datation par le radiocarbone, et les résultats ont été modélisés grâce à l'analyse statistique Bayésienne afin de créer une séquence chronologique très bien comprise. La construction initiale du site eut lieu vers 7850 avant JC, et il fut abandonné aux alentours de 7650 avant JC.

Les restes à l'intérieur des huttes correspondaient tous à leur utilisation comme site d'habitation. Ceux-ci se composaient d'un arrangement central de foyers qui contenaient des os d'animaux calcinés et quantités de fragments de coquilles de noisettes carbonisées, de zones d'activité représentées par la distribution d'artefacts en pierre, et de la présence d'une fosse pour griller les noisettes qui indique des stratégies associées au stockage des aliments. Bien que la fonction principale de la hutte fût sans aucun doute celle d'une structure d'habitation, cela n'a pas empêché certains aspects de la vie résidentielle de comporter une part de rituel. En effet, il est improbable que la vie domestique et rituelle ait été considérée séparément par les groupes de chasseurs-cueilleurs de l'Age de Pierre, qui auraient certainement incorporé le « rituel » à tous les aspects de la vie. Toutefois, il faut remarquer qu'il n'y avait pas d'indication physique nette de comportement rituel au sein des dépôts fouillés et qu'aucune découverte présente sur le site ne pourrait être interprétée comme une déposition spéciale ou comme ayant une signification rituelle propre. Il n'y avait pas non plus de signe d'inhumation ou de suppression de restes humains. En ce sens, le site de huttes n'était pas différent de ceux de Mount Sandel, Broomhill et East Barns, qui ont révélé des restes remarquablement similaires à ceux de Howick.

Les pièces lithiques provenant de Howick constituent l'ensemble daté de manière la plus exacte de tous les sites mésolithiques britanniques et elles forment un exemple classique d'une industrie de lames étroites associée au techno-complexe de pointes microlithiques triangulaires, avec des triangles scalènes, la forme microlithique la plus fréquente. Typiquement pour la Grande-Bretagne, ces sites datent d'environ 7500 avant JC calibré, mais les dates de Howick montrent que ce type d'industrie avait commencé plus tôt, au cours des siècles qui suivirent immédiatement 8000 avant JC calibré. Des datations plus récentes de East Barns concordent directement avec les dates les plus anciennes de Howick. On a récemment acquis des dates encore plus anciennes pour le site de pointes microlithiques triangulaires de Cramond, à côté d'Edimbourg, qui, considéré conjointement avec une date ancienne provenant de Daer Reservoir, aussi en Ecosse, constituent désormais les dates les plus anciennes, à ce jour, de la présence de cette industrie en Grande-Bretagne, aux environs de 8400 avant JC calibré. Ceci soulève d'intéressantes questions quant à l'origine et la diffusion de ce type de technologie, ses liens avec les industries de l'Europe du Nord, aussi bien que le chevauchement avec ce qu'on appelle traditionnellement les industries d'artefacts du « Mésolithique plus ancien » du sud de l'Angleterre.

L'ensemble d'éclats de pierre de Howick provient entièrement de galets de silex de la plage locale et ceci correspond au modèle plus général d'acquisition de matière première localisée par d'autres groupes du nord-est de l'Angleterre. Une grande variété de types d'outils est présente à l'intérieur de la hutte, représentant les activités diverses qui semblent y avoir eu lieu. On constate d'autant plus la diversité des activités grâce à la présence d'un grand ensemble d'outils de pierre à bords biseautés, à la quantité énorme de coquilles de noisettes carbonisées, aux quelques fragments d'ocre, et à la présence d'une variété d'animaux.

Le site de Howick se situe dans un écotone mettant à disposition une zone remarquablement riche en ressources. Avec une telle sélection de ressources disponibles tout au long de l'année, le site a été interprété comme un habitat de type camp de base utilisé par le même groupe et leurs descendants pendant plusieurs générations, sur une période d'environ 200 ans. La taille de la hutte indique qu'elle était utilisée par un groupe de la taille d'une famille. Aucune preuve ne nous est parvenue laissant à penser qu'il y ait eu plus d'une structure à la fois sur le site à quelque moment donné que ce soit, quoique les terres du côté du site face à la mer aient été perdues à cause de l'érosion et ces terres auraient pu contenir de telles preuves. Les preuves collectées lors de ramassages de surface suggèrent que d'autres lieux d'habitations mésolithiques existaient à proximité, tous à portée du ruisseau d'eau douce, ce qui pourrait suggérer la présence d'autres structures similaires dans les environs. On imagine des groupes familiaux qui occupaient de solides huttes de forme conique séparées par plusieurs centaines de mètres, mais tous ayant un accès facile à l'eau douce et au rivage, et facilement accessible les uns des autres. On n'a trouvé aucun site d'amoncellements des détritus à Howick et cela tient presque incontestablement à l'érosion du rivage contemporain au Mésolithique et les effets de la Transgression Marine Post-Glaciaire Principale, qui auraient enlevé et/ou englouti tout amoncellement près de la rive du 8ème millénaire avant JC calibré.

Les fouilles de Howick nous ont forcés à reconsidérer l'étendue et la nature des établissements mésolithiques du nord-est de l'Angleterre, aussi bien que la relation entre cette région et celles qui bordent le bassin de la Mer du Nord. Elles ont également montré le potentiel des dépôts conservés datant de cette période, aussi bien que les types de résidus et d'informations qu'on peut attendre de tels sites. Avec un peu de chance, ces travaux inciteront à plus de recherches sur le Mésolithique de la région et sur l'interaction des communautés avec celles des zones de plateaux adjacentes, celles du Bassin de la Mer du Nord, aussi bien qu'avec les groupes qui occupaient les terres plus au nord et au sud.

ZUASAMMENFASSUNG

Erste Anzeichen eines mesolithischen Fundplatzes in Howick wurden zu verschiedenen Gelegenheiten von zwei Amateurarchäologen bemerkt, die beide aus einer Felskante erodierende Silexgeräte beobachteten. Später bestätigten eine kleine Sondagegrabung und eine geophysikalische Prospektion, dass unterhalb des Pflughorizontes ungestörte mesolithische Schichten vorlagen. Nach einer Grabungssaison im Jahre 2000, die die Schichten beurteilen sollte, wurde 2002 eine umfassende Grabung begonnen, deren Aufgabe es war, alle archäologischen Hinterlassenschaften, die der Gefahr weiterer Erosion ausgesetzt waren, zu erfassen.

Die archäologischen Hinterlassenschaften in Howick bestehen aus mesolithischen Hütten und einem frühbronzezeitlichen Steinkistengräberfeld. Sie befinden sich am Rande einer neuzeitlichen Felskante, die eine kleine, den Gezeiten ausgesetzte Flussmündung überblickt. Dieser Band widmet sich ausschließlich der Beschreibung und Interpretation der mesolithischen Hinterlassenschaften. Das bronzezeitliche Material (Waddington *et al.* im Druck), sowie die gesamte holozäne Umweltentwicklung, die durch Sedimentbohrungen aufgeschlüsselt wurde (Boomer *et al.* im Druck), werden gesondert als Beiträge in Zeitschriften vorgestellt. Auf den Britischen Inseln sind nur wenige mesolithische Hüttenfundplätze bekannt, wohingegen in anderen Regionen, wie beispielsweise Südskandinavien, Hütten dieser Zeitstellung häufiger sind. Die relative Seltenheit solcher Fundstellen in Großbritannien kann durch das Zusammenspiel verschiedener Gründe erklärt werden. Die wohl wichtigsten sind die unterschiedlichen Auswirkungen der Meeresspiegelschwankungen und die Erhaltung von Fundstellen in verschiedenen Gebieten, die Tatsache, dass bisher keine großflächigen Ausgrabungen in Küstengebieten Großbritanniens durchgeführt worden sind, das in den letzten Jahren geringere Interesse der britischen Forschungsgemeinschaft am Mesolithikum, vor allem verglichen mit ihren skandinavischen Kollegen, und vielleicht auch die Unfähigkeit solche Fundstellen zu erkennen, wo sie durch vorherige Ausgrabungen und Voruntersuchungen entdeckt wurden. Spannenderweise wurde nur wenige Monate, nachdem die Ausgrabung in Howick beendet war, 80km nördlich ein fast identischer Fundplatz bei East Barns in der Nähe von Dunbar ausgegraben, der ebenfalls an der Nordseeküste liegt (Gooder im Druck). Zusammen mit den bereits bekannten Fundstellen Mount Sandel und Broomhill liefern diese Plätze die bisher eindeutigsten Nachweise für Siedlungen im britischen und irischen Mesolithikum.

In Howick waren drei Hütten erbaut worden, alle nach dem gleichen Schema und ohne Hinweise auf eine Besiedlungslücke. Dies wurde durch die Radiokarbondaten bestätigt, die darauf hindeuten, dass die verschiedenen Belegungsphasen ohne Unterbrechung aufeinander folgten. Ob dieser Platz saisonal oder als permanenter Aufenthaltsort genutzt wurde ist noch offen und wird zweifellos eine der wichtigsten Fragen für unser Verständnis der Fundstelle bleiben. Die Radiokarbondatierung stellte auch eine vierte, sehr kurze Besiedlungsphase fest, die folgte, als die Hütte schon aufgegeben worden war. Wahrscheinlich handelt es sich hierbei um eine vorübergehende Nutzung der Senke als kurzzeitigen Lagerplatz. Für die Hinterlassenschaften aus Howick wurde eine umfassende Serie von Radiokarbondaten gemessen, die durch Anwendung eines bayesischen Verfahrens statistisch ausgewertet wurden. Dies führte dazu, dass die chronologische Abfolge außergewöhnlich gut aufgeschlüsselt werden konnte. Das erste Gebäude wurde um 7850 cal BC errichtet und der Platz um 7650 cal BC aufgegeben.

Die Überreste in der Hütte selbst stimmten alle mit einer Nutzung des Gebäudes als Wohnplatz überein. Sie bestanden aus zentral angeordneten Herdstellen, die verbrannte Tierknochen und massenweise verkohle Fragmente von Haselnusschalen enthielten. Die Verteilung der Steingeräte ergab Aktivitätszonen und eine Grube zum Rösten von Haselnüssen weist auf Strategien zur Lagerung von Nahrungsmitteln hin. Auch wenn die Hütte zweifellos hauptsächlich als Behausung fungierte, so heißt das keineswegs, dass Aspekte des Lebens hier nicht auch ritualisierte Verhaltensweisen beinhalteten. In der Tat ist es unwahrscheinlich, dass die steinzeitlichen Wildbeutergemeinschaften häusliches Leben und Ritualleben auseinanderhielten. Es scheint plausibler, dass das „Rituelle" in alle Lebensbereiche mit einbezogen war. Es muss jedoch hervorgehoben werden, dass es in den ausgegrabenen Schichten keine offensichtlichen Hinweise auf rituelles Verhalten gab, und dass keine der Funde als intentionell deponiert oder von intrinsischer ritueller Bedeutung gedeutet werden können. Noch gab es Anzeichen einer Grablege oder der Deponierung menschlichen Skelettmaterials. In dieser Hinsicht war dieser Siedlungsplatz nicht anders als Mount Sandel, Broomhill und East Barns, die alle Hinterlassenschaften ergaben, die denen Howicks erstaunlich ähnlich sind.

Die Steingeräte aus Howick sind der am genauesten datierte Komplex aus dem gesamten britischen Mesolithikum. Sie sind ein klassisches Beispiel für eine auf schmalen Klingen basierende Industrie, die mit dem Technokomplex der Dreiecksmikrolithen verbunden ist. Ungleichschenklige Dreiecke sind die häufigste Mikrolithform. Wie für Großbritannien typisch, datieren diese Fundstellen ab 7500 cal BC, aber die Daten aus Howick zeigen, dass diese Industrie bereits früher, in den Jahrhunderten unmittelbar nach 8000 cal BC, begann. Die jüngst aus East Barns gewonnen Datierungen stimmen direkt mit den frühesten aus Howick überein. Ein noch höheres Alter wurde kürzlich für einen Fundplatz mit Dreiecksmikrolithen in Cramond bei Edinburgh ermittelt. Gemeinsam mit einem frühen Datum aus Daer Reservoir, ebenfalls in Schottland, sind diese Datierungen um 8400 cal BC nun die bislang ältesten für diese Industrie in Großbritannien. Dies wirft interessante Fragen zu Ursprung und Verbreitung dieser Technologie auf, sowie zu ihrem Verhältnis zu nordeuropäischen Industrien und der Überschneidung mit dem, was man traditionell die „frühmesolithischen" Werkzeugindustrien Südenglands nennt.

Die Silexgeräte aus Howick sind alle aus am örtlichen Strand vorkommenden Knollen hergestellt. Dies fügt sich gut in das weiter verbreitete Muster einer örtlich begrenzten Rohmaterialversorgung durch Wildbeutergruppen in anderen Teilen Nordostenglands. Aus der Hütte selbst stammt eine große Vielfalt von Gerätetypen, die die verschiedenen Tätigkeiten, die offensichtlich hier stattfanden, widerspiegeln. Weitere Hinweise auf weit gefächerte Tätigkeiten sind das häufige Vorkommen von Geräten aus schräg facettierten Knollen, große Mengen an verkohlten Haselnusschalen, einige Rötelfragmente und eine Reihe verschiedener Tierarten.

Die Fundstelle von Howick liegt in einem Ökoton, das Zugriff auf ein ungewöhnlich artenreiches Gebiet erlaubt. Da hier eine solche Bandbreite an Ressourcen das ganze Jahr über zur Verfügung stand, wird der Fundplatz als Basislager interpretiert, das von der gleichen Gruppe und deren Nachkommen über mehrere Generationen hinweg, wohl insgesamt um die 200 Jahre, genutzt wurde. Die Ausmaße der Hütte deuten auf ihre Nutzung durch eine Gruppe von der Größe einer Kernfamilie hin. Hinweise auf mehr als ein gleichzeitiges Gebäude haben sich an diesem Platz nicht erhalten. Jedoch hat an der dem Meer zugewandten Seite Landverlust durch Erosion stattgefunden, wobei solche Hinweise verloren gegangen sein könnten. Aufgelesene Oberflächenfunde deuten darauf hin, dass es in der Nähe weitere mesolithische Siedlungen gab, die alle leichten Zugang zum Süßwasser führenden Bach hatten. Auch hier könnten sich Hinweise auf ähnliche Gebäude finden. Zusammen ergibt dies den Eindruck von Familienverbänden, die stabile, konische Hütten bewohnten, welche einige hundert Meter voneinander entfernt waren. Alle hatten leicht Zugang zu Süßwasser und zur Küste, sowie leichten Zugang zueinander. In Howick wurden keine Überreste von Abfallhaufen gefunden, was höchstwahrscheinlich an der Erosion der damaligen mesolithischen Küste liegt, sowie an den Auswirkungen der postglazialen marinen Transgression, die eventuelle Ablagerungen nahe der im 8. vorchristlichen Jahrtausend bestehenden Küste weggespült und/oder überschwemmt hätte.

Die Ausgrabungen in Howick zwingen dazu, Ausmaß und Charakter des mesolithischen Siedlungswesens in Nordostengland, sowie das Verhältnis zwischen dieser und anderen Regionen um das Nordseebecken, neu zu überdenken. Sie haben auch bewiesen, dass Hinterlassenschaften aus dieser Zeit durchaus überdauern können und gezeigt, welche Überreste und Informationen man von solchen Fundplätzen erwarten kann. Hoffentlich wird diese Arbeit dazu beitragen, weitere Forschungen zum Mesolithikum in dieser Region anzuregen, sowie ihre Wechselbeziehungen mit benachbarten Gebieten im Hochland, mit anderen Gemeinschaften des Nordseebeckens und mit weiter nördlich und südlich siedelnden Gruppen zu erkunden.

Samenvatting

De eerste aanwijzingen voor een Mesolitische vindplaats nabij Howick kwamen aan het licht toen twee amateur-archeologen onafhankelijk van elkaar vuursteen ontdekten dat uit de klifrand erodeerde. Een kleine testput en geofysische survey bevestigden de aanwezigheid van onverstoorde Mesolitische lagen onder het maaiveld. Een evaluatieopgraving in 2000 werd gevolgd door volledige opgraving in 2002, met als doel het registreren van alle archeologische indicatoren die onder bedreiging stonden van verdere erosie.

De vindplaats Howick bestaat uit een Mesolithische hutplattegrond en een begraafplaats uit Vroege Bronstijd en bevindt zich op de rand van een hedendaagse klif die uitkijkt over een kleine riviermond. Deze publicatie is geheel gewijd aan de rapportage en interpretatie van het Mesolithische materiaal; een verslag van het Bronstijdmateriaal zal als apart artikel verschijnen (Waddington *et al.* in druk), evenals de opbouw van het complete Holocene pakket dat verkregen werd uit de boorstaaf (Boomer *et al.* in druk). Op de Britse eilanden zijn tot nog toe maar weinig Mesolitische hutplattegronden aangetroffen, in tegenstelling tot gebieden als zuid-Skandinavië, waar vindplaatsen uit dit tijdperk vaker voorkomen. Dit relatieve gebrek aan sites in Groot-Brittannië valt te wijten aan een combinatie van factoren, waaronder voornamelijk: het differentiële effect van zeespiegelverandering en de overlevingskans van archeologische indicatoren in verschillende gebieden; het gebrek aan grootschalige opgravingen in Britse kustgebieden; een verminderde recente nadruk op het Mesolithicum onder Britse onderzoekers vergeleken met hun Skandinavische collega's, en wellicht een onvermogen om zulke sites als zodanig te herkennen wanneer zij aan het licht komen tijdens opgravingen en evaluerend veldwerk. Een interessante ontwikkeling was dat binnen enkele maanden na afronding van de Howick-opgraving een nagenoeg identieke site werd opgegraven, 80 km ten noorden van Howick in East Barns nabij Dunbar, eveneens gesitueerd aan de Noordzeekust (Gooder in druk). In combinatie met de twee eerder bekende sites Mount Sandel en Broomhill vormen deze vier vindplaatsen de meest overtuigende aanwijzingen voor nederzettingen in het Britse en Ierse Mesolithicum tot dusver.

De Howick-site omvat drie hutten, alle met dezelfde plattegrond; er waren geen aanwijzingen voor onderbrekingen in de bewoning. Dit werd bevestigd door de radiokoolstofdateringen, die aangeven dat de verschillende fasen elkaar ononderbroken opvolgden. Of de bewoning seizoensgebonden of permanent was is vooralsnog onduidelijk, en dit zal ongetwijfeld een onbeantwoorde kernvraag omtrent deze site vormen. De koolstofdateringen brachten een vierde fase van zeer korte bewoning aan het licht nadat de hut verlaten was – waarschijnlijk een kort gebruik van de plek als overnachtingsplaats. Monsters van Howick werden onderworpen aan een uitgebreid ^{14}C-dateringsprogramma; met de resultaten hiervan werd vervolgens middels een Bayesiaans statistisch model een uitzonderlijk duidelijke chronologie opgesteld: de bouw van de site begon rond 7850 cal BC en de hut werd verlaten rond 7650 cal BC.

Binnenin de hut wezen alle indicatoren op gebruik als bewoningsplek. Zij bestonden uit een groep centraal gelegen haarden die verbrand dierlijk botmateriaal en enorme hoeveelheden verkoolde resten van hazelnootdoppen bevatten. De distributie van stenen artefacten vormde een aanwijzing voor waar in de hut bepaalde activiteiten werden uitgevoerd, en een kuil voor het roosteren van hazelnoten wees op strategieën voor de opslag van voedsel. Alhoewel de hut zonder twijfel in de eerste plaats als woonplek bedoeld was, wil dit niet zeggen dat ritueel gedrag geen deel uitmaakte van het dagelijks leven. Het is onwaarschijnlijk dat het dagelijks leven en ritueel gedrag van elkaar gescheiden waren bij deze jagers-verzamelaars uit de Steentijd; rituelen zullen deel hebben uitgemaakt van alle aspecten van het dagelijks leven. Het dient echter benadrukt te worden dat er geen in het oog springende fysieke aanwijzingen voor ritueel gedrag werden aangetroffen in de opgegraven lagen en dat geen enkele vondst geïnterpreteerd kon worden als zijnde specifiek ritueel geplaatst of van enig andere rituele betekenis. Ook van begraving of het anderszins ontdoen van menselijke resten was geen sprake. In dit opzicht verschilde Howick niet van Mount Sandel, Broomhill of East Barns, waar opvallend gelijksoortige archeologische indicatoren werden aangetroffen.

Het lithische materiaal van Howick is het meest precies gedateerde van alle Britse Mesolithische sites en is een klassiek voorbeeld van een technologie van smalle klingen geassocieerd met het micro-driehoekcomplex; de ongelijkbenige driehoek is de meest voorkomende microlitische vorm. In Groot-Brittannië dateren zulke sites typisch van rond 7500 cal BC; de Howick-dateringen geven echter aan dat dit type technologie al eerder begon, namelijk in de eerste eeuwen na 8000 cal BC. Recentere dateringen van East Barns zijn in directe overeenstemming met de vroegste Howick-datering. Nog vroegere dateringen komen van een micro-driehoek site in Cramond nabij Edinburgh; samen met een vroege datering van Daer Reservoir (eveneens in Schotland) vormen deze de vroegste dateringen tot nog toe voor deze technologie in Groot-Brittannië: ca. 8400 cal BC. Dit brengt interessante vragen met zich mee omtrent de oorsprong en verspreiding van dit type technologie, de relatie met Noordeuropese en de overlap met zuid-Engelse, traditioneel 'Vroeger Mesolithisch'genoemde, tegenhangers.

De collectie bewerkt steen van Howick bestaat geheel uit vuurstenen kiezels afkomstig van het nabijgelegen strand, wat strookt met het patroon van lokale grondstofverwerving elders in noordoost-Engeland. De hut bevatte een breed scala van werktuigen, wat erop wijst dat de aldaar uitvoerde activiteiten zeer divers waren. Deze interpretatie voor een grote diversiteit in taken wordt ondersteund door de aanwezigheid van een grote collectie schuin afgewerkte werktuigen vervaardigd van kiezels, enorme hoeveelheden verkoolde resten van hazelnootdoppen, enkele stukjes oker en overblijfselen van een grote verscheidenheid aan diersoorten.

De vindplaats Howick ligt in een ecotoon gebied dat toegang verschaft tot een regio zeer rijk aan voedselbronnen en grondstoffen. Gezien deze rijkdom, die bovendien het hele jaar door beschikbaar is, wordt Howick geïnterpreteerd als een basiskamp, ca. 200 jaar lang gebruikt door dezelfde groep en diens afstammelingen. Het formaat van de hut wijst op gebruik door een groep ter grootte van een gezin. Er waren geen aanwijzingen dat er zich in enige periode meer dan één bouwwerk tegelijk bevond, hoewel land aan de zeezijde van de site, door erosie verloren gegaan, aanwijzingen hiervoor zou kunnen hebben bevat. Materiaal verzameld tijdens de veldverkenningen wijst op andere Mesolithische activiteit in de buurt, steeds in de nabijheid van zoet water, wat zou kunnen betekenen dat er zich in de omtrek nog andere gelijksoortige structuren bevinden. Dit alles geeft de indruk van kleine groepen, woonachtig in stevige, kegelvormige hutten die een paar honderd meter uit elkaar liggen maar alle in buurt van zowel zoet water als de kust en die makkelijk onderling bereikbaar zijn. Er werden geen schelpenhopen aangetroffen in Howick, wat vrijwel zeker te wijten is aan erosie van de Mesolithische kustlijn en de effecten van de postglaciale mariene transgressie; schelpenhopen die in het achtste millenium cal BC dicht bij de kustlijn lagen zullen hierdoor weggespoeld of verdronken zijn.

De Howick-opgraving dwingt tot een heroverdenking van de schaal en de aard van het Mesolithische nederzettingspatroon in noordoost-Engeland, evenals van de relatie tussen deze en andere regio's rond de Noordzee. Tevens is aangetoond hoeveel informatie indicatoren uit deze periode kunnen bevatten en wat voor soort informatie verwacht kan worden van dit type vindplaatsen. Hopelijk moedigt het hier besproken werk aan tot verder onderzoek naar het Mesolithicum van deze regio, de interactie met aangrenzende hoger gelegen gebieden en met groepen ten noorden en ten zuiden, alsmede met andere gemeenschappen rond het Noordzeebekken.

Translated by Myra Wilkinson-van Hoek
Fine Line Archaeolological Language Services

Dansk resumé

Howick lokalitetens mulige status som mesolitisk boplads blev først bemærket af to amatørarkæologer, som uafhængigt af hinanden havde fundet bearbejdet flint i stedets eroderende klinter. En prøvegravning, kombineret med geofysiske undersøgelser, bekræftede tilstedeværelsen af uforstyrrede mesolitiske strata under pløjelaget. Efter den første udgravningssæson i 2000, hvis formål var at vurdere karakteren af disse lag, blev en egentlig udgravning indledt i 2002. Hensigten med sidstnævnte var at redde alle truede materielle levn, såvel som at beskrive levnenes kontekster.

Howick bopladsen ligger på kanten af en nutidig klint ud mod en mindre flodmunding. Lokaliteten inkluderer en mesolitisk hyttetomt, såvel som en stenkiste gravplads dateret til tidlig bronzealder. Nærværende monografi fokuserer udelukkende på beskrivelsen og fortolkningen af de mesolitiske levn, hvorimod bronzealder-fundene vil blive præsenteret i en selvstændig artikel (Waddington *et al*. in press). De naturvidenskabelige undersøgelser af bopladsens holocæne baggrund vil også blive publiceret selvstændigt (Boomer *et al*. in press). Få mesolitiske hyttetomter er kendt fra De britiske Øer, hvorimod de er relativt almindelige i andre regioner, såsom Skandinavien. Der er formodentlig flere grunde til at hyttetomter fra britisk mesolitikum er så sjældne: Først og fremmest har havstigninger haft forskellig effekt i forskellige dele af Nordvesteuropa; få større fladeudgravninger har været foretaget i de britiske kystegne; i nyere tid har interessen for mesolitisk forskning været faldende blandt britiske arkæologer, sammenlignet med en mere stabil interesse for den mesolitiske periode i for eksempel Skandinavien; og antagelig som en konsekvens af sidstnævnte har der været problemer forbundet med at erkende karakteren af mesolitiske levn, når de blev frilagt i forbindelse med udgravninger. Ved et sammentræf blev en næsten identisk lokalitet udgravet 80 km mod nord, ved East Barns nær Dunbar (Gooder in press), kun måneder efter at Howick udgravningen var fuldført. Også denne boplads lå ved kysten ud mod Nordsøen. Sammen med de velkendte lokaliteter Mount Sandel og Broomhill, præsenterer Howick og East Barns de mest entydige beviser for opførelsen af hytter i britisk og irsk mesolitikum.

På Howick lokaliteten var der fyldskifter fra tre hytter, som havde stået mere eller mindre på samme sted over en kontinuerlig periode. Dette blev bekræftet af kulstof-14 dateringerne, der i forbindelse med hytterne udgør en ubrudt sekvens. Det er uvist, hvorvidt bopladsen blev benyttet sæsonvist, eller om der er tale om helårsbosættelse. Dette vil antagelig udgøre et af de mere væsentlige spørgsmål i forbindelse med den fortsatte diskussion af bopladsens karakter. Kulstof-14 dateringerne antyder også en fjerde kortvarig bosættelsesfase, som fandt sted efter hyttens opgivelse. Sidstnævnte levn repræsenterer formodentlig en transitboplads, hvor bopladsen blev benyttet en enkelt nat eller to. Kulstofprøverne fra Howick er blevet indgående analyseret, og resultaterne er blevet statistisk behandlet med henblik på at producere en logisk kronologisk sekvens. Med baggrund i disse analyser antages det, at bopladsen blev besøgt første gang omkring 7850 cal BC, og at den blev opgivet omkring 7650 cal BC.

Fundene fra hyttens indre svarer til det, man ville forvente i forbindelse med en basisboplads. Centralt i boligen var der en samling ildsteder, som indeholdt brændte dyreknogler og forkullede hasselnødskaller, såvel som et aktivitetsområde med stenredskaber og en grube, hvor hasselnødder blev ristet. Ristningsgruben indikerer eksistensen af en strategi til konservering af fødevarer. Selvom hytten givetvis primært fungerede som bolig, udelukker dette ikke at rituel adfærd også forekom. Det er således usandsynligt, at stenalderens jæger-samler samfund adskilte almindelige dagligdags opgaver og rituelt liv, men i stedet inkorporerede 'ritualer' i alle livets aspekter. Det bør dog understreges, at der under udgravningen ikke bemærkedes åbenbare fysiske indikationer på rituel adfærd, og at ingen fund kunne fortolkes som specielle nedlæggelser eller som havende egentlig rituel betydning. Der var heller ikke tegn på gravlæggelse eller anden behandling af menneskelige levn. På disse punkter adskilte Howick hyttetomten sig ikke fra hyttetomterne ved Mount Sandel, Broomhill og East Barns, der generelt svarede bemærkelsesværdigt til hinanden.

Det lithiske inventar fra Howick er det mest præcist daterede fra britisk mesolitikum, og repræsenterer en materiel kultur kendetegnet ved produktionen af mikroflækker og skævtrekanter. I Storbritannien er de tidligste dateringer af bopladser med sådanne inventarer generelt blevet sat til ca. 7500 cal BC, men dateringerne fra Howick antyder en endnu tidligere begyndelse for denne materielle kultur, antagelig umiddelbart efter 8000 cal BC. Nylige dateringer fra East Barns svarer ret præcist til de tidligste dateringer fra Howick. Endnu tidligere dateringer er for nylig blevet opnået for en skævtrekant boplads ved Cramond nær Edinburgh, og sammen med en tidlig datering fra Daer Reservoir, også i Skotland, indikeres der nu en begyndelse for denne materielle kultur i Storbritannien omkring 8400 cal BC. Dette rejser en række spændende spørgsmål, såsom oprindelsen og spredningen af denne form for teknologi, dens forhold til tilsvarende Nordvesteuropæiske kulturer, og det tilsyneladende overlap med det, der i det sydlige England traditionelt er blevet henvist til som 'tidligere mesolitikum'.

Det lithiske inventar fra Howick er generelt baseret på lokalt forekommende kugleflint, hvilket passer fint ind i det almindeligt accepterede billede af, hvorledes de mesolitiske grupper i det nordøstlige England primært erhvervede sig lithiske råmaterialer i deres nærmiljø. Inde i hytten blev der fundet et vidt spektrum af redskabstyper, som belyser de mangeartede aktiviteter, der fandt sted. Beviserne for varieret adfærd suppleres af tilstedeværelsen af en samling redskaber baseret på rullesten, store mængder forkullede hasselnødskaller, fragmenter af okker, såvel som knogler fra en lang række dyr.

Howick lokaliteten er strategisk velbeliggende med adgang til et bemærkelsesværdigt rigt catchment område. Da der vil have været adgang til et stærkt varieret udbud af ressourcer året rundt, er det rimeligt at antage, at lokaliteten var en basisboplads, som blev benyttet af den samme gruppe over en række generationer. Formodentlig blev bopladsen benyttet over en 200-årig periode. Hyttens størrelse indikerer, at den blev brugt af en familiegruppe. Fundspredning og kontekster antyder, at der på intet tidspunkt var mere end en hytte på stedet af gangen, omend erosionen af den nærliggende kystlinje betyder, at dette spørgsmål ikke kan afklares entydigt. Fund fra markvandringer har påvist andre mesolitiske aktivitetsområder i området, som alle ligger nær vandløb og dermed ferskvand. Det kan ikke afvises, at disse lokaliteter kan være forbundet med lignende hyttetomter. Disse fund antyder, at familiegrupper boede i velbyggede, koniske hytter, adskilt af flere hundrede meter, men alle med let adgang til ferskvand, den nærliggende kyst og hinanden. Der blev ikke fundet nogen mødding ved Howick, men dette skyldes antagelig erosionen af den mesolitiske kystlinje og effekten af postglaciale havstigninger, som har fjernet eller oversvømmet alle eventuelle møddingslag nær den daværende kyst.

Udgravningerne ved Howick har bevirket en revurdering af omfanget og karakteren af den mesolitiske bosættelse i det nordøstlige England, såvel som forholdet mellem dette område og andre regioner omkring Nordsøen. De har også demonstreret mulighederne for at finde intakte lag fra denne periode, og den rigdom af information som fund fra sådanne bopladser har at tilbyde. Forhåbentlig vil dette arbejde styrke forskningen i regionens mesolitiske periode, såvel som den mesolitiske befolknings brug af nærliggende indlandsområder, og kontakten med grupper nord og syd for Howick, såvel som omkring Norsøen.

1 Introduction

Clive Waddington

Setting the Scene

Writing 80 years before the excavations at Howick, Francis Buckley anticipated the occurrence of Mesolithic remains there after his discovery of narrow-blade Mesolithic flints at Budle Crags near Bamburgh, Brada Crags near Spindlestone and Chester Crags near Outchester (Buckley 1922).

> "It is likely that the coastland crags south of Craster have some relics of the Tardenois fishermen; and under favourable circumstances such relics should in time be found." (Francis Buckley 1922, 323).

Buckley likened the flint industry from these sites to the 'Tardenois' industry recognised at the time in northern France and Belgium. Today these Northumberland flints are no longer seen as being a direct extension of the Tardenois industry, but rather fit into the Later Mesolithic micro-triangle techno-complex recognised to exist across the British Isles and related to traditions that extended over much of North-West Europe at this time (see Jacobi 1976). The drawings published by Buckley include scalene triangle and crescent microliths, together with scrapers typical of this tradition, and these are directly analogous to those found at Howick. His anticipation of the Howick site, which lies 3km south of Craster, demonstrates the regard with which the area was considered, even then, for hosting Mesolithic remains. This study presents the results of the investigation of an early 8th millennium cal BC Mesolithic hut site that was found eroding out of a cliff that overlooks the Howick Burn estuary in mid-Northumberland (Fig. 1.1).

Although significant work had been undertaken along the Northumberland coast by earlier researchers (see Young 2000a for review) who collected Mesolithic flints from erosion scars (e.g. Davies 1983, Young 2000a), burnt field surfaces (e.g. Buckley 1922), old sand dunes (e.g. Raistrick 1934) and ploughed field surfaces (e.g. Weyman 1984), very little was known concerning the dating of this material. Indeed prior to the work at Howick there were no published radiocarbon dated Mesolithic sites, no excavated Mesolithic structures and no sequence for Mesolithic flint assemblages in Northumberland. The opportunity provided by the Howick site for establishing firm radiocarbon dates for the Mesolithic, and for dating particular lithic types from undisturbed contexts, meant the beginnings of a chronological framework could be developed.

Against this backdrop of chronological uncertainty there was very little known about Mesolithic habitation sites. The only exceptions to this are the rock shelter sites that have been investigated along the Fell Sandstone escarpments at Goatscrag (Burgess 1972) (Fig. 1.2), Corby's Crag (Beckensall 1976) and most recently at Salter's Nick (John Davies pers. comm.). Goatscrag and Corby's Crag produced only

Figure 1.1. View over the Howick excavations looking south with the Howick Burn estuary in the background. The hut site is located towards the top of the trench along its left edge.

Figure 1.2. View of the Goatscrag rock shelter site B.

small quantities of lithic material together with some traces of structural features, including drip gullies, post holes, pits and hearth pits for what are thought to have been temporary structures (e.g. Burgess 1972). However, the discovery of Bronze Age cremation burials in inverted cinerary urns indicates that later activity took place in these shelters and it is possible that this later phase of activity accounts for the pits, gullies, post holes and fire pits. Until such features are directly dated, their Mesolithic attribution will remain contentious. Interestingly though, four carvings of quadrupeds, that most likely represent deer (Fig. 1.3), have been discovered on one of the vertical walls within rock shelter B at Goatscrag (van Hoek and Smith 1988). Although these images cannot be dated directly, the use of figurative art is a style common to hunter-gatherer groups, whereas the Neolithic–Early Bronze Age rock art of the region is purely non-figurative (see Beckensall 2001; Waddington 1999a, 108; Waddington 1998). This possible survival of Mesolithic art opens up an interesting avenue for future research, particularly in the light of the recent discoveries of early hunter-gatherer art in caves at Creswell Crags (Ripoll *et al.* 2004) and Cheddar Gorge (Mullan and Wilson 2004).

Although only limited work has taken place to date, the potential for Mesolithic research in Northumberland and the Borders, on the coast, along river valleys and in the uplands, is considerable, particularly given the fact that there are so many opportunities for acquiring environmental data from sediment sequences that extend from the Late Glacial onwards. The study presented here will contribute new detail to the study of early hunter-gatherer-fisher groups in the region while providing a platform for a renewed research impetus. However, beyond the regional research context, there have been few well-resourced excavations of Mesolithic sites in the British Isles as a whole, with study of the period dominated by a handful of key sites, notably Star Carr (Clark 1971), Thatcham (Wymer 1962), Mount Sandel (Woodman 1985), Morton, (Coles 1971; 1983), Oronsay (Mellars 1987), the Southern Hebrides Sites (Mithen 2000), Kinloch (Wickham-Jones 1990) and the Obanian sites (e.g. Bonsall 1996) amongst a few others. In the light of the current research climate the Howick project has been fortunate to enjoy the level of support necessary to undertake detailed and full recording of a relatively intact habitation site. Given the wealth of information that it has been able to produce it is hoped that other sites of this period will benefit from well-resourced study in the future, in order to help unlock some of the questions relating to the early settlement of the British Isles.

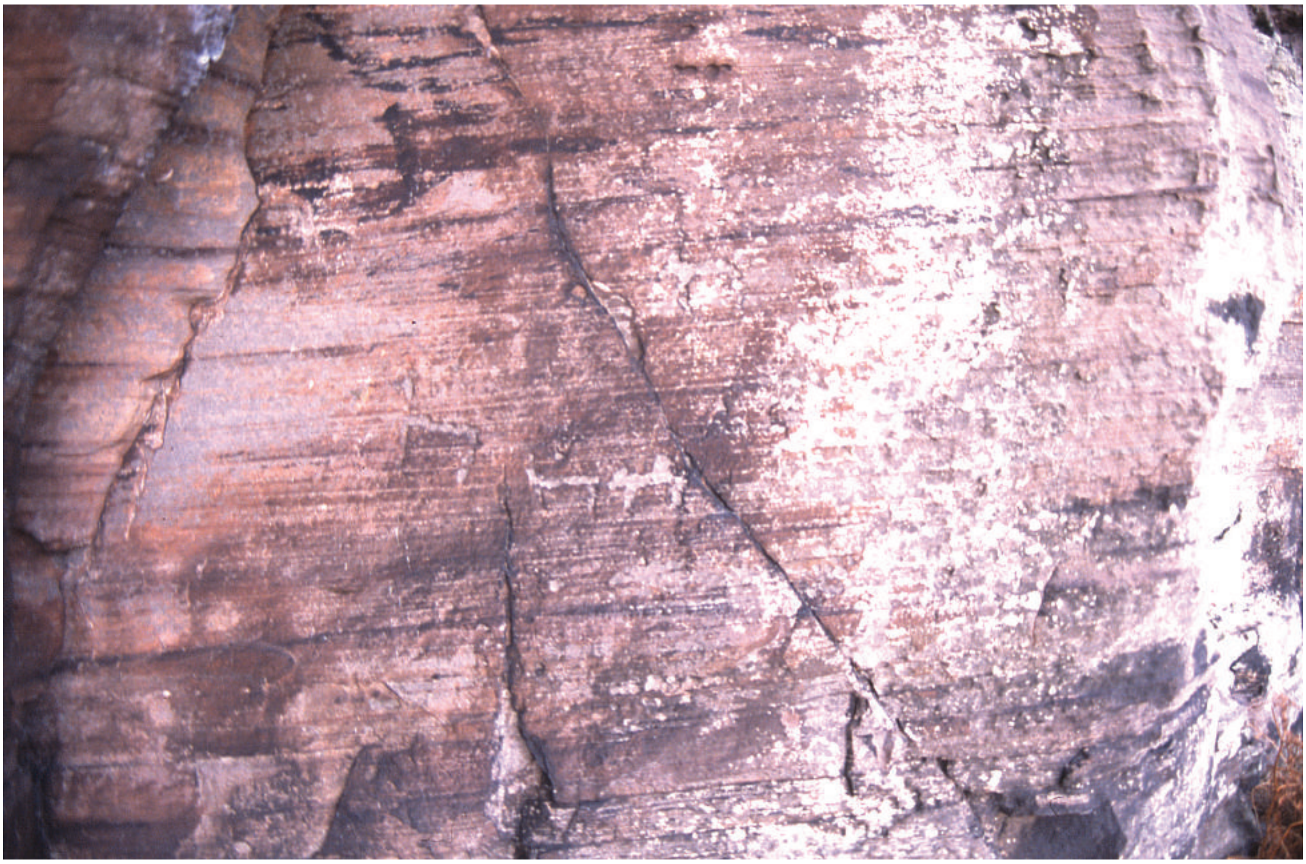


Figure 1.3. The 'deer' carvings on the vertical wall inside Goatscrag rock shelter site B.

Scope of the Volume

This volume provides a full report of the fieldwork programme directed at understanding the Mesolithic remains at Howick together with analysis and interpretation of the data in their wider North Sea context. The Bronze Age cist cemetery discovered during the excavation of the Mesolithic hut is not included in this volume but is reported separately in a journal article (Waddington *et al.* 2005). The volume has been structured to broadly follow the sequence of fieldwork undertaken at the site, followed by the analytical chapters and then the wider discussion. As most of the analyses proved highly revealing, and in some cases incorporated innovative and ground-breaking work (e.g. Chapter 6), it was considered important to present this work as a series of chapters in their own right rather than relegating them to appendices. As a result no appendices are included in this volume. The chipped stone recovered from the excavation is discussed in Chapter 7, starting with an assemblage description, followed by metrical, temporal and spatial analysis and concluding with an overview. Chapter 8 discusses the other lithic material produced by the excavation, while Chapter 9 presents a study of residues and use-wear on a selection of the chipped stone and other lithic material. It was decided to break the lithic work up into separate chapters for ease of navigation by the reader. A review of bevelled pebble tools and interpretation of the Howick group is provided in Chapter 14. However, discussion and interpretation of the chipped stone tool assemblage in relation to its wider chronological and geographic context is presented in Chapter 15.

A crucial point for readers to note is that all dates expressed in the text of this volume are given in calibrated years BC (i.e. calendrical dates). Although this is conventional for later prehistory it has not, in the past, been the custom for studies geared to the early Holocene. Adopting the same chronology for Mesolithic as for later sites will allow the real time difference between them to be articulated; accordingly all the 8th millennium cal BC sites in the British Isles have been calibrated using the latest curve (see Chapter 15). Another important point to make regarding the expression of chronologies in this volume is the use of age ranges given in italics, particularly in Chapters 6 and 15. These italicised date ranges refer to the mathematically modelled probabilities based on the combined radiocarbon determinations and do not indicate actual radiocarbon dates, which are always quoted in standard typeface. It is recommended that the reader consult Chapter 6 and its accompanying figure captions for further clarification.

Site Discovery

Flints were first recorded falling out of an erosion scar at Howick by John Davies (1983), an amateur archaeologist and member of the Northumberland Archaeology Group, who noted the flints as being of Mesolithic date. No further investigation of the site took place and it was largely overlooked for the next 17 years. Early in 2000 Jim Hutchinson, also a member of the Northumberland Archaeology Group, brought a handful of flints he had found at the same erosion scar and in nearby molehills to an artefacts day school organised by the then 'Centre for Lifelong Learning' at the University of Newcastle. The flints were shown to the author who was able to confirm that these flints were of Later Mesolithic 'narrow-blade' type. Subsequent to this Jim Hutchinson took the author out to the site and showed him the erosion scar and molehills. More flints were found eroding out of the section but it was noted that most of the material was coming from the soil layer below the plough zone, which, significantly, suggested that *in situ* remains survived on the site. This aroused a greater sense of interest and anticipation as it was known that there had been very few opportunities to excavate intact Mesolithic deposits in North-East England before. Photographs were taken and the farmer and landowner were informed. A return visit to the site was made by the author, together with Nicky Milner and Ben Johnson, to excavate a single 1m square test pit immediately behind the erosion scar to test whether subsurface archaeological deposits survived. The test pit produced a total of 51 flints and at the top of the sandy substratum an archaeological feature was identified that contained quantities of flint and charred hazelnut shell within a sandy weathered fill. This generated immense excitement as the survival of such deposits suggested that *in situ* Mesolithic remains did in fact survive on the site. What was more, these remains were being steadily eroded by a combination of slippage from the erosion scar and burrowing moles, and this added a sense of urgency to dealing with the site.

On the basis of this initial exploratory work, the author, Nicky Milner and Geoff Bailey, of the then 'Department of Archaeology' at the University of Newcastle, decided to undertake an evaluation of the site as a student training excavation. This evaluation work included a close-spaced geophysical survey around the immediate area of the site by Alan Biggins of Timescape Surveys (see Chapter 2), sediment coring around the Howick Burn by Ian Boomer from the Department of Geography, University of Newcastle, as well as the excavation of an evaluation trench behind the erosion scar. A sub-circular feature measuring around 6m across was identified by the geophysical survey behind the erosion scar and this could be defined on the ground when the archaeological horizon was exposed by the excavation. Although large quantities of Mesolithic flints were obtained from the unstratified soil above the site, it was considered important to obtain some dating samples that could be used to demonstrate beyond doubt that we were dealing with a Mesolithic structure. Initial sampling of a post hole and burnt feature took place, together with sampling some of the upper fill within the sub-circular feature. Two single entity charred hazelnut shell samples (AA-41788 and Beta-153650) were submitted for AMS dating, with assistance from the Society of Antiquaries of Newcastle upon Tyne and Northumberland County Council, and these returned early 8th millennium cal BC dates (see Chapter 6). These dates provided the proof necessary to convince potential funders that this was a nationally important site that deserved to be fully recorded before it was lost through further erosion. A project design was developed and grants were sought from the University of Newcastle, the Heritage Lottery Fund and English Heritage, who all contributed to the full-scale recording of the site in 2002, subsequent analyses, publication and public dissemination through information panels, leaflets and a schools pack.

Aims

The project set out to achieve the following overarching aims:

1. To record in full the archaeological remains on the site before they were destroyed through further erosion.
2. To identify more fully the extent of the archaeological resource at the site and its condition of preservation.
3. To place the site in its wider context by investigating land use across the surrounding spur of land and by gaining a more informed understanding of the past environment at the site and its linkages with the archaeological record. This was considered particularly relevant given that coastal erosion and sea-level change have affected the North-East coast since the early Holocene, which would have meant that the Howick site occupied a different setting then than it does today.
4. To improve archaeological understanding of the Mesolithic in the region, particularly in a coastal setting, and to embark on developing a chronology for the period in the region.

Field Research Strategy

In order to achieve the aims set out above it was decided to adopt a multi-disciplinary approach. Firstly it was recognised that a purely site-based

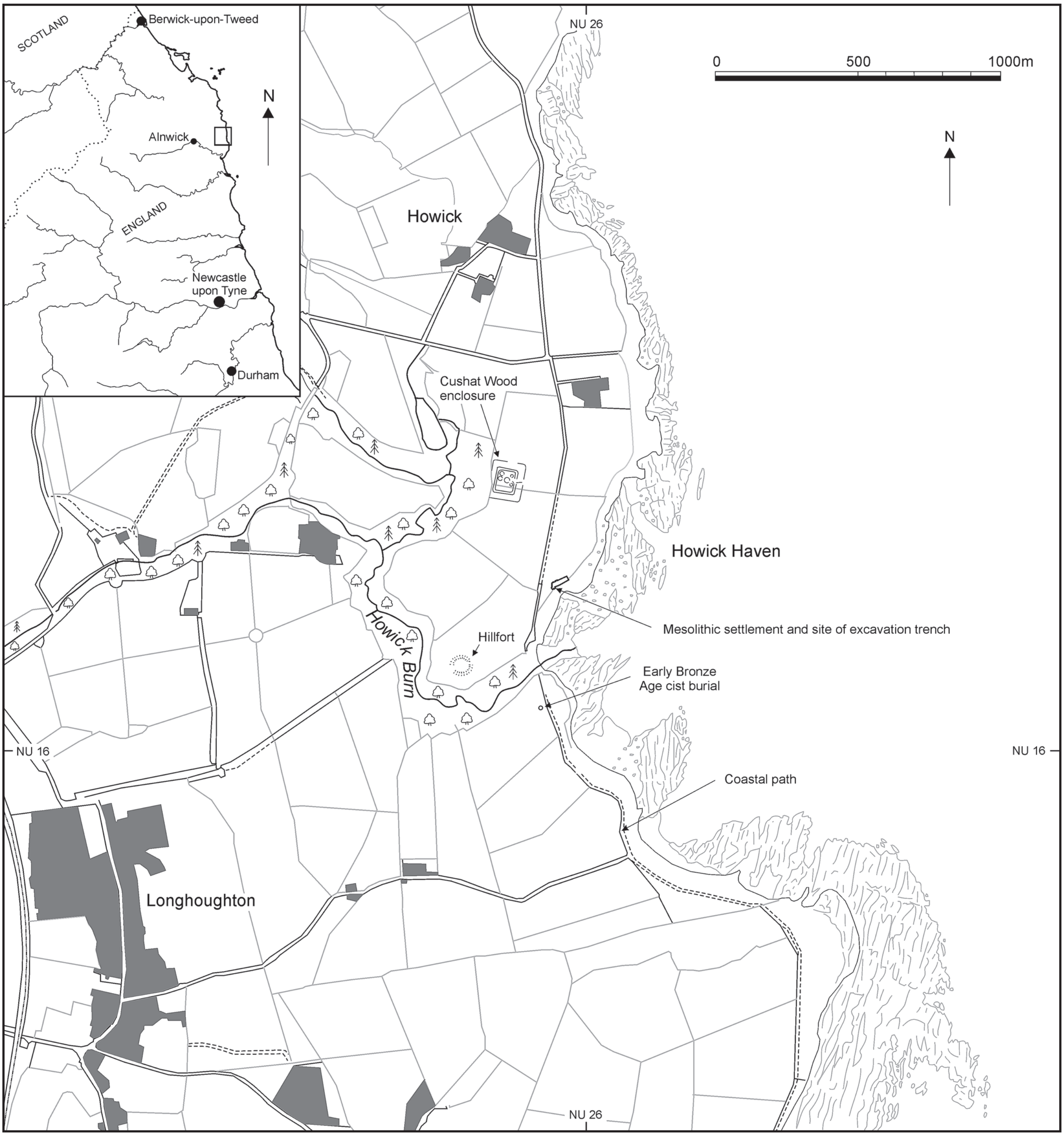


Figure 1.4. Location map showing the Mesolithic site and study area.

approach would not be sufficient to gain an understanding of how this site functioned and how it related to Mesolithic activity in the immediate environs. Secondly, it was also acknowledged that keyhole excavations and small-scale sampling were inappropriate in these circumstances for trying to understand the true extent and nature of this site. For these reasons it was decided that both on-site and off-site techniques should be employed to study the site and that the excavation trench was to be of a substantial size in order to be fully sure that all remains in danger of erosion were investigated and that any other immediate archaeology associated with the Mesolithic site be recognised and recorded.

As past human behaviour during the hunter-gatherer period was generally played out at the landscape scale rather than focussed on intensive occupation of a single site, it was considered important that the research strategy reflected this and that the site was not investigated in isolation. By taking an off-site approach to the research strategy (Foley 1981; Zvelebil *et al*. 1992) it was hoped that a more

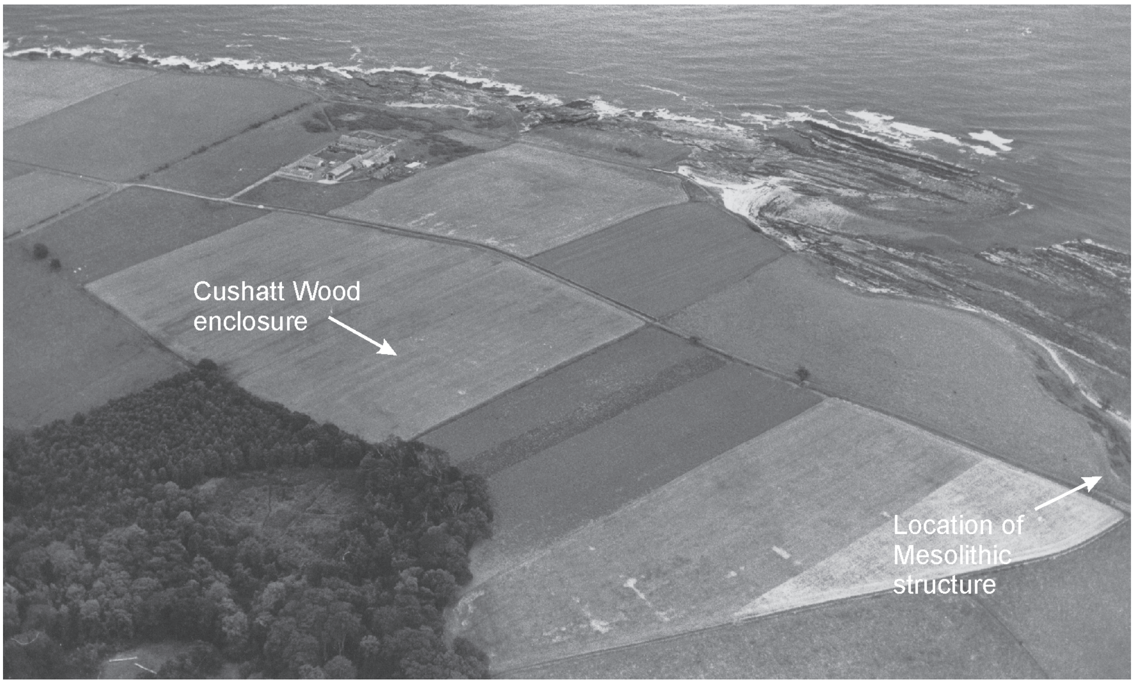


Figure 1.5. Aerial view of the Howick Mesolithic site. © Tim Gates.

Figure 1.6. Aerial view of the Cushat Wood triple-ditched rectilinear enclosure (centre). © Tim Gates.

Figure 1.7. Aerial view of the Howick Burn Hillfort. © Tim Gates.

accurate understanding of Stone Age activity might be achieved.

This approach was put into practice by utilising a range of off-site prospection techniques prior to the commencement of the main excavations, although in actuality some of this work proved to be of only limited value to accessing the off-site record (see Chapters 2, 3, 4 and 12). The programme of work combined assessment of existing aerial photograph coverage, although this did not add anything new to what was previously known, together with an extension of the close-spaced geophysical survey over an area of 4.8ha (see Chapter 2), and close-spaced fieldwalking of seven fields extending over 51.5ha around the site (see Chapter 3). Test pits were also excavated beyond the limit of the large excavation trench in order to assess whether other *in situ* deposits survived near to the site, and particularly in areas that may have been prone to future erosion (see Chapter 4) along the cliff edge. An appraisal of the soils and geomorphology of the site was also undertaken, together with sediment coring to obtain a datable sequence that could be analysed for the survival of insects and pollen to help with reconstructing the past environment at the site (see Chapter 12).

Site Location

The site is located on the Northumberland coast at NU 2585 1657, 8km to the north-east of Alnwick between Longhoughton and Craster (Fig. 1.4). The coastline at Howick consists of exposed rock cliffs of interbedded sandstone, limestone and mudstones, with sandy beaches in the small bays at Sugar Sands and Howick Haven. The cliff line is at the 10m contour with the ground behind rising to 58m on the crest of the Whinstone crag at Hips Heugh. The land is gently undulating and is mantled by a veneer of till deposits. This area of coastline is drained by the Howick Burn and an unnamed tributary which discharges into the sea at Iron Scars. The spur of land on which the Howick site is located is bounded to the south and west by the deeply incised valley of the Howick Burn, while to the east it is bounded by the North Sea. The only open approach to the site is along the neck of land from the north and in this way the site recalls the location of the prolific Mesolithic flint scatter site at Crimdon Dene on the Durham coast, which was also located on a spur of land between the shore and a deeply incised valley (Raistrick and Westoll 1933). The study area around the Howick site was defined by the spur of land extending southwards from Seahouses Farm (Fig. 1.4), as this is a geographically discrete landform that appears to have been respected through time, as indicated by the presence of a hillfort and a later rectilinear enclosure on the spur, both of which overlook the burn. Two fields outside the spur, to the south of the Howick Burn, were included in the fieldwalking as they were available to be walked at the time, and three test pits were also excavated behind an erosion scar to check if any archaeological remains were in danger of erosion. Otherwise, all the investigations were centred on the spur of land defined by the burn and the North Sea.

The Mesolithic hut site overlooks the small estuary of the Howick Burn, which falls into the North Sea 250m south of the site. The site commands extensive views along the coast to the south-east and out to sea. Although hindered by the present woodland cover above and within the valley of the Howick Burn, the site also has views over the ground to the south towards Boulmer and there are good views north along the spur towards the large outcrops of Whin Sill at Howick Scar and Hips Heugh. Only to the west does the site have restricted views, where rising ground leads up to the eminence on which the later hillfort is located. Today the site is in an exposed location on a cliff edge (Fig. 1.5) where a public footpath passes over it, however it is thought that during the Mesolithic the cliff edge would have been a hundred metres or so further away (see Chapter 12).

Previous Archaeological Work in the Howick Area

The Howick area forms a multi-period archaeological landscape containing remains from the Mesolithic (Davies 1983), Neolithic (Bateson 1895, 364; Bosanquet 1934), Bronze Age (Bateson 1895, 364; Jobey and Newman 1975), Iron Age (Maclaughlan 1867), Romano-British (Young 2000a; Steve Speak pers. comm.) and Early medieval (Keeney 1939) periods. Previous fieldwork has been predominantly site-based, including the excavation of a pagan Anglian cemetery in the area of the Howick Whinstone Quarry (Keeney 1939). As the quarrying progressed, a further excavation took place on the quarry site of an Early Bronze Age cremation cemetery (Jobey and Newman 1975). This excavation identified an enclosed cremation cemetery with a primary double cremation accompanied by a Collared Urn. The cremation provided a date of 1840–1690 cal BC (3390 ±90BP, I-6974). This quarry lies just west of this project's study area but other excavations have taken place closer to the Mesolithic site. Two evaluation trenches were excavated on the Cushat Wood rectilinear enclosure (Fig. 1.6), having been positioned to sample two of the three surrounding ditches. Up to five internal circular huts were identified on aerial photographs but none of these were sampled by excavation. A single sherd of undecorated pottery similar to the pottery recovered from the Fenton Hill curvilinear enclosure in the Milfield Basin (Burgess 1984) was found in the fill of the deeper ditch (Young 2000b; Steve Speak pers. comm.), but no organic material suitable for dating was recovered.

Prior to this more recent work, archaeological remains from the Howick area had long been known with the discovery of stone axe heads on the farm at Boulmer (Bateson 1895, 334) and near Longhoughton (Bosanquet 1934), an Early Bronze Age cist burial at Longhoughton, and a fragmentary Food Vessel Urn below a decorated cap stone to the south of the Howick Burn estuary on Lowstead Farm (Fig. 1.4) (Maclaughlan 1867; Bateson 1895, 333–4). The Howick Burn hillfort (Fig. 1.7) was ploughed around 1817 and pieces of ancient swords and some old coins (reported to have been Roman) were found (Maclaughlan 1867). The hillfort was surveyed as part of this project and a limited geophysical survey conducted to produce a condition report for the site. This has been completed and submitted to English Heritage and the County Sites and Monuments Record.

It is clear that the attractions of the Howick landscape have been felt across all generations, as archaeological remains from virtually every period have been discovered. It should come as no surprise that in landscape settings such as this, where freshwater, marine resources, terrestrial resources, fertile ground and defendable locations occur together, human groups will always be close at hand. It is no exaggeration to state that the area of land around the Howick Burn and adjacent coast has formed a 'persistent place' throughout history with each successive period leaving traces of its presence on the landscape. Although the Mesolithic project has been a substantial undertaking, it is clear that this rich and complex landscape still has many other stories to tell.

2 Geophysical Survey

Alan Biggins

The Howick geophysical survey consisted of an exploratory magnetometer survey of 0.3ha, focussed on the area around the initial test pit that located the Mesolithic deposits. This was followed by a larger extensive survey of 4.8ha covering the entire field in which the Mesolithic site was situated. An additional exploratory magnetometer survey was undertaken over the nearby hillfort (Biggins *et al.* 2002), originally surveyed by Henry MacLaughlan for the Duke of Northumberland in 1860 (Fig. 2.1), but is not reported here. The exploratory survey took place during June 2000 in conjunction with the first season of excavation at the site. The second survey was undertaken in advance of the second season of investigation during May 2002.

The application of magnetometer survey techniques for the identification of early prehistoric features, especially those dating from the Mesolithic period, is so far a relatively untested methodology, certainly in Northern England. The key issue is not the identification of substantial pit-like features, which can often generate a positive magnetic anomaly, but the identification of such a pit for what it is amongst features that may provide a similar response. The attempt to identify a hunter-gatherer site at Howick by high-resolution magnetometry and then excavating those features is a demonstration of the use of intensive geophysical survey for the prospection and future investigation of hunter-gatherer sites.

Objectives

The key objectives of the magnetometer survey can be summarised as:

- Identification of anomalies suggesting the presence of prehistoric features, together with information regarding constructional configuration, extent and character within the survey area.
- Identification of any previous agricultural activity, including features such as structures, routeways, field boundaries, pits and ditches that might be associated with the Iron Age and Romano-British occupation of this area.
- Identification of any potential archaeological features close to the cliff edge that may be susceptible to future erosion.

Location and Geology

The survey was centred upon NU 259 167 on land currently given over to pasture. The survey area was situated 500m south of Sea Houses Farm on land that slopes gently towards the north. However, a slight hollow exists towards the northern field boundary, which acts as a natural drainage channel. Evidence of this drainage effect can be seen particularly at the cliff edge where waterlogged, possibly anaerobic conditions, may exist. The soils are, overall, relatively free draining and sandy in composition (see also Chapter 12). The field boundaries have remained essentially unchanged since the 1850s, although some new fencing has been erected to supplement the previous derelict drystone walling. A farm track delineates the site towards the west and the eastern coastal side is typified by recent (and continuing) erosion of the coastline and defined by a steep cliff edge.

The Quaternary deposits overlying the solid geology often influence geophysical responsiveness, and tend to exhibit a high degree of local variation. It is recognised that drift geologies show a high degree of variability and the magnetic response is usually dependent on the magnetic mineralogy of the parent solid geology (English Heritage 1995, 10). The area of investigation is on geology of the Silesian (Millstone Grit Series) sedimentary formation called Namurian, comprising sandstones, mudstones, limestones and coal. To the north, bosses of amygdaloidal Whin Sill basalt are intruded amongst the bedding planes of limestone (Johnson 1995). In general, magnetometry survey can be recommended over any sedimentary geology, although in some cases overlying drift can introduce distorting factors. In this case the effects of the igneous Whin Sill intrusion did not overwhelm the survey, but some magnetic erratics may be present. These erratics, only identified during excav-

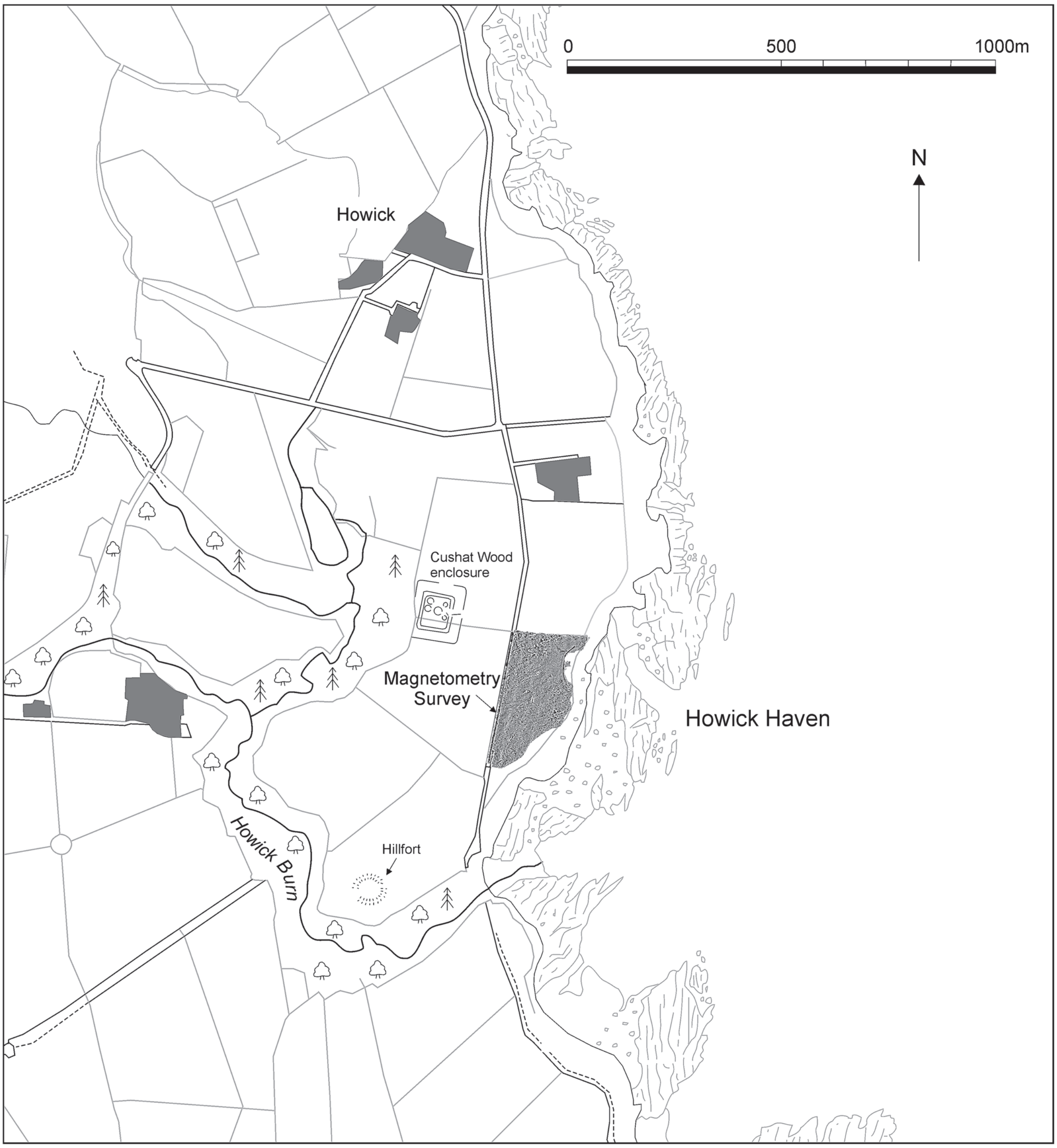


Figure 2.1. Overview of the second phase of the magnetometry survey comprising some 4.8ha.The much smaller first phase was conducted at the extreme southern sector of the area indicated. This historic landscape shows the defended settlement surveyed by Henry McLaughlan in 1860 and the crop mark transcription of a late Iron Age enclosed settlement 150m towards the west.

ation, produced a response indistinguishable from pits and could be easily mistaken for archaeological features.

Methods Statement

The surveys were conducted during periods of generally dry and warm weather conditions. A Geoscan FM36 fluxgate gradiometer was used, employing 1m parallel traverses with 0.25m sample intervals over a pre-surveyed grid of 30m squares (Fig. 2.2). The grid was set out parallel to the western farm track and set back 2m from the field boundary in order to minimise interference from the wire, but the road itself was surveyed. A digital terrain model (DTM) was derived from additional height measurements (Fig. 2.3).

The magnetometer survey data were computed and analysed using Geoplot 3 data processing software (Geoscan Research). Terramodel and Terra-

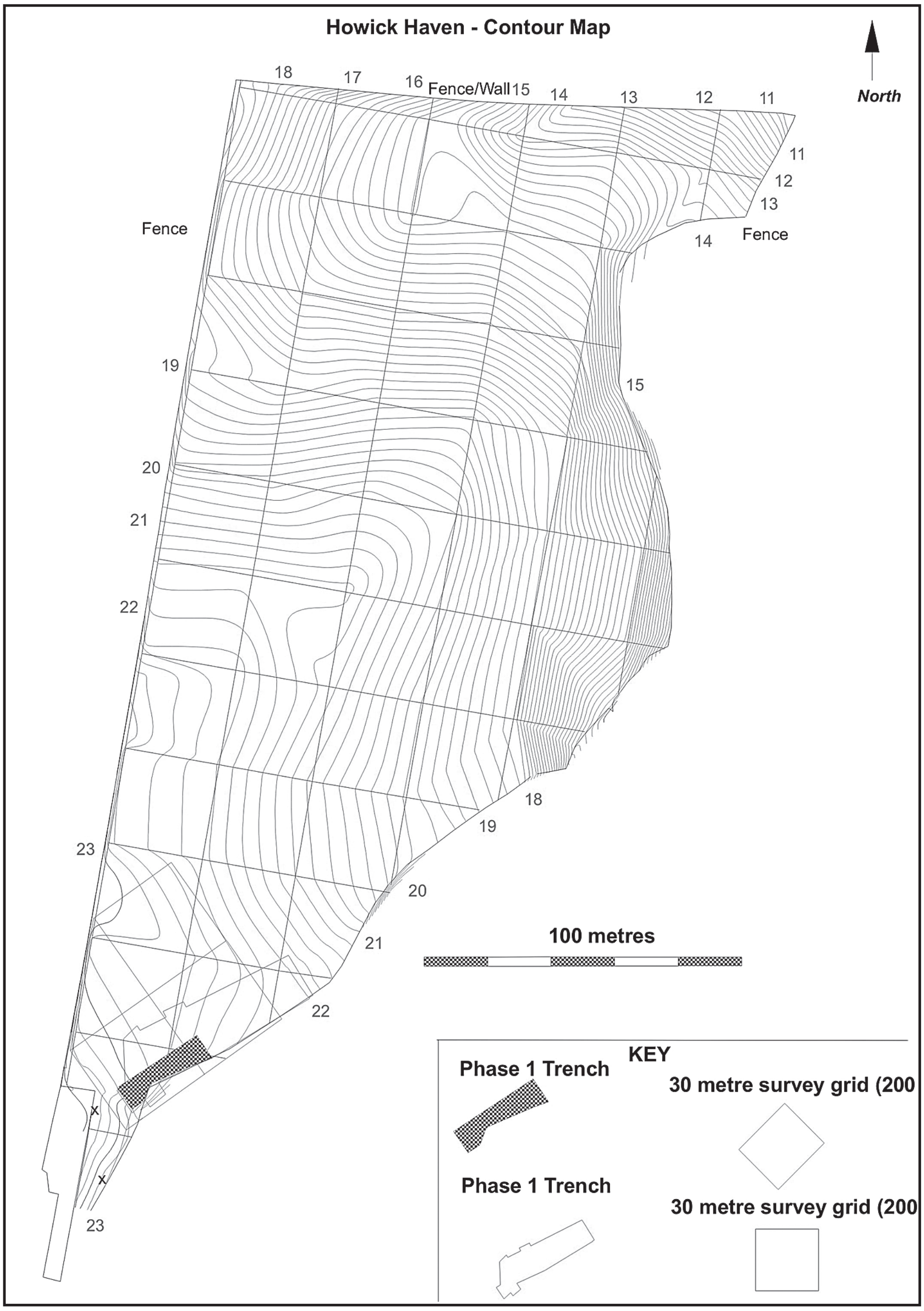


Figure 2.2. 30m survey grids and other relevant mapping features were recorded. From these relatively few points a contour map was produced which showed the major terrain features.

vista mapping and digital terrain software (Spectra Precision Software) was used to process the topographical and mapping data.

Results and Discussion

The survey results are illustrated here in both greyscale and trace plot format (Fig. 2.4). The data were interrogated and used to produce a colour-coded anomaly plan, which was also related to topographical features (Fig. 2.5). Not all possible features, especially those derived from positive anomalies (dark on the greyscale plots), have been indicated in Figure 2.5 and so this interpretation is subjective in nature and may indicate illusory alignments or relationships. These anomalies are enumerated and discussed below.

The pilot geophysical survey conducted prior to the first trench also included most of that area excavated in phase 2. One of the objectives of the

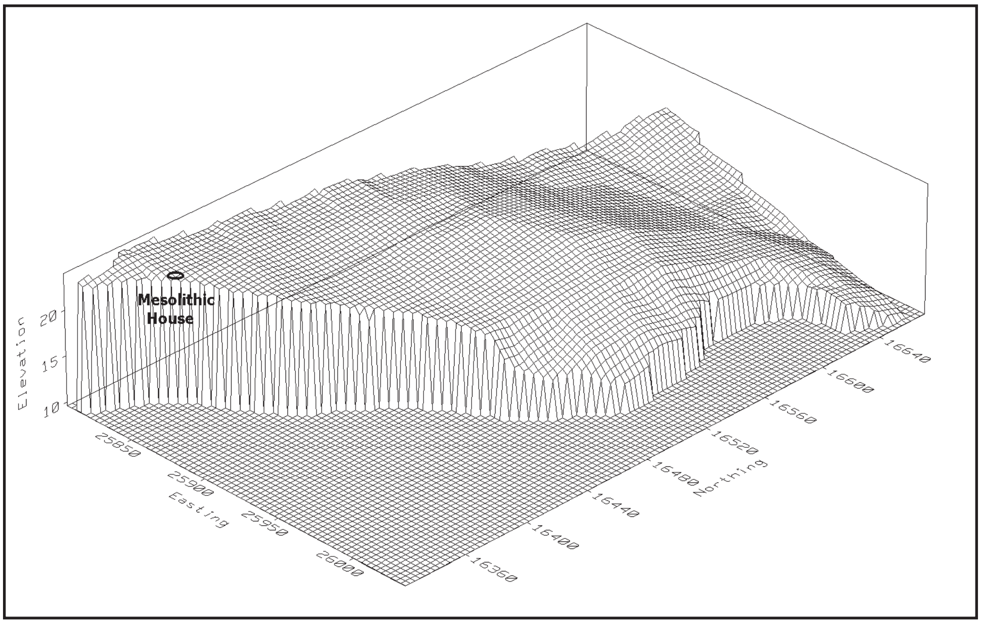


Figure 2.3. Digital terrain model viewed from the south-east derived from the 30m survey grids and other relevant mapping features. The model clearly shows a distinctive re-entrant in the north, which is where the majority of suspected anaerobic anomalies was detected.

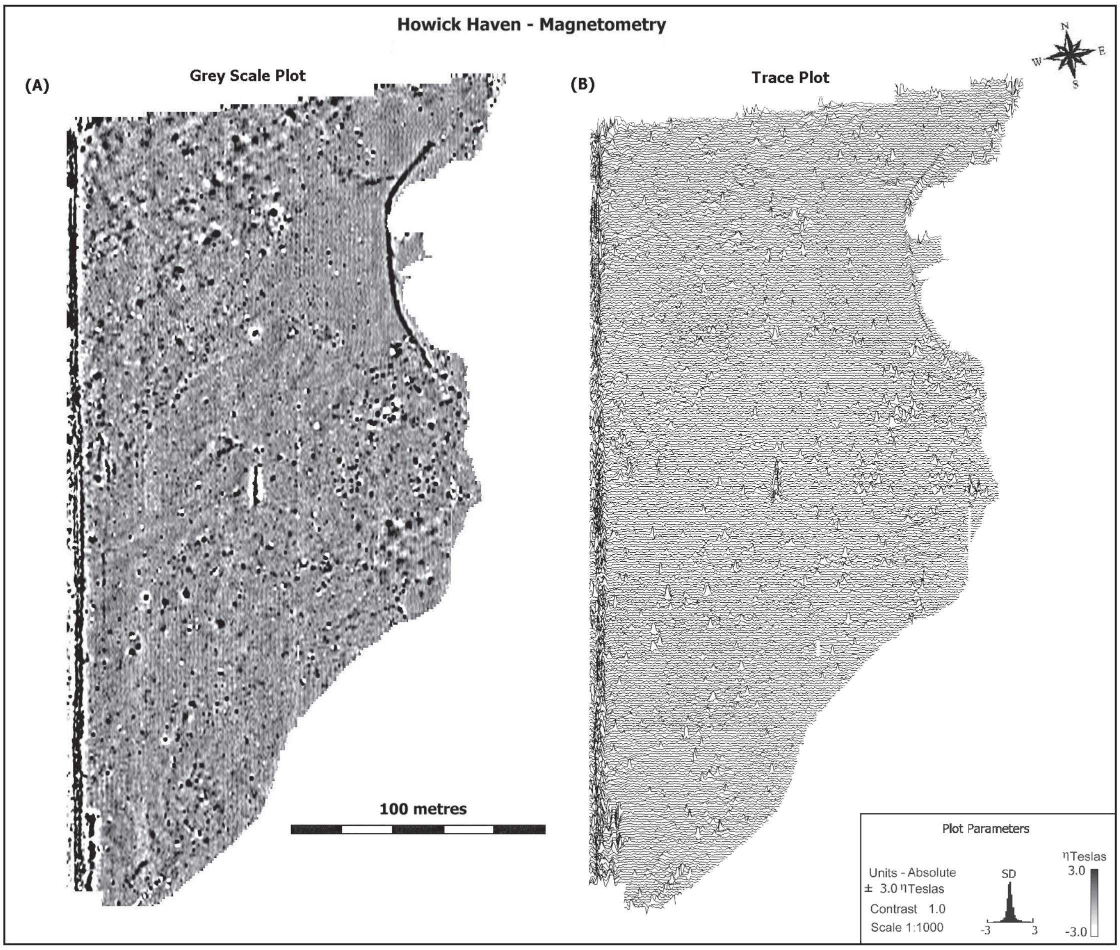


Figure 2.4. (A) Grey-scale plot in which dark features indicate positive anomalies (pits, ditches etc.) and white features negative (generally stone, but may be part of a bipolar, or ferrous response). (B) Trace plot produced from the same data, but which has been clipped at ±25 hTeslas to remove the more substantial and intrusive 'iron spikes'.

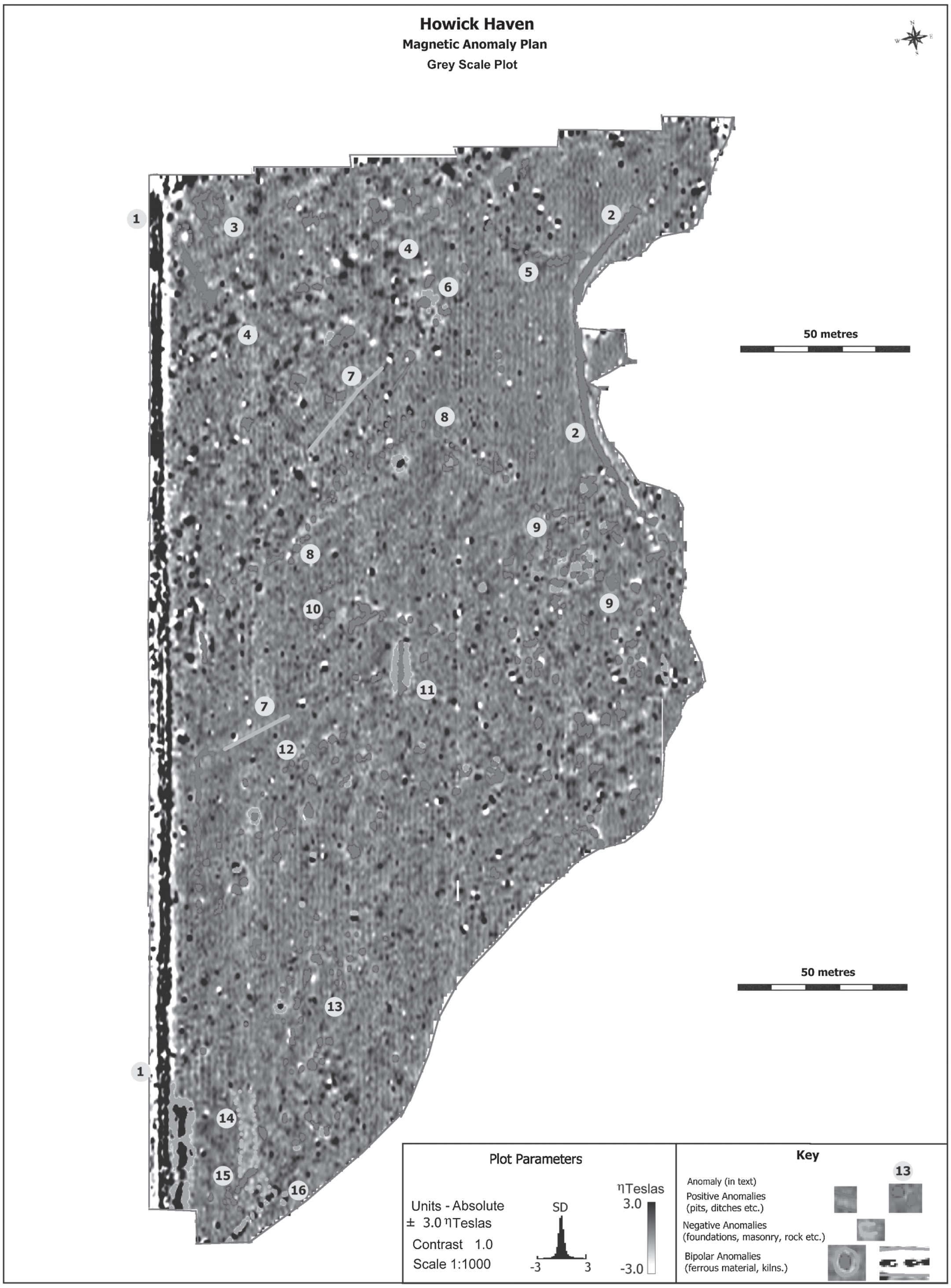


Figure 2.5. Interpretation plan highlighting anomalies within the survey area. Many possible features have not been indicated, such as the possible drainage and anaerobic areas towards the north of the survey transect.

larger survey was to identify potential archaeological features similar to those found during the phase 1 survey. In this report there will be a general discussion of those features detected over the entire survey, followed by a review of those anomalies detected and subsequently excavated.

The area in general is typified by a large number of relatively small positive anomalies, not all of which have been highlighted (Fig. 2.5). The western edge of the survey area was delineated by a farm track that showed as a prominent bipolar linear anomaly (1), giving a response of ±25hTeslas. The track may have been consolidated by hardcore rubble containing bricks or other ceramic material. An additional factor is the compression of the soil substrate, which creates a more dense medium resulting in a stronger intensity of response. The wire fence and a possible water pipe would all have contributed to this effect.

At the southern terminus of the track a broader band of anomalies was present. This general area at the time of survey was used to store bales of hay and may have been subjected to surface compression. Another prominent non-archaeological feature was the route of the footpath (2), which, where it was surveyed, showed as an intense dark positive anomaly (approx +3 to +20hTeslas). The reasons for this response are similar to those discussed earlier within this paragraph.

A number of small (*c*. 1.5–2m diameter) positive anomalies were detected which appear to form a linear configuration some 10m in length (5). Because of their location on a slope, caution must be exercised in attributing archaeological significance to these anomalies. A large bipolar anomaly (6), some 3–4m in diameter, elicited a strong response (*c*. -10 to +50h Teslas). Generally a response of this magnitude would indicate a large ferrous object, although an area of burning (and/or thermoremanence) may be responsible. Whether this anomaly is a product of ferrous agricultural debris or the site of a (primitive) kiln/ hearth can only be answered by excavation.

A faint negative linear anomaly (7), possibly associated with fainter-still parallel positive anomalies (unmarked) may be associated with drainage schemes. Directly to the south of this feature are a number of sinuous linear positive anomalies (8). On the eastern side these are some 100m in length and appear to bifurcate centrally towards the east, with an orientation south-west to north-east. At the north-eastern terminus one branch appears to change direction by almost 90º towards the south-east. Collectively these linear features appear as a rather faint attenuated positive anomaly, which in response is broad and rather intermittent and insubstantial. This may indicate the path of a former field boundary and associated ditch. At the eastern edge of this linear feature (8), towards the edge of the area of landslip and erosion, is a large group of circular positive anomalies (9). A number of bipolar anomalies are also present within this group. Superficially these anomalies have the characteristics of pits, but the nature of the slope may create spurious results. Nevertheless, it may be decided that some of these anomalies could be worthy of future investigation.

Within the central sector of the survey a number of circular positive anomalies (10) arranged in a linear manner were detected. The response from these was not intense, perhaps caused by archaeological features (such as truncated post holes), or by the molehills observed in this area. To the south of these is a large linear bipolar anomaly (11) creating a response some 16m in length and 5m in width, with values ranging between approx. -15 to +50hTeslas. Superficially this has the appearance of a substantial ferrous pipe, although there is no surface indication of this feature, or any suggestion that it is connected to another modern agricultural device. Large pipes especially would in general have a response above the threshold limit of the instrument (±204.7hTeslas) at the sensitivity setting in use. Whilst apparently unrelated to modern land usage at the site, this anomaly may represent a burial trench for ferrous material or a linear burning trench. It should be noted that the detectable magnetic response from rust is negligible compared to the response from less corroded ferrous debris.

A number of small circular positive anomalies (12) apparently some 1–2m in diameter, organised in a linear or curvilinear aspect, were detected. A similar group of anomalies was detected some 60m further south (13). The strength of the response was low, in the region of +2 to +5hTeslas, within the range typical of many archaeological features. A number of outlying small bipolar and positive anomalies are located nearby. Towards the south-west of these, a broad-band negative anomaly (14) was detected which could be geological in origin. At its southern extremity a linear arrangement of five closely linked circular positive anomalies were detected, each approximately 1.5–2.0m in diameter (15). Towards the south-west terminus, two outlying circular positive anomalies were detected with similar dimensions. None of the responses exceeds +5h Teslas. These anomalies were detected two years earlier in the pilot survey. The site of the previous excavation trench (16) was detected in outline as an extremely magnetically active disturbed area. It had been backfilled with a plastic lining and contained ferrous material deliberately left in order to recognise the extent of the trench when it was reopened for further excavation.

The initial investigative survey (Fig. 2.6A), which was conducted in advance of the phase 1 excavation, located a series of contiguous positive anomalies, which were identified as possible pits at the time. Subsequent excavation (see Chapter 5) revealed a linear burning pit (Fig. 2.5 anomaly 15), some 10m in length, including two additional 'pits', which were detected at the south-western terminus. The complexity of this composite anomaly only became apparent after excavation. In brief, it comprised multiple burning areas containing burnt stones, flint, charcoal and occasional tiny burnt bone fragments. The concentration of burnt material was clearly responsible for generating the magnetic anomalies. The net positive response (*c*. +5hTeslas) would have largely overwhelmed the negative response (*c*. -1hTeslas) expected from the stone cist (cist 5), which was found disturbed below the northern tip of the burning pit.

The spread of stones and flint located some 2.3m south of the burning pit was indicated by an area of

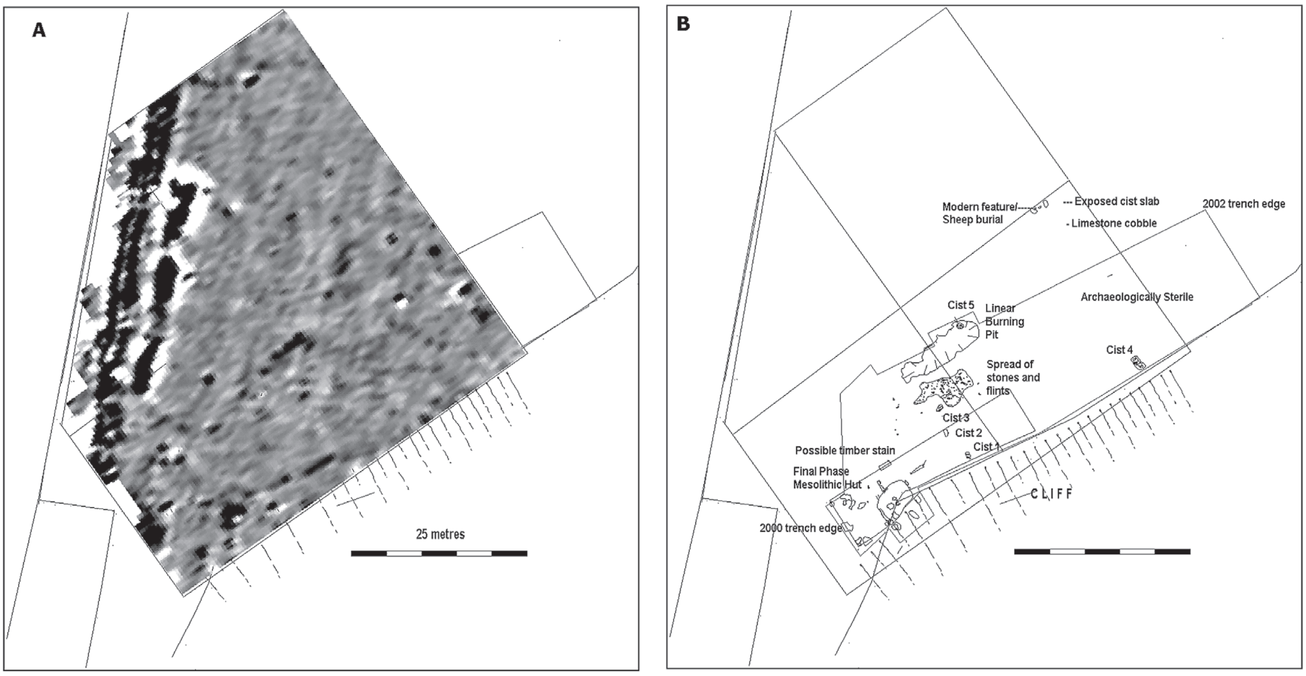


Figure 2.6. (A) Phase 1 geophysical survey grey-scale plot. (B) Excavated site plan. The location of the burning pit and the Mesolithic hut are clearly indicated as groups of strong positive anomalies.

reduced magnetic response, but realistically this could not have been differentiated from other similar features anywhere on the rest of the site. Cist 4 was detected as a central positive area with a maximum response of +1.3hTeslas, with a slight negative (-0.8hTeslas) periphery. In this instance the internal positive responsiveness would have been created by higher levels of organic matter and slow infill of the cist interior. The negative element would have been caused by the materials of the cist displacing the more magnetic medium of the surrounding soil. Cists 1, 2 and 3 produced negligible magnetic responses, certainly not enough to be recognised for what they are.

The Mesolithic hut was highlighted as a group of relatively strong positive anomalies (+5–6hTeslas) set in a sub-circular arrangement. The magnetic response was no doubt caused by the presence of magnetically enhanced burnt debris, associated with the Mesolithic occupation.

Although the hut was truncated towards the south-east by the cliff, the dimensions of the magnetic anomaly associated with it, in the region of 6–7m, accord well with the excavated size of *c*.6m (see Chapter 5). The smaller and less substantial structural features less than 0.2m in diameter were unlikely to be detected with a survey resolution of 1.0m x 0.25m spacings.

Most of the other single 'pit' anomalies are almost certainly caused by magnetic erratics, as a number of them were detected within the trench set in the boulder clay but were not specifically plotted. The effects of igneous intrusions are well documented and have been observed close to the Whin Sill. Less easy to distinguish are the effects of relatively small erratics, such as those of andesite or basalt (for instance, the response from a football-sized boulder of andesite is very similar to that measured from a large pit 1–2m in diameter). For the majority of the uniformly spread 'pit' anomalies at Howick, a similar effect is probably (but not necessarily) the cause. Having said that, the sheep burial detected within one of the test pits, although modern, showed all the attributes of an archaeological feature, which it would indeed become in the fullness of time.

In general, larger features, such as hearths, particularly ones that have been reused and are relatively undisturbed, produce a measurable response. The combined effects of burning and subsequent infill between firing episodes are likely to increase local magnetic susceptibility. The associated pits close to a hearth will increase the overall effect, whereas larger pits (*c*. 0.5–1.0m) of reasonable depth (*c*. 0.5m) will probably have a distinctive signature of their own. In summary, the best indicators for a Mesolithic hut are likely to be the associated infrastructure of pits and hearths with their conjoined, accumulated organic debris, and to a lesser extent the infilled circular or sub-circular hollows in which they are situated. Once these features have been recognised, characterised and tested by excavation at a number of sites, a more accurate geophysical signature for these types of sites may be forthcoming.

In summary, the magnetometer survey was successful in picking up the Mesolithic hut site as an archaeological feature, though it is difficult to ascribe distinctive morphological characteristics to such signatures. No strong evidence for previous farming activity (e.g. medieval ridge and furrow) was detected on the site. Large numbers of bipolar and positive anomalies were detected and spread almost uniformly across the entire survey area and some were subsequently shown by excavation to be glacial erratics. These, because of their abundance, have not been specifically identified or enumerated, nor has the ferrous and ceramic debris that will have caused some of the responses. Some of course may be genuine pits. The initial survey revealed the Mesolithic hut as a sub-circular anomaly, together with the location of the Bronze Age cist burials and a linear burning pit (see Waddington *et al.* 2006 for a report on the Bronze Age remains).

Conclusions

The effectiveness of geophysical survey is well known and magnetic survey in particular has been seen to work effectively on many sites in Northumberland (e.g. Biggins *et al.* 1997; Biggins and Taylor 1994). The method depends upon recognition of the morphological exemplars such as pit or post hole alignments, ditch configurations, hut circles and other relatively unequivocal features which have been proven by excavation. Even apparently obvious features such as a cist burial, some of which are quite small, may not be recognised unless they are found in the presence of larger, more diagnostic features. The problem invariably lies in the magnitude of background 'noise', with the effects of later agricultural practices often masking the relatively weak signals emanating from small and discrete sub-surface archaeological sites. Modern intensive deep ploughing has often disturbed previous horizons by cutting into them and truncating significant features.

What is less secure upon examination is the study of Mesolithic sites, which are often only recognised by artefact concentrations. The response expected from small and ephemeral episodes of occupation, usually only recognised by surface lithic scatters, is not generally considered to provide much scope for geophysical detection. It is thus perhaps inevitable that geophysical techniques have rarely been used as a prospection tool for hunter-gatherer sites in the British Isles. In view of the results from this site, more consideration might in future be given to the possible detection of small clusters of hearths, pits and also sub-circular hollows of 3–6m diameter (positive anomalies), which could be indicative of hunter-gatherer occupation.

To promote confidence in remote sensing in Mesolithic research, continued feedback from the results of excavation is crucial, so that the types of geophysical responses associated with such remains can be more accurately understood. Further evidence of the success of geophysical survey in detecting Mesolithic deposits is provided by the recent survey close to the cement works at East Barns, Dunbar in 2002, when a remarkably similar Mesolithic hut site was detected using magnetic survey and subsequently confirmed by excavation (Gooder 2007). Convincing results from these two Mesolithic hut sites are to be expected, given the size and sunken-floored form of these sites, although the recognition of other types of Mesolithic features remains a future challenge.

3 Fieldwalking

Clive Waddington

Introduction

As part of the Howick project, a fieldwalking component was included as one of the strategies for obtaining evidence of wider Mesolithic land use around this part of the coast. A total of 244 lithics was recovered from seven fields covering a combined area of some 51.5ha. (Figs 1.1 and 3.1). The fields are located adjacent to the site and the field numbers are shown on Figure 1.4. The field in which the site is situated was unable to be walked as it is given over to pasture, though it has been ploughed in the past.

Method Statement

Each field was line-walked at 5m intervals during spring 2002 (Fig. 3.3). As the project is focussed on the prehistoric archaeology of the area, the field-walking was directed towards the recovery of lithics. Other finds such as clay pipe and post-medieval pottery were discarded. The method employed followed that developed for the Milfield survey in north Northumberland (Waddington 1999a, 35–44; Waddington and Passmore in press). Assuming that each person scans an area 1m either side of their path, this means that two out of every five metres were inspected for surface artefacts. This translates to a 40% coverage rate that can be adjusted by multiplying by 2.5 to give a notional 100% count (see Tolan-Smith 1997a). Dividing this notional 100% figure by the area covered allows a count per hectare statistic to be arrived at for each field and these figures can then be compared to other fieldwalking surveys that have been carried out in the region. The location of all findspots was recorded using a total station to ensure accurate point-referenced data, and these can be tied to the Ordnance Survey grid by relating the findspots to the field boundaries (Figs. 3.1 and 3.2). All lithics were bagged, labelled, washed and then analysed with attribute data for each lithic input into an 'Excel' spreadsheet. Each field was mapped according to slope type at a scale of 1:10,000 to produce a series of morphometric (slope) maps that could be related to the distribution of surface lithics.

Taphonomy

In order to make meaningful interpretations from lithic scatters it is essential to identify, and account for, the major recovery biases that have affected the location and visibility of the assemblage. Recently archaeologists have paid attention to understanding the processes affecting artefact scatters in the plough-soil (e.g. Allen 1991; Boismier 1997; Waddington 1999a), as it has become clear that understanding and interpretation drawn from artefact scatter data are likely to be erroneous unless the taphonomy of the landscape has been considered. At Howick, the key geomorphological process that has affected artefact scatter recovery has been the loss of land to the sea due to an eroding coastline. Consequently the lithics picked up from the coastal edge during the field-walking were not at the cliff edge at their time of discard. This also means that we have lost the material evidence resulting from the activities that took place at or on the shore, as well as the cliff edge immediately above. Therefore, the activities rep-resented by the lithic scatters recorded as part of this survey should not be assumed to represent the full range of activities undertaken by these coastal groups. The lack of shell midden sites on the east coast of Britain must be directly related to the fact that it is, in general, an eroding coastline and one which has experienced submergence of the land relative to sea level, and this is likely to have resulted in the obliteration and/or drowning of most shore-edge sites, and certainly those sites that predate the Main Postglacial Transgression c.6000 cal BC (Smith 1992, 58). Suggestions that middens may have been widespread are provided by surviving sites that have been investigated at Morton, Fife (Coles 1971; 1983), and the midden-type deposit that was found below a Bronze Age cairn eroding from sand dunes at Low Hauxley, Northumberland (Bonsall 1984), which lies

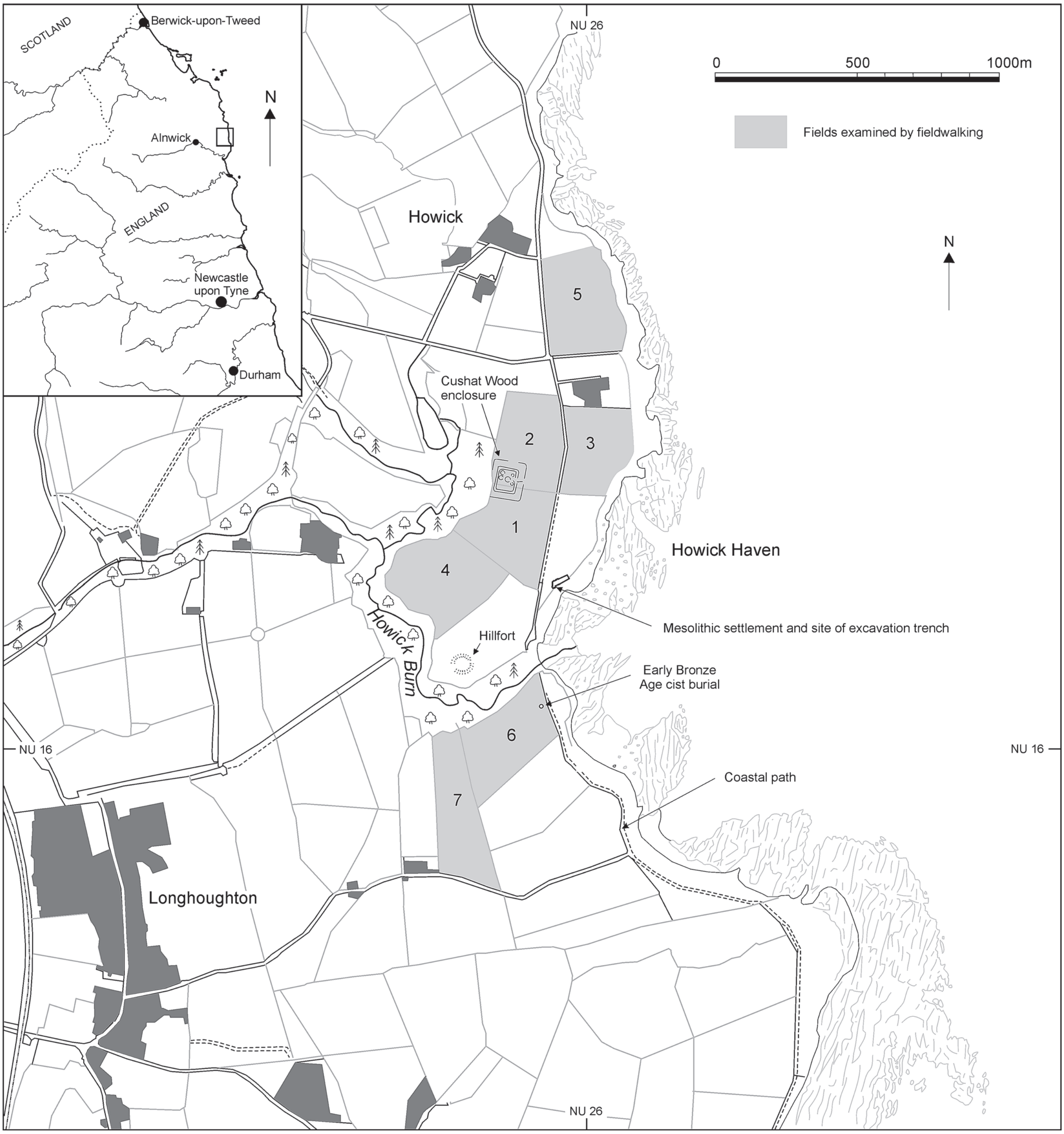


Figure 3.1. Map showing location of fields walked.

only 15km south of Howick. It is noteworthy that in both cases we are dealing with Mesolithic sites later in date than Howick; they post-date the maximum marine transgression. Being situated above the level of the transgression, these sites have survived intact. Therefore, sites that pre-date the transgression, such as Howick, are unlikely to have contemporary shoreline deposits such as middens surviving.

The other key geomorphological influences affecting the fields along the Howick coastal strip are slope processes. As slope type has a direct effect on the taphonomy of surface artefact scatters, and therefore any subsequent interpretations made from them (Allen 1991; Waddington 1999a, 85–91), biasing effects resulting from slope processes must be taken into account when assessing the distribution of material. The slope classes devised for the 'lithic scatter displacement model' (Waddington 1999a, 91–4) formed the basis for the mapping of the Howick fields (see also Waddington and Passmore in press for an up to date discussion). At Howick the terrain is neither flat nor uniform, but of undulating character

Figure 3.2. Plots showing individual lithic findspots within each field.

Figure 3.3. Fieldwalking at Howick.

with areas of short steep slopes, hollows and a deeply incised, steep-sided valley, now occupied by the Howick Burn. Many of the fields contain flat areas together with areas of slope. As these fields are ploughed and the soil becomes destabilised, this facilitates the movement of soil and artefacts downslope, particularly during wet conditions when processes such as rilling, hillwash and slumping assist the transportation of artefacts. A model of lithic scatter displacement in slope environments has been devised that identifies the degree of movement of material that can be expected on different slope types, and the type of inferences that can be drawn from artefact scatters affected in this way (Waddington 1999a, 91–4; Waddington and Passmore in press). This requires the distribution of artefacts in each field to be described and any patterns likely to be the result of slope processes identified.

Field 1 slopes down towards its north-east corner, though the upper areas of the field are flat (see Fig. 3.2). Half of the finds from this field are from the sloping area and most of these are on the area of medium slope leading down from a flat platform in the north-west corner of the field that is occupied by the Cushat Wood rectilinear enclosure. The enclosure also extends into Field 2 on the same flat area. As most surface lithics in medium slope environments are 'in transit' it can be inferred that the string of flints found running down the slope in this part of the field has originated from the edge of the flat area occupied by the enclosure, from where they have been eroded as a result of plough action and subsequent slope movement. Elsewhere in the field most lithics are in flat areas; these will have experienced little in the way of lateral displacement and can therefore be assumed to be broadly indicative of past human activity in these locations.

Field 2 contains the greatest concentration of finds with most located on the area of flat ground occupied by the Cushat Wood enclosure (Fig. 3.2), but also on the same medium slope that slopes down from the enclosure. It is important to note that the act of ditch digging for the construction of the enclosure has probably resulted in the disturbance of earlier artefacts and features, and it is these artefacts that later ploughing has dispersed across the slopes. This disturbance may also account for field 2 having by far the highest density of finds. Bearing in mind that virtually the entire depth of the Mesolithic hut deposits survived intact below the plough zone (see Chapter 5), it means that other features belonging to this period should also survive below the plough zone across this area. If the widespread survival of Mesolithic features can be identified, it raises important questions regarding future research, management and conservation priorities in the area, and in particular the need to avoid deep ploughing.

Although Field 3 slopes away steeply on its south-eastern flank, most of the lithics recovered from this field were located on an area of gentle slope above, where only limited downslope movement can be expected. Field 4 produced a high density of lithics and virtually all of these were located on the gentle slope that falls away from the western side of the field. Here again some limited downslope displacement can be expected, but this will not have moved the artefacts very far. Therefore, in the case of Field 4, most of the lithics will be broadly representative of their position of discard. Field 5 is relatively flat except for some areas of gentle slope and a hollow. Most of the artefacts were recovered from the flat area (Fig. 3.2), although one pattern worthy of note is the tendency, observed elsewhere in the Milfield basin (Waddington 1999a, 85), for the incidence of artefact recovery to increase close to breaks in slope. In this case a string of lithics can be identified running along the break in slope down to the cliff on the east edge of the field. In Field 6 all but two of the lithics were from the area of flat ground on the south side of the field. To the north, the field slopes steeply down to the valley containing the Howick Burn. The field boundaries along this edge of the field sit astride a positive lynchet – lynchets are known to obscure visibility of artefacts. It is likely that in this case any flints discarded on the slopes above the burn have been moved downslope and become trapped and buried in the lynchet. An Early Bronze Age barrow was located on the knoll in the north-east area of the field investigated by antiquaries during the 19th century. A small Food Vessel Urn was found covered by an ornamented stone (Bateson 1895, 330), the latter probably being a reference to a cup-and-ring marked capstone. Subsequently the mound has been ploughed virtually flat with only a slight surface expression left. It could be expected that lithics would be discovered in proximity to the site of this monument but none were found. This may again be because the barrow was located at the head of the steep slope down to the burn, and any artefacts disturbed by the ploughing are likely to have moved downslope. Field

Field	Area (ha.)	Actual No. Lithics	Adjusted No. Lithics (x 2.5)	No. Lithics per ha.
1	7.02	31	77.5	11.0
2	7.07	77	192.5	27.2
3	5.37	32	80.0	14.9
4	6.75	52	130.0	19.3
5	9.14	25	62.5	6.8
6	7.99	14	35.0	4.4
7	7.81	13	32.5	4.2
Total	51.15	244	610	av.11.9

Table 3.1. Lithic counts per hectare from the walked fields around Howick.

Project/Location	Average (100%) density per ha.	Reference
Coastal		
Maiden's Hall (Northumberland)	51.8	Waddington 2001a
East Durham and Cleveland Coast	13.0	Haselgrove and Healey 1992, 6
Howick (Northumberland)	11.9	
Middle Warren (Hartlepool)	11.8	Archaeological Practice 1996, 5
Turning the Tide (Durham Coast)	10.9	ASUD 1998
Inland		
Lower Tyne Valley (Northumberland)	10.0	(calculated from) Tolan-Smith 1997a, 82
Milfield Basin (Northumberland)	5.5	Waddington 2001b
Middle Tees Valley (Durham)	3.1	Haselgrove and Healey 1992, 14
East Durham Plateau (Durham)	0.6	Haselgrove and Healey 1992, 4
Tees Lowlands (Durham)	0.3	Haselgrove and Healey 1992, 13
Wear Lowlands (Durham)	0.3	Haselgrove and Healey 1992, 3

Table 3.2. Average lithic counts per hectare from other North-East fieldwalking surveys.

7 is mostly an area of flat ground where little movement of artefacts in the ploughsoil can be expected. Only one lithic was recovered from the north end of the field where there is a steep slope down to the burn.

Visibility was not consistent across the fields, as they were walked on different days under different weather conditions, and with differential cover of sprouting crop, which meant that there were variations in the percentage of ground exposed. Fields 1, 2, 3 and 5 were walked in fairly good conditions with sprouting crop, damp ground and not too intense sunlight. The level of sprouting crop cover was estimated to have obscured the ground surface by up to 25%, implying that the lithic recovery for each field could have been up to 25% higher. Field 4 was walked after it had been ploughed, allowing for full observation of the field surface. However, when it was walked the sun was extremely strong and this had resulted in the baking of the ploughed surface. This renders the surface more dusty and lighter in colour, making observation of flint more difficult. In addition, the glare that reflects from the ground surface also hinders visibility. Nonetheless, the field did produce a high lithic count, indicating that this field is probably extremely rich in lithics and should be classed on a par with Field 2. Fields 6 and 7 were walked in overcast conditions conducive to the spotting of artefacts, but in the case of both these fields the sprouting crop cover had increased dramatically due to the mild winter and warm spring so that up to 75% of the ground surface was obscured in places. Therefore, it is considered reasonable to assume that a more accurate indication of the lithic density in these latter fields would be achieved if the recorded total for each field was multiplied by four. This produces lithic densities comparable to Fields 3 and 4 and it is likely that this is a more accurate indication of the level of past human activity around Fields 6 and 7 than the actual recorded counts.

Density

Table 3.1 shows that the highest density of lithics is found in Field 2, which has a notional 100% lithic count per hectare of 27.2. Field 4 also has a high count of 19.3 per hectare and it should be considered that this is probably under-representative (see above). The counts for Fields 1 and 3 are also high and indicate significant densities of chipped stone in these areas. The low densities recorded for Fields 6 and 7 are almost certainly related to the poor recovery conditions. Field 5, however, has a low count and this field did not have particularly poor visibility so this is probably a realistic indication of a reduced level of activity in this area.

In comparison to other fieldwalking surveys in the North-East region (Table 3.2), the results from Howick

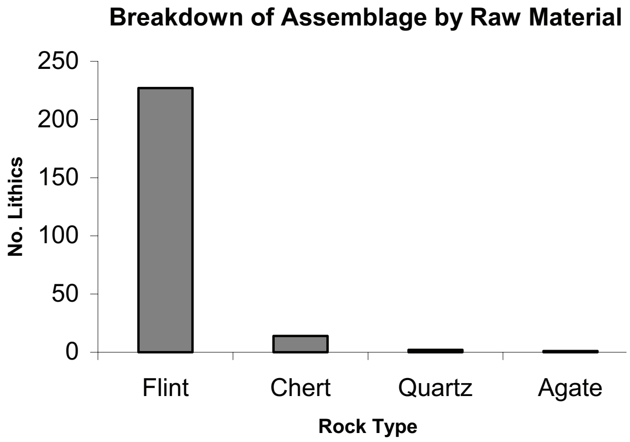


Figure 3.4. Lithic Assemblage by Raw Material.

fit comfortably with the lithic counts recorded for other coastal areas. For example the Middle Warren fieldwalking project outside Hartlepool recorded an average lithic density of 11.8 per hectare compared with the 11.9 per hectare recorded from Howick. Similarly the East Durham and Cleveland Coast survey recorded a figure of 13.0 per hectare. The incredibly flint-rich Maiden's Hall survey near Chevington, Northumberland, recorded an average lithic count of 51.8 per hectare, but this was found to be primarily the result of the area itself being used as a source of glacial flint, containing large quantities of primary and secondary flaking debris, and because it was walked in ideal circumstances by an experienced fieldwalking team. It is clear from the Howick survey that if more suitable ground conditions had been encountered, and a more experienced team had been employed, then this survey would have yielded a significantly higher count per hectare. Therefore, when comparing with these other surveys it should be considered that the Howick flint count is very much a minimal figure. It is also interesting to note that lithic counts for inland areas are, in general, significantly lower than those recorded for the coastal areas, even in areas known to have been heavily exploited during the Stone Age, such as the Milfield Basin for example. Although a suite of taphonomic processes has been identified that has served to under-represent lithic counts in the Milfield area (Waddington 1999a, 55–7), it can still be seen that the North-East coastlands were particularly favoured by Stone Age hunter-gatherer groups.

However, it must also be noted that most of the flint sources are located on and around the coastal strip as secondary deposits in the tills, and as beach pebbles washed on to the shore. As a result, the availability of flint would have attracted Stone Age groups to the coast, and primary testing, flaking and dressing would have undoubtedly produced a greater quantity of waste material near these 'quarry' areas, resulting in higher than average lithic counts. This was seen to be the case at Maiden's Hall where 36% of the material belonged to the primary stage of the reduction sequence (Waddington 2001a) and similarly at Howick, 32.8% of the assemblage belonged to this stage. In contrast, however, the primary-stage material in the Milfield survey accounted for only 23.5% of the assemblage (Waddington 2001b) which is more typical for inland areas. Otherwise, these three surveys for which such information is available revealed remarkable consistency in the percentage of tools, or tool fragments, that represent the tertiary stage of the reduction sequence or *chaîne opératoire*. In the case of the Howick survey 10.6% of the assemblage belonged to this stage, while the Milfield survey produced 10.4% and the Maiden's Hall survey 10%. This percentage is significant as it reflects perhaps a similar level of activity associated with settlement for all three areas because, as Schofield has noted (1991, 119), high proportions of tools are usually associated with settlement areas.

Distribution

Consideration of the densities of lithics from the different fields shows that those fields with the highest densities are those that immediately fringe the valley of the Howick Burn, such as Fields 1, 2 and 4 (see Table 3.1). In contrast, Field 5 lies furthest from the burn and has one of the lowest densities. When it is considered that recovery conditions on this field were fine and that those for Fields 6 and 7 significantly under-represented their actual lithic population, it appears that Field 5 probably has by far the lowest lithic count in actuality. Therefore, on the basis of the data recovered so far it can be concluded that the lithic concentrations tend to cluster close to the Howick Burn and that the lithic counts appear to fall off with distance from it. This observation gains further support when the position of the excavation site is taken into account, as this is situated close to the mouth of the burn.

Observing the distribution of lithic types across the various fields (Table 3.3) reveals some areas of interest. In Field 2 the cores fall into two distinct groups: one on the flat area partly occupied by the Cushat Wood enclosure and another larger group in the south-east corner of the field, on the area of flat and medium slope running down from the enclosure platform. In addition, three of the four scrapers recovered from this field are situated amongst the group of cores in the south-east corner and the fourth scraper is situated with the cluster of cores on the west side of the field. Two possible awls are also associated with the concentration of material in the

Field No.	NGR	Parish	Size (ha.)	Nodules and Bashed Lumps	Flakes and Blades	Cores	Retouched Flakes and Blades	Scrapers	Microlith	Other	Total
1	NU257168	Longhoughton	7.02		24	3	2	2			31
2	NU258172	Longhoughton	7.07	2	50	14	5	4	1	1 awl	77
3	NU260171	Longhoughton	5.37	5	20	4	2	1			32
4	NU255166	Longhoughton	6.75	5	34	10	1	1	1		52
5	NU260175	Longhoughton	9.14	5	14	4		2			25
6	NU257160	Longhoughton	7.99	2	9	1	2				14
7	NU256157	Longhoughton	7.81		11	1	1				13
Totals				**19**	**162**	**37**	**13**	**10**	**2**	**1**	**244**

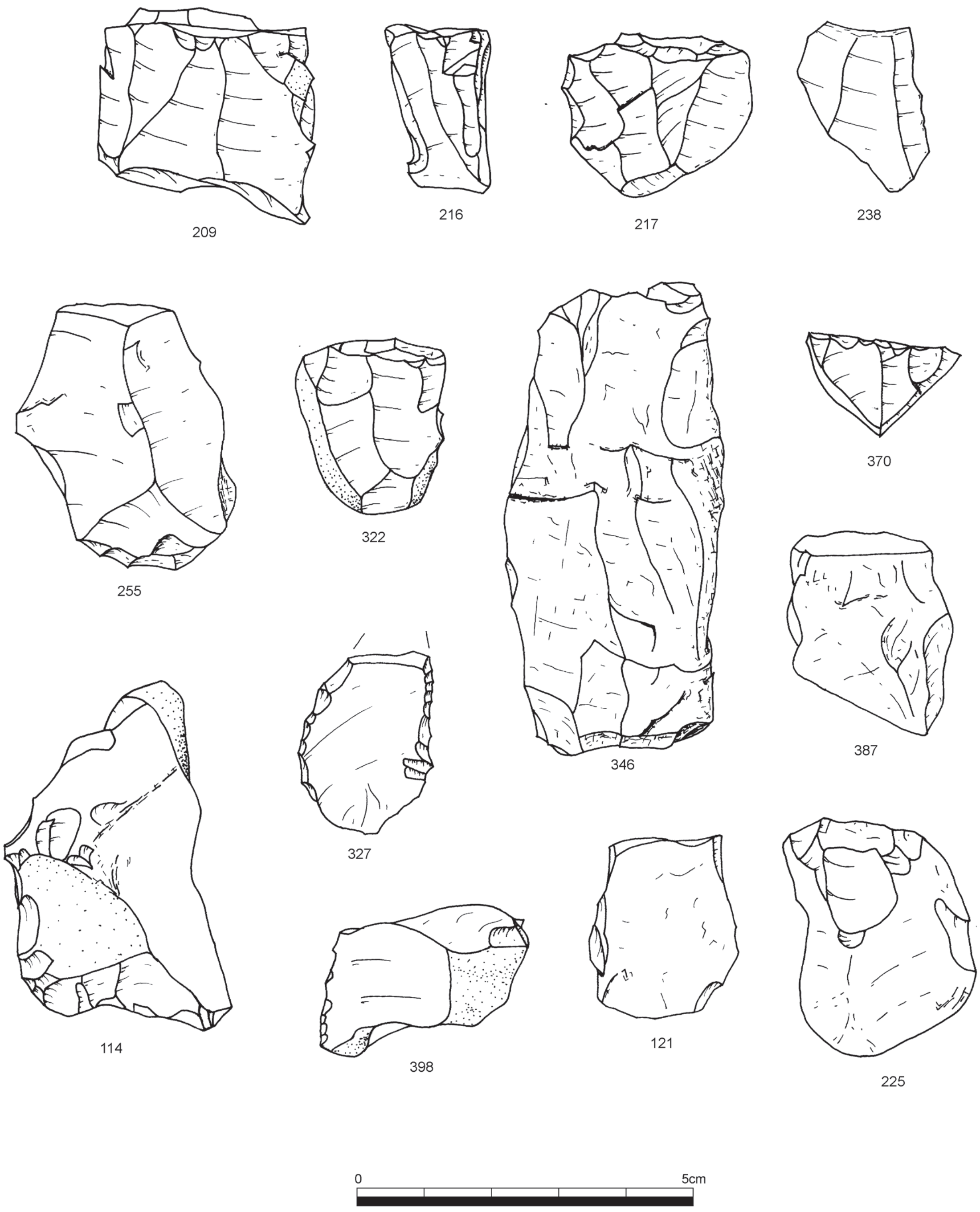
Table 3.3. Summary of lithic finds by field.

south-east corner. Bearing in mind that much of the material on the medium slope in this corner of the field will have been transported downslope from the flat area above, it is the ground in the southern half of the field that can be identified as having formed a focus for Stone Age activity and may well conceal remains of sites similar to that excavated as part of this project. This pattern is confirmed by the distribution in Field 1 where two of the three cores and one of the two scrapers are also located on the enclosure platform and area of slope that continues into this field from Field 2. Elsewhere, in Field 3 a concentration of material on a gently sloping bluff in the southern half of the field that projects out towards the coast suggests that this locale formed a focus for activity. This gains further support when the position of two cores and two possible awls on the steep slopes running down from this bluff are considered, and which should be interpreted as representing activity that had actually taken place further upslope. A scraper was also recovered from on top of this bluff. In Field 5, half the pieces were found on or close to the break in slope that leads to the present cliff edge. All four cores and one of the two scrapers were found in this area, suggesting that the small amount of activity represented in this field tends to be clustered on the flat ground.

Assemblage Chronology

As is typical for fieldwalking assemblages in North-East England, the majority of the diagnostic lithics identified in this assemblage belong to the Mesolithic. A total of 34 lithics could be characterised as Mesolithic, representing 13.9% of the total assemblage, while a further four pieces could be either Mesolithic or Early Neolithic in date, and the thumbnail scraper 142 (Fig. 3.6) could belong to either the Mesolithic or Early Bronze Age. Of the Mesolithic pieces none could be definitely identified as Earlier Mesolithic on typological grounds, although the reworking of already chipped and heavily patinated pieces does provide indirect evidence for Earlier Mesolithic and perhaps Palaeolithic activity (see below, Chapters 7 and 14). Most of the diagnostic pieces were the product of a narrow-blade manufacturing tradition indicative of Later Mesolithic flintworking. The other pieces that showed diagnostic traits included four retouched blade tools, including end scrapers, that could belong to either the Mesolithic or Early Neolithic, two very heavily patinated pieces that could conceivably be Palaeolithic or Earlier Mesolithic, and the thumbnail scraper that could be Mesolithic or Early Bronze Age. However, all the other material showed direct similarities with the lithic assemblage recovered from the Mesolithic hut site (Chapter 7) including varying degrees of patina development, reliance on locally available material and flaking characteristics indicative of small narrow-blade production. There were no indications of later material in the assemblage other than the possible scrapers referred to above. Therefore, this assemblage is treated as being of predominantly Later Mesolithic date. The formal implement types are also directly comparable to those recovered from the Mesolithic hut site (Chapter 7) and so the fieldwalking assemblage is considered to have accumulated, for the most part at least, during the Later Mesolithic, *c*.8000–4000 cal BC.

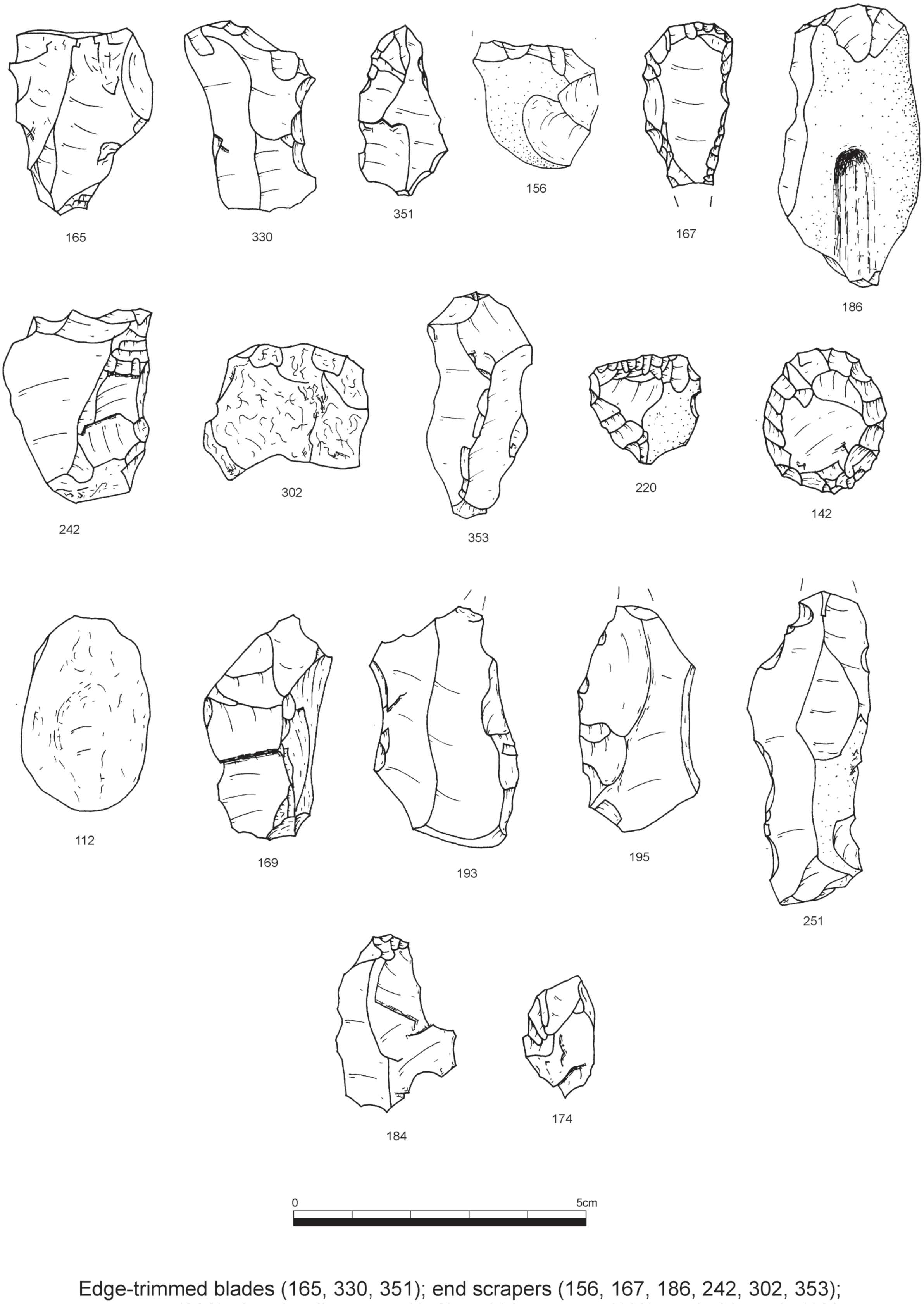
The assemblage included some heavily patinated and rolled pieces that are probably significantly older than the more common Later Mesolithic material, as well as a few end scraper and blade forms that could be either Mesolithic or Early Neolithic in date. Nearly half of the pieces are broken (117) and this includes pieces broken in antiquity, perhaps at their time of use, as well as more recent plough-damaged pieces. There are also some burnt pieces (19), some of which were finished tools, such as the fragmentary end scraper 302 from Field 5 that may have been brought to the surface from disturbed burnt/hearth deposits. Beach-rolled, previously chipped flints were collected from the shore and brought on to the higher ground for reworking, and flints 149, 103, 144 from Field 1 are typical examples. Another feature common to this assemblage, and evidenced widely in flint collections from the North-East coast (e.g. Waddington 2001a), is the reworking of previously chipped pieces that have then been rolled in the sea and have usually



Cores (209, 216, 217, 238, 255, 322, 346); pyramid core (370); bi-polar core (387); Edge-trimmed flakes (114, 327, 398); retouched flakes (121, 225).

Figure 3.5. Selected cores and flakes recovered by fieldwalking.

developed a heavy patina. For example flints 178, 208, 225, 244 and 399 from Fields 1–4 all show clear evidence of having been re-chipped in this way. These flints provide a proxy indicator of Earlier Mesolithic, and more likely Palaeolithic, occupation in this now submerged area. Still more flints show evidence of recycling as patinas have developed over the original flaking scars; these pieces were then re-chipped during the Mesolithic, such as the core 408 and awl 251. However, in these cases there is no evidence of them having been beach-rolled before recycling, which indicates that these pieces were collected from the terrestrial environment. These flints therefore indicate the presence of earlier activity on the land



Edge-trimmed blades (165, 330, 351); end scrapers (156, 167, 186, 242, 302, 353); scraper (220); thumbnail scraper (142); pebble scraper (112); probable awls (169, 193, 195, 251); tanged microlith (184); cresentic microlith (174).

Figure 3.6. Selected implements recovered by fieldwalking.

that now forms the coastal strip. Therefore, by observing the 'stratigraphy' apparent on some of the pieces in this lithic assemblage, it is possible to posit evidence for pre-Later Mesolithic activity along this stretch of coastline in what are now both the terrestrial and marine zones (see Chapters 7 and 16 for further discussion in relation to the excavated material).

Raw Material

The lithic assemblage is dominated by flint, which accounts for 227 of the 244 pieces (93%) (Fig. 3.4). The other material that is relatively common in the assemblage is chert, which accounts for 14 pieces (6%). The remaining one percent is made up of two quartz and one agate pieces.

As many of the flints retained small areas of cortex this has allowed examination of the type of raw material being utilised. Of the 119 pieces that could be identified to type, 118 (99%) were beach flint while one piece was from nodular flint. No boulder clay flint could be recognised with certainty, although it is likely that some of the pieces were produced from this type of secondary flint source. As nodules of the same kind of flint as those found during the fieldwalking can still be picked up on the Howick beaches today, it can be concluded that most of the utilised flint was originally obtained from the beach. This rich source of flint, in an otherwise relatively flint-sparse region, was no doubt one factor that attracted Stone Age groups to this area. The virtually complete reliance on locally available flint indicates a self-sufficient community that did not rely on the importation of stone from distant sources.

A wide variety of flint colours was evidenced in the assemblage (see Table 3.4), though for some pieces it was not possible to identify their true colour as they had developed thick patinas of a different colour. Otherwise it was flints of various shades of grey that tended to dominate the assemblage, with 29.5% being light grey material and 19.3% medium grey. However, there was also 11.9% red-brown flint, often speckled,

Flint Colour	No. Pieces	% of Entire Assemblage
Light Grey	72	29.5%
Medium Grey	47	19.%
Red-Brown	29	11.9%
Orange	12	11.9%
Orange-Grey	10	4.9%
Fawn	8	3.3%
Orange-Brown	7	2.9%
Dark Grey	6	2.5%
White	4	1.3%
Brown	3	1.2%

Table 3.4. Classification of flints by colour (only includes those flints for which a colour could be assigned).

that is common in other coastal assemblages from Northumberland. Similarly there were 12 examples (4.9%) of the orange beach pebble flint, together with 10 pieces (4.1%) of orange-grey and 7 pieces (2.9%) of orange-brown flint, which are also frequently seen in other North-East assemblages. More than half of the chert (8 of the 14) is of the blue-grey variety common in assemblages across Northumberland. The other types of chert belonged to a mixture of oranges and greys with one piece of red-brown chert.

The provenancing of flint by visual inspection only is a subjective art, and as flint nodules can have great colour variation within a single nodule as well as throughout flint-bearing strata, colour is not always a reliable indicator of provenance. However, in this case the colour and texture of most of the flint, and the survival in many cases of areas of cortex, were sufficiently distinctive and consistent to indicate that most of the material was coming from the beach, and this gains further support by the consistencies it shares with other coastal assemblages examined by the author in the Museum of Antiquities of Newcastle and Sunderland Museum.

Types

As is typical, flakes dominate the lithic assemblages, accounting for 54.9% of all pieces (see Table 3.5). There is a significant percentage of cores, 15.2%, which compares with 17% from the Milfield survey (Waddington 2001b) and 12.7% from the Maiden's Hall survey (Waddington 2001a).

Scrapers accounted for 4.1% of the Howick fieldwalking assemblage, whereas they only account for 0.2% of the Maiden's Hall assemblage. The Maiden's Hall assemblage also differs in having higher frequencies of primary material, as is indicated by the counts for test-pieces; 9.6% for Maiden's Hall compared with 5.7% for Howick. However, if the frequencies of all tools are combined, they form 10.6% of the Howick survey compared with 10% of the Maiden's Hall survey, making them broadly similar.

According to Schofield's model of expected assemblage characteristics (reproduced as Table 3.6 below) this would suggest that the Maiden's Hall area was used primarily for industrial processes, which in this case were acquisition and preliminary dressing of flint, while the Howick area was used more for settlement purposes. However, the contrast is certainly not as clear-cut as this, as there is evidence for activities associated with primary flint working and settlement activity in both areas. Rather, the difference is one of degree. The Howick landscape, particularly those areas located near to the freshwater burn, appears to have been an attractive settlement focus for hunter-gatherer groups, while the nearby coast

Type	No.	% of Assemblage
Nodule	5	2%
Bashed Lumps/Test Pieces	14	5.7%
Flakes	134	54.9%
Blades	28	11.5%
Cores	37	15.2%
Modified Flakes	6	2.5%
Modified Blades	4	1.6%
Scrapers	10	4.1%
Microliths	2	0.8%
Awls (inc. possibles)	4	1.6%
Total	***244***	

Table 3.5. Breakdown of lithics by type.

Activity	Density	Primary Waste	Tools	Cores
Settlement	Low	Low	High	High
Industrial	High	High	Low	Low

Table 3.6. Schofield's model of expected assemblage characteristics (1991, 119).

(now eroded back) provided a source area for flint extraction. In the case of the Maiden's Hall area, the boulder clays were intensively exploited as a source of flint but settlement also appears to have taken place.

Most pieces in the assemblage are relatively small and this is probably a direct result of the nature of the raw material used, as beach flint is not usually as large as flint nodules from primary geological deposits.

Most of the cores are blade cores with single platform cores present, indicating the reliance on a narrow-blade technology typical of Later Mesolithic flint-working traditions. In addition, there are examples of pyramidal, bipolar and flake cores which are also typical of Mesolithic assemblages from this region (Fig. 3.5). A range of scrapers was evident in the assemblage, including Mesolithic 'tiny' scrapers as well as end scrapers and an excellent specimen of a thumbnail scraper (Fig. 3.6). These types of tool are usually thought to be indicative of hide working. The presence of awls in the assemblage is also of note as these are usually associated with stitching hides and skins. The working of hides, a processing activity usually associated with domestic (i.e. settlement) occupation, is also indirect evidence for hunting and exploitation of game and terrestrial fauna, even though this is a coastal setting. Little can be said of the one certain microlith other than that it most closely resembles a crescentic form. Microliths of this type have been found on the excavated site (see Chapter 7) and also in abundance at the Fife Ness coastal site in Fife (Wickham-Jones and Dalland 1998) where their specific purpose remains problematic, though specialist activities associated with catching birds and/or fish are possible.

Activity in the Wider Landscape

The Howick fieldwalking assemblage is informative on several counts. The artefact types and their stages in the reduction sequence indicate that a wide range of activities took place across the area. Most notably this included the acquisition and preliminary working of flint from the nearby beach. This comprised the flaking of flint nodules as well as the reworking of previously chipped and patinated pieces washed on to the shore. The large proportion of cores and tools in the assemblage is indicative of processing activities that are generally thought to be associated with settlement sites, suggesting that residential occupation took place across this coastal strip and was not just confined to the single structure excavated as part of this study. As nearly all the diagnostic pieces present in the assemblage can be associated with Later Mesolithic flint-working traditions, and this also corresponds with the radiocarbon dates returned from the excavation site, it is likely that most of the material in the assemblage dates from this broad period. Therefore, it can be argued that during the Later Mesolithic period the coastal strip around Howick, and particularly the relatively flat elevated areas close to the Howick Burn, were used extensively by Mesolithic groups visiting the coast, both for the acquisition of flint and also for habitation. It is likely that the availability of fresh water from the burn was an important factor affecting the location of settlement sites. The steep-sided burns that discharge into the North Sea along the Durham coast are well known for their extremely rich assemblages of Mesolithic flints, such as the site at Crimdon Dene (Raistrick and Westoll 1933; Raistrick *et al.* 1939), and the Howick landscape appears to have been similarly exploited. The fieldwalking survey has been crucial in demonstrating that Mesolithic exploitation of the landscape was not confined to the area immediately around the excavated site, but rather that settlement activity appears to be spread around this coastal margin on areas of free-draining flat land within easy reach of freshwater. Therefore, it can be expected that other Mesolithic deposits survive *in situ* below the plough zone in the fields around the Howick site. In particular areas of Fields 1, 2, 3 and 4 have been identified as being of interest (see above).

4 Test Pits

Clive Waddington

Methods Statement

The test pits were excavated primarily to check if any other Mesolithic structures or deposits were at risk from current or future erosion from the cliff edge. A total of 73 test pits was excavated around the Howick site (Fig. 4.1). Each pit measured 1m^2 and was excavated down to, or below, the natural substratum horizon, which consisted of glacial till deposits. After removal of the turf, each pit was excavated using trowel, mattock and spade, and the entire contents of the pit passed through a 5mm sieve to maximise finds recovery. The pits were positioned to radiate out from the excavation trench in order to try and locate any other surviving structures. In particular, the eroding cliff edge was targeted so that any remains in danger of immediate erosion could be recorded. Lines of pits were excavated at varying intervals of 2, 5, 10, 20 and 50m in order to assess what spacing interval was required in order to pick up areas of high artefact densities. The pits aligned along the cliff edge were excavated at 5m intervals so that if another hut feature of similar dimensions (c.6m diameter) to the one already discovered was under immediate threat of erosion, this sampling interval would allow for picking up traces of it. The pits were excavated at the same time as the Mesolithic hut during summer 2002 by a combination of professional staff and supervised volunteers and school groups.

Distribution and Artefact Density

A total of 246 lithics was recovered from the pits, together with 309 modern shells (as they show little sign of erosion by soil acidity), eight sherds of modern pottery, two fragments of modern animal bone (probably sheep), five clay pipe fragments and one piece of modern glass. The lithic total is substantial, giving an average count of 3.3 lithics per pit – although without including pit 1a, which was located on top of the Mesolithic hut –; this gives a total count of 195 and an average of 2.7. This compares with 0.7 lithics per pit recovered during the excavation of 146 test pits around the Milfield Basin (Waddington 1999a, 62–71). The Howick results, therefore, indicate a focus of Stone Age activity around the area of the Mesolithic hut. No cut archaeological features were found in any of the test pits.

As all but one of the diagnostic lithics are Mesolithic, and as they are directly analogous with the material from inside the hut, this implies that it is largely Mesolithic activity that is represented by the test pit lithic finds. Assuming some degree of contemporaneity with the hut site, this high-density artefact spread indicates that activity took place beyond the immediate confines of the hut. Indeed, the concentration of lithics in pits 67, 68 and 64 suggests an activity area near to the hut on its west side, and this fits in with the presence of undated pit features found between the test pits and the hut (Fig. 4.2). Other concentrations were noted on the cliff in pits 1–6, before the ground slopes away to the north-east, suggesting that this area may have been utilised for a range of outdoor processing tasks. It is apparent, however, that the density of lithics falls off with distance from the hut along the north-east line of pits. Another localised activity focus is suggested by pits 38, 44 and 47 on the north-west edge of the trench, which produced 19 lithics between them. The concentration of material on what is currently the cliff edge would have been located in a more sheltered position set back from the Mesolithic cliff by perhaps as much as a few hundred metres. Test pit 69, cut into the collapsed cliff deposits that had eroded out from the hut site, was not excavated to full depth (i.e. down to the substratum) as it became heavily waterlogged during excavation. However, it is likely that most of the 10 lithics from this pit had eroded out of the Mesolithic structure above and this would account for the high concentration in the levels that could be excavated. The three test pits excavated on the headland to the south of the Howick Burn around an erosion scar (pits 71–73) yielded only a low quantity of material (six pieces from the three pits), and so no more evaluation took place in this area.

Comparing the results from the lines of pits set at different spacings aligned inland from the north-west end of the trench shows an interesting pattern (see

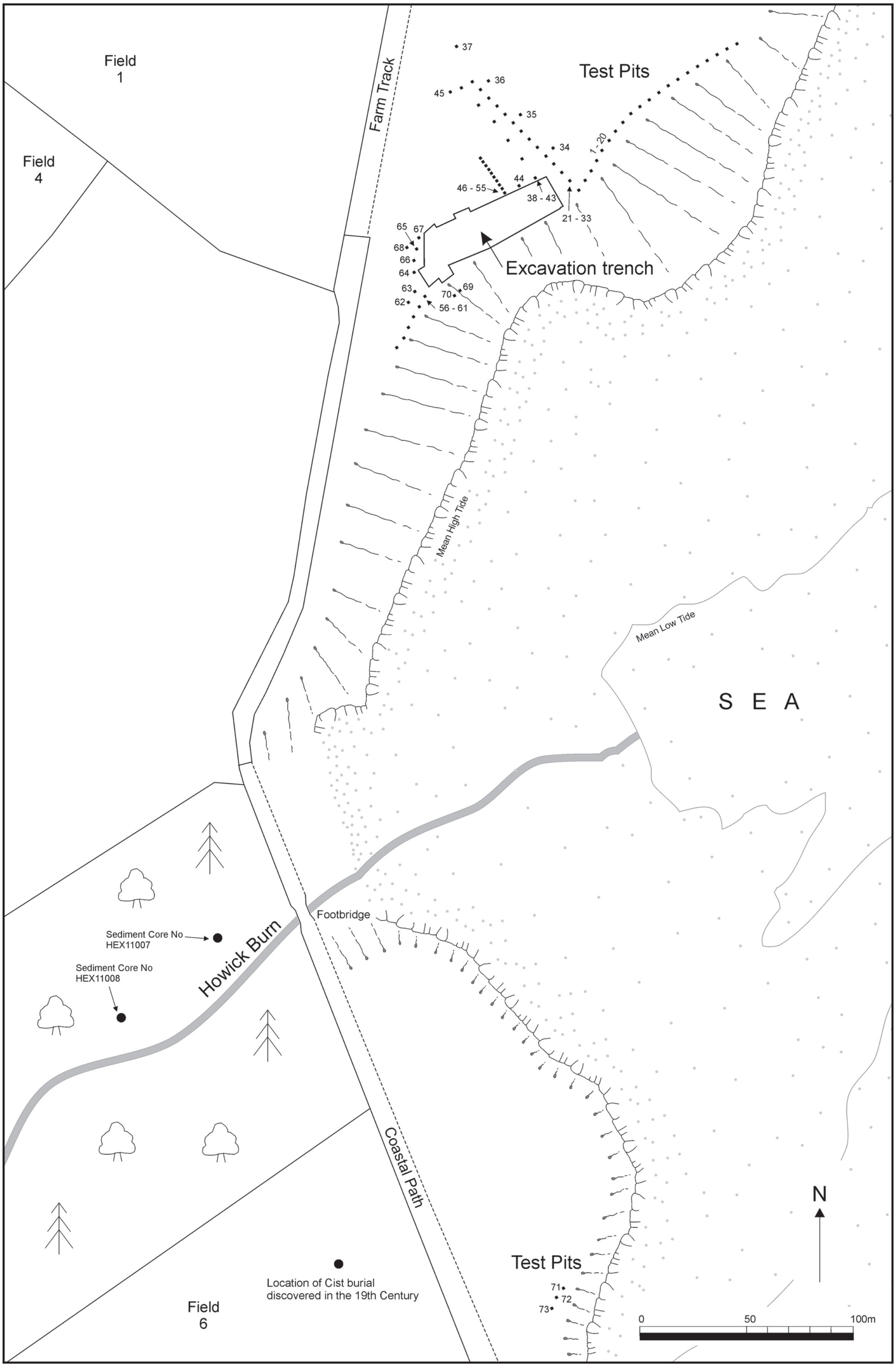


Figure 4.1. Plan showing the location of all test pits in relation to the excavation site and the cliff edge.

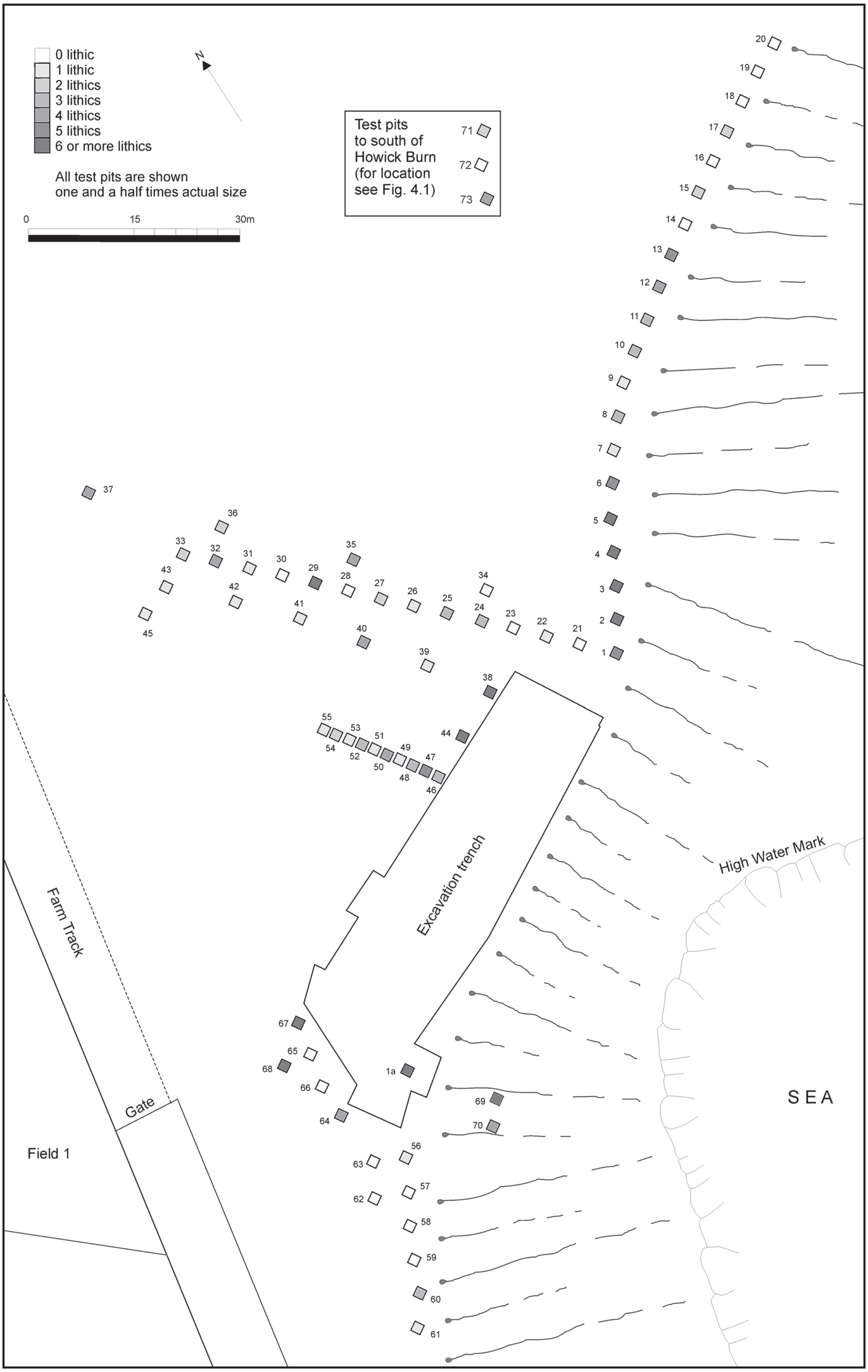


Figure 4.2. Detailed plan showing numbers of lithics per test pit.

Test Pit No	Lithics	Shells	Modern Pot	Modern Bone	Clay Pipe	Glass
1a (over meso hut)	51					
1	5	8				
2	8	1				
3	10	8				
4	8	5				
5	8	2			3	
6	5	8				
7	1	11				
8	3	2				
9	1	3				
10	3	7				
11	3	1				
12	4					1
13	5	2				
14		10				
15	2	4				
16		13	1			
17	2	5				
18		2				
19		3				
20		1				
21						
22	1	1				
23						
24	3					
25	3					
26	1	1				
27	2	4				
28		7				
29	8	3				
30		6				
31	1	4				
32	4	12			1	
33	2	3				
34		15				
35	4	2				
36	2	3				
37	4	5				
38	7	4				
39	1	1				
40	4	5				
41	1	4				
42	1	8				
43	1	1				
44	7	2				
45	1	1				
46	3	1				
47	5	5				
48	3	4				
49	1	10				
50	4	5				
51	1					
52	3	3				
53	1	5				
54	2	3				
55	1	3				
56	1	5				
57		4				
58		2				
59		4				
60	3	9				
61	1	7				
62		3				
63						
64	4	2				
65		15		1		
66		6		1		
67	6	2	3		1	
68	10	17	2			
69	10	2	1			
70	4	3	1			
71	2	1				
72						
73	4					
Total	**246**	**309**	**8**	**2**	**5**	**1**

Table 4.1. Numbers and types of finds from each test pit.

Interval	No. pits	No. lithics	Average no. lithics per pit
2m	10	24	2.4
5m	14	30	2.1
10m	6	15	2.5
20m	5	18	3.6
50m	2	8	4.0

Table 4.2. Lithic counts of pits set at different spacings.

Type	Number	% of Test Pit Assemblage
Nodule	4	2
Test Piece	9	4
Flakes	156	63
Blades	39	16
Cores	19	8
Retouched Flakes	9	4
Retouched Blades	1	
Utilised Flakes	3	1
Utilised Blades	3	1
Microliths	2	
Scraper	1	
Total	**246**	

Table 4.3. Lithic types recovered from the test pits.

Table 4.2). The average number of lithics per pit tends to rise if the interval spacing is larger and if there are fewer pits. This is perhaps the opposite of what may have been expected, as pits with a greater spacing are less likely to provide an accurate indication of densities and fall-off than more closely spaced pits. The 50m spacing result is therefore probably skewed by pit 44 which produced 7 lithics and, given that only one other pit was excavated in this line, the average density has inevitably remained high. The same is true for the 20m spaced pits where the high count from one pit, in this case pit 38 with 7 lithics, has raised the average density count for the few other pits included in this line that usually only contained just one lithic. However, it is telling that the results from pits positioned at 2m, 5m and 10m intervals are remarkably consistent, ranging from 2.1 to 2.5 lithics per pit. Given that the 2m spaced pits are likely to give an accurate indication of lithic densities, as it represents a 50% sample of the entire plough zone assemblage in any given line.These results suggest that pits positioned at 5m and 10m intervals can also provide a reasonably accurate reflection of the patterns. However, interval spacings greater than this tend to give results inconsistent with the 2m 'control'. Another way of undertaking this experiment would have been to excavate a long line of 2m spaced pits and then record every 2nd, 5th, 10th, 20th and 50th pit and compare those results. This would ensure absolute consistency across the ground being examined.

The Lithic Assemblage

The test pit assemblage reveals a wide range of pieces, including primary material, such as nodules and test pieces, which together account for 6% of the total, as well as the usual preponderance of flakes (63%), blades (16%) and cores (8%), but also a significant proportion of tools (7%). The presence of primary waste, together with the cores, blade blanks, flake debitage and finished tools, shows that the entire reduction sequence is manifested in the assemblage. This is consistent with the findings from both the fieldwalking and the excavated lithic assemblages, reinforcing the view that flint was collected locally and worked into tools at and around the site. As 55% of the test pit lithics are broken, including most of the tools, many of these represent pieces discarded in antiquity, although some breakages have evidently resulted from plough damage. The former is confirmed by a number of the broken lithics having patination development over the broken area. The important point here is that if some of the tools were broken and discarded in antiquity then not only is the entire reduction process evidenced in this assemblage but also the discard of tools after they have been used. In other words, the tools were also used here in processing activities of various kinds. A single scraper was found, hinting towards hide preparation, while the two broken microliths, although unclassifiable, may have formed part of a hunting tool kit, or as some commentators have suggested, been used in plant processing tasks. The retouched and utilised flakes and blades could have been used for a wide variety of purposes. The presence of a range of processing tools indicates that activities consistent with domestic occupation took place in the open air in the immediate environs of the hut. Some of the lithics were patinated (38%), but most of these only lightly, while 9% of the lithics were burnt.

As with the fieldwalking and hut flints, most of the cores were platform varieties of one type or another, but as most of them were small they had evidently been struck wherever there was an opportunity for producing a blade. On the whole the assemblage is geared around a blade-based tradition, with the use of bipolar flaking evident in a few instances. Many of the retouched pieces have areas of cortex remaining on them, revealing the small size of the raw materials generally available for chipping. The variation in the size of the bulb of percussion and evidence for crushed striking platforms in some cases shows the use of both hard and soft hammers. Only one piece in the assemblage has been pressure-flaked to produce some fine invasive retouch. This broken retouched flake from pit 22 is likely to be Neolithic in date and, together with the leaf arrowhead recovered in the nearby excavation trench (Chapter 7), shows some evidence for activity on the site in a later period.

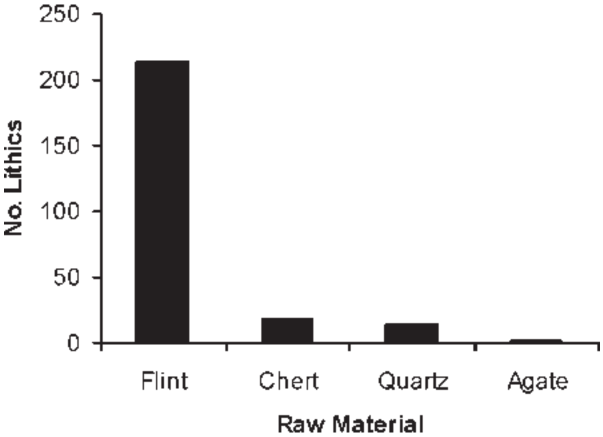


Figure 4.3. Number of lithics made from different raw materials.

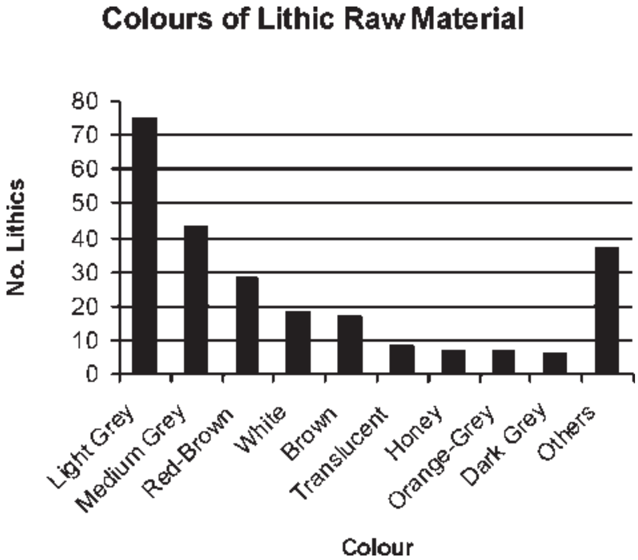


Figure 4.4. Number of lithics made from different coloured raw material.

It is notable that a lower proportion of cores was recovered from the test pit assemblage (8%) compared with the fieldwalking assemblage (15.2%), which suggests that cores are perhaps over-represented in surface collections, no doubt on account of their larger size and greater visibility.

The spread of raw materials used for making stone tools during the Mesolithic is skewed towards the use of flint (86%). However, other locally occurring materials were also used from time to time, probably as washed-up beach material, and this included chert (7%), quartz (6%) and one piece of agate. Of all the flint that could be provenanced, every single one was of beach flint (14% of the test pit assemblage). As with the fieldwalking and excavation results, the test pit lithics demonstrate a reliance on locally available material from the nearby beach and cliff-sections.

The range of flint colours present in the test pit assemblage was directly analogous to that in the fieldwalking, and what is more, the colours occurred in the same proportions (Fig. 4.4). All the types of flint common on the North-East coast are represented in the assemblage, with varieties of light grey the most common, followed by medium grey and red-brown (see Fig. 4.4). These types of flint are common in other coastal collections such as those from Newbiggin, the Bamburgh area and from areas on the Durham coast such as Crimdon Dene and Middle Warren. Thirty pieces could not be attributed a colour as they were either too heavily patinated or burnt.

Comparison of the lithic density from the test pit above the Mesolithic structure with those from the test pits away from the site provides a rough indication of the sort of densities that can be considered indicative of a dwelling site. A total of 51 lithics was recovered from test pit 1a that was excavated above the inside of the Mesolithic hut, while the highest counts in any of the other test pits was 10, though the average was 2.7. During the initial stripping of the site in 2000, all the topsoil and subsoil was removed in 1m squares and sieved, so in effect this soil was removed as a series of 1m square test pits. The highest density of lithics occurred immediately over the hut area (up to 51 lithics in a single metre square), with the densities gradually falling off with distance from the hut. Although these numbers can only be taken as guides, these figures provide baseline data for assessing how many lithics can be expected in a pit if occupation deposits had accumulated in that position.

5 Excavation of the Howick Hut

Clive Waddington

Methods Statement

Further to the observation of flints falling out of the erosion scar (see Chapter 1), the site was first investigated with a single 1m square test pit during May 2000. This revealed a stratigraphic sequence consisting of a topsoil, subsoil and sand substratum, the latter containing a cut archaeological feature. Lithics and shells were recovered from all these layers and charred hazelnut shells from the top of the archaeological feature. Based on these findings a strategy was adopted for an evaluation excavation that took place during June and July 2000. This involved removing the overburden in metre squares and bucket-sieving all the soil through a 5mm mesh in order to maximise finds recovery and to gain some sense of flint distribution and density. The topsoil of a trench covering 195 square metres was stripped away and sieved, followed by removal of 90 square metres of the subsoil, repeating the same metre by metre sieving, down to the beginning of the archaeological horizon (Fig. 5.1). Although the results of sieving the subsoil were to some extent informative (see below), it was reasoned that the time taken to remove the overburden by this method did not justify the meagre results. The full excavation of the site, which took place during summer 2002, involved opening a much larger area than the evaluation, measuring 68m by 20m and extending over some 1120 square metres. The layout and extent of this trench was based on the results from the initial evaluation and the geophysical survey. In order to ensure the full excavation of all the deposits at risk from erosion, and to maximise the time available to record intact deposits, the topsoil across the entire area was removed by a machine, leaving the subsoil to be removed by hand. The start of the archaeological horizon was trowelled back to reveal the surviving features.

All features were excavated in their entirety with full records made using plans, sections, photographs and recording forms. A single-context planning system was employed to record the archaeology and this proved useful in helping to unpick the complex archaeology of the Mesolithic hut deposits. All small finds were spatially located using a total station. The area of Mesolithic deposits was situated in a localised area of sand inset within the till deposits and all features within this unit required delicate excavation. This meant that small tools such as plasterer's leafs and spoons were employed for most of the excavation work rather than trowels. A 100% sample of most deposits from the Mesolithic structure was passed through a flotation tank which had graduated brass sieves to collect the flot and a 2mm mesh to catch non-organic material (Fig. 5.2) (see also Chapter 11). This not only ensured collection of organic residues but it also maximised the recovery of small finds, and lithic material in particular. The Bronze Age remains, which consisted of a cist cemetery together with a later linear burning pit, were cut into the heavier clay till deposits to the north of the Mesolithic hut. The excavation of these features is reported in full in a separate publication (Waddington *et al*. 2005).

Site Stratigraphy

The Mesolithic site is situated in grassland given over to pasture for livestock. The sandy topsoil, which is a plough zone, varies between 0.22m and 0.4m in thickness and overlies a red-brown sandy subsoil which varies between 0.1m and 0.2m thick. Below the subsoil was the sand substratum, although in the north-eastern half of the site this changed to glacial till. A schematic summary of the geoarchaeological setting of the Howick site is provided in Figure 5.3. There were no traces of archaeological features in the topsoil as this ground has been ploughed on several occasions during living memory. The occurrence of clay pipe stems and bowls in the topsoil suggests the ground has been ploughed as far back as the 18th century, perhaps in association with the enclosure of land. The subsoil and topsoil have also been affected by bioturbation (including moles, worms, soil chemistry and so on) over the last 10,000 years. However, in some instances an extremely vague discolouration in the subsoil horizon above an archaeological feature

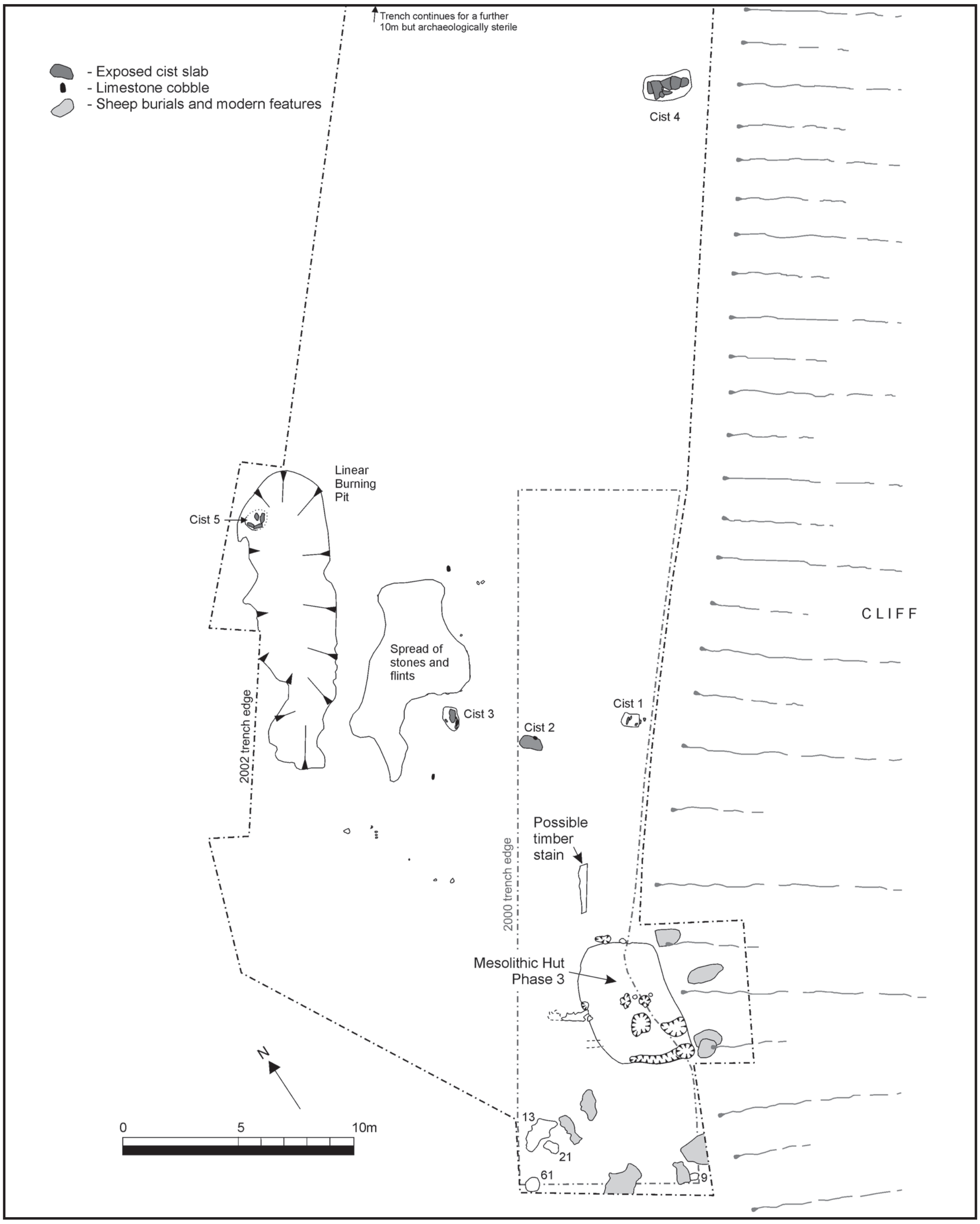


Figure 5.1. Trench plan showing the location of the 2000 and 2002 trenches and archaeological features.

could be observed, representing the 'ghost' of a feature in this layer. The bioturbation-driven truncation in the subsoil has not actively broken through features, as is the case with plough truncation, but has had the effect of breaking down the integrity of deposits and effectively 'smudging' them into the surrounding matrix. Therefore, it was only when the subsoil was removed, and the natural substratum exposed, that intact archaeological features could be distinguished. It is evident, then, that the top lens of the Mesolithic archaeology, and much of that from later periods, has been lost and it is only the features that were cut into the underlying substratum that have survived.

Mesolithic archaeological features were only distinguishable in the lowest 6cm of the subsoil horizon. The survival of a fallen timber associated with the Mesolithic structure, with only the top few centimetres disturbed by bioturbation and soil weathering, indicates that only the top few centimetres (i.e. 6cm) of this archaeology has been truncated. This means that the Mesolithic land surface must be located in what is now the lower subsoil horizon. Therefore, the Mesolithic soil appears to have consisted of a thin soil cover immediately overlying the sandy sediments, with the bulk of the modern soil having built up since then. In contrast, the Bronze Age remains survived through the entire subsoil horizon, indicating that they had been cut down from a higher, truncated, level within what is now the plough zone horizon. Therefore, the Bronze Age land surface was considerably higher than in the Mesolithic and was situated somewhere in what is now the topsoil. It can be concluded that a considerable build-up of soil took place on the site between the Mesolithic and Bronze Age occupations, a period of some 5800 years.

The overburden

Table 5.1 summarises the finds recovered from both seasons of excavation in the overburden. During the 2000 season, the entire topsoil and subsoil within the area of the evaluation trench were sieved and counts recorded on the basis of a 1m square grid system. The distribution of lithic material in the topsoil showed little patterning across the site other than concentrations in the general area of the hut; however, a concentration of lithics was found in the subsoil directly on and around the hut area. This finding is considered important as it indicates that there has been relatively little horizontal movement of lithic material in the subsoil, whereas that in the overlying topsoil has been moved both horizontally and vertically through the stratigraphic sequence. This is not surprising given that the field has been cultivated and ploughed, probably over many hundreds of years, resulting in the displacement of material in the plough zone. The spread of lithics around the hut is likely to indicate that processing and domestic activities took place in the immediate environs of the building, however this assumption must be viewed with caution, as the subsequent ploughing of the site must account for the spread of much of this material in the topsoil. The concentration of lithics immediately above the hut deposits in the unploughed subsoil appears to reflect a remarkably concentrated pattern of lithic discard in the hut, suggesting that most processing tasks took place indoors.

During the 2002 excavation the topsoil was surface-stripped and the subsoil cleaned back. This produced a quantity of unstratified lithic material from across the site (Fig. 5.4). A clear distinction was evident between the north-east and south-west ends of the site. The north-east half of the trench lay over a heavy clay till and contained remarkably few finds compared with the south-west half of the trench that contained a sandy hollow set within the surrounding till and had a distinct abundance of finds. The Mesolithic hut was situated in the soft sandy deposits, demonstrating a clear preference for site location on this free-draining substratum. The cists were situated further to the east with some cut into sandy sediments and others cut into heavier till sediments.

Mesolithic Hut

The only radiocarbon-dated Mesolithic feature in the trench was the remains of a substantial sub-circular hut situated along what is now a cliff edge (Fig. 5.5). It is estimated that about a quarter of this structure has been truncated on its south-east side as a result of slippage down the cliff and modern sheep burials. The cliff-top fence used to run along the truncated edge of the structure, and the remains of a modern fence post were found driven into the truncation line on the east side of the structure. However, the rest of the hut survived in a remarkable state of preservation, with clear structural evidence, including the stains of timbers, as well as post holes, post sockets, stake holes, pits and hearths, together with an abundance of artefactual material including over 13,000 flints (Chapters 7 and 8), 32 bevel-ended tools and tool blanks, several hundred thousand charred hazelnut shells (Chapter 11), together with burnt bone fragments (Chapter 10) and occasional fragments of mollusc shells (Chapter 10) and ochre (Chapter 8). The site has experienced considerable mole damage but the mole holes were clearly visible and could be distinguished from the archaeological features; this meant care had to be taken when sampling features for dating material.

Deposit	Lithics	Shell	Pottery	Clay Pipe	Other	Flints previously found at the surface by John Davies and Jim Hutchinson
Topsoil	604	794	109	7	ochre, bone, glass, plastic, iron, brick, slag,	233
Subsoil	239	63	7	1	ochre, glass, lead, iron, bone, slag	
Sand Substratum	3				3 small burnt stones	
Till Substratum	55					
Total	**901**	**857**	**116**	**8**		

Table 5.1. Summary of finds from the overburden and underlying natural sediment surfaces.

The hut had three distinct constructional phases, indicated by the stratigraphic sequence and supported by the chronological spread of radiocarbon dates throughout these deposits (see Chapter 6). No turf lines or hiatuses could be identified in the stratigraphic sequence that would indicate any substantial period of abandonment. Many of the archaeological features survived as ephemeral remains with the constituent make-up of most fills comprising a sand of varying colour and compaction. All unburnt organic content had decayed, leaving features such as timbers only visible as stains and 3-dimensional shapes in what was otherwise an acidic sand matrix (see Chapter 12). Features could be identified and delimited through distinctions in colour, texture and compaction, and in the case of heat-affected features, by fire-reddening and the presence of black charred material. It also became apparent while excavating that a number of features had developed a slight iron/mineral stain around their edges where the iron/mineral fraction in the soil and sediments had accumulated at the edge of archaeological cuts. This created a ginger halo effect around a number of features, particularly those cut into the sand substratum. In addition to this, three ferruginous layers were identified running across the entire hut deposits and beyond into the natural sand. At first this complicated the recording and interpretation of the archaeological deposits, but once it was observed that these lenses continued into the surrounding sand it was realised that they had formed as a result of natural soil processes.

The stratigraphy of each phase is discussed in turn below and full descriptions of each context are provided in the accompanying phase tables. There are accompanying plans for each phase together with section drawings. The sections of the two baulks, shown on the Phase 1a plan, are also included in the Phase 1a section. An exploded view of the phase plans is provided in the concluding section.

Figure 5.2. On-site flotation of sediments from the Howick hut.

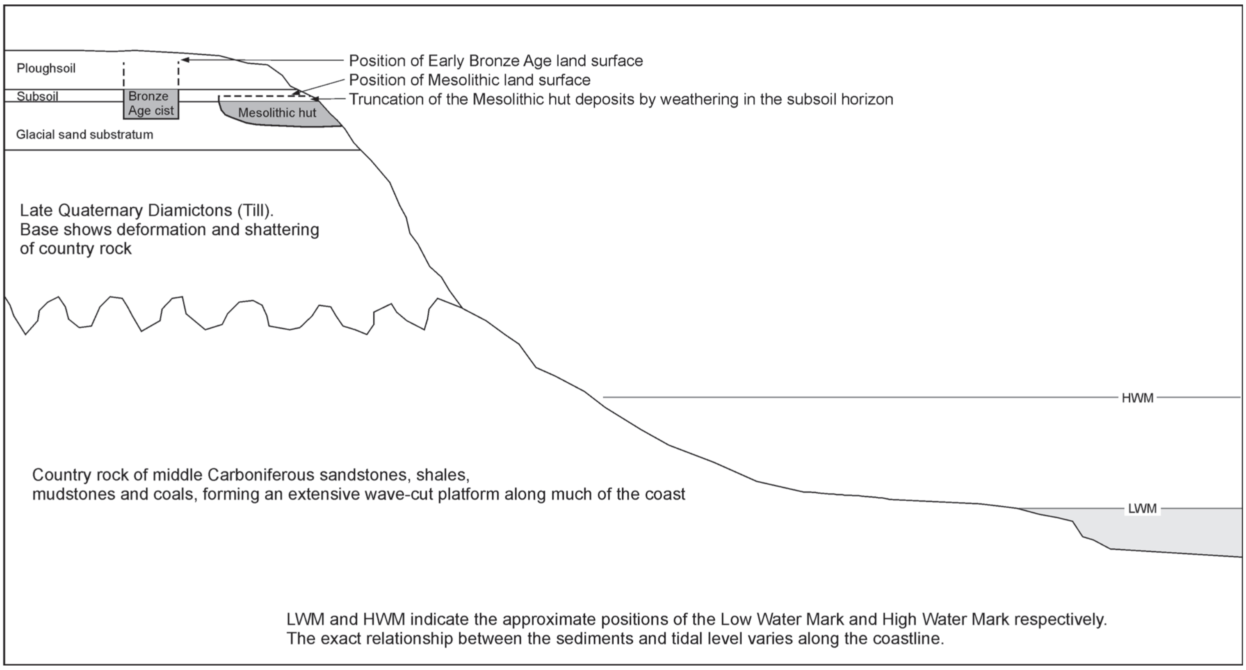


Figure 5.3. Schematic section of the archaeological remains and surrounding sediments at Howick.

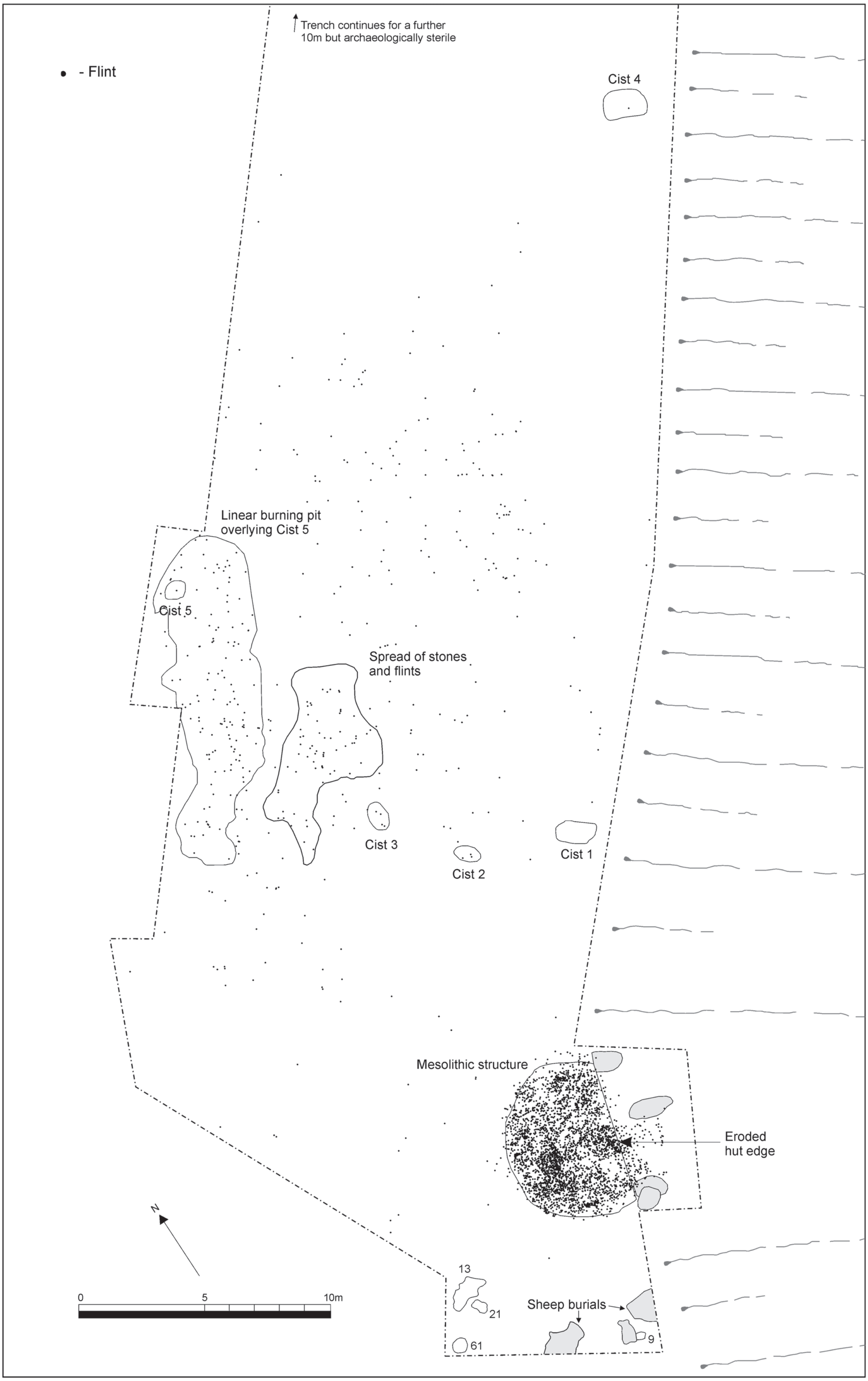


Figure 5.4. Trench plan showing lithic findspots.

Phase 1a Hut (see Figs. 5.6–5.9)

Within the first structural phase of the hut was a succession of internal features and debris that had accumulated during this first phase of occupation. These were excavated layer by layer and form the subdivisions a and b of the Phase 1 hut. Whether they represent different phases of occupation, or rather the successive build-up of debris from one single permanent occupation remains unclear. However, the Phase 1b occupation may be related to minor structural alterations suggested by some flat stone pads, possibly for supporting timbers, and some stake holes identified in the Phase 1b deposits.

Structural Features

The first phase of the hut consisted of a sunken-floored circular structure cut into sand deposits on a flat area of land (Fig. 5.6). The sunken-floor area measured 6m across and averaged 0.4m–0.45m deep below the start of the archaeological horizon, except in the centre where some of the hearth features were cut to a depth

Figure 5.5. Aerial view of the Mesolithic hut during the early stages of excavation.

Figure 5.6. View of the Phase 1a hut after complete excavation looking north-east (2m scale).

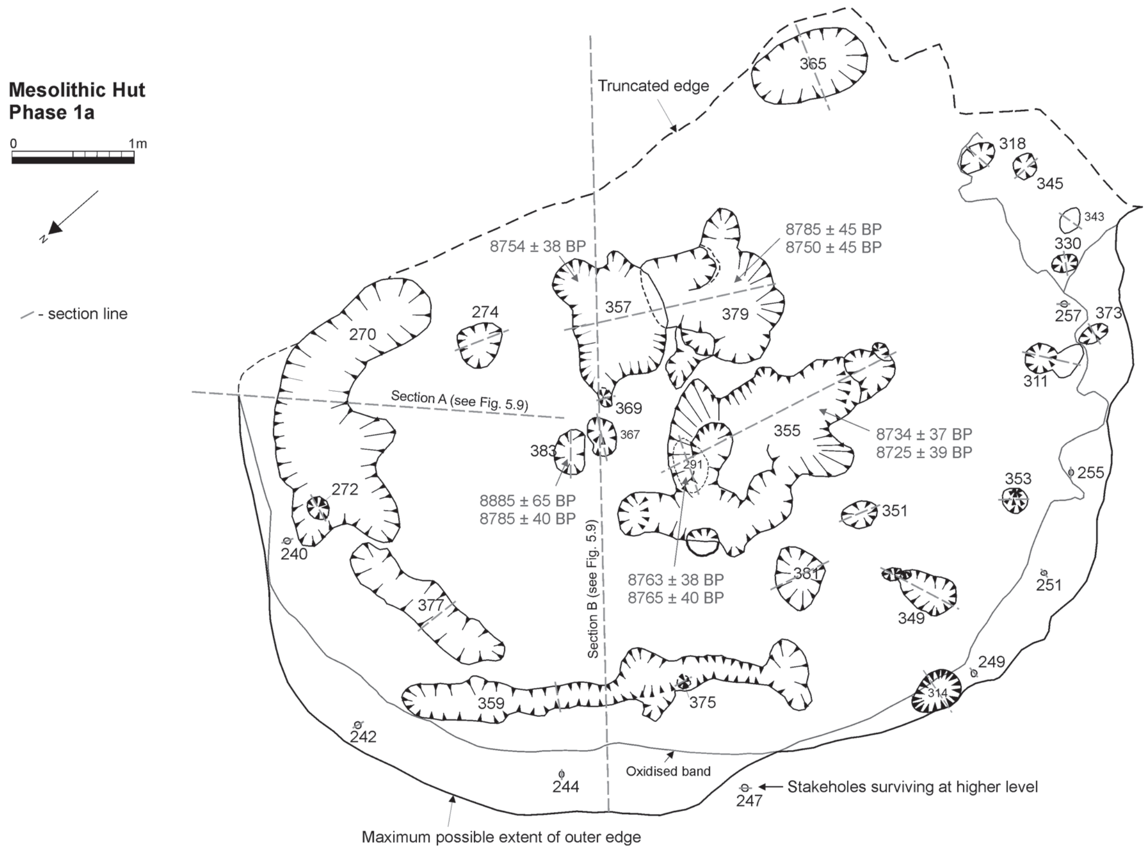


Figure 5.7. Plan of the Phase 1a hut.

of 0.65m. None of the 'occupation deposits' (see Phase 1b section) could be directly linked to this first phase of construction, although some parts of these deposits must relate to this initial occupation.

A series of circular features [318, 345, 343, 330, 373, 311, 353, 349, 314, 272, 369], consistent with the appearance and form of sockets for timber posts, was identified set in a ring within the sunken-floored area (Fig. 5.6). These features were circular or sub-circular in shape and consisted of shallow, usually flat-bottomed, sockets with the bases averaging 0.15m in diameter and averaging between 0.12m and 0.2m deep. None of these sockets had any evidence of packing material and it is thought that they were formed by stout timbers being driven into the sand substratum with the weight of the roof used to hold them in position.

Set at a higher level, 0.25m above the floor of the structure around the perimeter edge, was a ring of evenly-spaced stake holes [240, 242, 244, 247, 249, 251, 255, 257] that contained the degraded charred ends of sharpened poles. These stake holes were covered by the upper deposit [210], into which the Phase 2 hut post sockets were set. Therefore, it is evident that these stake holes form part of the Phase 1 hut. The stake hole slots averaged 0.04m in diameter but as these were only the sharpened ends the actual thickness of the poles is thought to have been in the order of 0.07m in diameter. The poles were set in the ground at an angle close to 65° and aligned towards a central apex, thus forming a steep angle of pitch.

Two linear features [359] and [377] may have had a structural purpose. Both of these features survived as ginger-brown stains set in the natural yellow-brown sand and had curved profiles. Feature [359] contained occasional flints, charred hazelnut shells, mollusc shell fragments and charcoal. Feature [377] contained no small finds. These contexts were considered to be structural components of the hut as they were positioned around the edge of the structure and a stake hole, [375], was cut into the fill of [359]. Precisely how these linear sockets were utilised remains unclear although it is possible that feature [359] is the remains of a fallen timber post surviving only as a stain in the sand, as it had a round profile and even appeared to have had a bough removed from it on it one side. As unburnt organic material decays in this acidic environment, leaving only a sand matrix, it is not surprising that occasional lithics and other small finds have found their way into such deposits as a result of earthworm action and other mixing processes.

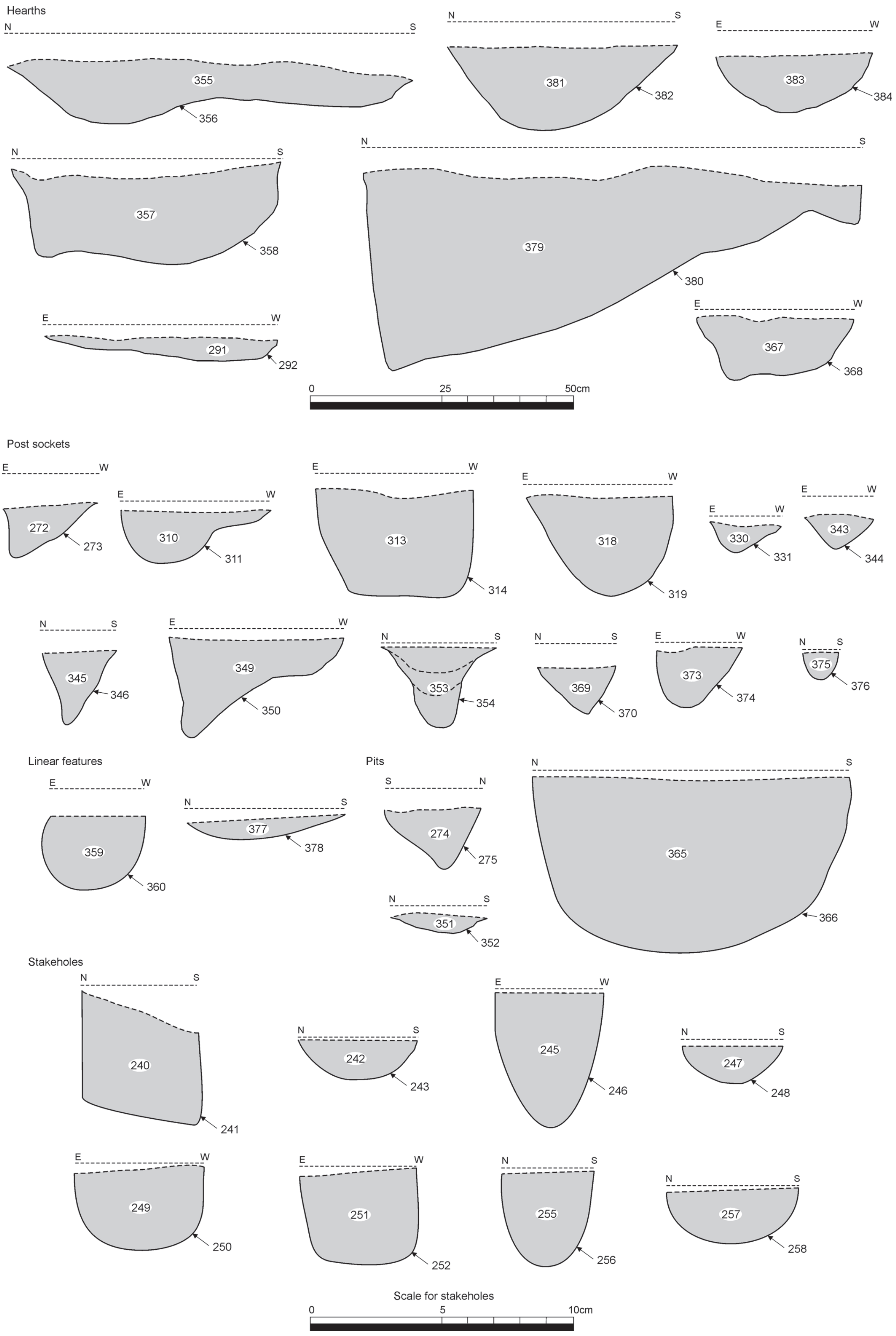


Figure 5.8. Phase 1a feature sections.

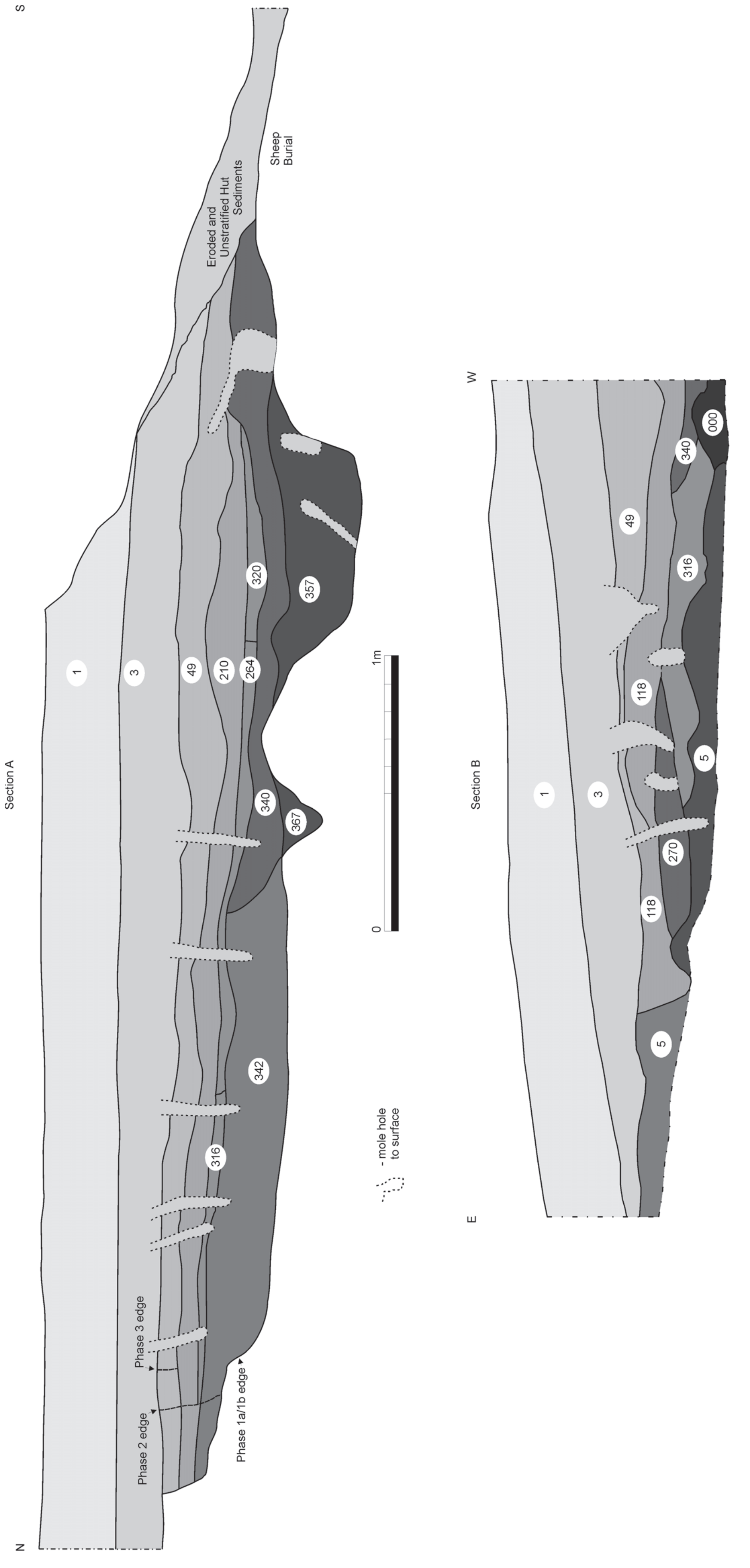


Figure 5.9. The baulk sections.

Hearths

The primary central hearth [355] measured 2.3m long at its maximum extent and in places measured up to 0.58m deep. This is a very large pit that contained evidence within its fill for multiple burning events. Indeed this sizable hearth appears to have formed as a result of numerous re-cuts resulting in a large irregular pit with cuts at different levels. The ground around the pit was heavily scorched and fire-reddened and the fill was blackened as a result of the burnt and charred material. Grey patches of ash were also present. The fill contained large quantities of burnt flints, charred hazelnut shell and charcoal, together with occasional fragments of burnt bone. Two radiocarbon dates were obtained from *in situ* single-entity charred hazelnut shell samples (see Table 5.2 and Chapter 6). This hearth had an unusual burnt feature resembling an angled post hole, averaging 0.22m in diameter, projecting below the base of the hearth. This is thought to be the likely remains of a degraded charred post; probably associated with fire-side activities such as cooking. This burnt feature had been set deep into the hut floor, reaching a depth of 1.2m from the start of the archaeological horizon, and 1.6m below the modern ground surface, making it the deepest archaeological feature on the site.

Lying to the east of the central hearth area [355] were two other large hearth pits, [357] and [379]. Of these, [379] was the earlier as it was cut by [357]. As with hearth [355] both pits were somewhat irregular in shape, but substantial, with [379] measuring up to 1.25m across and 0.67m deep while [357] measured up to 0.33m across and 0.12m deep. Both had dark charred fills with areas of ash together with fire-reddened edges and patches of burnt, fused sand. Both hearth pits also contained many pieces of flint, some of them burnt, together with abundant charred hazelnut shells, charcoal, and in the case of [357], occasional fragments of burnt bone. Single-entity charred hazelnut shell fragments, from *in situ* burnt residues from pits [379] and [357], were submitted for radiocarbon dating. Intriguingly, as with hearth [355], evidence for a dark charred circular post was observed on the north-west side of hearth pit [357]. This small post socket [369] measured 0.18m in diameter and had a depth of 0.14m. Two opposed slots were extant at the edges of the hearth [379], one of them also positioned on the north-west side. The suggestion here is that these three major hearths, occupying the central area of the hut, may have had timber supports associated with them.

Two much smaller burning pits, [383] and [381], were also observed cut into the natural sand at this level. Pit [383] contained a black charred sandy fill surrounded by fire-reddened sand indicative of *in situ* burning. Two single-entity charred hazelnut shells from an *in situ* burning event within pit [383] were submitted for radiocarbon dating. The fill contained charred hazelnut shell and burnt bone fragments. Pit [381] was slightly larger and had a fill similar to that of [383] but also contained charred hazelnut shell fragments. These pits lay beyond the large central hearth pits but still within the central area of the hut space. Neither had evidence in its fill for multiple burning events, as in the case of the three large hearths.

Two later hearths, [367] and [291], were located cut into the primary hearth pit [355]. Both of these were small; [367] measuring 0.33m by 0.23m by 0.12m deep and [291] 0.41m by 0.24m by 0.055m deep. Both had black charred fills surrounded by fire-reddened sand indicating *in situ* burning. Both contained flint, charred hazelnut shell and occasional burnt bone fragments and charcoal. Two single-entity charred hazelnut shells, resulting from *in situ* burning in hearth [291], were submitted for radiocarbon dating.

Other Internal Features

The other interior features discovered in the Phase 1a hut consisted of four pits of varying form and no doubt function. Two small pits, [274] and [351], were located closest to the central hearth area, suggesting they may have been associated with domestic activities such as food preparation or storage. Pit [274] measured 0.32m across by 0.13m deep and was filled by dark grey-brown loose sand that contained the occasional flint. Pit [351] measured 0.22m by 0.17m across by 0.07m deep and was also filled by dark grey silty sand with occasional fragments of charred wood but no evidence for *in situ* burning. Pit [365], located on the south-east side of the structure, was oval in shape and somewhat larger than pits [274] and [351], measuring 0.75m by 0.61m by 0.42m deep. It was filled by a grey-brown silty sand that contained occasional flints. However, by far the largest pit, [270], had an irregular arc-shape and was situated on the north-east side of the hut. It had a maximum length of 2m, varied considerably in width from 0.4m to 0.8m and averaged 0.13m deep. The fill was generally darker than the other pits as it contained black charred material and loose brown sand towards the edges of the feature. The fill contained occasional flints and charred hazelnut shells, though there was no definite evidence for *in situ* burning. The purpose of this pit remains uncertain although it appears to be associated with the arc of elongated pebble tools situated in this part of the hut (see also Chapters 8 and 14) and it is worth noting that the deposit was cut by post socket [272]. This pit is early in the structural sequence of the Phase 1a hut and could be associated with possible construction slot [377] and slot/timber [359] that continue around the north and west sides of the hut.

Context	Decsription	Max Dimensions (m.)	Max depth	Colour of fill	Texture of fill	Small Finds	^{14}CDates bp (uncal.)
Hearths							
355	Large and complex irregular hearth area with multiple burning episodes within	2.3 x 1.1	0.58	Black with fire-reddening and brown patches, surrounded by scorched sand	Charred sandy silt with occasional Small stones	557 flints, burnt bone, c.43000 charred hazelnut shell fragments, charcoal, charred wood, sandstone stone fragment	8734±37 OxA-11801 8725±39 OxA-12327
379	Large, deep irregular hearth	1.25 x 1.0	0.67	Black with fire-reddening and brown patches, surrounded by scorched sand	Charred sandy silt	262 flints, over 5000 charred hazelnut shell fragments, charcoal, charred wood, beveled pebble tool blank	8785±45 OxA-11856 8750±45 OxA-11857
357/371	Large, irregular hearth	1.0 x 0.8	0.3	Black with fire-reddening, surrounded by scorched sand	Burnt sand	147 flints, burnt bone, c.4500 charred hazelnut shell fragments, charcoal, charred wood, a beveled pebble tool blank	8754±38 OxA-11802
383	Sub-circular small hearth	0.27 diameter	0.12	Black surrounded by scorched sand	Burnt sand	1 flint, burnt bone, charred hazelnut shell, charcoal, charred wood	8885±65 OxA-12402 8785±40 OxA-12292
381	Sub-circular hearth	0.47 x 0.37	0.25	Black surrounded by scorched sand	Burnt sand	Charred hazelnut, charred wood	
367	Hearth	0.33 x 0.23	0.12	Black with fire-reddening, surrounded by scorched sand	Charred sandy silt	12 flints, burnt bone, c.80 charred hazelnut shell fragments, charcoal, charred wood	
291	Small oval hearth	0.41 x 0.24	0.055	Black with light brown sand lenses	Burnt silty sand	7 flints, burnt bone, c.100 charred hazelnut shell fragments, charcoal, charred wood	8763±38 OxA-11803 8765±40 OxA-12326
Post Sockets							
318	Ovoid post socket	0.28 x 0.14	0.2	Grey brown	Silty sand		
345	Circular post socket	0.15 x 0.13	0.21	Dark grey brown	Silty sand	3 flints, 45 charred hazelnut shell fragments	
343	Subcircular post socket	0.17 x 0.14	0.09	Grey brown	Silty sand	30 charred hazelnut shell fragments	
330	Ovoid post socket	0.15 x 0.13	0.1	Medium brown	Silty sand	1 flint, 16 charred hazelnut shell fragments	
373	Ovoid post socket	0.17 x 0.14	0.12	Light grey brown	Silty Sand	1 flint, 25 charred hazelnut shell fragments	
311	Post socket, with disturbed fill caused by extraction	0.22 diameter	0.1	Medium brown	Silty sand	1 flint and charred hazelnut shell	
353	Ovoid possible post socket (3 phases)	0.17 diameter 0.14 diameter 0.08 diameter	0.1 0.2 0.28	Medium brown	Sand	7 flints, c.40 charred hazelnut shell, fragments	
349	Post socket	0.25 x .33	0.21	Grey brown	Silty sand	16 flints, c.120 charred hazelnut shell fragments	
314	Large ovoid post socket	0.4 x 0.3	0.2	Medium brown	Silty sand	1 flint	
272	Circular post socket	0.17 diameter	0.1	Medium yellow-brown	Loose silty sand	20 charred hazelnut shell fragments	
369	Post socket	0.18 diameter	0.14	Dark Brown	Silty sand	Over 200 charred hazelnut shell fragments	
375	Stakehole	0.07 diameter	0.12	Black	Charred wood		
Stakeholes at higher level							
240	Circular stakehole fill	0.05 diameter	0.04	Black	Charred wood degraded into sand matrix		
242	Circular stakehole fill	0.045 x 0.04	0.015	Black	Charred wood degraded into sand matrix		
245	Circular stakehole fill	0.04 x 0.04	0.05	Black	Charred wood degraded into sand matrix		

Context	Decsription	Max Dimensions (m.)	Max depth	Colour of fill	Texture of fill	Small Finds	^{14}CDates bp (uncal.)
242	Circular stakehole fill	0.045 x 0.04	0.015	Black	Charred wood degraded into sand matrix		
245	Circular stakehole fill	0.04 x 0.04	0.05	Black	Charred wood degraded into sand matrix		
247	Circular stakehole fill	0.04 x 0.03	0.015	Black	Charred wood degraded into sand matrix		
249	Circular stakehole fill	0.06 x 0.05	0.03	Black	Charred wood degraded into sand matrix		
251	Circular stakehole fill	0.045 x 0.045	0.035	Black	Charred wood degraded into sand matrix		
255	Circular stakehole fill	0.035 diameter	0.035	Black	Charred wood degraded into sand matrix	3 flints	
257	Circular stakehole fill	0.05 x 0.04	0.02	Black	Charred wood degraded into sand matrix		
Linear Features							
377	Linear, probably a timber	1.0 x 0.3	0.4	Medium ginger brown	Compacted sand		
359	Linear, probably a timber	2.5 x 0.4 (av. 0.25)	0.26	Medium ginger brown	Sand	c.250 charred hazelnut shell fragments, 36 flints, charcoal	
Pits							
270	Linear pit	2.0 x 0.8	0.13	Black with brown areas towards edges	Loose sand	113 flints, over 3000 charred hazelnut shell fragmentst, 2 bevelled pebbles, 2 sandstone cobbles and a sandstone fragment	
274	Sub-circular Pit	0.32 x 0.32	0.13	Dark grey brown	Loose silty sand	32 flints, c.200 charred hazelnut shell fragments	
365	Ovoid pit	0.75 x 0.61	0.42	Medium grey-brown	Silty sand	142 flints, over 2000 charred hazelnut shell fragments	
351	Ovoid shallow pit	0.22 x 0.17	0.07	Dark grey	Silty sand	Charred wood, 4 flints, c.25 charred hazelnut shell fragments	
Floor Level							
005	Sand spread			Medium brown	Sand	Charred hazelnut shell fragments, 263 flints, 4 bevelled pebble tools on the original hut floor and a beveled pebble blank	

Table 5.2 Phase 1a Context Descriptions

Phase 1b Hut (see Figs. 5.10–5.12)

Immediately overlying the primary Phase 1a deposits was a series of later features that comprised internal occupation deposits but with little evidence for a full structural rebuild of the hut, though some building alterations and/or maintenance may be inferred.

Post Sockets and Stake Holes

A number of stake holes were observed in this stratigraphic phase, although most of them were in a localised area running along the south and west edges of the hut, suggestive of repairs or maintenance in this area (Fig. 5.10). Stake holes [300], [332], [334], [336], [338] and [307] were grouped around a small flat stone next to the south edge of the structure cut into occupation deposit [326]. These stake holes averaged 0.06m in diameter and varied in depth from 0.04m to 0.12m. They were filled with a dark grey charred deposit of degraded wood that had decayed, leaving a sand matrix which contained occasional charred hazelnut shell fragments. A larger stake hole or post socket, [310], also lay along the south edge of

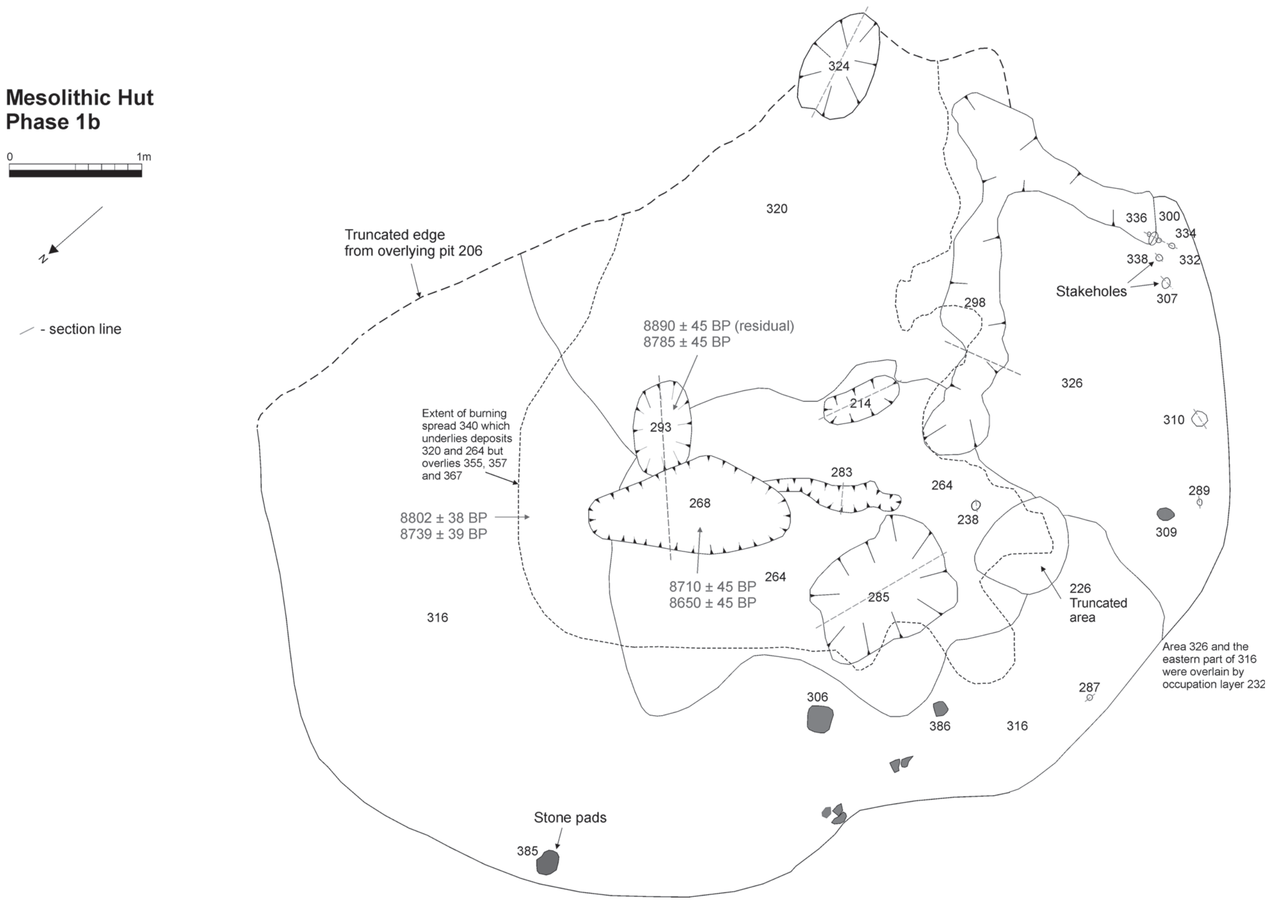


Figure 5.10. Plan of the Phase 1b hut.

the structure. Stake hole [238] was an isolated feature located further into the hut, cut into burnt spread [264]. Two further stake holes, [289] and [287], were located round the south-western edge of the structure and had similar dimensions to the stake hole group.

Possibly associated with post socket [310] were the stone pads/wedges [309], [386], [306] and [385] that were also set inside the hut edge running along the south and west sides. If timbers had been placed on these stone pads then they form a continuation of the structural features represented by the stake hole group and post socket [310]. If this is the case, as seems likely, then it suggests that a repair of the south-west arc of the hut took place during this phase. Two groups of small stone fragments were also found at this level, set in the yellow sand occupation deposit [316]. These small stones were too small to have had any structural purpose or than as wedges to stabilise timber posts and small caches of flint cores were found close to each of these groups of stones. Maybe flint knappers had sat with their backs against the timber posts while they produced flint tools.

Linear Feature

An irregular linear feature in the shape of an 'r', [298], was located next to, and partly overlying, burnt spread [340] in the south sector of the hut. This was a very shallow spread of distinctive medium brown silty sand. It contained occasional flints, charred hazelnut shell fragments and charcoal. Its slight form and unusual shape suggests it was not a structural feature, though it could have had a use associated with activities specific to the south side of the hut interior.

Occupation Deposits

Two occupation deposits, [316] and [326], surrounded the burning spreads [264] (see below) and [320]. Deposit [326] consisted of medium brown sand that had a maximum extent of 2.7m by 1.78m and contained flint and charred hazelnut shell fragments. Deposit [316] consisted of light brown sand and extended over the rest of the hut floor around the burnt spreads with a width of up to 5.5m and extending up to the truncated edge. The deposit contained flint, charred hazelnut shell, occasional mollusc shell fragments and charcoal. It also contained five small pieces of sedimentary rock, each containing copper mineral making the stone heavy. Unfortunately these samples were lost during transit for analysis.

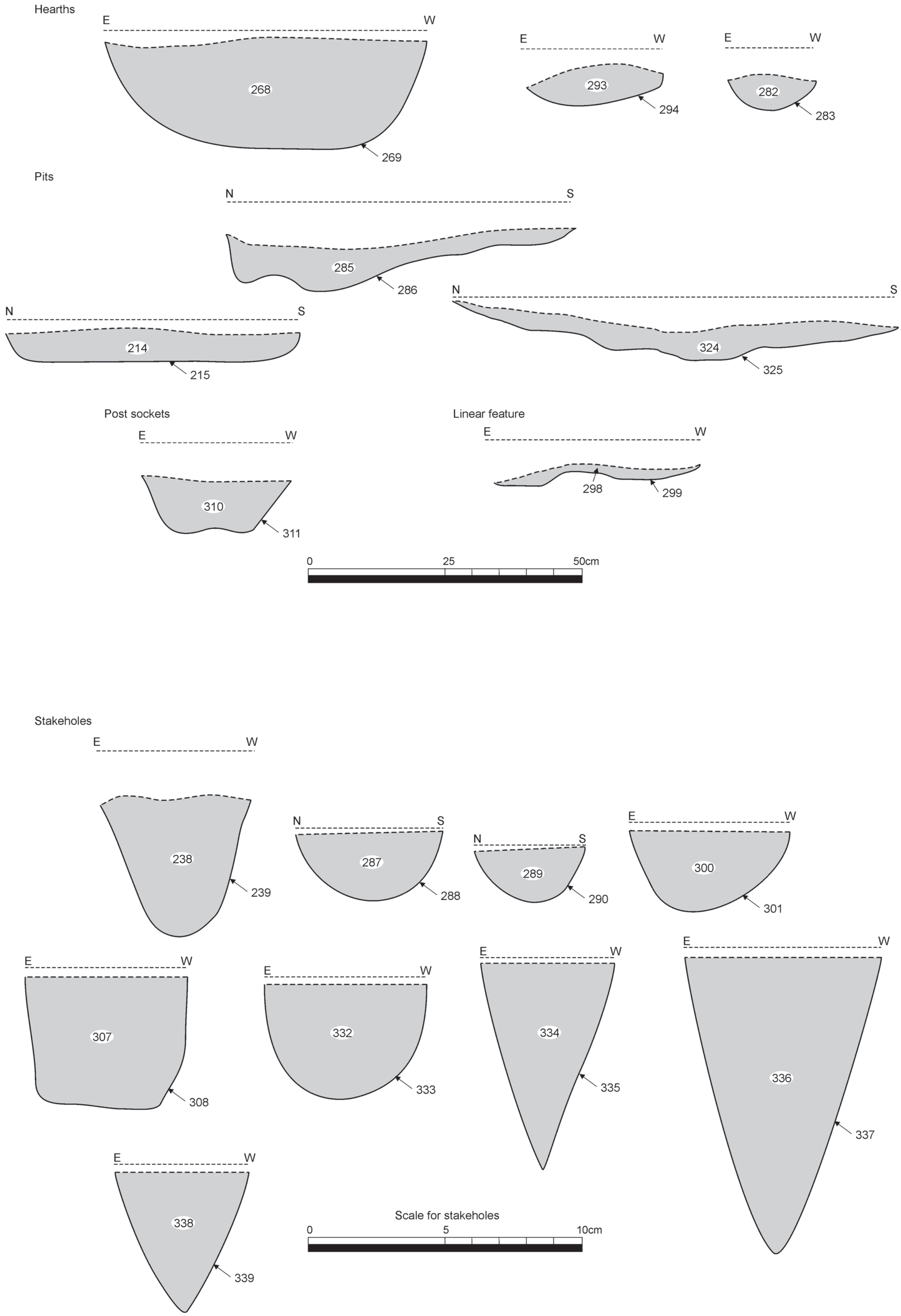


Figure 5.11. Phase 1b feature sections.

Figure 5.12. Hearth 357 (Phase 1a) after half-sectioning looking north.

Hearths

A sequence of well preserved stratified hearths was found stacked over the primary hearths [355], [379] and [357] of Phase 1a. Lying immediately above the primary hearths was an extensive burnt spread [340] that covered the central area of the hut. It measured 2.8m wide and continued all the way to the truncated edge and was, therefore, over 3.75m long. Patches of discrete *in situ* burning were observed within the spread and single-entity charred hazelnut shell samples from one of these patches were radiocarbon dated. The spread varied in colour and texture from black charred patches through various shades of grey and brown to fire-reddened and ginger scorched sand. Large quantities of flint and charred hazelnut shell, together with some fragments of burnt bone, were recovered from the fill. Two discrete spreads of burning, [264] and [320], were noted overlying burning spread [340]. Burnt area [264] lay slightly to the west of centre in the hut and extended over an area 2.7m by 2.2m with a largely uniform thickness of 0.1m. Again, patches of *in situ* burning were observed across this deposit that consisted of black and grey charred material in a scorched sand matrix. This deposit also contained flint, charred hazelnut shell and burnt bone fragments. Abutting [264] was another burnt spread, [320], that contained patches of *in situ* burning set in a charred black and burnt sand deposit. This spread measured 2.54m by 2.5m and had a thickness of 0.1m. It contained flints and charred hazelnut shell.

A hearth pit, [293], cut into the north-east side of burnt spread [264], measured 0.5m by 0.38m by 0.2m deep. The fill of this hearth pit consisted of black charred material and ginger scorched sand and contained flints and charred hazelnut shell. Two *in situ* single-entity charred hazelnut shell fragments from this hearth were radiocarbon dated (see Table 5.3 and Chapter 6), although the first of these two dates is clearly residual from earlier activity at the site (see Chapter 6). A linear sinuous burning deposit [283] lay above burnt spread [264] and measured 0.68m long by 0.13m wide by 0.08m deep. This deposit had the texture of charred wood and is thought to most likely represent the remains of a burnt log. The sand immediately around it was heavily burnt indicating that it had been burnt *in situ*. Occasional flints and charred hazelnut shell were found around the edges of the deposit and these are thought to have become worked into the sandy fill after the wood had degraded. Truncating hearth pit [293] and the probable burnt log [283], and cut into burnt deposit [264], was a well-preserved hearth pit, [268] (Fig. 5.12). This latter hearth had a broadly oval shape and measured 1.3m by 0.61m by 0.22m deep. It was filled with the characteristic black and dark grey charred material in a heat-affected red-ginger sand. The fill contained flint, charred hazelnut shell and occasional burnt bone fragments. Two single-entity charred hazelnut samples from *in situ* burning within hearth pit [268] were radiocarbon dated (see Table 5.3 and Chapter 6).

Pits

Three pit features belonged to this phase of occupation. Pit [285] was cut into burnt spread [264] close to hearth pit [268] and probable burnt log [283]. This pit measured 1.0m by 0.62m by 0.12m deep. It was filled by a dark to medium grey silty sand and ash, which contained occasional flints and charred hazelnut shell. The fill of this pit is consistent with hearth debris but there was no evidence for *in situ* burning and therefore may have functioned as a raking pit. Pit [214], although also cut into burnt spread [264], was significantly smaller, measuring 0.54m by 0.22m by 0.06m deep. The pit was filled by yellow-brown sterile sand that contained occasional charred hazelnut shells. Pit [324] was situated on the east side of the structure next to the truncated edge. It had an oval shape and measured 0.7m by 0.46m and was shallow, with a maximum depth of just 0.04m. The fill was clean orange-brown sand with occasional flecks of charcoal and charred hazelnut shell fragments. The purpose of pits [214] and [324] remains uncertain although a use associated with storage or other activities that could be undertaken next to the hut edge seems most likely.

Phase 2 Hut (see Figs. 5.13–5.16)

The Phase 2 hut was identified on the basis of two defining characteristics. First, all the Phase 1 features had been covered by layer [210] that extended across the full area of the hut floor (Fig. 5.9). As this material covered all earlier deposits, including the post sockets and stake holes, the preceding structure must have been dismantled and this layer of material spread over it, probably as a levelling layer. Second, a new arc of stake holes was inserted around the edge of the structure, cut into layer [210], indicating the construction of a new superstructure.

Levelling and Occupation Layers

Levelling layer [210] extends over the full area of the hut floor, which in this phase was slightly smaller than the Phase 1 hut, with a maximum diameter of 5.9m and an average depth of 0.1m. The layer consisted of pale yellow-brown sand with occasional patches of *in-situ* burning near to the centre of the structure. The deposit was exceptionally rich in flint, though it also contained hazelnut shell fragments and charcoal. Of particular note, however, was the fact that a few of the flints encountered in this layer were vertically set. As most of the pieces are from a blade-based industry they usually fall flat if dropped on to a surface. In order to explain these vertical settings it is considered most likely that at least some of the sandy deposit [210] was tipped into the hut floor, levelled and compacted (see Chapter 7 for further discussion).

Layer [118] was set within levelling layer [210] but was distinguished by its slightly different colour. It was an irregular layer of yellow-brown sand with a maximum extent of 1.7m by 1.2m and a maximum depth of 0.1m. Otherwise it was the same as layer [210]. This deposit also contained charred hazelnut shell and flint, the latter including vertically set examples. Layer [111] partly overlay the edge of [118] and was itself partly overlain by what is interpreted as a hazelnut-roasting pit [109] (see below). This small levelling layer was also discerned on account of its colour (medium brown). However, as with [210] and [118], it also contained vertically set flints and occasional charred hazelnut shell. The upper lenses of these levelling layers have undoubtedly accrued occupation debris as a result of activities taking place within the hut.

Post Sockets and Stake Holes

An arc of stake holes that includes [260], [262], [180], [182] and [184] was located along the south edge of the hut. These stake holes were generally small, ranging from 0.035m–0.06m diameter and 0.02m–0.045m deep. They were either set vertically or inclined slightly towards the centre of the structure. A post socket, [113], was positioned immediately next to this group. It measured 0.4m in diameter and 0.02m deep and was filled by a dark to medium grey silty sand that contained occasional flints, charred hazelnut shell fragments and charcoal flecks.

Stake holes [180], [182] and [184] were filled with dark brown loose sand while stake holes [260] and [262] contained black, charred, degraded wood that had decayed into a sand matrix. Set inside the group of stake holes [180], [182] and [184] was post socket [224] that had been inserted into the fill of a pit [206]. This post socket measured 0.17m by 0.11m across and was 0.24m deep. It was filled with a distinct grey sandy fill with occasional small stones, flints and charred hazelnut shell. A group of three stake holes, [169], [170] and [171], was located along the north edge of the hut. These all had a diameter of 0.05m and were between 0.04m and 0.05m deep. All had a dark brown-grey fill of charred wood that had also decayed into a sand matrix. They were either vertically set or inclined slightly inwards.

A group of four stake holes, [194], [196], [198] and [200], was located close to the centre of the hut around a high concentration of hazelnut shells and patches of *in situ* burning. These circular stake holes, averaging 0.05m in diameter and 0.04m in depth, contained the remains of charred stakes in their fill, although this wood had decayed leaving a sandy texture. The stakes appear to have formed some kind of small internal structure and, given their position in the centre of the hut next to the central burning area and charred food debris, it is considered likely that they may have formed some kind of cooking or smoking facility.

Context	Decsription	Max Dimensions (m.)	Max depth	Colour of fill	Texture of fill	Small Finds	^{14}C Dates bp (uncal.)
Hearths							
340	Large burnt spread, overlain by 264	3.75 x 2.8	0.1	Various, scorched ginger sand, black and dark grey burnt organics	Scorched sand and charred organics	682 flints, 0ver 15000 charred hazelnut shell fragments, occasional burnt bone and charcoal	8802±38 OxA-11804 8739±39 OxA-12325
264	Large burnt spread	2.7 x 2.2	0.1	Black and dark grey burnt material and red-ginger sand	Compacted burnt charcoal and burnt sand	364 flints, over 11000 charred hazelnut shell fragments, occasional burnt bone and charcoal, 2 bevelled pebble tool blanks	
320	Large burnt spread	2.54 x 2.5	0.1	Black and dark grey burnt material and red-ginger sand	Burnt silty sand	78 flints, over 2700 charred hazelnut shell fragments and charcoal, beveled pebble tool, a limestone possible smoothing stone	
268	Large hearth	1.3 x 0.61	0.22	Black and dark grey burnt material and red-ginger sand	Burnt silty sand	259 flints, over 8000 charred hazelnut shell fragments, occasional burnt bone and charcoal	8710±45 OxA-11854 8650±45 OxA-11855
283	Linear burnt deposit *in-situ*	0.68 x 0.13	0.08	Black	Mineralised charred wood in silty sand	36 flints, c.1000 charred hazelnut shell fragments	
293	Hearth area next to 268	0.5 x 0.38	0.20	Black burnt organics and ginger brown scorched sand	Fused, hard, sand	17 flints, c.850 charred hazelnut shell fragments	8890±45 OxA-11829 (residual from earlier activity) 8785±45 OxA-11828
Pits							
285	Large irregular pit	1.0 x 0.62	0.12	Dark to medium grey	Silty sand and ash	51 flints, c.4000 charred hazelnut shell fragments, a sandstone cobble	
214	Small sausage-shaped pit	0.54 x 0.22	0.06	Yellow-brown	Sand	Charred hazelnut shell	
324	Sallow ovoid pit	0.7 x 0.46	0.04	Orange-brown	Sand	11 flints, c.70 charred hazelnut shell fragments, charcoal flecks	
Post Sockets							
238	Circular stakehole	0.06 x 0.05	0.03	Black, charred	Charred organic material		
310	Circular post socket	0.28 x 0.22	0.1	Medium brown	Silty sand	5 flints, c.100 charred hazelnut shell fragments and birch	
307	Circular stakehole	0.06 x 0.05	0.06	Medium brown	Silty sand		
332	Circular stakehole	0.06 diameter	0.04	Dark grey	Silty sand and charred wood	14 charred hazelnut shell fragments	
334	Circular stakehole	0.08 x 0.05	0.12	Dark grey	Silty sand and charred wood	10 charred hazelnut shell fragments	
336	Circular stakehole	0.10 x 0.06	0.12	Dark grey	Silty sand and charred wood	15 charred hazelnut shell fragments, 1 flint	
338	Circular stakehole	0.05 x 0.06	0.05	Dark grey	Silty sand and charred wood		
289	Circular stakehole fill	0.04 diameter	0.02	Dark brown/black	Loose sand		
287	Circular stakehole fill	0.055 diameter	0.025	Dark brown/black	Loose sand		
300	Circular stakehole fill	0.06 diameter	0.03	Dark brown	Loose sand		
Stone pads							
385	Ovoid flat stone	0.18 x 0.14	0.035	Yellow brown	Sandstone slab		
306	Sub-rectangular flat stone	0.18 x 0.16	0.04	Yellow brown	Sandstone slab		
386	Sub-rectangular flat stone	0.09 x 0.08	0.02	Yellow brown	Sandstone slab		
309	Sub-circular flat stone	0.12 x 0.08	0.03	Yellow brown	Sandstone slab		

Context	Decsription	Max Dimensions (m.)	Max depth	Colour of fill	Texture of fill	Small Finds	^{14}C Dates bp (uncal.)
Irregular linear Feature							
298	Long 'r' shaped linear	2.34 x 0.45	0.03	Medium brown	Silty sand	c.1200 charred hazelnut shell fragments, 61 flints, charcoal	
Occupation Deposits							
326	Sand spread	2.7 x 1.78	0.05	Medium brown	Sand	Charred hazelnut shell fragments, 5 flints, 3 bevelled pebble tools and a bvelled pebble blank	
316	Sand spread	3.0 x 1.0	0.04	Light brown	Sand	Over 2000 charred hazelnut shell fragments, 325 flints, shell, charcoal, 5 small pieces copper mineral in sedimentary rock, a sandstone cobble, a sandstone faceted pebble, abevelled pebble tool and a beveled pebble tool blank	
232	Sand spread		0.05	Medium brown	Sand	2548 flints, a faceted sandstone pebble, c.30000 charred hazelnut shell fragments	

Table 5.3 Phase 1b Context Descriptions

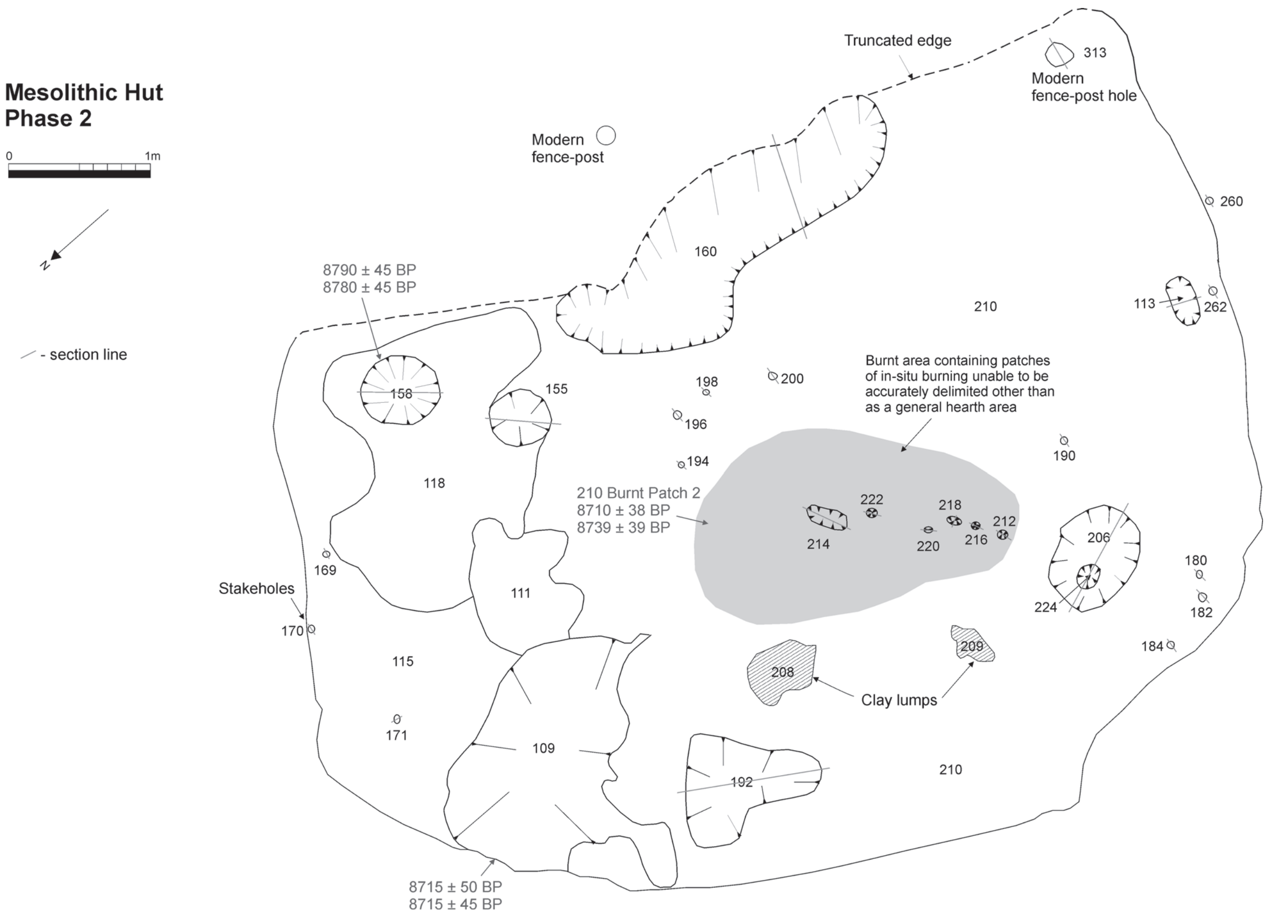


Figure 5.13. Plan of the Phase 2 hut.

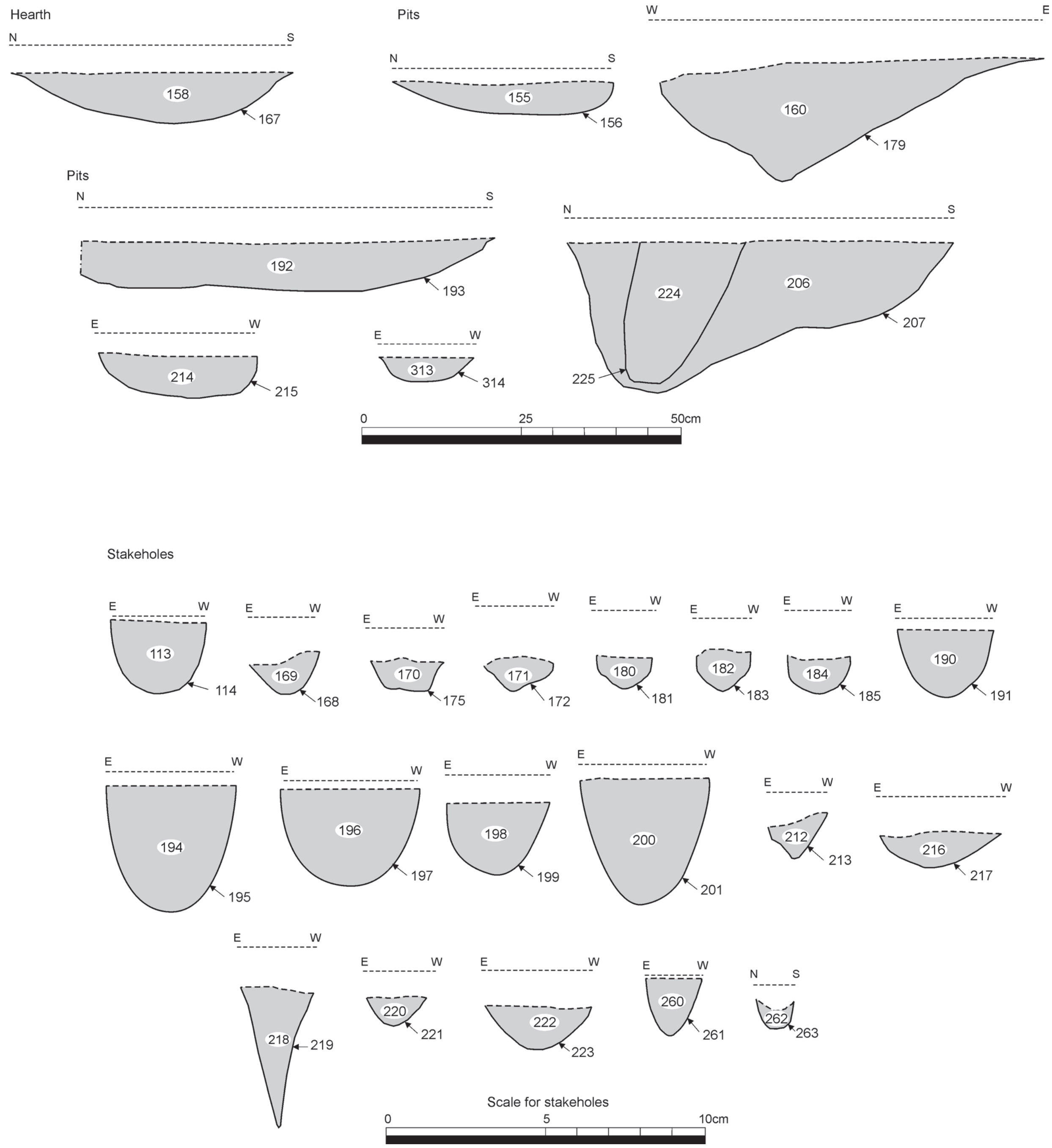


Figure 5.14. Phase 2 feature sections.

A second group of five stake holes, [212], [216], [218], [220] and [222], was positioned on the west side of the central burning area in a linear configuration. These circular stake holes averaged 0.07m across and 0.04m deep and contained the remains of charred stakes, though this dark brown residue had decayed leaving only a sandy matrix. As with the previous stake hole concentration, this group appears to have formed part of an internal structure possibly associated with cooking activities in the centre of the hut. A single isolated stake hole [190] was recorded 0.7m to the south of the previous group of stake holes. It measured 0.04m in diameter and 0.03m deep and contained a dark brown loose sand fill. It may be related to the linear group of stake holes, and if so could suggest some kind of internal partition.

Hearths

Although there had clearly been a succession of open fires in the central burning area that no doubt served as cooking hearths on occasions, only one discrete hearth pit, [158], was identified in the Phase 2 hut. It was sub-circular in shape and located in the north-

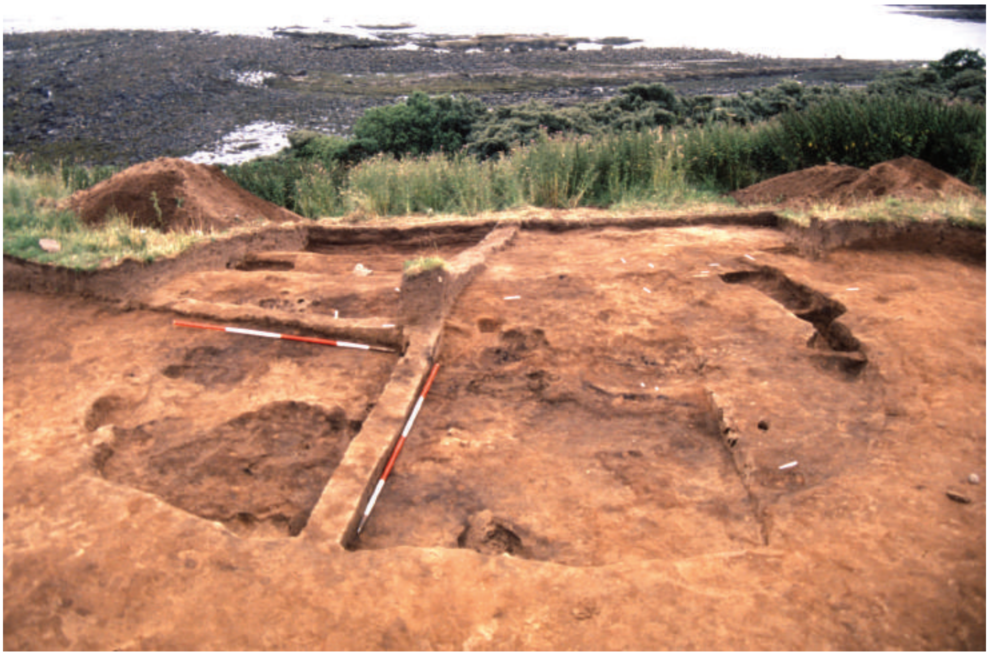


Figure 5.15. The Phase 2 hut during excavation.

Figure 5.16. The fused lining of the hazelnut roasting pit 109.

east part of the hut cut into sandy levelling layer [118]. It measured 0.48m in diameter with a depth of 0.17m. The hearth fill consisted of black charred material and a fire-reddened silty sand that contained flints and charred hazelnut shell. The surrounding scorched sand again indicated *in situ* burning. Two fragments of *in situ* single-entity charred hazelnut shell from this hearth were radiocarbon dated (see Table 5.4 and Chapter 6). Within the central burning area, discrete patches of burning could be identified although they could not be accurately delimited. Nonetheless *in situ* burnt residues adhering to scorched sand could be identified and single-entity charred hazelnut shells from two of these patches were submitted for radiocarbon dating (see Table 5.4 and Chapter 6).

Pits

Six pits of varying shape and size were located in the

Context	Decsription	Max Dimensions (m.)	Max depth	Colour of fill	Texture of fill	Small Finds	^{14}C Dates bp (uncal.)
Hearths							
158	Circular burning pit containing charred hazelnuts but cut by later post pipe	0.48 diameter	0.17	Black charred material	Silty sand, scorched	5 flints, charred hazelnut shell	8780±45 OxA-11832 8790±45 OxA-11853
Central burning area forming part of 210	Central burning area with individual areas of burning too indistinct to accurately delimit	2.6 x 1.65	0.1	Black, grey and red-brown scorched and charred material	Silty sand	See 210	8739±39 OxA-12324 8710±38 OxA-12347 8355±39 OxA-12323 8310±40 OxA-12322
Pits							
160/276	A truncated linear pit on E side of structure	2.4 x 0.6	0.21	Dark brown-black, burnt material	Silty sand	150 flints, c. 2300 charred hazelnut shell fragments, 2 beveled pebble tools	
206	Sib-circular steep-sided pit	0.58 x 0.48	0.24	Yellow brown	Sand	126 flints, c.1400 charred hazelnut shell fragments, small burnt bone fragments, charcoal flecks	
192	Irregular pit containing much charred hazelnut, possibly extension of 109	0.75 x 0.70	0.12	Black grey charred material	Sandy silt	23 flints, c.200 charred hazelnut shell fragments	
214	Small oblong flat-bottomed pit	0.22 x 0.11	0.055	Yellow brown	Sand	2 flints, c. 40 charred hazelnut fragments	
155	Small, shallow, sub-circular pit	0.36 x 0.39	0.05	Light yellow brown	Loose sand	4 flints	
313	Small irregular pit that may not be archaeological	0.15 x 0.17	0.04	Dark brown/black	Sandy silt loam		
Roasting Pit							
109/236	Hazelnut roasting pit lining	1.8 x 1.37	0.03	Burnt red-brown	Heat affected sand and charred material	Over 7100 Charred hazelnut shell fragments, 309 flints	8715±50 OxA-11830 8715±45 OxA-11831
107	Fill of roasting pit 109	1.8 x 1.37	0.03	Brown grey	Silty sand and ash	Over 2000 Charred hazelnut shell fragments, 127 flints and charcoal	
Post Sockets							
113	Circular post socket fill	0.4 diameter	0.2	Dark – medium grey	Loose silty sand	24 flints, 113 charred hazelnut shell fragments, charcoal flecks	
169	Circular stakehole fill	0.05 diameter	0.05	Dark brown-grey	Charred wood degraded into sand matrix		
170	Circular stakehole fill	0.05 diameter	0.04	Dark brown-grey	Charred wood degraded into sand matrix		
171	Circular stakehole fill	0.05 diameter	0.05	Dark brown-grey	Charred wood degraded into sand matrix		
180	Circular stakehole fill	0.04 x 0.045	0.02	Dark brown	Loose sand		
182	Circular stakehole fill	0.045 diameter	0.02	Dark brown	Loose sand		
184	Circular stakehole fill	0.035 diameter	0.025	Dark brown	Loose sand		
190	Circular stakehole fill	0.04 diameter	0.03	Dark brown	Loose sand		
194	Circular stakehole fill	0.05 diameter	0.045	Black charred	Burnt organics and sand		
196	Circular stakehole fill	0.06 diameter	0.04	Black charred	Burnt organics and sand		
198	Circular stakehole fill	0.04 diameter	0.04	Black charred	Burnt organics and sand		
200	Circular stakehole fill	0.06 diameter	0.045	Black charred	Burnt organics and sand		
212	Circular stakehole fill	0.04 x 0.07	0.04	Dark brown-grey	Charred wood degraded into sand		
					matrix		
216	Circular stakehole fill, inclined at *c*.65°	0.07 x 0.05	0.03	Dark brown-grey	Charred wood degraded into sand matrix		
218	Circular stakehole fill	0.09 x 0.07	0.12	Dark brown-grey	Charred wood degraded into sand matrix		

Context	Decsription	Max Dimensions (m.)	Max depth	Colour of fill	Texture of fill	Small Finds	^{14}C Dates bp (uncal.)
220	Circular stakehole fill	0.08 x 0.07	0.04	Dark brown-grey	Charred wood degraded into sand matrix		
222	Circular stakehole fill	0.13 x 0.09	0.04	Dark brown-grey	Charred wood degraded into sand matrix		
224	Post socket fill	0.17 x 0.11	0.24	Grey	Sand with occasional stones	4 flints, c. 30 charred hazelnut shell fragments	
260	Circular stakehole fill	0.035 diameter	0.035	Black	Charred wood degraded into sand matrix		
262	Circular stakehole fill	0.06 x 0.04	0.045	Black	Charred wood degraded into sand matrix	112 flints, c.1500 charred hazelnut shell fragments	
Clay Lumps							
208	Irregular clay spread	0.48 x 0.30	0.14	Pink brown	Clay lump (imported into the hut)		
209	Irregular clay spread	0.33 x 0.18	0.10	Pink brown	Clay lump (imported into the hut)	2 flints, 8 hazelnut shell fragments	
Levelling/ Occupati on Layers							
210/115/1 61/244	Sand occupation deposit into which all other features in this phase are cut or overlie	Full width of structure (5.9)	0.1	Pale yellow brown	Sand	1280 flints, much of it set vertically as though tipped in, c.17500 charred hazelnut shell fragments, charcoal, 2 bevelled pebble tools, 1 bevelled pebble blank and a sandstone fragment	
118/159/2 34	Irregular sand deposit	1.7 x 1.2	0.1	Yellow brown	Sand spread	610 flints, c.4000 charred hazelnut shell fragments, beveled pebble tool blank	
111/259	Irregular sandy deposit	0.75 x 0.65	0.1	Medium brown	Sand spread	38 flints, c. 100 charred hazelnut shell fragments	

Table 5.4 Phase 2 Context Descriptions

Phase 2 deposits, all cut into levelling layer [210]. Pit [160] was the largest, located on the east edge of the surviving structure where part of its east side had been truncated by the cliff edge erosion. The pit was linear in shape, measured 2.4m long and had a maximum depth 0.17m. The profile was unusual as its west side was near-vertical while its east side sloped more gently. The fill consisted of dark brown-black silty sand with much burnt material, and contained flints, charred hazelnut shell and an elongated pebble tool. Pit [206] was located in the southern area of the hut, also cut into layer [210], and was sub-circular in shape. The pit measured 0.58m by 0.48m and was 0.24m deep. It had a curved profile and the fill consisted of yellow-brown sand that contained flints, charred hazelnut shell and occasional fragments of burnt bone and charcoal. A later post socket, [224], had been inserted into the fill of this pit (see above). An irregular pit, [192], was located near to the west edge of the hut, cut into layer [210]. This pit was filled by a black and grey charred sandy fill that contained a large quantity of charred hazelnut shell, together with flint, and may be related to what is thought to be a hazelnut-roasting pit [109] (see below). The pit measured 0.54m by 0.22m by 0.055m deep. Pit [214] was a small oblong feature located in the approximate centre of the hut. This was a flat-bottomed pit that measured 0.22m by 0.11m by 0.055m deep. The pit was filled with sterile yellow-brown sand that did not contain any small finds. Pit [155] was a shallow circular pit located next to layer [118], 0.3m from hearth pit [158]. The pit had a maximum diameter of 0.39m with a shallow dish profile and a maximum depth of 0.05m. It was filled with light yellow-brown loose sand that contained the occasional flint. The final pit, [313], was a small irregular feature that is likely to be a modern intrusion on account of it being located next to a sheep burial on the truncated edge of the hut and having a black sandy loam fill identical to the modern plough soil. The fill and edges of this feature were not weathered like the other archaeological deposits and it contained no small finds. It probably formed part of the old fence line that ran along the cliff edge.

Roasting Pit

An irregular heat-affected dished feature, [109], was located in the north-west area of the hut, abutting one of the edges (Figs. 5.13, 5.14 and 5.16). This shallow feature, measuring 1.8m by 1.37m and 0.03m deep, was filled by an extremely high density of charred hazelnut shell (see also Chapter 11) and heat-affected sand [107]. However, there was no evidence for *in situ* burning as there was no black charred debris other than the hazelnut shell. The heat-fused lining of pit [109] was scorched rather than burnt and had uncountable quantities of charred hazelnut shell fragments incorporated into its surface that must have numbered many tens of thousands. In addition to the mass of hazelnut shells, the fill also contained occasional flint and charcoal flecks. The clear evidence for *in situ* heating of the pit surface, but with no clear sign of actual burning, together with the high concentration of charred hazelnut debris within it, suggests this was a pit used for the roasting of hazelnuts, presumably to preserve them for later consumption (see also Chapter 11). Two samples of single-entity hazelnut shell from the heat-affected surface of the pit lining were submitted for radiocarbon dating (see Table 5.4 and Chapter 6).

Clay Lumps

Two discrete clay lumps, [208] and [209], were found in the Phase 2 occupation horizon overlying layer [210]. Both were irregular in shape and consisted of pure clay with no inclusions or associated small finds or structural features. Lump [208] measured 0.48m by 0.3m and was 0.14m thick while lump [209] measured 0.33m by 0.18m by 0.1m thick. Both were a pink brown colour, suggestive of a common source, and had evidently been brought into the hut. Glacial clay can be easily obtained from nearby cliff and river sections. The use and implications of these clay lumps, as yet, remain uncertain.

Phase 3 Hut (see Figs. 5.17–5.20)

The Phase 3 hut was constructed directly over the previous huts although it was less circular in plan and tended to have straighter sides. The Phase 3 hut was not quite as large as the previous huts, having an internal width of 5.4m compared with 6m and 5.9m for the earlier two. Furthermore, when this final structure was ultimately abandoned, two of the fallen timber uprights survived in the form of stains that could be seen on the south and west sides of the structure. These substantial timbers indicate that this final-phase hut was of a different constructional form to the previous two structures, with vertical set timbers placed immediately inside the outer edge. It also had one, or perhaps more, central posts, though whether these were for roof support or for a fireside feature remains equivocal. This structural evidence indicates another very robust timber-framed structure but based on a different structural template to the two previous huts.

Levelling and Occupation Deposit

Layer [49] extended over the full area of the hut floor covering all the Phase 2 deposits. This yellow-brown fine sand layer averaged 0.1m thick and contained a range of features cut into or laid on top of it. The layer itself was not entirely homogeneous and it is thought that these variations reflect different dumps of material as part of a levelling layer spread over the previous hut deposits once the Phase 2 structure had been dismantled. However, as with layer [210], the upper lenses of this layer are likely to have accumulated *in situ* as a result of the build-up of occupation debris. Some burnt patches towards the centre of the layer were more discrete and were indicative of a central burning/hearth area. The central area of [49] was noted for its higher proportion of charred material, particularly around hearth features [47] and [173]. As with layer [210] this levelling/occupation horizon [49] was very rich in material, producing high quantities of flints and charred hazelnut shell, as well as occasional fragments of mollusc shell, red ochre and some burnt bone fragments. In addition, the flints encountered in this layer were vertically set, indicating that, like [210], much of this deposit was probably tipped in, perhaps to level off and cover the previous hut floor.

Post Sockets

The post sockets occurred in two distinct groups: there was a group of three positioned in the central area of the hut, [148], [153] and [67], and the other four, [51], [35], [33] and [267], were positioned around the hut edge. The latter group would become five if probable post socket [106] is included (see below). The central post sockets were all of similar size, shape and form, ranging from 0.19m to 0.23m in diameter and 0.1m to 0.14m deep. They were all of broadly circular shape and were vertically set. All the sockets were filled with dark brown silty sand that contained occasional flints and charred hazelnut shells. Some packing stones were also noted in pit [148]. The pits form a triangular arrangement to the east of the hearth area and are certainly for substantial timbers that could have formed structural supports for some kind of cooking/smoking/drying structure. It is also

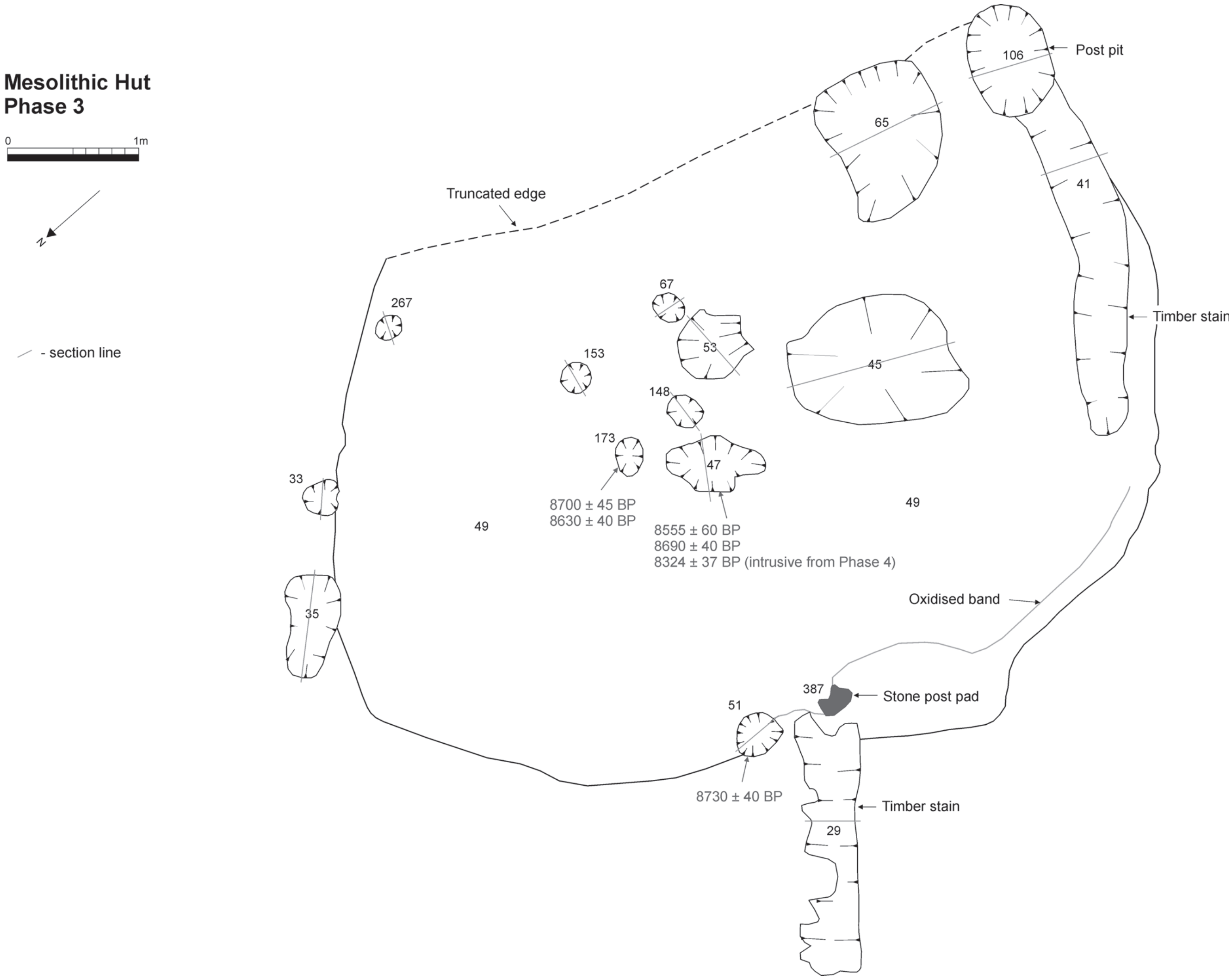


Figure 5.17. Plan of the Phase 3 hut.

possible that they formed structural supports for the hut superstructure; however, whether they were used contemporaneously as a triangular arrangement or whether they represent subsequent replacements of a central post remains entirely hypothetical.

On the north-east side of the structure three sockets were identified that were all thought to have been structural. Socket [267] was clearly seen in the baulk section during excavation where it had cut down into earlier deposits. This vertically set circular socket had held a post of 0.17m in diameter and had been cut down 0.15m. It was filled by light grey-brown silty sand. Post socket [33] was slightly larger, measuring 0.2m in diameter and had been cut down 0.16m. This socket was also circular and had been vertically set. It had a similar dark brown silty sand fill that contained occasional flints, charred hazelnut shell and some red ochre. Socket [35] was more elongated than the previous two, measuring 0.7m by 0.37m by 0.2m deep. This was also filled with dark brown silty sand that contained occasional flints and charred hazelnut shell. Although no obvious post pipe could be identified in this socket, its location on the edge of the structure close to [33] implies that it had a structural purpose.

Post hole [51] was a substantial feature clearly observed in plan and section, measuring 0.29m in diameter and 0.31m deep. It was filled by a distinctive dark brown silty sand that contained occasional flints and charred hazelnut shell. The post hole was vertically set and had vertical sides. A single-entity charred hazelnut shell fragment from within the fill of this post hole was submitted for radiocarbon dating after the initial evaluation in 2000 in order to obtain a provisional date for the structure (see Chapter 6). This post hole was located next to timber stain [29] and its associated stone post pad or wedge [387] (see below).

Timber Stains

Two stains of unsplit timbers were evident in the Phase 3 horizon (Figs. 5.17 and 5.20). Timber [41] was situated inside the south edge of the hut and measured 2.3m long by 0.34m wide with a surviving depth of

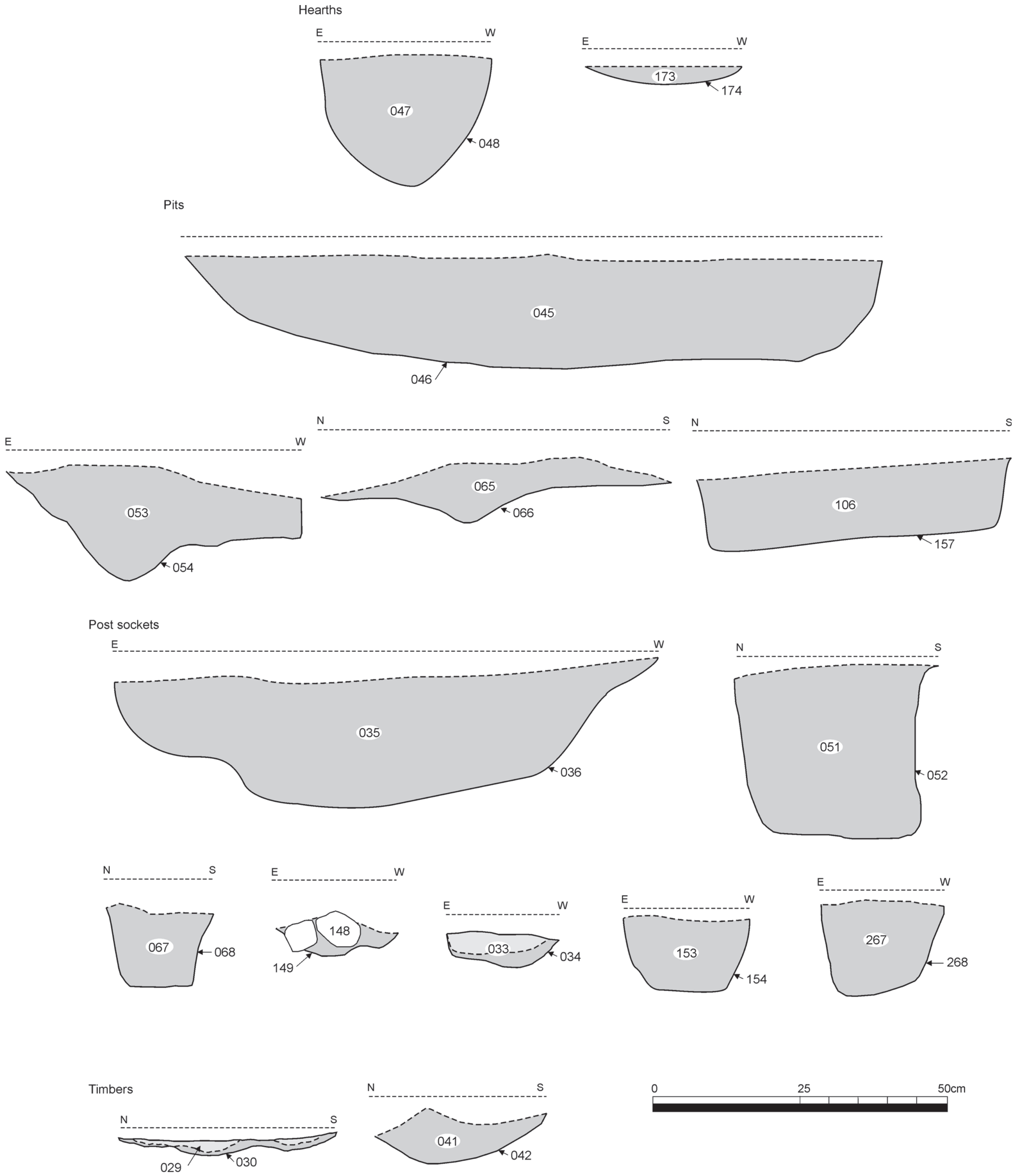


Figure 5.18. Phase 3 feature sections.

0.14m. The profile of the timber was rounded and had a consistent curvature along its length, suggesting that it was an undressed segment of tree trunk. The organic wood component had decayed to leave a dark brown stained silty sand matrix. Occasional flints, charred hazelnut shell fragments and charcoal were found within this matrix; they are thought to have worked into the sand as the wood degraded, as a result of earthworm activity and other processes of bio-turbation. It is possible that this timber formed a revetment against the south edge of the hut, but as it does not lie flush with the edge at its west end this is unlikely. It is more likely that this was an upright that fell to the floor when the site was abandoned. This

Figure 5.19. The Phase 3 hut during excavation.

gains support from the fact that a flat-bottomed pit, [106], lies at the east end of the timber, forming its post-socket. A second timber stain, [29], was located on the west side of the hut. At the east end of the timber, immediately inside the hut edge, was a flat stone which is thought to have been a post pad, but bearing in mind the experience gained from building the second reconstruction (see Chapter 13), this is interpreted as a wedge inserted beneath the post to raise it up and provide stability. Again the timber has fallen towards the west, which is consistent with the direction of the prevailing wind. Immediately next to the post pad, also situated immediately inside the hut edge, was a substantial post hole [51]. The post that had sat in the post hole was at some time replaced by the timber that sat on the post pad. This suggests that the Phase 3 hut was probably repaired before it was finally abandoned. Timber stain [29] measured 1.6m long by 0.36m wide, though as it had been more severely truncated than timber [41] during the initial subsoil stripping, it only survived to a maximum thickness of 0.05m; its inconsistent shape is also a result of this. As this timber had lain above the hut deposits and must have lain partly on the Mesolithic land surface it is fortunate that any trace survives of it. Timber [29] had a dark brown sand fill containing the occasional flint that is thought to have become worked in as the timber decayed. The stone pad, [387], comprised a flat yellow-brown sandstone slab that measured 0.22m by 0.18m by 0.04m thick. Both timbers and the stone pad lay directly on occupation deposit [49].

Figure 5.20. Close-up view of one of the truncated timber stains [29] from Phase 3 with the post pad at its base and post hole [51] next to it.

Context	Decsription	Max Dimensions (m.)	Max depth	Colour of fill	Texture of fill	Small Finds	^{14}C Dates bp (uncal.)
Hearths							
47	Hearth near centre of structure	0.49 x 0.29	0.25	Black, burnt	Heat fused sand and charred organic material	34 flints, c.900 charred hazelnut shell fragments, burnt bone fragments, charcoal, ockre	8555±60 AA-41788 8324±37 OxA-11805 8690±40 OxA-12294
173	Small burning pit	0.26 x 0.19	0.035	Black, burnt	Heat fused sand and charred organic material	150 charred hazelnut shell fragments, charcoal	8630±40 OxA-11826 8700±45 OxA-11827
Pits							
45	Large pit next to hearth area	1.15 x 0.84	0.23	Ginger brown	Heat affected sand and a degraded charred log	75 flints, c.1650 charred hazelnut shell fragments, charcoal	
53	Pit	0.50 x 0.43	0.21	Dark brown	Silty sand	31 flints, c.450 charred hazelnut shell fragments	
65	Pit	1.04 x 0.80	0.17	Grey brown	Silty sand	49 flints, c.230 charred hazelnut shell fragments	
106	Pit	0.73 x 0.5	0.08	Dark brown	Sand	107 flints, over 500 charred hazelnut shell fragments, charcoal	
Post sockets							
33	Post socket at edge of structure	0.20 diameter	0.16	Dark brown	Silty sand	10 flints, charred hazelnut shell, ochre	
35	Structural socket on edge of structure	0.7 x 0.37	0.2	Dark brown	Silty sand	23 flints, c.150 charred hazelnut shell	
51	Post hole at edge of structure	0.31 diameter	0.29	Dark brown	Silty sand	13 flints, 62 charred hazelnut shell fragments, a beveled pebble tool blank	8730±40 Beta-153650 This date probably on residual material
67	Post socket near centre of structure	0.19 diameter	0.14	Dark brown	Silty sand	9 flints, 10 charred hazelnut shell fragments, mollusc shell	
148	Post socket near centre of structure	0.23	0.1	Dark brown	Silty sand	Three packing stones, 6 flints, 60 charred hazelnut shell fragments, charcoal	
153	Post socket near centre of structure	0.22 diameter	0.13	Dark brown	Silty sand		
267	Post hole	0.17 diameter	0.15	Grey brown	Silty sand	71 flints, c.450 charred hazelnut shell fragments	
Timbers							
29	Linear stain of split timber, rectangular profile	1.6 x 0.36	0.05	Dark brown/black	Silty sand	1 flint and a sandstone chocking pad	
387	Stone pad for timber 29	0.22 x 0.18	0.04	Yellow brown	Flat sandstone slab		
41	Linear stain of timber, rounded profile indicating a tree trunk	2.3 x 0.34	0.14	Dark brown	Silty sand	277 flints, over 2000 charred hazelnut shell fragments, charcoal	
Leveling/ Occupation Deposit							
49	All phase A features cut into this occupation layer containing vertically set flints	Full width of structure 5.4	0.10	Yellow brown	Fine silty sand	3573 flints, over 44000 charred hazelnut shell fragments, burnt bone fragments, ochre fragment, mollusc shell, small burnt stones, 2 bevelled pebble	
						tools, 2 bevelled pebble blanks, a sandstone hammerstone and a sandstone fragment	

Table 5.5 Phase 3 Context Descriptions

Context	Decsription	Max Dimensions (m.)	Max depth	Colour of fill	Texture of fill	Small Finds	C^{14} Dates bp (uncal.)
Hearths							
63	Small burning pit	0.31 x 0.10	0.09	Dark red-brown	Heat fused sand and charred organic material	4 flints, charred hazelnut shell, charcoal	8278±35 OxA-11806 8233±36 OxA-11807
55	Small burning pit	0.40 x 0.12	0.18	Dark-brown/black, burnt	Heat fused sand and charred organic material	9 flints, c.170 charred hazelnut shell fragments, charcoal	8330±45 OxA-12408 8280±40 OxA-12293
210 Patch 1	Small burnt patch	0.2m diameter	?	Dark-brown/black, burnt	Black charred organic material		8355±39 OxA-12323 8310±40 OxA-12322

Table 5.6 Phase 4 Context Descriptions

Context	Decsription	Max Dimensions (m.)	Max depth (m.)	Colour of fill	Texture of fill	Small Finds
13	Subcircular pit	1.1 x 0.4	0.14	Light brown	Silty sand	Flint, charcoal
21	Subcircular pit	0.7 x 0.52	0.38	Red brown	Silty sand	Bone, iron, bevelled tool, flint
61	Circular pit	0.49 x ?	0.18	Dark brown	Silty sand	Flint, shell, charcoal

Table 5.7 Context Descriptions of features to the south of the Mesolithic hut

Hearths

Two hearth-type features were located in the central area of the hut, cut into deposit [49]. The largest hearth pit, [47], had an irregular elongated shape and measured 0.49m by 0.29m with a maximum depth of 0.25m. It was filled with black charred debris and scorched sand, with the sand around its edges fire-reddened and fused as a result of *in situ* burning. The fill contained flints, charred hazelnut shell, burnt bone fragments, charcoal and red ochre. Two single-entity samples of charred hazelnut shell were radiocarbon dated (see Table 5.5 and Chapter 6). Hearth pit [173] was located 0.4m to the east of hearth [47], cut into layer [49], measuring 0.26m by 0.19m with a depth of 0.035m. The fill consisted of black burnt material surrounded by heat-fused sand, again indicating *in situ* burning. Within the fill were flint, charred hazelnut shell and charcoal. Two single-entity charred hazelnut shell fragments were submitted for radiocarbon dating (see Table 5.5 and Chapter 6). These hearths were surrounded by an abundance of charred material in occupation deposit [49] that had probably accumulated as a result of open fires and fireside activities.

Pits

Pits [45] and [53] were located to the south and south-east of the central hearth area. Pit [45] was sub-circular in shape with a bowl-shaped profile, measured 1.15m by 0.84m and had a maximum depth of 0.23m. The fill was a distinctive ginger brown heat-affected sand that contained a considerable quantity of flint and charred hazelnut fragments. A small charred log was found at the base of the pit but the surrounding sandy deposits did not appear to be heat-affected, and so it is unlikely that this piece of wood was burnt *in situ*. It was this pit that was encountered in the first exploratory test pit on the site in 2000. Pit [53], measuring 0.5m by 0.43m and 0.21m deep, had an irregular shape and a stepped profile. It was filled by dark brown silty sand that contained flints and charred hazelnut shell. It is likely that these pits were used for some type of hearth-associated activity as they contained much charred debris, charcoal and heat-affected sand in their fills, though evidence for *in situ* burning in these pits remained equivocal. They may have served as pit ovens or as receptacles for raked ashes.

Two further pits were noted in this phase of occupation. Pits [65] and [106] were located in the south corner of the structure, next to the truncated edge. Pit [65] had a slightly irregular shape with a shallow flat base and measured 1.04m by 0.8m by 0.17m deep. It was filled with grey-brown silty sand that contained flints and charred hazelnut shell. No *in situ* burning was evident and the use of this pit remains indeterminate. Pit [106] was ovoid in shape with vertical edges and was situated on the edge of the hut at the foot of the timber stain [41]. It measured 0.73m by 0.5m and was 0.08m deep. It was filled by dark brown sand that contained occasional flints, charred hazelnut shell and charcoal. It is thought likely that this was a post socket for the timber represented by stain [41].

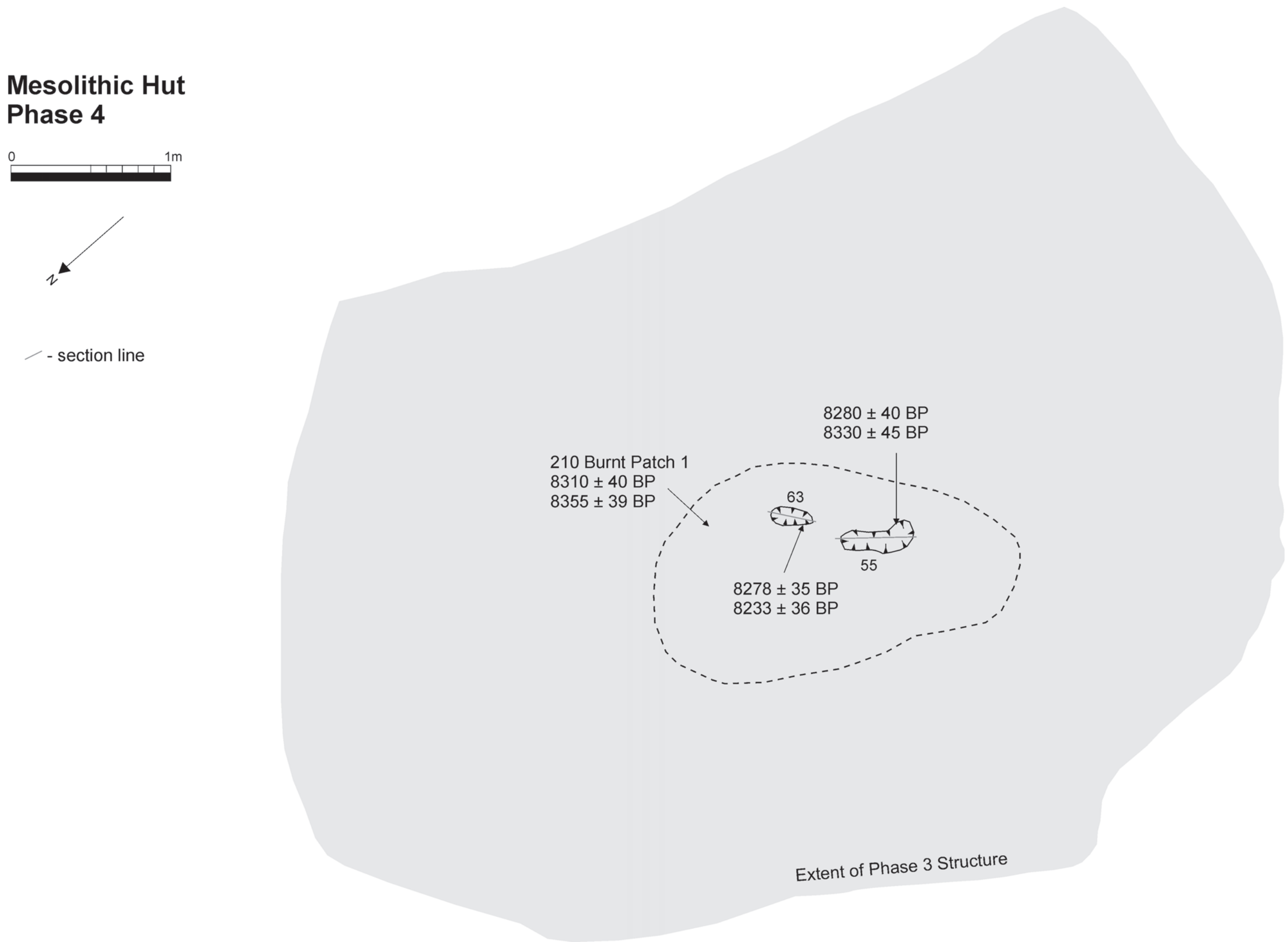


Figure 5.21. Plan of the Phase 4 deposits together with sections.

Phase 4 Hut Re-Occupation (see Fig. 5.21)

This phase of re-use of the hut site was only recognised as a result of the radiocarbon dating programme and could not otherwise have been identified from the surviving site stratigraphy. All the Phase 3 and Phase 4 deposits lay immediately below the same subsoil horizon and did not share any horizontal stratigraphic associations, which meant that a relative stratigraphy could not be observed.

The features associated with this phase of use include a small burnt ovoid feature, [63], measuring 0.31m by 0.1m and 0.09m deep, which was located next to hearth [47] that is dated to Phase 3. Although too small to be characterised as a hearth, this feature had evidently experienced burning *in situ* as it had a dark charred and fire-reddened fill and was surrounded by heat-fused sand. This small burning pit also contained flints, charred hazelnut shell and charcoal. Two samples of single-entity charred hazelnut shell were radiocarbon dated (see Table 5.6 and Chapter 6). A second small burning pit, [55], was located to the south-west of hearth [47], forming a slightly arcing pit. It measured 0.4m by 0.12m and was 0.18m deep. It was filled with charred, dark brown and black organic material and heat-affected sand, with the surrounding sand fire-reddened and fused by *in situ* burning. The fill also contained flints, charred hazelnut shell and charcoal. A discrete patch of *in situ* burning identified in the burnt central area, cut into levelling layer 210 and referred to as [210] burnt patch 1, has also been dated to this phase, having clearly been cut down through the earlier deposits during the Phase 4 activity at the site. Likewise an intrusive charred hazelnut shell of Phase 4 was dated from hearth [47], in the Phase 3 deposits. This could easily have been worked into the adjacent Phase 3 feature either as a result of bioturbation or ground disturbance during the Phase 4 occupation. No other features could be attributed to this phase.

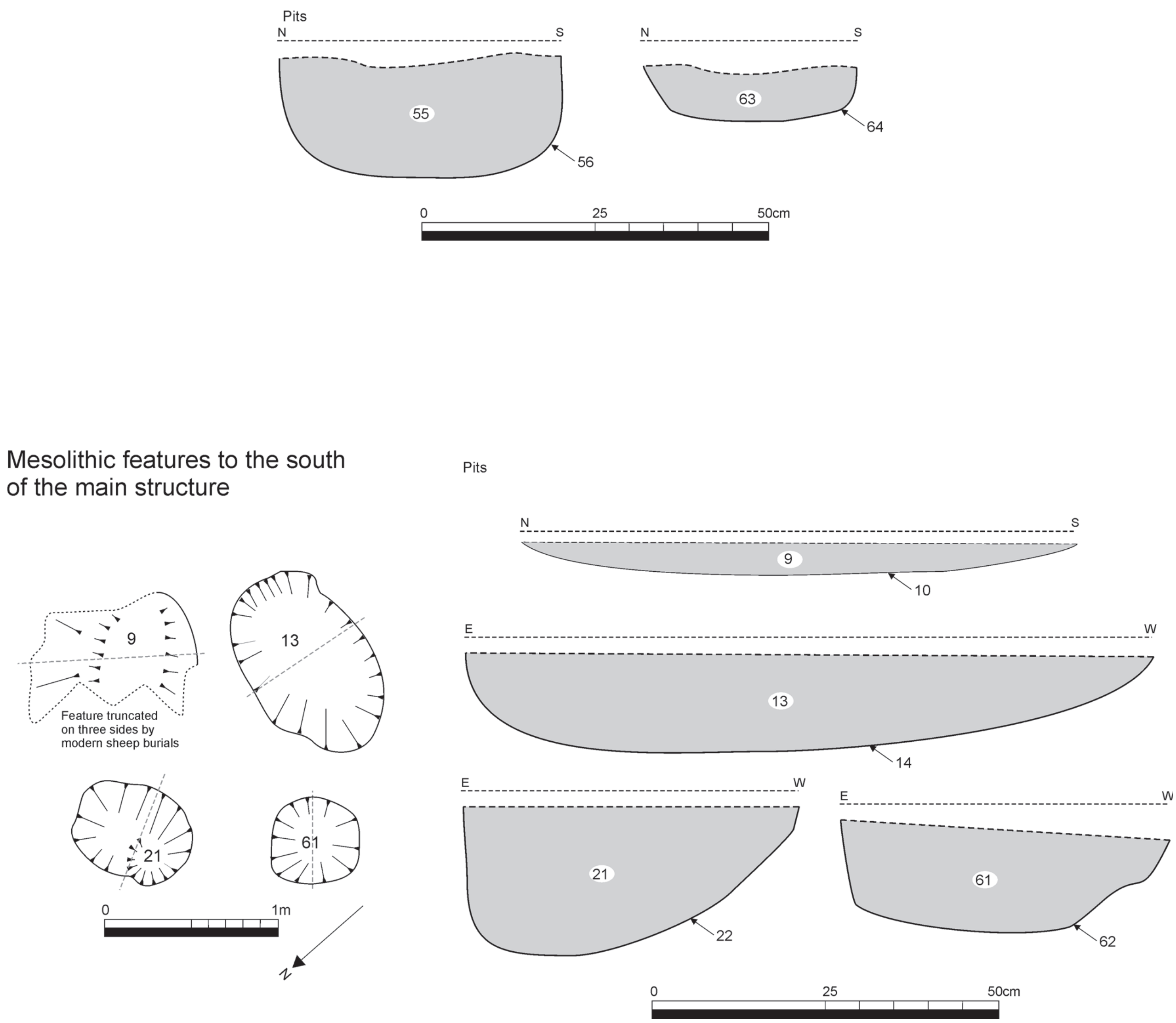


Figure 5.22. Phase 4 feature sections and plans and sections of external features outside the Mesolithic hut.

Features and Activity Outside the Mesolithic Hut

A series of pit and scoop features was identified which clustered at the south-west end of the trench (Fig. 5.1). The following table summarises the characteristics of each of these features.

Pits [11] and [15] could be modern pits/scoops associated with the sheep burials, as they contained fragments of brick and iron objects respectively. Pit [27] was extremely shallow and was so heavily truncated that it was not possible to confidently describe this feature as being prehistoric in date. However, the other pit features, [13], [21] and [61], are considered to be archaeological on the basis of their shape, form, the texture of the fill and the weathered nature of the pit sides as well as their contents.

The function of pit features [13], [21] and [61] can only be guessed at but the presence of flints, charcoal and shell in [61] and of a coarse stone tool and flint in [21] is consistent with domestic/processing activities. It is possible that the contents of these pits are residual material from the Mesolithic ground surface, but the absence of the modern materials found in the sheep burial pits favours the view that they are more likely to be contemporary with the occupation of the Mesolithic hut. These pits are located downwind from the main structure and could, therefore, be rubbish pits or pits associated with outdoor activities.

A pit with a clay-lined base, [9], was located in the south corner of the trench and had been truncated on three of its four sides. It survived as an irregular outline in plan, although its intact side suggested it had originally been of sub-circular shape. It survived to a maximum width of 0.9m and had a maximum thickness of 0.11m. The feature consisted of a shallow pit cut into the natural sand [5] that had up to 0.07m thickness of clay spread across its base. The base of the pit was slightly convex so that its centre projected as a low dome. The clay was blue-grey with some fire-reddening on the interface with the sand fill, and was flecked throughout with charcoal. The sand lying on the clay was reddened suggesting *in situ* heating. Situated within the clay lining a thin spread (0.04m thick) of fire-reddened sand survived, representing presumably the final contents of the pit before it went out of use. A number of small shallow holes were observed across the clay lining of the pit. On excavation these gave the appearance of stake holes; given the action of moles on the site this cannot be stated with certainty, although the mole damage tends to be at a higher level in the trench.

The function of this clay-lined pit remains problematic, especially as it cannot be ascertained that it is Mesolithic. Speculation as to its purpose has included a fish-smoking structure or an oven pit.

Sadly, the area to the south-west of the hut where the evidence for external activity was located had been heavily truncated and disturbed by a combination of sheep burials and old fence lines. This meant that it was hard to disentangle true Mesolithic features contemporary with the hut from those of more modern origin. As a consequence, very little can be said with any certainty concerning activities external to the hut, other than that it was clear from the distribution of lithics in the overburden that processing activities requiring the use of flint tools occurred in the immediate environs of the building. The scorched clay in pit [9] implies some activity associated with burning. Attempts to answer the question of whether this hut formed part of a larger settlement or was an isolated building are hindered by the fact that the land to the immediate east of the hut has eroded away, destroying any other features that may have existed in this area. However, the extensive size of the trench, the test-pitting and geophysical survey all go to show that there is no evidence for another hut to the north, south or west of the known hut and so, on balance, it is most likely that this is an isolated hut. The results from the fieldwalking, however, suggest that other huts, or areas of occupation, are located nearby and probably comprise similarly isolated hut foci.

Conclusions

The stratigraphy of the Mesolithic hut deposits at Howick represents one of the best-preserved sequences of Mesolithic activity so far discovered in the British Isles. The careful excavation, flotation and sampling of *in situ* material demonstrate the potential of such sites to reveal complex occupation sequences and structural forms. Despite the deposits surviving in a fragile sand matrix that had been subjected to considerable mole damage, and despite cliff collapse, together with weathering of the uppermost deposits, identification and delimitation of discrete features was possible. The sequence recorded during the excavation has been supported by a comprehensive dating programme (see Chapter 6), providing an independent test for the observed stratigraphic sequence of occupation. Summaries of each phase are provided in Chapter 14.

6 Absolute Dating

Alex Bayliss, Ian Boomer, Christopher Bronk Ramsey, Derek Hamilton and Clive Waddington

Introduction

Fifty-nine radiocarbon measurements have been obtained from Howick; 33 from archaeological features and 26 from sediment cores. Fifty-five samples of carbonised or waterlogged plant material were dated by the Oxford Radiocarbon Accelerator Unit between 2002 and 2004. Two further samples of charred hazelnut shell were dated in 2001, one by the Scottish Universities Research and Reactor Centre (SURRC), and one by Beta Analytic Inc. Two samples of waterlogged plant macrofossils were dated by SURRC, also in 2001.

General Approach

A Bayesian approach has been taken to the interpretation of chronological data from this site (Buck *et al.* 1996). This is a mathematical modelling technique that combines the radiocarbon dates with the stratigraphic sequence. This allows more precise dating to be provided by determining which parts of the simple calibrated radiocarbon dates are unlikely because of the relative dating provided by the stratigraphic relationships between samples. The process results in a reduced date range, known as a *posterior density estimate* (shown in black in Figs 6.1–6.2*). These distributions are based on probability, and are shown in italics when expressed as date ranges in the text. The *posterior density estimates* are not absolute, they are interpretative *estimates*, which can and will change as further data become available and as other researchers choose to model the existing data from different perspectives.

The technique used for the Bayesian analysis is a form of Markov Chain Monte Carlo sampling, and has been applied using the program OxCal v3.5 (http://units.ox.ac.uk/departments/rlaha/), which uses a mixture of the Metropolis-Hastings algorithm and the more specific Gibbs sampler (Gelfand and Smith 1990; Gilks *et al.* 1996;). Details of the algorithms employed by this program are available from the OxCal on-line manual or in Bronk Ramsey (1995; 1998; 2001), and fully worked examples are given in the series of papers by Buck *et al.* (1991; 1992), Buck, Litton *et al.* (1994), and Buck, Christen *et al.* (1994). The algorithms used in the models described below can be derived from the structure shown in Figures 6.1–6.2*.

Replicate radiocarbon measurements on the same sample have been combined before calibration by taking a weighted mean, and the consistency of groups of results which are, or may be, of the same actual age has been tested using methods outlined by Ward and Wilson (1978).

The following section concentrates on the archaeology – particularly on the reasoning behind the interpretative choices made in producing the models presented. These archaeological decisions fundamentally underpin the choice of statistical model.

Objectives

The principal aims of the dating programme were:

- to determine the absolute dates of the structure;
- to estimate the duration of occupation;
- to test whether the identified stratigraphic phases represent an accumulation of *in situ* material that forms a temporal sequence of separate structural episodes;
- to provide absolute dating for the associated flint assemblage (the first dated Mesolithic assemblage from North-East England);
- to determine whether the lower horizons of the sediment core from the Howick Burn were contemporary with the Mesolithic structure;
- to provide absolute dating for the environmental changes shown in this sediment record.

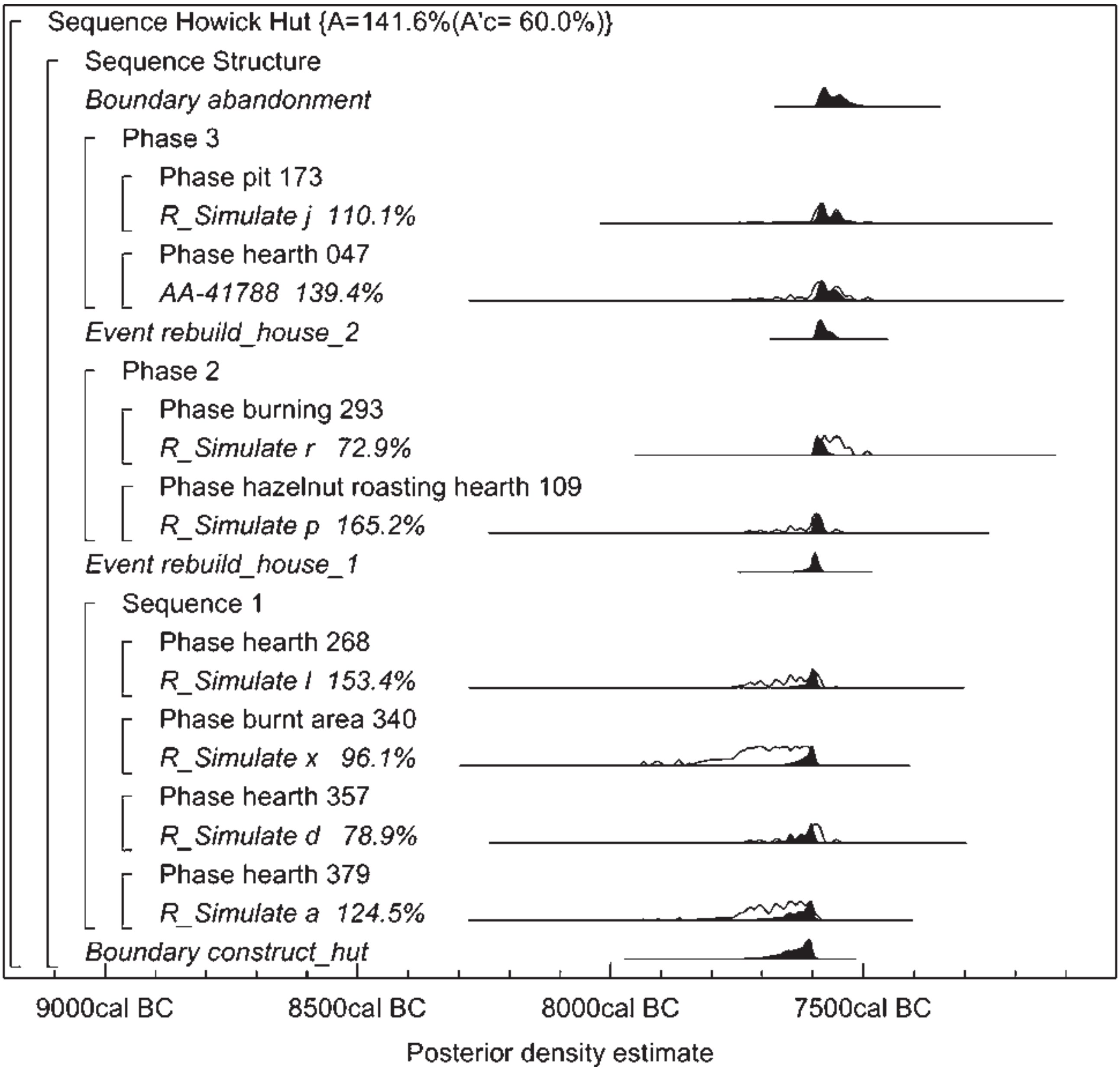


*Figure 6.1. Probability distributions of simulated dates from the Mesolithic structure at Howick: each distribution represents the relative probability that an event occurred at some particular time. For each of the simulated radiocarbon measurements two distributions have been plotted, one in outline, which is the result of simple radiocarbon calibration, and a solid one, which is based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution '*construct_hut*' is the estimated date for the construction of the building. The large square brackets down the left hand side along with the OxCal keywords define the overall model exactly.*

Sampling

The initial step in sample selection was to identify non-residual short-lived material. In the case of the Mesolithic hut deposits, this meant that sampling was largely restricted to material that had been burnt *in situ*, and so had a demonstrable functional relationship with the context from which it was recovered. All samples consisted of single fragments of carbonised or waterlogged material (Ashmore 1999). Those from the structure consisted of charred hazelnut shells recovered from features that showed evidence of *in-situ* burning, with the exception of one sample of hazelnut shell from a post-hole fill, which was dated in 2001 as part of the assessment of the site (Beta-153650).

Once a pool of potentially suitable samples had been identified, a number of models were built simulating the results of the dating programme (e.g. Fig 6.1). These models included the stratigraphic order of samples and phases, and archaeological

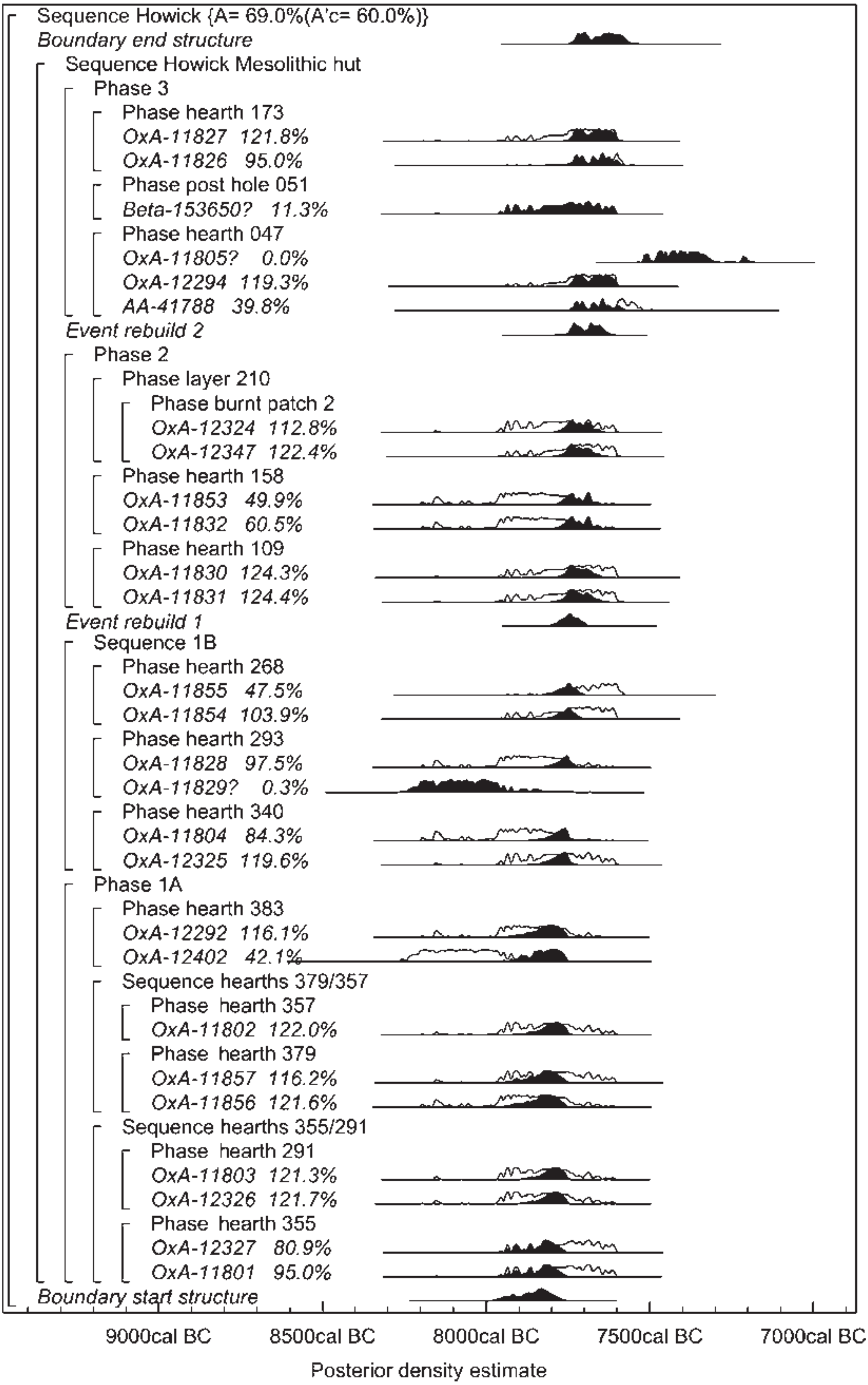


Figure 6.2. Probability distributions of dates from the Mesolithic structure at Howick during Phases 1A, 1B, 2, and 3. The format is identical to that of Figure 6.1. Radiocarbon dates marked with a "?" have been excluded from the analysis. The large square brackets down the left hand side along with the OxCal keywords define the overall model exactly.

Laboratory Number	Sample	Material and Context	$\delta^{13}C$ (‰)	Radiocarbon Age BP	Calibrated Date (95% confidence)	*Posterior Density Estimate (95% probability)*
Mesolithic Structure						
OxA-11801	HEX02 355	hazelnut shell from hearth [355]	-25.7	8734±37	cal BC 7960-7600	*cal BC 7940-7930 (2%) or cal BC 7920-7750 (93%)*
OxA-11802	HEX02 357	hazelnut shell from hearth [357]	-25.1	8754±38	cal BC 8160-7600	*cal BC 7880-7740 (95%)*
OxA-11803	HEX02 291	hazelnut shell from hearth [291]	-24.0	8763±38	cal BC 8160-7610	*cal BC 7890-7740 (95%)*
OxA-11804	HEX02 340	hazelnut shell from hearth [340]	-23.8	8802±38	cal BC 8200-7680	*cal BC 7840-7730 (95%)*
OxA-11805	HEX02 047	hazelnut shell from burnt feature/possible hearth [047]	-23.7	8324±37	cal BC 7520-7190	-
AA-41788	HEX02 047	hazelnut shell from same context as OxA-11805	-23.4	8555±60	cal BC 7740-7480	*cal BC 7750-7580 (95%)*
OxA-11806	HEX02 063A	hazelnut shell from burnt feature/possible hearth [063]	-23.4	8278±35	cal BC 7520-7140	*cal BC 7460-7310 (95%)*
OxA-11807	HEX02 063B	hazelnut shell from same context as OxA-11806	-26.6	8233±36	cal BC 7450-7080	*cal BC 7460-7310 (95%)*
OxA-11826	HEX02 173A	hazelnut shell from hearth [173]	-23.4	8630±40	cal BC 7750-7580	*cal BC 7750-7590 (95%)*
OxA-11827	HEX02 173B	hazelnut shell from same context as OxA-11826	-22.6	8700±45	cal BC 7940-7590	*cal BC 7740-7600 (95%)*
OxA-11828	HEX02 293A	hazelnut shell from hearth [293]	-22.8	8785±45	cal BC 8200-7650	*cal BC 7830-7720 (95%)*
OxA-11829	HEX02 293B	hazelnut shell from same context as OxA-11828	-23.9	8890±45	cal BC 8240-7830	-
OxA-11830	HEX02 109A	hazelnut shell from roasting feature [109]	-25.2	8715±50	cal BC 7960-7590	*cal BC 7780-7650 (95%)*
OxA-11831	HEX02 109B	hazelnut shell from same context as OxA-11830	-28.2	8715±45	cal BC 7960-7590	*cal BC 7780-7650 (95%)*
OxA-11832	HEX02 158A	hazelnut shell from hearth/hazelnut pit [158]	-25.0	8780±45	cal BC 8200-7610	*cal BC 7780-7650 (95%)*
OxA-11853	HEX02 158B	hazelnut shell from same feature as OxA-11832	-23.1	8790±45	cal BC 8200-7650	*cal BC 7780-7650 (95%)*
OxA-11854	HEX02 268A	hazelnut shell from hearth [268]	-23.1	8710±45	cal BC 7950-7590	*cal BC 7810-7700 (95%)*
OxA-11855	HEX02 268B	hazelnut shell from same context as OxA-11854	-22.4	8650±45	cal BC 7800-7580	*cal BC 7810-7700 (95%)*
OxA-11856	HEX02 379A	hazelnut shell from hearth [379]	-26.5	8785±45	cal BC 8200-7650	*cal BC 7930-7750 (95%)*
OxA-11857	HEX02 379B	hazelnut shell from same context as OxA-11856	-23.6	8750±45	cal BC 8160-7600	*cal BC 7920-7750 (95%)*
Beta-153650	HEX02 051	hazelnut shell from post hole fill [051]	-26.1	8730±40	cal BC 7950-7600	-
OxA-12292	HEX02 383B	hazelnut shell from hearth [383]	-25.8	8785±40	cal BC 8200-7650	*cal BC 7920-7750 (95%)*
OxA-12293	HEX02 055B	hazelnut shell from burning pit [055]	-23.7	8280±40	cal BC 7520-7140	*cal BC 7480-7320 (95%)*
OxA-12294	HEX02 047A	hazelnut shell from hearth [047]	-24.4	8690±40	cal BC 7940-7590	*cal BC 7740-7600 (95%)*
OxA-12322	HEX02 210(1)A	hazelnut shell from levelling layer [210]	-23.5	8310±40	cal BC 7520-7180	*cal BC 7450-7300 (93%) or cal BC 7220-7200 (2%)*
OxA-12323	HEX02 210(1)B	hazelnut shell from levelling layer [210]	-23.8	8355±39	cal BC 7540-7200	*cal BC 7450-7310 (93%) or cal BC 7220-7200 (2%)*
OxA-12347	HEX02 210(2)A	hazelnut shell from levelling layer [210]	-23.1	8710±38	cal BC 7940-7590	*cal BC 7780-7650 (95%)*
OxA-12324	HEX02 210(2)B	hazelnut shell from levelling layer [210]	-23.0	8739±39	cal BC 7970-7600	*cal BC 7780-7650 (95%)*
OxA-12325	HEX02 340A	hazelnut shell from hearth [340]	-23.0	8739±39	cal BC 7970-7600	*cal BC 7840-7730 (95%)*
OxA-12326	HEX02 291A	hazelnut shell from hearth [291]	-22.6	8765±40	cal BC 8160-7600	*cal BC 7890-7740 (95%)*
OxA-12327	HEX02 355A	hazelnut shell from hearth [355]	-24.8	8725±39	cal BC 7960-7600	*cal BC 7940-7930 (2%) or cal BC 7920-7760 (93%)*
OxA-12402	HEX02 383A	hazelnut shell from hearth [383]	-24.2	8885±65	cal BC 8260-7750	*cal BC 7930-7750 (95%)*
OxA-12408	HEX02 055A	hazelnut shell from burning pit [055]	-23.7	8330±45	cal BC 7530-7190	*cal BC 7510-7500 (1%) or cal BC 7490-7320 (94%)*

Laboratory Number	Sample	Material and Context	$\delta^{13}C$ (‰)	Radiocarbon Age BP	Calibrated Date (95% confidence)	***Posterior Density Estimate (95% probability)***
Sediment Core						
OxA-12944	HEX02-11007-11	phragmites from 137cm	-26.3	2982±34	cal BC 1380-1050	*cal BC 1380-1330 (8%) or cal BC 1320-1110 (87%)*
OxA-12945	HEX02-11007-12	unidentified herbaceous material from 178cm	-27.2	3755±35	cal BC 2290-2030	-
OxA-12967	HEX02-11007-13	phragmites from 200cm	-25.8	3311±35	cal BC 1690-1510	*cal BC 1690-1510 (95%)*
OxA-12946	HEX02-11007-14	alder (*Alnus glutinosa*) roundwood including bark from 213 cm	-27.7	3820±35	cal BC 2410-2140	*cal BC 2410-2370 (5%) or cal BC 2360-2130 (90%)*
OxA-12947	HEX02-11007-15	alder (*Alnus glutinosa*) roundwood from 297cm	-29.1	5846±38	cal BC 4810-4600	*cal BC 4810-4600 (95%)*
OxA-13028	HEX02-11007-16	oak (*Quercus* sp.)/ash (*Fraxinus excelsior*), knotty fragment from very degraded roundwood from 366cm	-24.3	6661±38	cal BC 5660-5480	-
OxA-12948	HEX02-11007-16	oak (*Quercus* sp.)/ash (*Fraxinus excelsior*), knotty fragment from very degraded roundwood from 366cm	-25.7	6473±37	cal BC 5490-5360	-
OxA-12949	HEX02-11007-17	woody stem from 406cm	-31.3	5985±36	cal BC 4950-4730	*cal BC 4960-4780 (95%)*
OxA-12950	HEX02-11007-18	woody stem/root from 437cm	-30.1	6290±45	cal BC 5370-5080	*cal BC 5310-5200 (58%) or cal BC 5180-5070 (37%)*
OxA-12951	HEX02-11007-19	hazel (*Corylus avellana*) roundwood from 444cm	-26.6	6274±38	cal BC 5320-5080	*cal BC 5340-5200 (92%) or cal BC 5170-5140 (3%)*
OxA-13029	HEX02-11007-20	alder (*Alnus glutinosa*) fragment from roundwood or largewood from 485cm	-27.9	6586±39	cal BC 5620-5470	*cal BC 5620-5580 (22%) or cal BC 5570-5470 (73%)*
OxA-12952	HEX02-11007-21	hazelnut shell from 580cm	-26.5	6988±37	cal BC 5990-5740	*cal BC 5980-5940 (7%) or cal BC 5930-5740 (88%)*
OxA-12953	HEX02-11007-21	hazelnut shell from 580cm	-26.1	7117±39	cal BC 6070-5890	*cal BC 6000-5870 (91%) or cal BC 5860-5840 (4%)*
OxA-12954	HEX02-11007-22	sliver of wood bark from wide roundwood/trunk from 583cm	-30.7	7075±37	cal BC 6020-5840	*cal BC 6020-5900 (95%)*
OxA-11859	HEX02-11007A/09	*Corylus avellana*, ?carbonised wood from 627cm	-26.4	7174±35	cal BC 6160-5920	*cal BC 6070-5980 (95%)*
OxA-11860	HEX02-11007A/10	*Corylus avellana* twig from 630cm	-27.3	7160±40	cal BC 6160-5920	*cal BC 6160-6140 (2%) or cal BC 6090-5990 (93%)*
OxA-11858	HEX02-11007A/08	hazelnut shell from 683cm	-25.6	7308±40	cal BC 6240-6030	*cal BC 6200-6050 (95%)*
OxA-11833	HEX02-11007A/07	hazelnut shell from 684-685cm	-24.9	7269±39	cal BC 6230-6020	*cal BC 6230-6080 (95%)*
OxA-11936	HEX02-11007A/05	small twig from 764-765cm	-29.4	10035±45	cal BC 10140-9310	*cal BC 9750-9300 (95%)*
OxA-13370	HEX02-11007A/06	indeterminate herbaceous stem from 770 cm	-29.1	10000±90	cal BC 10150-9250	*cal BC 10020-9840 (15%) or cal BC 9830-9390 (80%)*
OxA-12825	HEX02-11007A/04	bulk sediment (humin) from 783-784cm	-24.6	10265±70	cal BC 10790-9740	*cal BC 10390-9740 (95%)*
OxA-11852	HEX02-11007A/04	bulk sediment (humic acid) from 783-784cm	-25.8	8465±45	cal BC 7590-7380	-
OxA-12824	HEX02-11007A/03	bulk sediment (humin) from 791-792cm	-23.9	10430±140	cal BC 10970-9740	*cal BC 10860-10760 (4%) or cal BC 10730-9810 (91%)*
OxA-11870	HEX02-11007A/03	bulk sediment (humic acid) from 791-792cm	-26.4	8250±45	cal BC 7590-7380	-
AA-45401	HOW4-439	hazel (*Corylus avellana*)/willow (Salicaceae) from 439cm	-27.3	6595±55	cal BC 5630-5470	-
AA-45402	HOW4-720	hazelnut shell from 720cm	-26.3	6865±55	cal BC 5840-5630	-

Table 6.1: Radiocarbon determinations from Howick

estimates of the likely age of the site. Radiocarbon results were simulated using the R_Simulate function in OxCal, with error terms estimated on the basis of the material available. Once the first series of results had been received, further simulation models were constructed and further samples submitted to refine the dating.

The first dates from the sediments in the Howick Burn consisted of two samples of plant macrofossils dated from core HOW4 in 2001, as part of the assessment of the palaeoenvironmental potential of these sediments. These results suggested that part of the sequence might be contemporary with the Mesolithic structure, and so a second core (11007) was taken for detailed analysis.

Two series of radiocarbon samples were submitted from core 11007. The first set of samples concentrated on the base of the core to determine whether this was contemporary with the Mesolithic structure, and the second series aimed to date particular episodes in the pollen record.

Unfortunately, the stream at Howick runs across exposed coal measures, potentially contaminating any samples of bulk sediment with carbon of geological age (thus making the resultant dates anomalously old). For this reason, samples of single waterlogged plant macrofossils, which had been extracted from known levels in the core, were dated wherever possible. Preservation was not ideal, and so the range of suitable material was limited.

It was particularly disappointing that no macrofossils could be recovered from the lowest organic sediments, which were thought most likely to preserve a record of the environment contemporary with the use of the Mesolithic structure. Because of the desirability of dating these lowest levels, bulk sediment was submitted for dating. Both samples consisted of 10mm of sediment, and repeat fractions (humic acids and humin) were extracted from each. This is important because any coal contamination would make the humin fractions anomalously old. If consistent results are returned from different fractions of the same sample, then more confidence can be placed in the reliability of the date (Shore *et al.* 1995).

Radiocarbon Analysis and Quality Assurance

Samples processed at the Oxford Radiocarbon Accelerator Unit were prepared using methods outlined in Hedges *et al.* (1989). Those with OxA-numbers below 12000 were dated as described by Bronk Ramsey and Hedges (1997), those with OxA-numbers above this were measured as described by Bronk Ramsey *et al.* (2004). All targets were graphite, except those for OxA-12402, OxA-12824-5, and OxA-13370 which were carbon dioxide. The samples dated by the Scottish Universities Research and Reactor Centre were processed as described by Stenhouse and Baxter (1983) and Slota *et al.* (1987), and dated using methods outlined in Donahue *et al.* (1997). The sample dated at Beta Analytic Inc was dated by AMS using methods outlined at http://www.radiocarbon.com/.

All three laboratories maintain continual programmes of quality assurance procedures, in addition to participation in international inter-comparisons (Scott 2003). These tests indicate no laboratory offsets and demonstrate the validity of the precision quoted.

The Results

The results are given in Table 6.1, and are quoted in accordance with the international standard known as the Trondheim convention (Stuiver and Kra 1986). They are conventional radiocarbon ages (Stuiver and Polach 1977).

Calibration

The calibrations of these results, which relate the radiocarbon measurements directly to the calendrical time scale, are given in Table 6.1 and in outline in Figures 6.2, 6.3, and 6.5. All have been calculated using the datasets published by Stuiver *et al.* (1998) and the computer program OxCal (v3.5) (Bronk Ramsey 1995; 1998; 2001). The calibrated date ranges cited in the text are those for 95% confidence. They are quoted in the form recommended by Mook (1986), with the end points rounded outwards to 10 years. The ranges in Table 6.1 have been calculated according to the maximum intercept method (Stuiver and Reimer 1986); all other ranges are derived from the probability method (Stuiver and Reimer 1993). Those ranges printed in italics in the text and tables are *posterior density estimates*, derived from the mathematical modelling described below.

Analysis and Interpretation

Mesolithic Hut

The model for the chronology of the Mesolithic structure at Howick is shown in Figures 6.2–6.4.

Hearths 355, 379, and 383 were dated, and are among the earliest identifiable features inside the structure (OxA-11801, OxA-12327, OxA-11856-7, OxA-12292 and OxA-12402). Directly above hearth 355 lay hearth 291. Two fragments of hazelnut shell were also dated from this deposit (OxA-11803 and OxA-12326). Directly above hearth 379 was hearth 357. One sample was dated from this feature (OxA-11802). There was no direct relationship between hearth 291 and 357. All these samples fall in stratigraphic Phase 1a.

Later than all these samples was the large burnt spread 340, which produced two radiocarbon dates (OxA-11804 and OxA-12325). Above this is hearth 293 (OxA-11828-9), and above this in turn was a large hearth 268 (OxA-11854-5). These three features provide dates for stratigraphic Phase 1B. The results are consistent with the stratigraphic positions of these contexts, except for OxA-11829, which has only a 0.3% probability of dating this phase of activity. This hazelnut fragment is clearly earlier reworked material.

The first rebuilding of the hut is evidenced by levelling layer 210 and associated structural features. A number of discrete features were dated on, and cut into, layer 210. This included an unnumbered burnt patch (OxA-12347 and OxA-12324), hearth 109 (OxA-11830-1), and circular burning pit 158 (OxA-11832 and OxA-11853). All these features fall in stratigraphic Phase 2. The results are consistent with the stratigraphic positions of these contexts.

The second rebuilding of the hut is recognised by levelling layer 049, and associated structural features. Two hearths on top of this layer (047 and 173) produced radiocarbon dates (OxA-11805, AA-41788, OxA-12294 and OxA-1186-7). Following the initial assessment excavation in 2000, a sample from post hole 051 was dated (Beta-153650). Although this measurement provided a useful preliminary indication of the age of the structure, it has not been included in the model described here because the taphonomy of a charred hazelnut within a post hole is uncertain. These features provide absolute dating for stratigraphic Phase 3.

A number of features appear to have been cut into the uppermost archaeological deposits within the hut. Two hearths (055 and 063) produced radiocarbon dates that are significantly later than those from the hut itself (OxA-12293, OxA-12408 and OxA-11806-7). It appears that another unnumbered burnt patch from context 210 may be part of this activity, since this feature produced two similar radiocarbon measurements (OxA-12322-3). An anomalously late sample from Phase 3 (OxA-11805 from hearth 047) appears to be intrusive in its context and may also relate to this late use of the site. This final phase of activity was only recognised as a result of the radiocarbon programme, and forms a fourth phase of activity at the site.

The model explained above, and shown in Figures 6.2 and 6.3, can now be used to address the objectives of the dating programme outlined above.

The hut was first occupied in *cal BC 7970–7760 (95% probability; start structure*; Fig 6.2). The first rebuild occurred in *cal BC 7800–7700 (95% probability; rebuild 1*; Fig 6.2), and the second rebuild occurred in *cal BC 7750–7630 (95% probability; rebuild 2*; Fig 6.2). Occupation of the hut appears to have ended in *cal BC 7740–7560 (95% probability; end structure*; Fig 6.2).

Phase 1 occupation lasted for *20–230 years (95% probability)* or *40–160 years (68% probability; use 1*; Fig 6.4). Phase 2 occupation lasted for *1–110 years (95% probability)* or *10–80 years (68% probability; use 2*; Fig 6.4). Phase 3 occupation lasted for *1–100 years (95% probability)* or *1–60 years (68% probability; use 3*; Fig 6.4). Overall the hut was occupied for *40–380 years (95% probability)* or *100–300 years (68% probability; use hut*; Fig 6.4). It is apparent that each phase of occupation becomes progressively shorter. This is shown clearly in Figure 6.4, where the skewed probability distributions for the duration of each phase of occupation suggest that shorter periods of use are more likely within each range. In contrast the probability distribution for the duration of use of the entire structure is less skewed, and it is likely to have had an overall occupation of a couple of centuries.

The dating of Phase 4 is shown in Figure 6.3. The re-use of the site began in cal *BC 7560–7330 (95% probability; start re-use;* Fig 6.3), and according to the model the site was finally abandoned in *cal BC 7450–7240 (93% probability) or cal BC 7220–7120 (3% probability; end re-use*; Fig 6.3). The three features assigned to Phase 4 produced six radiocarbon results which are statistically consistent (T'=6.4; T'(5%)=11.1; ˜=5; Ward and Wilson 1978). This means that this re-occupation could simply represent a single visit to the site. Alternatively, these features could span a period of *1–280 years (95% probability)* or *1–120 years (68% probability; use 4*; Fig 6.4), although the shape of the probability distribution suggests that a shorter period of re-use is most likely.

The site appears to have been abandoned between Phases 3 and 4, for a period of *50–360 years (95% probability)* or *130–280 years (68% probability; gap;* Fig 6.4).

The model is in good overall agreement with the stratigraphic sequence ($A_{overall}$ = 69.0%; Bronk Ramsey 1995), and with the structural phasing identified by excavation. Whilst there is clearly a gap between Phases 3 and 4, the model suggests that occupation from Phase 1 to Phase 3 is continuous. This is also reflected in the stratigraphic sequencing, which provided no indication of a break between phases.

The dating of this site to the earlier eighth millennium cal BC provides the first absolute dating for a discrete Mesolithic flint assemblage in North-East England. Together with the dates recently published for Crammond (Lawson 2001; see Table 6.2), the Howick excavations have produced early dates for scalene triangle microliths. Indeed, the dates from these sites have pushed back the chronology of narrow-blade industries in northern Britain to the centuries before and around 8000 cal BC.

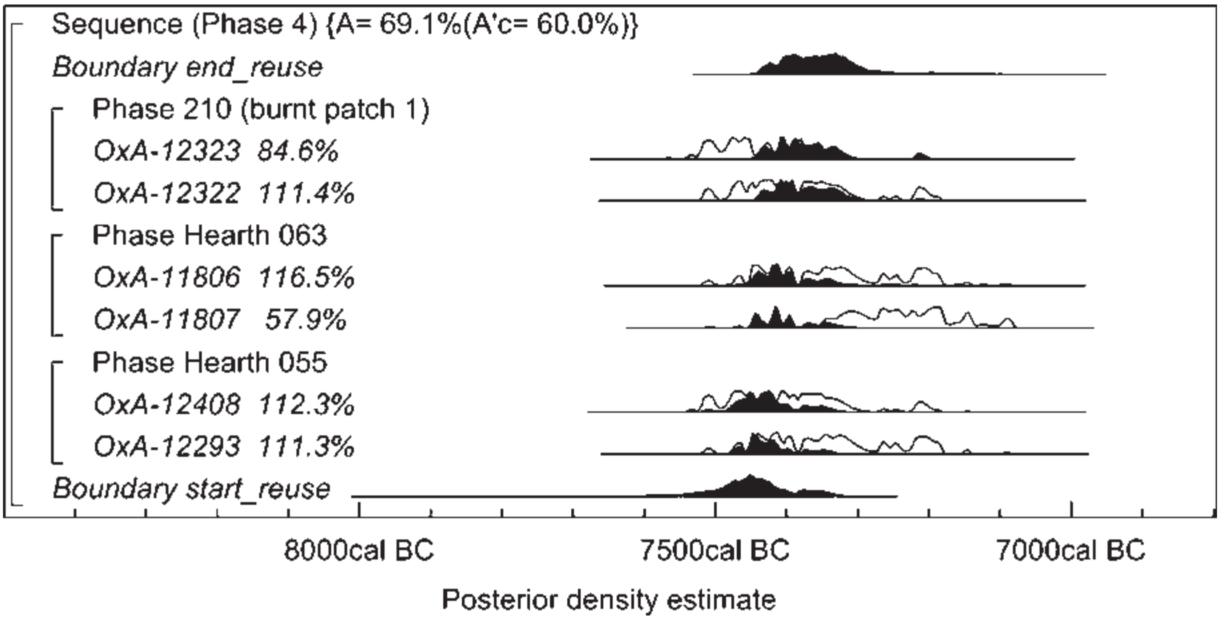


Figure 6.3. Probability distributions of dates from the Mesolithic structure at Howick during Phase 4, which is a later reuse of the area. The format is identical to that for Figure 1. The large square brackets down the left hand side along with the OxCal keywords define the overall model exactly.

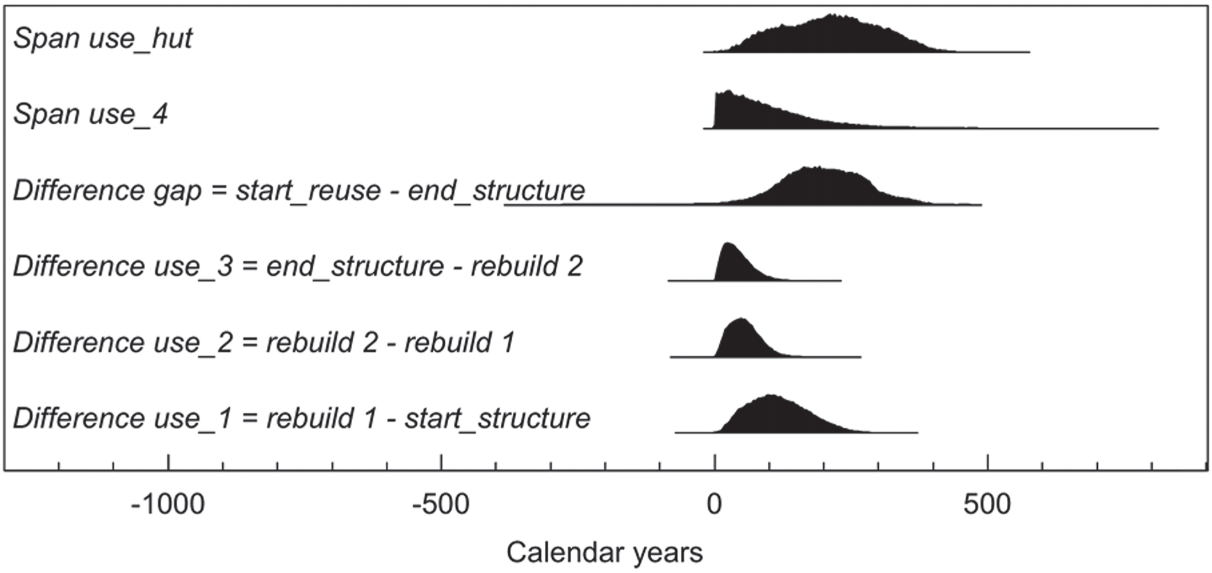


Figure 6.4. Probability distribution showing the length of time during which the structure at Howick was in use. The distribution is derived from the model defined in Figures 6.2 and 6.3.

Sediment Sequence

The chronological model for Core 11007 from the Howick Burn is shown in Figure 6.5. A full discussion of this core in relation to its wider Holocene context is published elsewhere (Boomer *et al.* 2007). In general, the relative dating provided by the height in the sediment column is consistent with the radiocarbon measurements. The first exception to this is the two results on the humic acid fractions of samples 11007-03 and 11007-04. These were from near the base of the organic deposits, and in both cases the humic acid fractions are several thousand years younger than the replicate measurement on the humin fractions of the same samples. The results from these humin fractions (OxA-12824-5), however, are consistent with the results from the plant macrofossils in the immediately overlying levels (OxA-13370 and OxA-11936). As these macrofossils cannot have been contaminated with coal fragments, it seems likely that it is the measurements

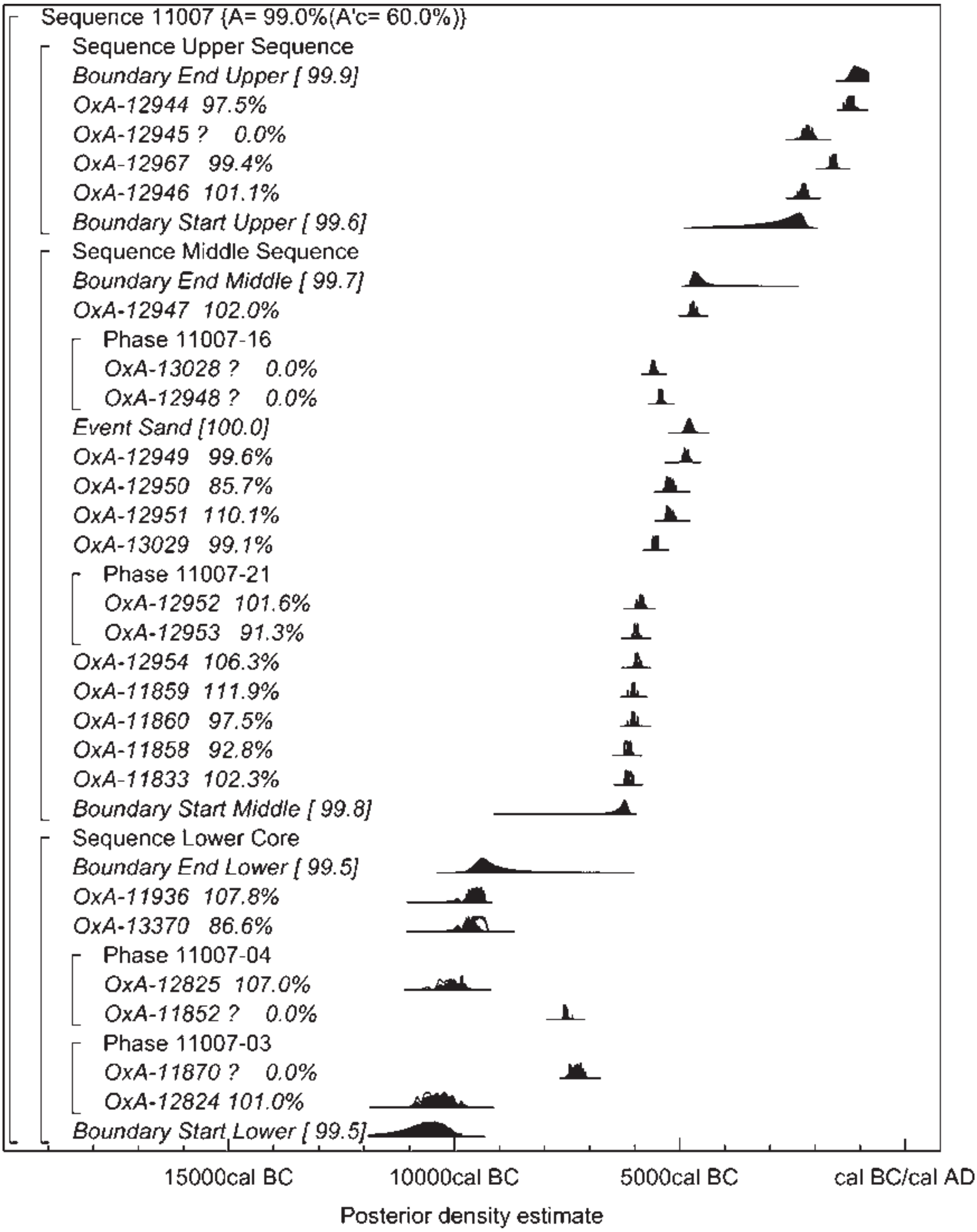


Figure 6.5. Probability distributions of dates from the sediment core 11007 at Howick Burn. The format is identical to that of Figure 6.1. Radiocarbon dates marked with a "?" have been excluded from the analysis. The large square brackets down the left hand side along with the OxCal keywords define the overall model exactly.

on the humin fractions that are nearer in age to the deposition of the sediment at these levels, and the humic acid results are anomalously young. It appears that younger humic acids may have been translocated down the sediment profile. For this reason the results from the humic acid fractions have been excluded from the model.

There also appear to be re-worked plant macrofossils present at two levels higher up the profile. Both samples at 366cm (OxA-13028 and OxA-12948) are older than their relative stratigraphic position would indicate, and may have been washed into the lower valley from higher up in the catchment. A single macrofossil collected at 178cm (OxA-12945)

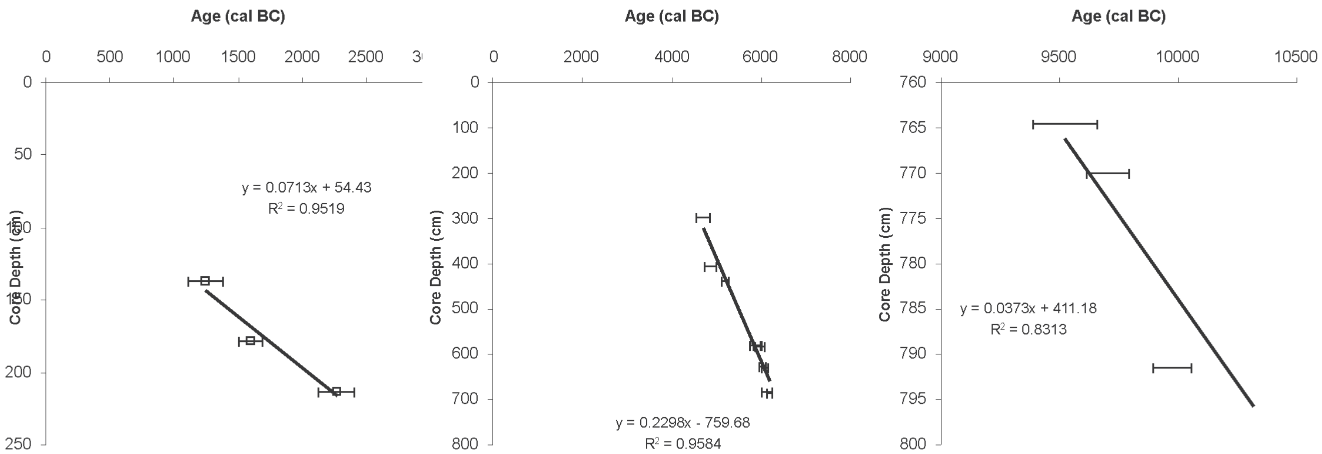


Figure 6.6. Age-depth relationships for the three sections of Core 11007. Trend lines indicate mean accumulation rates.

also appears to be too old for its position in the column. Consequently, these three measurements have also been excluded from the analysis.

Figure 6.5 demonstrates that Core 11007 contains sediments that span at least 12,000 years. The lowest organic deposits measured, between 791–2cm, date to *cal BC 10860–10760 (4% probability) or cal BC 10730–9810 (91% probability; OxA-12824)*. Sediment appears to have accumulated relatively constantly until at least *cal BC 9750–7300 (95% probability; OxA-11936; 765–4cm)*. If we assume that the posterior density estimates are normally distributed and calculate their means, simple linear regression can be fitted, thus providing an estimate of the accumulation rate of this part of the core of 0.34m ka^{-1} (0.3m per thousand years; Fig 6.6a).

There appears to be an erosional event, represented by the deposition of a coarse sand and gravel unit, between 750cm and 705cm. It is likely that this event would have eroded pre-existing sediments. The next datable horizon, at 684cm, is dated to *cal BC 6230–6080* (*OxA-11833*), suggesting that around 3000 years of sediment have been lost. Given the relatively rapid sediment accumulation of the sediments overlying this sand and gravel, it is likely that the erosional event occurred close to this date.

The sedimentation rate appears to be reasonably constant between 684cm and 297cm, at approximately 2.63m ka^{-1} (Fig 6.6b). The last datable level within this unit dates to cal *BC 4810–4600 (95% probability; OxA-12947)*. This horizon also marks the end of a period of sedimentation under permanent aquatic conditions, as witnessed by the microfossil record (see Chapter 12). A 45cm thick deposit of silty sand represents more rapid accumulation within this phase, an event dated to cal *BC 4920–4650 (95% probability; sand)*.

The next datable level occurs at 213cm, dated to *cal BC 2410–2370 (5% probability) or cal BC 2360–2130 (90% probability; OxA-12936)*. The accumulation rate of the overlying material reduces to approximately 0.74m ka^{-1} (Fig 6.6c). This rate suggests that there may well be no gap in the sediment sequence, just a slowing in the accumulation rate above 297cm. The youngest sample, at a depth of 137cm, dates to *cal BC 1380–1330 (8% probability) or cal BC 1320–1110 (87% probability; OxA-12944)*, and so the upper 1.3m of sediment represents the last three thousand years. Landscaping in the valley during the nineteenth century is represented by disturbance in the upper 30cm of the sediment profile. This makes it impossible to extrapolate the sedimentation rate to the modern floodplain surface.

The posterior density estimates for the sediment core are plotted against their absolute core depths in Figure 6.7.

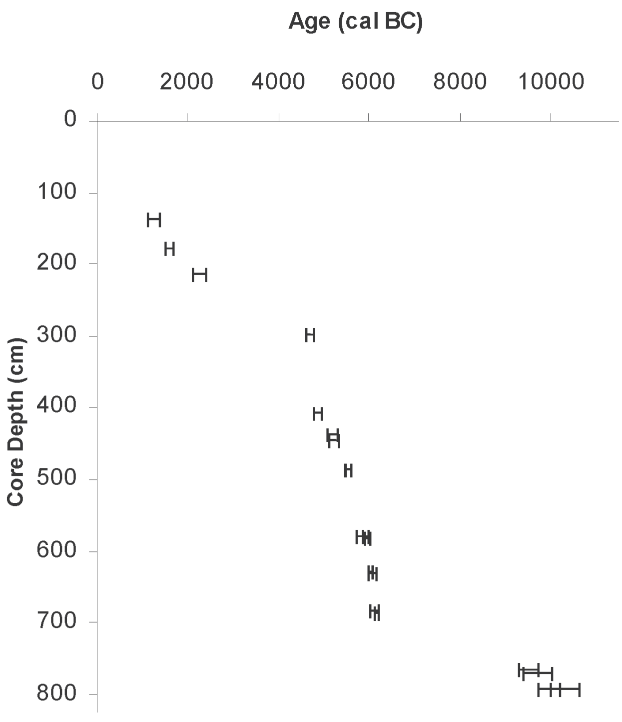


Figure 6.7. Age-depth relationship for Core 11007.

7 Chipped Stone Tools

Clive Waddington and Kristian Pedersen

The Lithic Assemblage

Clive Waddington

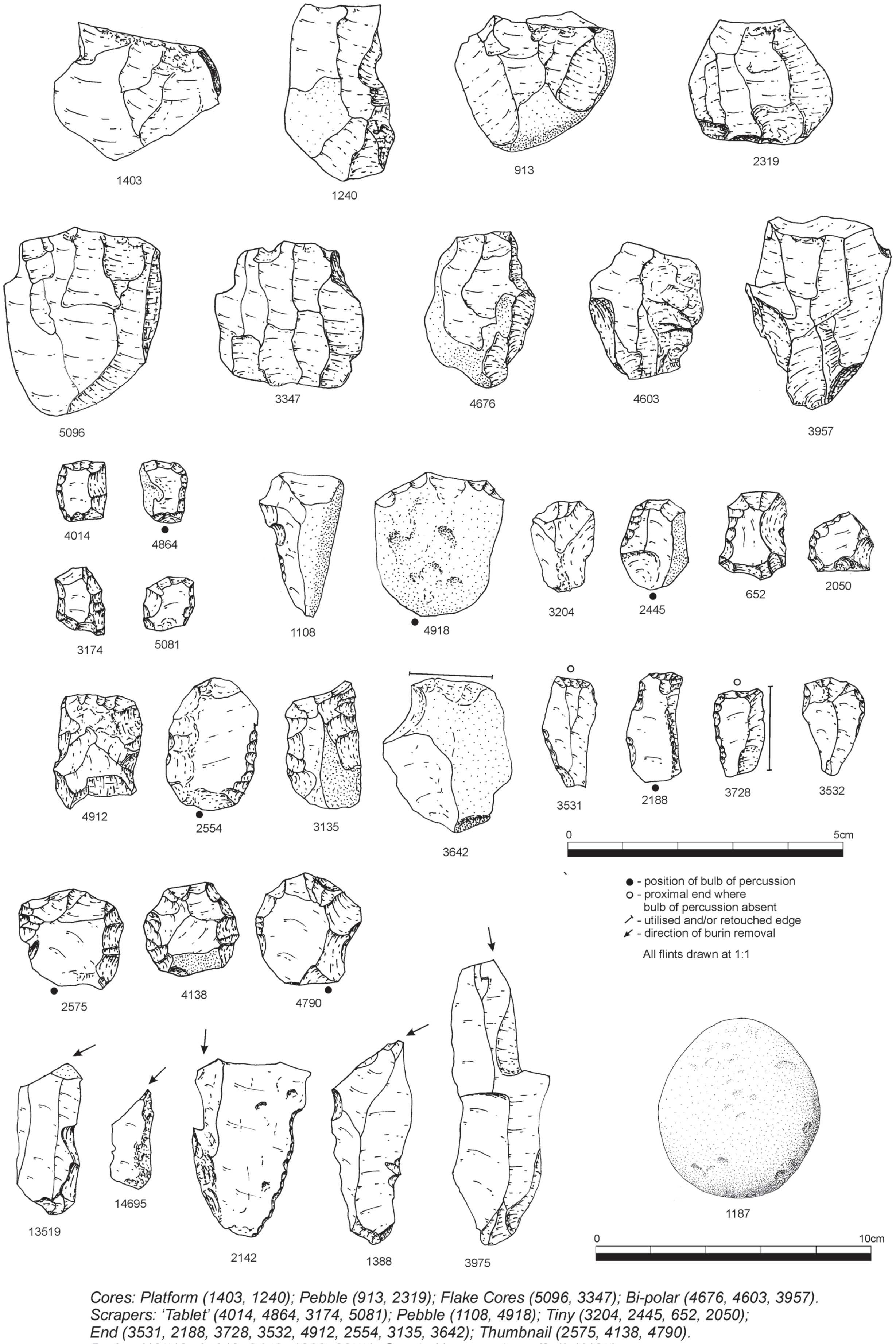
Introduction

The archaeological deposits at Howick produced lithic material from most contexts. This included 13,219 lithics from the Mesolithic hut, 58 from the external pits near to the hut, 64 from the Bronze Age cists, 240 from a later linear feature and 901 from unstratified deposits. The lithics from the fieldwalking and test pits are dealt with separately in their respective chapters, while those from the cists and the later linear burning pit are reported in a separate publication (Waddington *et al*. 2005). The lithics from the pits and unstratified locations are reported under a separate section towards the end of this chapter, otherwise the rest of this chapter is concerned solely with those lithics recovered from the stratified deposits within the Mesolithic hut. Every piece was examined and catalogued and this information recorded into a database, which forms part of the archive. The following report provides an account of the raw material, artefact types, technology, assemblage types and stratigraphic and spatial distribution, together with a discussion of the results. A selection of the various implement types is illustrated in Figures 7.1 and 7.2. The following chapter reports the results of a limited programme of residue and use-wear analysis on a sample of the lithic assemblage.

The lithic assemblage is remarkable in several respects. The lithics from within the Mesolithic hut form a discrete stratified group that is not disturbed by any intrusive or overlying later material. This means it is the most coherent and stratigraphically intact Mesolithic assemblage so far recovered in North-East England. Thanks to the high-resolution radiocarbon dating of the hut deposits, the assemblage is also tightly defined in terms of its chronological span, which, as more assemblages are dated, will allow for the identification of typological progression in the North-East during the Mesolithic. All the lithic materials from the Mesolithic deposits are from local sources and this has allowed the assemblage to be related directly to local patterns of resource procurement, as well as other comparable North-East lithic assemblages. The hut deposits have produced a substantial collection of 276 microliths that will allow North-East traditions to be fitted into the wider milieu of Mesolithic industries from adjacent areas of England and Scotland, as well as further afield across the North Sea and Irish Sea.

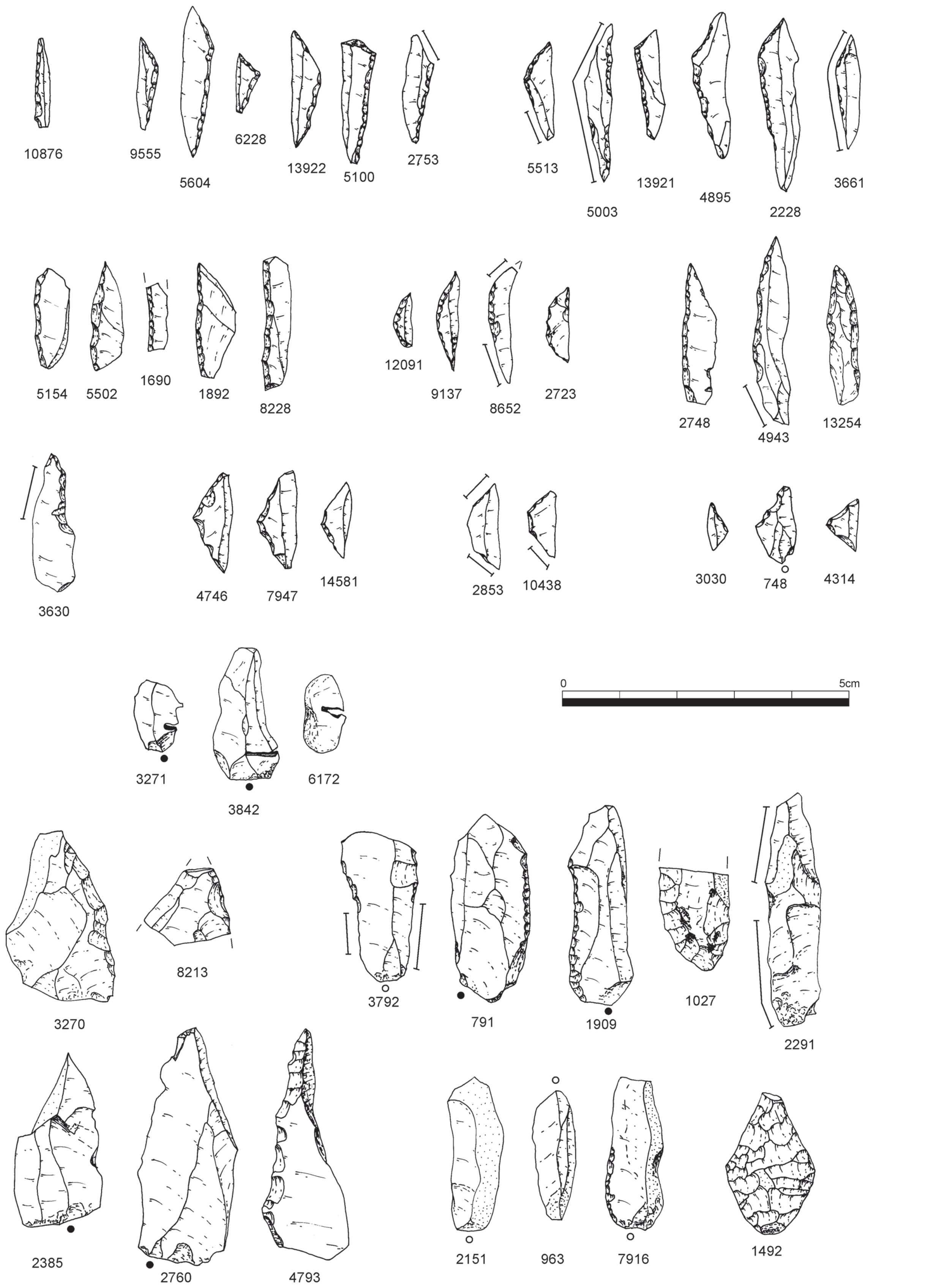
The proportion of tools in the hut assemblage is 4.6%, which is low when compared with other sites such as Star Carr with 14% (Clark 1971; 1972) and, closer to Howick, South Shields with 8% (Waddington 2001a, 78). However, the Howick figure is skewed in relation to many other excavated Mesolithic assemblages in the UK, as the entire hut deposits were passed through a 2mm mesh in a flotation tank to maximise the retrieval of microdebitage, which increased the recovery of flint from the hut by around 8200 pieces. Without this material the assemblage would have only numbered around 5000 and the proportion of tools would have been significantly higher, around 12%, which is directly comparable to other Mesolithic settlement sites where sieving or flotation have not taken place. All phases of the *chaîne opératoire* are represented in the assemblage, indicating not only stone-tool working on the site but also the use of tools for a wide variety of processing tasks. This conclusion is strengthened by the fact that many of the finished tools in undisturbed deposits are broken as a result of their use. The actual amount of utilised pieces in the assemblage is likely to be considerably higher than the 4.6% figure for visually recognised tools, as the use-wear and residue analysis (see below, Chapter 8) has shown that many pieces that retain no visible surface traces of retouch or utilisation have, on microscopic inspection, clear traces of use.

All the diagnostic pieces in the assemblage from the hut and nearby pits are Mesolithic types. The only diagnostic piece in the entire assemblage that is later than the Mesolithic is a broken leaf-shaped arrowhead, typical of Early Neolithic assemblages, from the unstratified subsoil to the north of the hut (ill. in Fig. 7.2).



Cores: Platform (1403, 1240); Pebble (913, 2319); Flake Cores (5096, 3347); Bi-polar (4676, 4603, 3957).
Scrapers: 'Tablet' (4014, 4864, 3174, 5081); Pebble (1108, 4918); Tiny (3204, 2445, 652, 2050);
End (3531, 2188, 3728, 3532, 4912, 2554, 3135, 3642); Thumbnail (2575, 4138, 4790).
Burins (13519, 14619, 2142, 1388, 3975); Quartz Hammerstone (2:1) (1187).

Figure 7.1. Cores, scrapers and burins from Howick.



Microliths: Rod (10876); Right-hand scalene triangles (9555, 5604, 6228, 13922, 5100, 2753); Leftt-hand scalene triangles (5513, 5003, 13921, 4895, 2228, 3661); Backed blades (5154, 5502, 1690, 1892, 8228); Crescents (12901, 9137, 8652, 2723); Needle points (2748, 4943, 13254); Lamelles à cran (3630); Isoceles triangles (4746, 7947, 14581); Trapeze (2853, 10438); Microburins (3030, 748, 4314). Flints with echinoids eroded from them giving the impression of having been 'cut'; (3271, 3842, 6172); Retouched flakes (3270, 8213); Retouched blades (3792, 791, 1909, 1027, 2291); Possible Awl (2385); Awls (2760, 4793); Utilised blades (2151, 963, 7916); Leaf-shaped arrowhead (1492).

Figure 7.2. Microliths and blade tools from Howick.

Raw Material

The lithic assemblage is composed almost entirely of flint (13,073 pieces = 98.9%) with a few pieces of chert (94 pieces = 0.7%), quartz (49 pieces = 0.4%) and one piece each of chipped agate, sandstone and an unidentified stone. Most of the flint pieces have been struck from small nodules and as a result, areas of cortex survive on many pieces, which has allowed the likely origin of 14.4% of the assemblage to be assessed. Beach flint – that is, nodules that have been rolled in the sea and redeposited on the shore – account for 97.8% of the provenanced flint. Glacial flint from till deposits, which forms the drift cover along this stretch of the coastal plain, accounts for 2.1%. Possible pieces of nodular flint with a chalky cortex accounted for just 0.1%.

The flint comes in a wide range of shades, shapes and sizes, although the most common types are various shades of light grey material (52%), medium and dark grey (15.4%), a distinctive speckled red-brown flint (5.8%), an off-white flint (5.7%) and brown flint (2.8%), together with small quantities of honey-coloured, purple, pink, orange and translucent flints (0.7%). The remaining 17.6% of the assemblage was unable to be attributed a colour as these pieces were either patinated or burnt. The beach material tends to have a very rounded and smooth cortex that is often a very different colour from the flint within the nodule. Although impurities are fairly common, both the beach pebble and glacial flint are generally of high quality. The main limitation of this local material is its small size, which has evidently constrained, to some extent, the size and range of tools that were made. The beach flint pieces from the site show that nodules ranging from thumb to fist-sized were typically used. As beach and glacial flint can come from a wide variety of sources and still end up in the same area it is not surprising that a wide range of flint material is represented in this assemblage.

The origin of the beach flint is an intriguing question that requires attention here. Some of this material derives from the glacial till deposits of the coastal plain that are eroded by the sea and then redeposited on the shore. Others are from till deposits eroded from the submerged sea floor and this material no doubt has a wide catchment, ranging from inshore waters to deep North Sea waters where the tills from the Scandinavian ice sheets are eroded during storm events. Still another type of beach flint is that which comes from the erosion of submerged prehistoric sites that now lie under the North Sea. This material is distinctive: although evidently chipped – usually to form blades and what for Northumberland are large blade tools – these pieces have developed very heavy patinas over the chipped areas and have subsequently become heavily beach-rolled along all edges. These pieces appear to be mostly of Palaeolithic origin, although some may belong to the early Mesolithic. When found on site at Howick they have a distinctive flaking stratigraphy evident on their surfaces, including: fresher Mesolithic flaking facets that go with the occupation at Howick, earlier flaking facets that are very heavily patinated and beach-rolled, dating from the Palaeolithic/Early Mesolithic, and areas of original cortex. A particularly good example is scraper [3050], which has been re-chipped from a previously struck patinated piece that had been beach-rolled. There are many other examples where beach-rolled and heavily patinated previously struck pieces have been collected as nodules for reworking on site, usually as cores. This includes cores [2319] and [3737], together with flakes and blades struck from recycled pieces such as [793], [1748] and [3641]. This is an important phenomenon, as it not only serves as proxy evidence for Palaeolithic and Early Mesolithic occupation in areas now submerged below the North Sea, but the earlier flaking of these pieces cannot have gone unnoticed by the Howick inhabitants. It is tempting to speculate how the Howick people regarded these, by then, ancient artefacts, although they clearly had few concerns when it came to recycling this material. Howick is not the first place on the North-East coast where the re-use of already ancient chipped flints has been evidenced in Mesolithic collections. Lithic assemblages assessed by the author from Middle Warren near Hartlepool (Waddington 1996), various locations on the Durham coast (Waddington 1998a), and the Trechman collection from the North-East coast (personal inspection at Sunderland Museum), have all produced evidence for this recycling. Therefore, the behaviour witnessed at Howick, although more firmly dated than at the other sites, is part of a pattern of what appears to be opportunistic acquisition of flint during the Mesolithic.

The glacial flint, which can be collected from exposures and scars in the local till such as cliff and stream sections, tends to have a thinner cortex than the beach flint and has a rougher, usually non-chalky texture, sometimes with a slight honeycomb effect. The cortex is generally dull and opaque and can range in colour from a dirty grey to sandy brown. It is common for pieces of glacial flint to contain impurities and sometimes these can be observed to have affected the flaked shape of a piece. In contrast, the nodular flint can be recognised by the presence of a more or less uniform and thick chalky cortex and with fewer impurities evident in the flint. There is no history of ballast dumping in the Howick area and only a couple of possible pieces of nodular flint were recorded.

The chert pieces are more opaque and less fine-grained than the flint. The colours of the chert pieces are also distinctive, in particular the blue-grey variety that accounts for 14.8% of the 97 chert pieces. There are also various shades of grey, accounting for 49%, together with brown (13.8%), white (7.4%), red-brown (4.3%), purple (3.2) and other colours (7.4%). The chert, like the flint, comes from beach and glacial sources; 18% could be provenanced as beach material on account of the surviving areas of cortex. Chert can be collected today both from the beach and from the boulder clay, although in much less abundance than the flint.

The quartz component was easily recognised, being crystalline and having a distinctive sparkle. Most of the quartz was either light grey (40.8%) or white (34.7%), with occasional pieces of translucent material (12.2%) and the rest a mixture of pink, red and brown (12.2%). Some quartz nodules can be found in the coastal boulder clays and it is likely that these struck materials represent the opportunistic collection of pieces that were suitable for knapping. The single piece of agate is of the banded variety and is also likely to have come from a boulder clay source, while the single piece of flaked sandstone no doubt came from the exposed solid geology at the base of the cliffs, which consists of inter-bedded sandstones, limestones and mudstone.

Technology

This blade-based assemblage is typical of Later Mesolithic industries of the British Isles, even though chronologically it occurs at the very beginning of this phase. It is characterised typologically as a narrow-blade industry, similar to those from Filpoke Beacon (Jacobi 1976), and fits well with a date of around 7800 cal BC for the initial occupation of the site (see below Chapter 6). This type of narrow-blade assemblage has been characterised by Jacobi as comprising 'micro-triangles' with elongated scalene microliths diagnostic of this techno-complex (Jacobi 1976, 71–2). No axes were present in the assemblage, which is consistent with Jacobi's observation that core axes do not occur on Later Mesolithic northern British sites (Jacobi 1976, 73), although this should probably be seen as a function of the small beach nodules precluding widespread axe head manufacture, and those axe heads that were used being recycled into smaller tools rather than being discarded. Flint from the entire knapping sequence is present in the hut assemblage, revealing a focus on the production of small parallel-sided blade-based tools. As the raw material was already small when collected, some of the blade forms tend to be fairly squat although more slender blades, typical in more southern collections, also occur. However, the squat forms are blades nonetheless and this is further evidenced by the flaking scars on cores which all reveal traces of blade detachments. Bipolar flaking is a common feature of the assemblage, apparent on both cores and detached flakes. This is almost certainly due to the nature of the raw material: being small, the pieces could be most easily worked by placing them on an anvil stone. Indeed one of the reasons why there are no large flint pieces in the assemblage, such as axes, large blades and cores, is that pieces of this size are unlikely to have been discarded on account of their ability to be recycled into further tools. This would also explain why most of the finished and broken tools are so small, as they had reached the size where they could not be recycled further. Indeed direct evidence for recycling is apparent on a number of pieces, such as the broken flake [1732] that was reworked into a scraper. Overall this indicates a parsimonious attitude towards the discard of re-usable pieces, reflecting the size constraint of an otherwise abundantly available source of raw material.

Direct flaking with hard hammers is evident throughout the assemblage, as witnessed by the abraded surfaces and crushed striking platforms on primary and secondary flakes together with the common occurrence of eraillure scars, bipolar flakes made on anvil stones and the presence of a quartzite hammerstone within the hut deposits. Visual inspection indicates the use of hard and soft hammers and possibly some indirect percussion. A curious occurrence in the hut assemblage is the presence of three small flint blades (ills. 3271, 3842, 6172 in Fig 7.2) that appear on first inspection to have been finely cut in a straight line; however, these are in fact a natural phenomenon resulting from the erosion of echinoids within the flint (Jacobi pers. comm.).

As said, all stages of the *chaîne opératoire* are present in the hut assemblage, indicating that nodules were collected locally, brought to the hut, knapped and fashioned into tools where they were also used and, ultimately, discarded. The assemblage has been classified into primary (nodules, test pieces and primary flakes), secondary (secondary flakes, cores and blanks) and tertiary material (finished tools only, not including the debitage from tool production, which probably makes up most of the unascribed material). Primary material accounts for 13.2% of the assemblage; secondary material 75.1% and tertiary pieces 4.6%, leaving 7.2% that could not be ascribed to one of these stages in the reduction sequence. The relatively low proportion of primary waste, which could be expected to form more of the assemblage if all of this work was taking place on site, suggests that much of the primary working took place elsewhere, no doubt closer to the source of the material. Therefore, working of stone at the primary stage was only undertaken on a relatively small scale in and around the hut. The high proportion of secondary material is typical for settlement sites and indicates the manufacture of blanks, although the number of cores recovered from the hut is relatively small (see below). The high counts of debitage and micro-debitage and the presence of blade blanks and finished tools indicate that the manufacture of flakes and blades into stone tools took place on a considerable scale in the hut. As the use-wear study makes clear (see below, Chapter 9) many of what appear to be blanks, based on visual inspection alone, are likely to have been utilised, and therefore classified as secondary. The fact that many of the identifiable tools were broken in antiquity (see above) and show visible signs of wear, as well as microscopic residues, indicates that most of the tools were used in and around the hut for processing activities, only to be discarded when they broke or were of no further use. Some, however, were curated and recycled after their initial use. This paints a picture of an organised sequence of stone tool production from the collection strategy to tool manufacture and use around the hut, as well as a sparing approach to tool production, use, curation and discard.

Final flaking is dominated by abrupt retouch, which, in virtually all cases, is applied to only one side of the piece. This is consistent with the flaking apparent in most Mesolithic assemblages. Such unifacial working, however, applies to fully retouched pieces, whereas some of the edge-trimmed pieces can have trimming on both sides depending on the shape and form of the piece concerned. In those few instances where the piece has working on more than one side, this is usually due to the odd shape of the piece and/or the presence of impurities. In other words, it is a strategy that appears to have been employed expeditiously to cope with the irregularities of the raw material. Other tool manufacturing techniques include the widespread practice of snapping the ends of blades as part of the microlith production strategy. There are many examples of snapped blade segments in the assemblage, with snapping at an angle across the proximal end most common, although sometimes it occurs across the distal end. This technique is particularly well suited to the production of triangle forms and it is precisely these types which dominate the microlith assemblage (see below).

The Assemblage

The Howick assemblage has produced a range of different artefact types, summarised in Table 7.1 below, testifying to a wide range of activities at the site. As is typical of assemblages of this sort, it is dominated by flake and blade debitage, although there is a significant collection of microliths of different types. Many pieces show evidence for very light patina development but otherwise the lithics are remarkable for surviving in a very fresh state. On those pieces where patina development is more advanced it tends to be milky white in colour. This contrasts with the heavier patina visible on the re-used beach-rolled material that is usually an opaque orange-brown colour. In fact the patina on the re-used pieces is so thick that they have in effect become entirely recorticated. It is not just the flint, though, that shows signs of patina development. Occasional pieces of chert and agate do so too, such as a re-struck piece of quartz, [4068], used as a core. A total of 163 pieces had evidence for some patina development, which accounts for just 1.2% of the assemblage. Those flints with heavy patina development are, by and large, likely to be extremely old and in some cases potentially of Palaeolithic age.

Measurements were only taken on whole pieces with dimensions recorded to the nearest half millimetre. Mean average measurement calculations exclude the broken pieces, which were not measured. All measurements given are the maximum dimensions of length, breadth and thickness based on the recording technique advocated by Saville (1980). Cores, test pieces and nodules had measurements taken along their two longest axes, while all other pieces were recorded across three axes. Micro-debitage has been characterised as waste material that has maximum dimensions of 5mm or less, while debitage has been characterised as waste material with dimensions greater than 5mm. As we are dealing here with a blade-based assemblage, the terms 'primary', 'secondary' and 'tertiary' have been used to describe pieces in relation to different stages of the reduction sequence. For those pieces where colour or stage in the reduction sequence could not be ascertained no data were recorded for these attributes. This was particularly frequent for broken, burnt and patinated pieces. A feature of this assemblage is the use of multi-directional flaking in order to gain as many flakes and blades from a piece as possible. This has resulted in flake facets from previous core removals giving some flakes the appearance of being retouched.

A significant proportion of the assemblage is broken (62.7%), presumably through use, which indicates that this is an assemblage directly related to functional activities that took place at the place of discard. The breaks have occurred due to use, the knapping process and perhaps some trampling underfoot, although the floor surface was soft sand. As the assemblage was retrieved from occupation deposits within a defined hut that had a sequence of hearth pits at its centre, it is not surprising that a significant number of the lithics are heavily burnt. Indeed most of the 2045 burnt pieces were from the hearth fills and in total the burnt pieces account for 15.5% of the assemblage.

Type	Count	% of Assemblage
Hammerstone	1	-
Nodules	11	0.1%
Test Pieces	21	0.2%
Unretouched Flakes	10,093	76.4%
Unretouched Blades	2,376	18%
Cores	107	0.8%
Retouched Flakes	92	0.7%
Retouched Blades	51	0.4%
Utilised Flakes	14	0.1%
Utilised Blades	39	0.3%
Notched Flakes and Blades	4	-
Scrapers	109	0.8%
Awls	10 + 1 poss.	0.1%
Burins	4 + 1 poss.	-
Microliths	275	2.1%
Microburins	9	0.1%
Crested Bladelet	1	
Total	**13,219**	

Table 7.1. Summary of artefact types from the Howick hut.

Phase	Lithic Count
Phase 1A	1609
Phase 1B	4462
Phase 2	2883
Phase 3	4253
Phase 4	12
Total	**13219**

Table 7.2. Summary of lithic counts by Phase.

Hammerstones

One hammerstone was recovered from the Mesolithic hut assemblage together with one from an unstratified context [87]. Both were made of quartzite, being red-brown and brown respectively. Both were fist-sized pieces, the one from the hut having maximum dimensions of 45mm by 42mm and the unstratified one 67mm by 61mm. A coarse stone elongated tool was classified as having potentially been used in a hammering motion (see below, Chapter 8), but as it is made from relatively soft sandstone it is unlikely to have been used for the knapping of flint.

Nodules and Test Pieces

Unworked nodules comprise 0.1% of the assemblage and their presence indicates the acquisition of material for chipping into tools. A total of eleven nodules was recovered of which nine were flint and two quartz. Their mean average dimensions are 33.7mm by 24.8mm, indicating that the flint collected from nearby sources was generally small. All six of the pieces that could be provenanced were beach flint. As nodules only account for a very small proportion of the assemblage it can be assumed that most nodules underwent initial working closer to the place of acquisition and that those brought to the site were chipped to produce tools, resulting in only a few nodules being lost or discarded in the hut. Test pieces, sometimes referred to as 'bashed lumps', account for 0.2% of the assemblage and their presence indicates the working of unprepared nodules on the site. Test pieces are characterised here as nodules that have been struck no more than twice before being discarded. Their mean maximum dimensions are 36.4mm by 28.7mm, which corresponds with the small sizes of the nodules found on the site. Of the 21 test pieces found in the hut, 17 were flint, 3 quartz and 1 chert. Apart from one piece of glacial flint all the other pieces were from the beach. The presence of these test pieces confirms that some preliminary working and testing of pieces took place at the hut.

Unretouched Flakes and Blades

The Howick assemblage is dominated by debitage and unretouched flakes and blades, which together account for 96.4% of all pieces. The debitage results from all stages of the reduction sequence. Out of a total of 10,093 flakes, 2617 (25.9%) were classed as microdebitage, 7107 (70.4%) as debitage and 369 (3.7%) as blanks or possible debitage. The microdebitage mostly results from the tertiary stage of tool production and has mean average length, breadth and thickness measurements of 4.1mm, 3.5mm and 1.0mm respectively. The debitage has mean average length, breadth and thickness measurements of 10.7mm, 8.6mm and 2.5mm respectively while the remaining blanks have mean average measurements of 19.8mm, 15.7mm and 4.8mm. These diminutive average sizes result partly from the use of sieving to recover small lithics, and partly from the small size of the raw materials available. Many pieces still retain areas of cortex on one or more facets, which further indicates that the parent nodules from which they were derived were of no great size. Given the small size of most of the pieces it was difficult to ascribe with any precision which stage of the reduction sequence many of the pieces were associated with, particularly as the presence of cortex is not an instant indication of primary flaking in assemblages such as this. This is confirmed by the fact that many of the finished tools still have cortex surviving on their surfaces.

Of the 2376 pieces characterised as blade forms, 113 (4.6 %) were classed as microdebitage, 1288 (54.2%) as debitage and 975 (41%) as blanks or possible debitage. When the blank components of the unretouched flakes and blades are compared there is a striking contrast: there are only 3.7% flake blanks compared with 41% blade blanks. This is indicative of the flaking industry on the site which is evidently geared towards the production of blade-based tools of which the blanks, or perhaps more accurately 'unretouched blades', are a key component. The low number of flake blanks results from the rest of the flakes being largely the result of debitage from the knapping process. The unretouched-blade component demonstrates an industry reliant on narrow parallel-sided small-blade technology for the production of a range of tools. The use of a blade-based industry has been associated with non-wasteful production strategies and a light-weight tool kit (Bradley 1987, 183).

Cores

A total of 107 cores was retrieved, which accounts for 0.8% of the hut total. Multi-faceted cores predominate, accounting for 35.6% of all cores, with platform cores accounting for 27.1% and flakes re-used as cores accounting for 24.3%. A further 6.5% were pebble cores and the remaining 8.6% were core fragments that could not be accurately attributed. The detachment scars on virtually all cores showed the intentional production of blades. Bi-polar working was apparent on a number of the cores, indicating the use of anvil stones. Together with the presence of the pebble cores these flaking techniques demonstrate the adoption of strategies for coping with the small-sized beach pebble flint. It is pertinent that only one pyramidal-type core was found in the assemblage, which could suggest that such core types are associated with later developments in the Mesolithic flint-working traditions of the region, or perhaps the raw material again made flaking in this way difficult. Indeed the nature of the raw material accounts for the high percentage of multi-faceted cores, which were clearly being struck this way to maximise the amount of detachments from what are otherwise irregularly shaped small pieces. Again, this is likely to be a response to dealing with the type of raw material available and hence explains the shortage of regular-looking cores in the assemblage. The use of flakes as cores is by no means restricted to northern sites but the high proportion of flake cores (i.e. flakes re-used as cores) (24.3%) in the assemblage reveals a careful approach to husbanding this precious commodity. The mean average size of the cores is consistent across all types; multi-faceted cores averaging 29.4mm by 24.2mm, pebble cores 27.1mm by 25.4mm, platform cores 26.0mm by 25.7mm and flake cores 24.4mm by 22.3mm. Most of the cores are very small and this is related to the paring down of the material to the point where no further useful detachments could be made. Core rejuvenation flakes were identified in the assemblage, which confirms that the curation of cores took place. These features of the cores, together with the recycling of pieces and the blade technology itself, point towards a parsimonious attitude to discard. The small size of the blade scars evident on most cores also reflects the concern for producing microlith-sized blade blanks, which is consistent with other northern Mesolithic assemblages (e.g. Weyman 1984; Waddington 1999a).

Retouched Flakes

A total of 92 retouched flakes was identified, accounting for 0.7% of the assemblage. Of these, four were edge-trimmed, one was microlithic in size, while another was a possible scraper. Their mean average length, breadth and thickness measurements are 18.5mm, 15.8mm and 5.6mm respectively, indicating that most of these pieces are small; indeed the largest only had measurements of 31mm, 38mm and 15mm. As 64 (70%) of the retouched pieces are broken, the functions of most of these pieces can only be guessed at, although it is clear from their diversity that a wide range of processing tasks was involved (see also Chapter 9). Most of the pieces show signs of utilisation visible to the naked eye, and together with the high proportion of broken pieces, this indicates that retouched flakes were utilised and discarded when of no further use.

Retouched Blades

Fifty-one retouched blades were identified in the assemblage, accounting for 0.4% of the total. Of these, four were edge-trimmed, one was a possible awl and the rest could not be ascribed to a specific tool type. However, it is of some interest that most are only retouched along one of their long edges. One piece, [1027], has been retouched around its entire surviving perimeter and may have been a knife but as it is broken this is not certain (see Fig 7.2). Their mean average length, breadth and thickness measurements are 24.7mm, 10.5mm and 3.9mm respectively. Like the retouched flakes, 67% (34) of the retouched blades are broken. This makes understanding their functional capabilities more difficult although undoubtedly some were cutting tools. Similarly, most of the pieces show signs of utilisation visible to the naked eye. The blades are all of regular parallel-sided form and are typical of Later Mesolithic assemblages.

Utilised Flakes and Blades

Flakes and blades that were not formally retouched but nevertheless had their edges worn as a result of use have been categorised under the term 'utilised flake/blade'. A total of 14 utilised flakes was present in the assemblage, accounting for 0.1% of the total. Their mean average length, breadth and thickness measurements are 22.6mm, 21.3mm and 6.4mm respectively. Although these pieces have evidently been used as tools it is not possible to suggest a use on the basis of their visual appearance alone. However, the use-wear and residue analyses have shown that these pieces can be used for a range of purposes (see below, Chapter 9). A total of 39 utilised blades was present in the assemblage, accounting for 0.3% of the total. Their mean average length, breadth and thickness measurements are 26.7mm, 11.7mm and 3.7mm respectively. As with the utilised flakes, although these pieces have evidently been used as tools it is not possible in most cases to suggest a use based on visual inspection alone, but the use-wear indicates that some such pieces were used for cutting fibrous plants, such as [963] [2151], and these have been illustrated (Fig. 7.2).

Notched Flakes

Four notched pieces were present in the assemblage, accounting for less than 0.1% of the total. The mean average length, breadth and thickness measurements are 14.5mm, 11.0mm and 3.0mm respectively. Three of the notched pieces are notched flakes, the other being a notched blade. These pieces are thought to have been notched for some kind of use that required the angle of a trimmed indentation, though it is possible that in some cases the notch may have been associated with hafting the implement or the production of microliths.

Scrapers

For an assemblage of this size the number of scrapers is relatively low, with 109 pieces confidently assigned to this category, which accounts for just 0.8% of the assemblage total. Their mean average length, breadth and thickness measurements are 16.9mm, 14.1mm and 5.8mm respectively. A range of scraper types could be discerned (see Fig 7.1) and these include: tiny scrapers (28); small chunky end scrapers made on short bulbous blades (19); abruptly retouched thumbnail scrapers (3); pebble scrapers (2) and an assorted group of pieces (51) that did not fit any particular category, either because they were broken or because they were opportunistically made on an available flake or blade blank. A type of scraper that has not previously been recognised in North-East assemblages was a small 'tongue' or 'tablet-shaped' scraper made on a blade with abrupt retouch, regular shape and measuring around 10mm long by 8mm wide and 3mm thick (ills 4014, 4864, 3174 and 5081, Fig. 7.1). Six examples of this type were identified in the assemblage and are distinctive not only on account of their shape and size but also because they are retouched around virtually all their sides in order to achieve the intended shape. They are so small that they must have been hafted in some way although quite what their use was remains unknown. Most of the scrapers are abraded along their retouched edges, indicating that they were used as functional tools before being discarded. In all cases the retouch is abrupt and unifacial, which produces a slightly blunted edge. Although usually associated with the preparation of hides, which is confirmed to some extent by the residue and use-wear analyses, a more diverse range of activities may also be associated with the Howick implements, such as the working of hard materials like wood, bone and antler (see below, Chapter 9). If hide preparation was a key function of scraper tools at Howick then their relatively low number in the hut may indicate that this was a task that mostly took place outside.

Awls

A total of 10 awls was present in the assemblage, together with another possible example, which together account for 0.1% of the total. Their mean average length, breadth and thickness measurements are 29.0mm, 13.0mm and 5.0mm respectively. These pieces were some of the larger tools identified in the assemblage and usually had marginal retouch along all or part of one long edge up to the point (ills 2760 and 4793, Fig 7.2). These tool types are usually associated with hide working, in connection with piercing and stitching. Alternatively they may have been used on other materials such as wood, bark or bone.

Burins

Only four burins could be confidently assigned to this category out of the entire assemblage, plus one possible burin, which together account for less than 0.1% of the assemblage. Their mean average length, breadth and thickness measurements are 26.0mm, 10.3mm and 3.0mm respectively although only three survived unbroken. They took a variety of forms with one broken blade having had what appears to be a burin splinter detached from one of its long sides that terminated in a hinge fracture. This same piece, [2142], had been retouched along its opposite long edge. Two of the other burins were more typical small blades that had been snapped or struck at one end to achieve a diagonal edge. One piece, [14695] (Fig. 7.1), had been retouched along this edge while the other piece, [13519], although it may just be an accidental snap, makes a classic engraving piece.

Microliths

The microliths form the largest tool component in the assemblage, totalling 275 pieces and accounting for 2.1% of the assemblage. This is perhaps not surprising as microliths are usually regarded as forming parts of composite implements that by their very nature would require a greater number of lithic pieces to render them effective. A range of microlith types was present in the hut deposits and includes several commonly associated with Later Mesolithic industries as well as an unusual form that has been termed here 'thick-edged'. A few of the microliths are so small, such as [6324] and [9314], which have maximum lengths of 7.5mm, that they must have been used for very detailed work. However, being so small these pieces do not conform to any typical typological category. The distribution of the microliths and their functional associations are dealt with later in this section. It is notable that most are made from flint although there are occasional examples made from other stone such as scalene triangle [13485], which is made from agate.

Scalene Triangles

As with the contemporary Mesolithic hut site at Mount Sandel (see Chapters 6 and 15), the dominant form of microlith in the Howick assemblage is the scalene triangle. A total of 102 could be attributed to this class, which forms 37.1% of the microlith component. They form a cohesive typological group with a narrow elongated form evidenced by the mean average length, width and thickness measurements of 17.8mm, 5.1mm and 1.7mm respectively. The angle between the two retouched edges varies from very acute to obtuse, though in most cases this angle is close to 45°. Unlike the Mount Sandel pieces (Woodman 1985), these scalenes rarely have a concavity on the short edge, this being straight in most cases. The base of some of the scalene pieces appears to have been snapped off to give them a squared profile at the opposite end to the retouched angle. The discovery of a scalene triangle still hafted to an arrow at Lilla Loshult, Sweden (Petersson 1951), indicates that in some cases this type of microlith was used as a barb on projectiles. The proportion of left-shouldered and right-shouldered scalenes is roughly equal, which makes an interpretation of the scalenes as armatures for projectiles with bi-serial rows of microliths rather tempting. However, there is a considerable range in size for the scalene triangles, with the smallest measuring 9.5mm long and the longest 30.5mm long. Indeed the scalene component could probably be subdivided into different categories based on size and angle made by the two retouched edges. Whether this would be instructive is debatable but it would reinforce the point that there is considerable variation in the size of these pieces. It is likely that microliths were used in tools that served a variety of purposes and not just in hunting weapons (see also Chapter 9 below).

Backed Blades

A total of 54 backed blade microliths was present in the assemblage, which accounts for 19.6% of the microlith total. These small, generally narrow pieces show some variation in shape and size and are something of an eclectic group. They tend to have a slender, somewhat rectangular or narrow leaf-shape form, but they are not triangles or crescents and nor do they form obvious points. Occasionally they may have a crescentic shape but the retouch is along the back edge and not the curving edge, which precludes them from the latter category. These pieces have retouch usually along all, or part, of the length of the thickest edge and it is usually abrupt, although light edge-trimming is evident on some pieces. One piece of particular interest is [4410], which has a deliberate notch towards the proximal end that may have served a hafting purpose. The mean average length, width and thickness measurements are 18.4mm, 5.7mm and 1.9mm respectively.

Crescents

A total of 21 crescent microliths was present in the assemblage, which accounts for 7.6% of the microlith total. These pieces are typically small in size and have abrupt retouch along their curving edge. In some cases, such as [9137] (Fig. 7.2) and [7814], there was retouch on both the straight and curving edge but these are the exception rather than the norm. The crescents have mean average length, width and thickness measurements of 15.4mm, 4.6mm and 1.7mm respectively. There is some variation in size with the smallest piece measuring just 10.5mm in length and the largest 25.5mm. They probably compare most closely with the 20 crescentic microliths from the Scottish east coast site at Fife Ness, which are very similar in size and appearance and come from a radiocarbon-dated site that is contemporary with the later phases of occupation at Howick (Wickham-Jones and Dalland 1998). The authors of the Fife Ness report suggested that the focus on crescentic microlith forms at this site could be associated with a particular specialist activity, although there was no clear evidence for what this might have been.

Points

Fifteen points were present in the assemblage, which account for 5.5% of the microlith total. The most striking type are the narrow elongated forms, retouched on both long edges, which can be equated with Woodman's 'type A needle points' from Mount Sandel (Woodman 1985, 45). These needle points have mean average length, width and thickness measurements of 22.2mm, 6.1mm and 2.3mm respectively. There are also smaller points that tend to be wider and shorter but may also have retouch on one or both edges. These more squat points have measurements of 21.3mm, 6.3mm and 2.4mm respectively. The retouch on all the points is usually abrupt, although some light edge trimming has been used on certain pieces, such as [2748] (Fig. 7.2), to achieve the desired shape along the thinner long edge.

Other Triangles and Geometrics

Fifteen triangles and geometric microliths were present in the assemblage, which account for 5.5% of the microlith total. This group could be subdivided into three types: isosceles triangles, trapezes and a lanceolate. Twelve isosceles pieces were identified, accounting for 4.4% of the microlith assemblage. These pieces generally had a regular shape with two sides of equal length and mean average length, width and thickness measurements of 12.6mm, 5.1mm and 1.4mm respectively. However, there appeared to be a divide between a small group measuring less than 10mm in length and a larger group measuring 14mm or more. The retouch was abrupt in all instances and, notwithstanding their more uniform shape, they were very similar in form to many of the scalene triangles. The two trapezes were both small and very similar in size, with mean average length, width and thickness measurements of 13.5mm, 5.0mm and 1.3mm respectively. The single lanceolate piece was small, having mean average length, width and thickness measurements of 21.0mm, 6.0mm and 4.0mm respectively. Geometric forms such as these are typical in Later Mesolithic flint assemblages across the British Isles, such as the two isosceles triangles recovered from Filpoke Beacon on the County Durham coast (Jacobi 1976). Nearly all of these small geometric pieces were recovered by sieving and if this had not taken place, no strictly geometric component would have been recognised in the microlith assemblage from Howick.

Other types

A single rod microlith was recovered from the site and being less than 5mm in width would fall into the 'narrow rod' category as defined by Woodman (1985, 43). This piece, [10876], is retouched along the full length of one side parallel to the main axis of the blade. Both ends of the piece are squared off, suggesting they were deliberately snapped to produce this effect or that they are broken.

A single example of a *lamelles à cran* microlith, [3630], was found, with retouch that has thinned the blade along one edge but, unusually, on the ventral side. Further down the same edge on the surviving original blade edge is a section of light edge trimming, but this time on the dorsal side. These types have been suggested as representing a stage in the manufacture of scalene triangles (Brinch-Petersen 1966), but as there is additional edge trimming, this suggests it could have served as an implement – possibly used as a point. It measures 24mm long by 7mm wide by 2mm thick.

Two obliquely blunted microliths were present in the assemblage. These types of microliths are usually associated with Early Mesolithic assemblages although they do sometimes occur in later assemblages (e.g. Filpoke Beacon, Jacobi 1976, 71). These pieces appear fresh and are likely to be contemporary with the other Howick material. The mean average length, width and thickness measurements for these pieces are 15.0mm, 5.5mm and 1.3mm respectively.

A total of 65 unclassified microliths was present in the assemblage, which account for 23.6% of the microlith total. Most of these pieces were broken and/or burnt and so could not be reliably attributed to any particular microlith class. However, all were made on narrow blades and were evidently of the same narrow-blade tradition as the rest of the assemblage. Retouch was abrupt in all instances and some light edge trimming could be observed on a few pieces. Two of the pieces may be examples of *Mèche de foret*, resulting from re-pointing a tool such as an awl.

Microburins

Nine microburins were present in the assemblage, accounting for 0.1% of the total and therefore rare. Being the snapped off ends of microlithic blades, their mean average length, breadth and thickness measurements are small: 7.9mm, 5.2mm and 1.4mm respectively. For most of the pieces it is not clear from which side they have been notched, as the bulbar end does not survive, but in at least one unambiguous case the notch had been made from the right when viewed from the dorsal side. Given that there are equal numbers of right and left-handed scalene triangles it would be unlikely that a preference for notching one side was found.

External Pits

A total of 58 lithics was recovered from the pits to the south of the Mesolithic hut. Since they may be later features with residual finds (Chapter 5), this material is only briefly described as it is not considered to be of particular interpretive value other than to document its presence.

The lithic summary shows the usual predominance of flakes and blades and both the platform core and the backed blade microlith indicate the presence of diagnostic Mesolithic material. The blade component is large and shows a concern for small narrow parallel-sided blade production, some showing evidence of bi-polar flaking. All these flints compare directly with the Mesolithic material from the hut deposits and not one piece of possibly later material was in evidence. The same variety of flint colours was present, together with the same types of beach and glacial flint; 79.3% of the material is broken and 8.6% shows patina development.

Type	**Actual Number**	**As % of Assemblage**
Unretouched Flakes and Blanks	34	58.6%
Unretouched Blades and Blanks	22	37.9%
Core	1	1.7%
Microlith	1	1.7%
Total	**58**	

Table 7.3. Summary of artefact types from the pits outside the hut.

Context	**Flakes**	**Blades**	**Core**	**Microlith**	**Total**
Pits					
013	3	2			5
014	17	12			29
015		1			1
021	2	1			3
061	1				1
Suspected Sheep Burial Pits					
023	2				2
037	2				2
039	1	1			2
081	4	1	1		6
083	1	4		1	6
085	1				1

Table 7.4. Summary of pit lithics by context.

Unstratified Material

A total of 901 lithics was recovered from unstratified contexts around the Mesolithic site, mostly from the topsoil (001) and subsoil (003) layers. Importantly, the presence of a broken leaf-shaped arrowhead demonstrates Neolithic activity on the site for which no other trace has survived, although this piece may reflect no more than casual loss. This is an invasively retouched specimen made from a red-coloured flint. Otherwise, the rest of the unstratified assemblage is directly comparable to the Mesolithic material recovered from the hut deposits. The same range of raw materials is present, which includes 3 pieces of chipped agate (0.3%), 8 chert (0.9%), 14 quartz (1.6%), and the remaining 876 (97.2%) flint. Of all the flint that could be provenanced, 185 pieces (84.1%) were beach flint and 35 (15.9%) glacial flint. The same range of colours is found in the unstratified material including the predominant light grey shades, together with dark grey, red-brown, white, orange, brown, fawn, purple and pink. The range of tool types accurately reflects the range of types recovered from the stratified hut deposits, including scrapers, burins and microliths (see Table 7.5 below). Of the eight microliths recovered, two are scalene triangles, one a crescent, one a backed blade and the remaining four could not be classified. Six of the scrapers were tiny scrapers and the other six abruptly retouched flakes and blades, not able to be ascribed to any particular classic scraper type. The retouch is abrupt on most of the finished pieces although occasional edge trimming was attested. One of the burins (1388) is worthy of particular note as it is heavily patinated and made on a broad blade and is likely to be of Late Upper Palaeolithic or Early Mesolithic date. Being unstratified, this piece could be present as a result of earlier activity on the site and together with a heavily patinated retouched blade (2291) hint at an earlier human presence on this site.

The lithic summary table shows the usual predominance of flakes and blades in addition to primary pieces, including collected beach nodules and test pieces. The blade component (19.2%) compares closely with the blade proportion in the stratified hut assemblage (18.0%). This substantial proportion shows a concern for the production of small, narrow, parallel-sided blades directly analogous with those from the hut. The flakes, blades and associated debitage display working at all stages of the reduction sequence, indicating the working of nodules through to tools in the immediate environs of the site. Bi-polar flaking is attested on a number of pieces, suggesting the use of stone anvils and the need for strategies that allow small nodules to be utilised. Of the unstratified total, 64.9% was broken although some of this is no doubt a result of plough damage and other later disturbance. The truncation of some of the hut deposits, particularly the upper hearth pits, would no doubt account for at least some of the 13.4% burnt lithics in the unstratified assemblage. One distinct difference with the stratified lithic assemblage is the proportion of patinated material: in

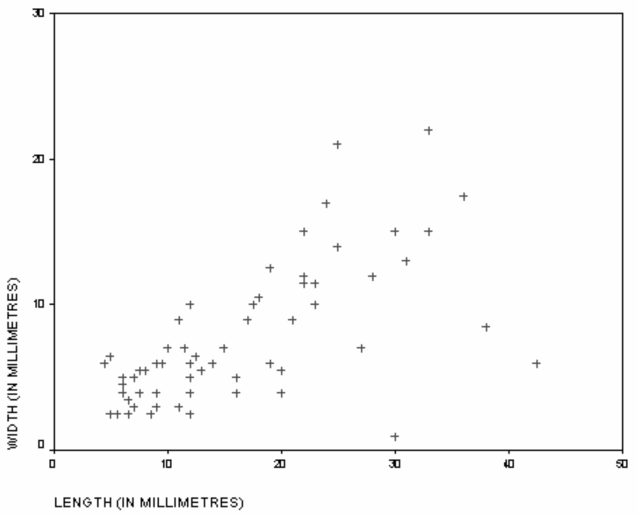


Table 7.5. Summary of artefact types from unstratified contexts.

the stratified assemblage, patinated pieces account for 1.2% of the assemblage (see above), whereas in the unstratified assemblage they account for 32% of the assemblage. As the two assemblages are both clearly Mesolithic and directly associated, it raises the question why there should be such a profound difference in the degree of patina development between these two groups of material. Whatever the specific reasons for this difference, it is evident that the conditions in the sandy stratified deposits did not encourage patina development, whereas those prevailing in the humic sandy soils above appear to have facilitated a distinctly more rapid development.

Stratigraphic and Spatial Distribution

Kristian Pedersen

Introduction

This study seeks to investigate the temporal and spatial patterns in the lithic assemblage from the Mesolithic hut deposits. It consists of three discrete inquiries: firstly, a study of the metrical attributes of the blades and microliths; secondly, an inquiry into the composition of the assemblage by phase; thirdly, an investigation of the spatial patterning in the artefacts. As the dwelling comprised three structural phases (1a–3), these studies are arranged in three corresponding sections, followed by a comparative analysis and then a summary of the main points. Each of the inquiries is prefaced by a discussion of the methods, principles and assumptions that underpin the analysis. The assumptions are based partly on observations made at other Mesolithic sites in North-West Europe, partly on ethnographic studies of forager populations, and partly on analyses of patterns produced in flint-knapping experiments.

All small finds encountered during the excavation were labelled according to the deposit in which they occurred and digitally plotted. All excavated sediment was subjected to flotation and wet sieving through a 2mm mesh and this produced a substantial quantity of further lithic material (see above, this Chapter), most of which was too small to have been identified during excavation. The deposits from which the latter material was recovered are therefore known, but its precise location within these deposits is not. The method by which the lithic material was recovered did not affect the study of the metrical attributes of the artefacts, nor the investigation of the lithic assemblage by phase. It did, however, affect the selection of material for the spatial analysis, since debitage, given its small size, is not well represented in the material that was digitally plotted and therefore those that were recorded in such a fashion are unrepresentative as they form only a small portion the overall debitage assemblage. This is also true for the burnt flint, which was also largely recovered through the flotation process as it tended to be small in size.

Not all classes of the larger artefacts are sufficiently prevalent for a statistically meaningful inquiry based on their spatial patterning to be conducted (e.g. scrapers, awls, burins). Furthermore, some classes of artefact are so poorly represented that their occurrence in an assemblage has little significance (e.g. the single 'rod' microlith). This problem is to some extent reduced as not all artefacts have the same significance for the reconstruction of past activities. The blades and microliths are two classes of artefact of foremost importance in the study of Mesolithic assemblages. Because the lithic industry at Howick was blade-based, it is assumed that blades, and those tools based upon them, were accorded special attention in order to achieve consistent form and proportions, as well as in their placement and handling during their production and use. The microliths are of special interest because of the social significance that they may contain: ethnographic studies provide examples of hunter-gatherer populations using the idiosyncratic stylistic attributes of their projectile points to express kinship and tribal affiliations (Sackett 1990; Wiessner 1983; 1990). Based on idiosyncrasies in microlithic armatures observed in the Low Countries (Gendel 1984), and subtle changes in the shape of flake axes noted along the Øresund littoral in Denmark (Vang Petersen 1982), the existence of discrete social territories has been inferred. It might also be expected that because of the potential significance of these artefacts in social life they were fashioned with distinctive attributes, and thus conformed to a stylistic template more closely than any other types of tool preserved on the site. The identification of such patterns cannot be achieved through the study of a single site, as the idiosyncrasies only become apparent when contemporaneous assemblages throughout a given region are compared. It is however worth bearing in mind that these artefacts are likely to have had a significance beyond that of armatures for hunting weapons and that their production was governed by more than merely functional considerations. It has already been referred to above how this assemblage fits into the 'micro-triangle' technocomplex identified at other contemporary North-East British coastal sites such as Filpoke Beacon (see also Jacobi 1976).

An assumption applied to the spatial analysis undertaken here is that blades are laid out in either concentric patterns around the artisan whilst he is in the process of producing these implements, or arranged to one side (according to whether the artisan was right- or left-handed), in arc-shaped rows:

> 'One phenomenon often seen in flint knapping experiments is that knappers behave differently with respect to blades than to the flint waste of flakes and chips …. the knapper may collect the blades in front of him, placing them more or less in a semi-circle. Or he may place them to his left or to his right, often in arc-shaped rows. Small flakes and chips, on the other hand, just fall to the ground, or are brushed off the knapper's lap. Blades are what the knapper is aiming to produce, so it is only natural that they should be treated with special care and attention.' (Johansen and Stapert 1998, 34).

The patterning in the distribution of blades shall therefore serve as the cornerstone of the attempt made here to reconstruct the locales at which flint knapping was undertaken within the hut, whereas the distribution of flakes and other types of lithic material is of only subsidiary significance in this respect. The microliths are, however, important since they were treated similarly to blades; their arrangement is similar, as they are subject to retouch and arrayed for hafting into bone or wooden points. The distribution of blades and microliths is considered concurrently with cores, which are customarily deposited in the immediate vicinity of flint-knapping activity. The distribution of formal tools may not be informative in connection with the location of flint-knapping events, but they may provide indications of where activities associated with their use took place. Only scrapers occurred in sufficient quantity to render such an inquiry meaningful, and because these tools are typically associated with the preparation of hides, this affords important evidence since the faunal remains indicate the presence of seal and other mammals such as pig and fox (see Chapter 10), which, in addition to providing meat, would have been a valuable source of skin and fur.

Although the microliths are an important component of the assemblage, they are not considered separately according to type, as all types of microliths occurred throughout all stratigraphic phases and so no typological difference through time is apparent. When the different types of microliths were plotted spatially, no difference could be observed between the spatial patterning of microliths of different types. Apart from the scalene triangles and backed blades, the rest of the microliths occurred in such small quantities that they were too few to allow for any statistically significant results to be obtained anyway. As a consequence, the microliths were considered together throughout this analysis.

The spatial analysis also relies on studies of the distribution of flint produced by modern flint knappers. A few remarks concerning the nature of the flint resources available to the inhabitants of the Howick hut are necessary by way of preface to this discussion, as the quality and quantity of the raw material imposed constraints on both the metrical attributes of the artefacts and on the distribution of lithic waste. Many of the models derived from the distribution of flint waste from tool production have been undertaken by flint knappers in flint rich regions, or by flint knappers who have access to flint and chert nodules of good quality and reasonable size. The inhabitants at Howick did not have such resources: they had to rely on small pebbles found on the shore, which were often riddled with flaws. The size of the pebbles renders it difficult to use the antler punch for the manufacture of blades and therefore alternate methods, less likely to produce regular blades and discrete waste patterns, were employed. Amongst these methods was direct percussion; the prevalence of this technique in the production of blades is indicated by the crushing on the platform and by the absence of a pronounced lip on the bulb of production (see also above, this Chapter). Another method employed was the 'hammer-and-anvil', or 'bi-polar' technique, which consists of placing the flint pebble on an anvil stone and striking the top with a stone or antler billet and thereby detaching blades. This is an effective method for the production of blades from small pebbles, but it does not result in the manufacture of regular blades with the same consistency as the use of an antler punch. Moreover, the distribution of flint waste is also less regular.

It is also important to bear in mind that, given the paucity of good quality flint, the tools might have been resharpened and transformed into other types of tools as they broke and became increasingly worn (see above, this Chapter). The metrical attributes of the microliths and the blades might, therefore, not be directly comparable to those in contemporaneous assemblages from regions benefiting from more copious quantities of flint of good quality. In regions where high-quality flint was prevalent, a more profligate use of tools is observed. For instance, in Denmark during the Later Mesolithic, micro-wear analysis has determined that long and regular blades were often used on only one or two occasions and then discarded as waste (Juel Jensen 1986). Since most flint knappers involved in experimentation work in flint-rich regions, a perfect correspondence in waste patterns between that observed on the occupation floors at Howick and that replicated in experiments cannot be expected. Nevertheless, the general patterns are likely to be comparable, which is the justification for the comparisons below.

The main assumption regarding the use of domestic space in this study is that the hearth was the focus for internal activities, including flint knapping. The hearth as a focus of domestic life is partly explicable by practical considerations, such as the warmth, light and cooking requirements, which it affords to inhabitants whilst they undertake various tasks. Nevertheless, symbolic considerations must also be entertained, as the ethnographic record is replete with examples of houses representing microcosms, and with specific features bearing religious significance (e.g. Eliade 1959; 1964). Other aspects pertaining to the use of domestic space in small structures amongst hunter-gatherers involves the segregation of families on either side of the hearth (Grøn 1989; 1999). The segregation of activities, in accordance with the observance of taboos, must also be considered because some populations, such as the Netsilik Eskimo, strictly avoided the processing of animals living in different environments (such as terrestrial and marine beasts) in the same area (Balicki 1962). An even more complex series of taboos occasioning the spatial segregation of activities, and even the sex of those permitted in certain precincts or structures, is encountered amongst the Pacific peoples like the Kwaio (Keesing 1982). Although the inferences ventured in this report principally concern industrial and economic behaviour, some profitable courses of inquiry are suggested that might elucidate social and symbolic practice.

Methods

The principal objective of the metrical analysis is to attempt to identify distinctions in the blades and microlithic armatures from each phase of the Mesolithic occupation, as this might provide a basis for observing technological developments and/or changes in activities carried out during succeeding phases. A metrical characterisation of these implements will facilitate a comparative analysis of the assemblage from Howick with those from other contemporaneous sites in the British Isles and North-West Europe. The attributes of blades and microliths are those most commonly calculated from Mesolithic assemblages, and indeed, the study of the typological attributes of microliths has traditionally formed the foundation for chronological studies, as well as the arrangement of material into discrete industries, typically regarded as revealing the degree of social interaction or cultural affinity amongst regions.

The availability of raw material from which the lithic tools were produced did not change through the period in which the dwelling at Howick was occupied, nor did the *chaîne opératoire*. It is therefore assumed that there would be little probability of a change in the metrical attributes of the debitage; the material most likely to produce any diachronic change would be blades and microlithic armatures, since their form was governed by stylistic considerations more than the technical constraints imposed by the reduction methods and the characteristics of the raw material. However, no such changes are evident.

A clear pattern emerges in the length-width relationship of the blades. However, as this class of artefact is customarily defined by the length exceeding the width, it is necessary to tease out patterns which might have stylistic and industrial significance, rather than those that merely express the classification criterion employed (Andrefsky 1998, 69). Moreover, it is also necessary to contend with the variability in the blade assemblage introduced by the decision not to adhere to a strict length-width ratio for the classification of the artefact as a blade. Instead, the intention of producing a blade was deemed most important. This approach seemed justified because of the nature of the lithic raw material available to the Mesolithic artisans, which consisted overwhelmingly of small, flawed beach pebbles. Such material is most effectively worked by the hammer-and-anvil technique which, when used on lithic material of this quality, results in the production of irregular blades. The ability to consistently produce blades from this material with a length-width ratio of 2:1 or more (the traditional metrical criterion used to distinguish blades from flakes) is thus less likely than with better-quality flint resources. With regard to these points, the decision to make intuitive judgements on the intention to produce blades is no more arbitrary than an insistence that blades might be distinguished from flakes by a minimum length-width ratio. Furthermore, it is more likely to approximate the actual quantity of blades attempted whilst flint knapping at Howick than the imposition of metrical criteria developed to define this class of artefact from regions that provide better flint resources.

Less equivocal is the identification of microliths, for the retouch applied to one or more of the sides clearly distinguishes this class of artefact from ordinary blades and flakes. Nevertheless, in rare instances there is scope for uncertainty in distinguishing these artefacts from scrapers, awls, and so forth because of discontinuous retouch or the anomalous shape of the blade upon which they were produced. A key assumption of this study is that not all blades were regarded as suitable for the production of microliths – only those with specific proportions were typically selected, and therefore the microlithic armatures will tend to aggregate in clusters with metrical attributes diverging from the main body of the blades. The degree of this divergence is presumably governed by the difference in the blades commonly produced and the characteristics regarded as desirable for the production of microliths.

The statistical methods employed to identify significant metrical attributes involves the calculation of the correlation coefficient, mean lengths and widths along with standard deviations, and cluster analysis. The calculation of correlation coefficients involves the use of the commonly applied regression formulae such as the Pearson correlation (Shennan 1997), which indicates whether the correlation is significant. This is undertaken on the basis of bivariate correspondences, since only two variables (length and width) are relevant in this investigation. The Pearson correlation assumes that a linear relationship exists between length and width; this is a justifiable assumption in the study of blades, as this class of artefact is usually defined by this linear relationship. At a 0.05 level of significance, the nearer the correlation coefficient is to 1, the more significant the relationship (Shennan 1997, 127ff.).

The second method that is employed is that of cluster analysis. This seeks to arrange the material into discrete clusters, or groups of finds. A more detailed discussion of the assumptions underpinning the use of the *K*-means algorithm occurs in the section pertaining to spatial analysis (see below), but it is apposite here to mention the use of hierarchical cluster analysis. This method seeks to arrange the material into groups, and is therefore 'agglomerative'; the clusters are most clearly identified by using dendrograms. These plots are typically extremely large, and therefore they are not presented in either the text or appendices; however, the agglomerative schedules are offered in tabular form as these represent visual depictions of the clusters on a manageable scale. The principal concern in using the hierarchical cluster method is at what scale the clusters are significant, since many small clusters with a population of only one or two cases are identified. A certain subjectivity must come into play here – the visual depictions in the dendrograms permit the selection of the most inclusive clusters. A more objective selection of clusters is not possible for two reasons: firstly, and most important for the purposes of this inquiry, is that there is no model of blade metrics against which the material might be tested. The experimental studies of blade production have chiefly been focussed on the metrics and spatial distribution of this class of artefact produced on flint of much better quality than that available to the artisans at Howick, and also on large nodules. Secondly, the size of the pebbles available at Howick precludes the use of the antler-punch technique, which results in the manufacture of long, regular and elegant blades. The blade clusters selected were therefore those that encompassed groups that formed a statistically significant sample of the overall assemblage for which metrical attributes could be determined. Small clusters of no statistical significance that remained were nevertheless kept, since these represent outlying examples and to seek to subsume these in the other clusters would skew the results.

Metrical Analysis

Blades

The number of blades suitable for metrical analysis is less than the total quantity of blades present in each phase of the occupation, as most of them were broken and their original dimensions are unknown. Therefore, the blades investigated here only form a portion of the total blade assemblage in each phase, ranging from 6.43% in Phase 1 to 15.56% in Phase 3 (Table 7.6). The largest quantity of artefacts was recovered from Phase 1 (a and b) and this also provided the largest quantity of complete blades. The proportion of complete blades expressed as an overall percentage of blades within the phase is, however, lowest in Phase 1. No obvious reason for this suggests itself, nor is it apparent why Phase 3 provides the largest proportion of complete blades. The tendency for the percentage of complete blades to increase through time, as the duration of the structure's use becomes shorter (see Chapter 6), does imply that a correlation between the fracturing of blades and length of occupation exists.

Phase	Number of Blades	Number of Complete Blades	Percentage of Blade Assemblage
1	1164	181	6.43
2	511	63	12.32
3	649	101	15.56

Table 7.6. Complete and fractured blades by phase.

The metrical attributes of all the blades from Howick are depicted in Figure 7.3. A positive relationship between length and width is immediately apparent, but it is not apparent whether this merely expresses the selection criterion. Moreover, another salient aspect of the assemblage is that there is considerable overlap, with a tendency for the blades to be short (<20mm in length) and thick (<15mm in width). The clustering of blades into groups with specific metrical attributes is explored by employing cluster analysis, of which the *K*-mean algorithm shall assume a prominent role. For the moment, however, it is worth remarking on the characteristics of the overall blade assemblage. The

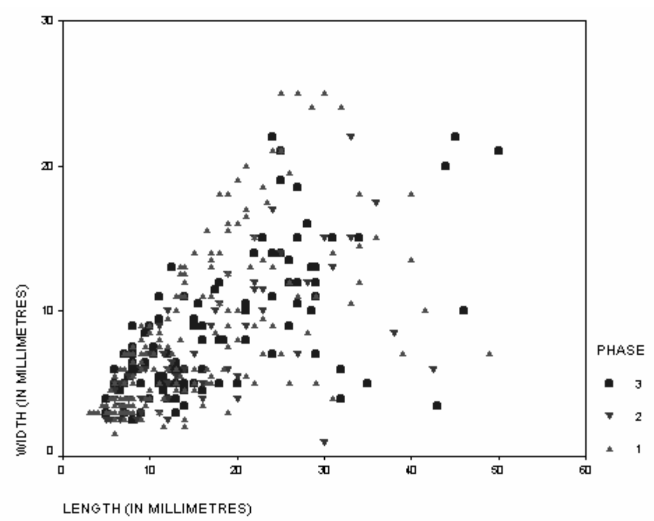


Figure 7.3. Length-width relationship of blades from all phases.

Pearson Correlation Coefficient of 0.618 demonstrates a significant linear relationship, calculated at the 0.01 level, between the length and width of the blades. The blades have a mean length of 16.3971 mm and a mean width of 8.4043 mm; the standard deviations are 9.34156 and 5.11577, respectively. There is, then, considerable variability in the metrical attributes of this assemblage. The most appropriate method for identifying significant similarities is therefore by arranging the material from each phase into clusters and then comparing them.

Phase 1

As discussed above, the number of complete blades expressed as a percentage of the overall blade population is least here of all the assemblages. A cursory glance at the length-width relationship of the blades presented in the scatter plot in Figure 7.4 reveals that many of the blades are short (<20 mm) and wide (<10 mm). The Pearson Correlation Coefficient (0.615) shows, firstly, that there is a significant linear relationship between length and width; secondly, that this assemblage closely conforms to the attributes that characterise the blades from all the phases of occupation.

The hierarchical cluster analysis, which seeks to group the material in hierarchical groups, identified six clusters. A *K*-means test was then run on the basis of the existence of these six clusters. The number of blades in each of the clusters is presented in Table 7.7, whereas the metrical centres of these clusters is presented in Table 7.8. The most striking aspect of the blade clusters is that the largest cluster (4) is characterised by short and wide blades, with a length-width ratio of just slightly under 2:1. Indeed, half of the clusters (4, 5, and 6) are distinguished by a length-width ratio of less than 2:1. This does not seem to reflect a stylistic preference, as the metrical attributes of the microlithic armatures, which were based on selected blades, differs slightly. Rather, this pattern was most likely governed by the raw material availability because it is essentially repeated in each phase. Moreover, the largest clusters fall within the same general length-width range; these could hardly be regarded as affording the most desirable blade metrics, given they were so short and thick and that the microlithic armatures seemed to have been, as a rule, selected from longer and more narrow blades.

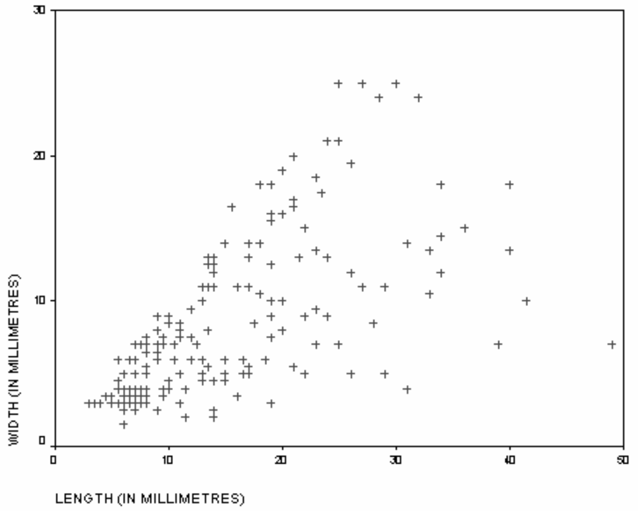


Figure 7.4. Length-width relationship of blades from Phase 1 (Pearson Correlation = 0.615).

Phase	Mean Length	Mean Width	Standard Deviation (Length)	Standard Deviation (Width)
1	15.5939	8.5387	8.88848	5.46439
2*	15.1296	6.5000	9.92917	4.60769
2	16.2222	7.5952	9.36008	4.69974
3	18.0594	8.7129	10.15906	4.69007
All	16.4275	8.4203	10.15906	4.69007

Table 7.7. Mean length and width of blades from all phases (Denotes calculations made without material from the levelling deposits).*

Phase 2

The metrical attributes of the blades in Phase 2 are fundamentally similar to those in Phase 1, although there is some uncertainty concerning the provenance of those blades occurring in levelling deposits [115], [118] and [210]. This uncertainty occurs because the levelling deposits might have introduced material from the preceding occupation horizon, or from material introduced into the hut (see Chapter 5). If material was introduced to the hut, the metrical attributes would presumably be largely similar since this material is contemporaneous with the occupation; if the material was chiefly introduced from the former source, the metrical characteristics of the blades from these deposits might more closely approximate to those from Phase 1.

In order to address this problem the metrical attributes of the assemblage were characterised in the following way. Firstly, by calculating the mean length and width of the blades from the overall assemblage, then secondly calculating the same measurements from the material that does not derive from the levelling deposits, and then thirdly calculating the same measurements from the material within the levelling deposits. An attempt to identify groupings in the results from these analyses could then be made. The blade assemblage as a whole is broadly similar to that in Phase 1, and, indeed, with the material from the Phase 3 occupation horizon. This can be seen in Table 7.9, which presents not only the calculations for mean length and width but also the standard deviations in these values.

The cluster analysis of the blades occurring in only those deposits that were not part of the levelling spreads reveals five groups. The largest group

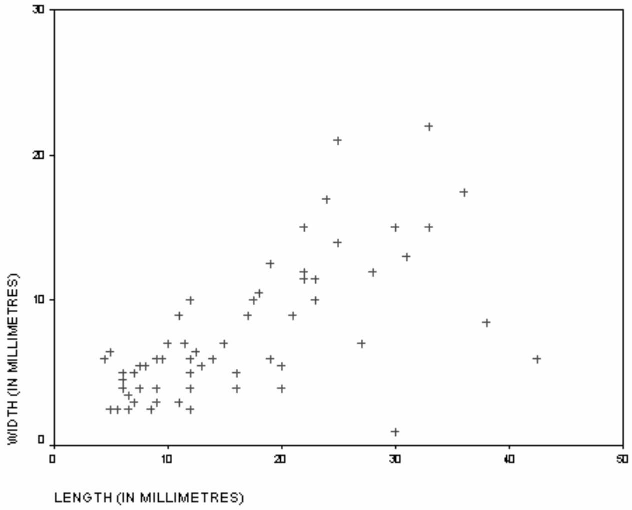


Figure 7.5. Length-width relationship of all blades in Phase 2 (Pearson Correlation = 0.650).

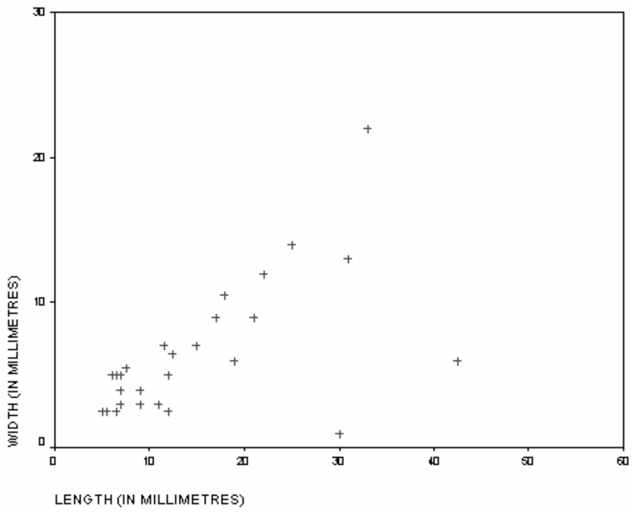


Figure 7.6. Length-width relationship of blades from Phase 2, excluding those from the levelling deposits (Pearson Correlation = 0.589).

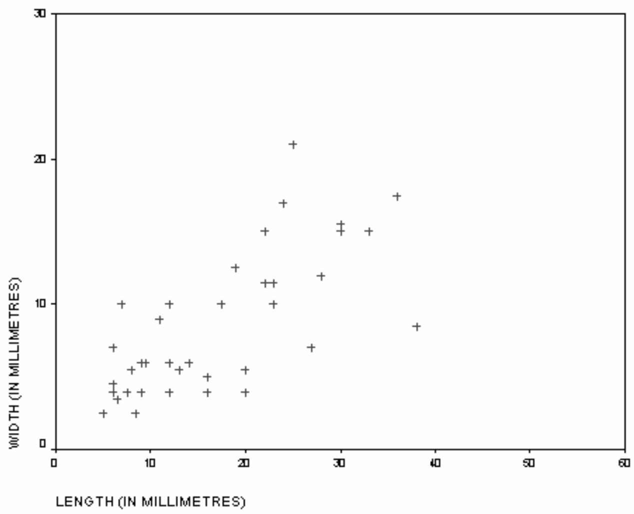


Figure 7.7. Length-width relationship of blades from levelling deposits in Phase 2 (Pearson Correlation = 0.726).

contains sixteen specimens, followed by a group containing only seven, whereas the remaining groups consist of only one or two specimens. As with all the other phases, the richest cluster is distinguished by blades that are relatively short and thick, with a length-width ratio of slightly less than 2:1. The second largest cluster is centred on material that has a ratio of slightly over 2:1. The remainder of this material represents outlying artefacts with metrical attributes that diverge substantially from the main body of finds.

A very strong correlation between length and width is observed when only the material from the levelling deposits in Phase 2 is considered. This is, indeed, the strongest linear correlation seen in any of the material subjected to a metrical analysis. Nevertheless, the grouping of blades into discrete clusters follows the pattern already established, that is to say, the largest cluster consists of material that is distinguished by a length-width ratio of roughly 2:1 and is generally short and thick. Therefore, it is not possible to determine whether this material consists largely of material from the preceding phase or was instead deposited whilst the levelling deposits served as an occupation floor.

Phase 3

The visual impression given from the length-width relationship of the blades in this phase is that several discrete groups exist and that there is considerable variability in the metrical centres of the groups. This, however, is not immediately suggested by the Pearson Correlation Coefficient, which displays a strong linear relationship between length and width. Again, three clusters were identified; the first two of these contained the largest amount of material, whereas the third represents an outlying metrical centre. Some metrical variation is observable in Phase 3, as the largest cluster is centred on longer blades than in the preceding occupation phases. Nevertheless, the length-width ratio of these blades remains centred on a point that is still slightly less than 2:1.

The arrangement of the material from levelling/occupation deposit [049] into clusters shows the same tendency. Only three clusters were identified, the largest of which consisted of material centred on blades that were longer than those in the preceding phases, but still provided a length-width ratio of slightly less than 2:1.

Microliths

The microlithic armatures display relatively little metrical variability, a tendency which is obvious both in the calculations of their mean length and width and the concomitant standard deviation in both these attributes, as well as their distribution in the scatter

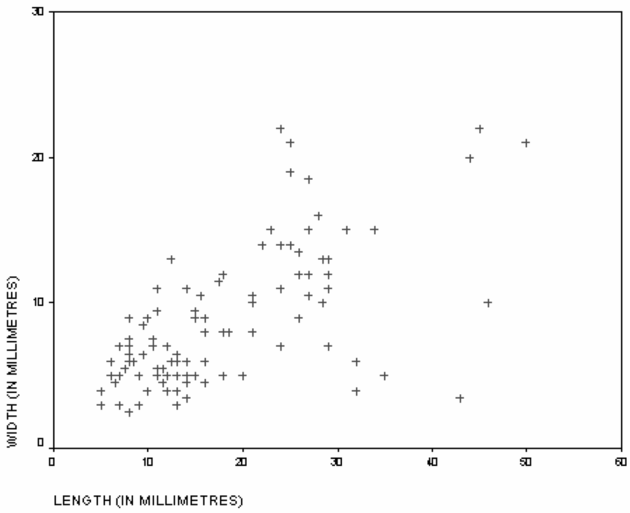


Figure 7.8. Length-width relationship of blades in Phase 3 (Pearson Correlation = 0.633).

diagram. One immediate impression is that the standard deviation in the length of the armatures is roughly half that of the blades, whereas the deviation in width is only slightly less than that observed in the blades. Moreover, the mean length is significantly greater amongst the microlithic armatures. The cumulative effect of these observations is that the armatures were fashioned with greater metrical consistency than the blades. This might be explained by the fact that only specific blades were selected for further manufacture into microliths; thus, the main cluster of blades does not represent those with the most desirable characteristics for the production of armatures.

Before describing the metrical analysis, it is worth considering the possible causes of the breakages in the microlithic armatures. The fractures probably occurred because of use, being trodden upon, or during their manufacture. Breakage during hunting has been investigated in other studies of fracture patterns in microlithic armatures (e.g. Fischer *et al.* 1984; Friis Hansen 1990), but the microliths were obviously not used for hunting within the precincts of the dwelling. The high occurrence of fractured implements cannot therefore be attributed to this

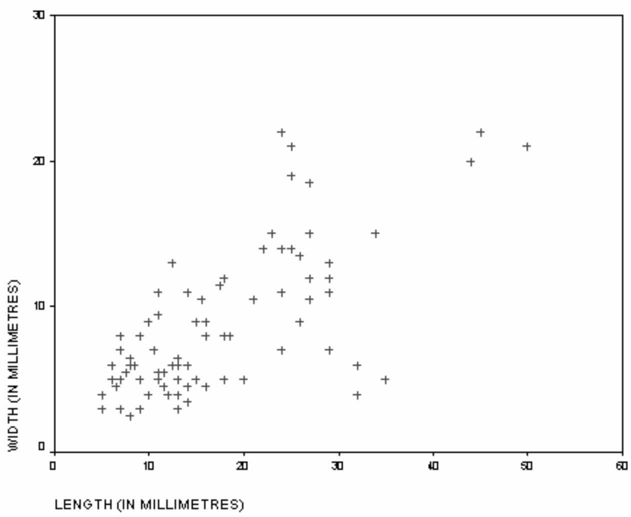


Figure 7.9. Length-width relationship of blades in levelling deposit [049] from Phase 3 (Pearson Correlation = 0.692).

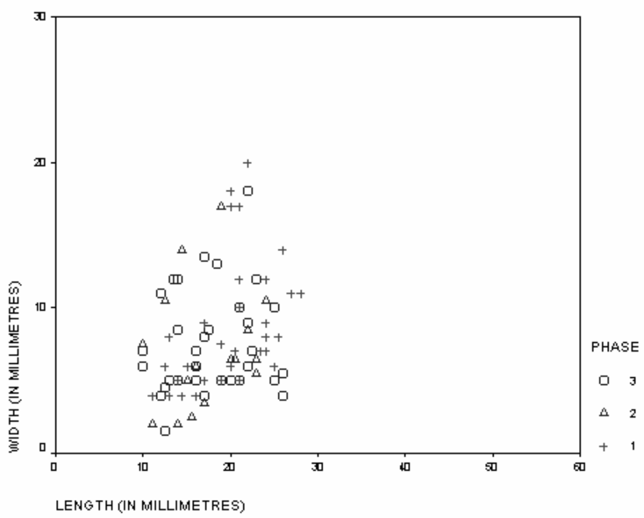


Figure 7.10. Length-width relationship of all microliths (Pearson Correlation = 0.310).

Phase	Number of Microliths	Number of Complete Microliths	Percentage of Microlith Assemblage
1	110	31	28.18
2	62	18	29.03
3	96	33	34.37

Table 7.8. Number of complete and fractured microliths.

Phase	Mean Length	Mean Width	Standard Deviation (Length)	Standard Deviation (Width)
1	20.1613	8.8387	4.45419	4.44107
2	16.9722	7.0000	4.34021	3.97418
3	17.6061	7.5152	4.75125	3.57833
All	18.4329	7.9024	4.70725	4.03185

Table 7.9. Mean length-width relationship of microliths.

activity. The most likely explanation of the fracturing must be that they broke whilst being retouched or repaired, that broken projectiles were brought into the dwelling in the wooden or bone tools in which they were hafted for subsequent replacement, or that they were trodden upon. Little indication that they were transported into the hut lodged within animal bone is forthcoming, but this does represent a possibility – consider the projectiles embedded in the bone of aurochs from Vig and Prejlerup (Aaris-Sørensen 1984), and that lodged in the elk at Skottemarke and Favrbo (Møhl 1980). Such an explanation would not necessarily account for all the broken microlithic armatures, but it is certainly possible that some were introduced to the structure in this manner. Being trodden upon remains the most likely explanation, but a resolution of this matter must await a study of the fracture patterns.

Phase 1

The microlithic armature assemblage from Phase 1 was the only one of the three that revealed a statistically significant linear correlation between length and width, calculated by the Pearson Correlation Coefficient at a 0.05 level of significance. Although the relationship is significant, the sample size for each cluster is quite small.

Four clusters are apparent in this material. Three (2, 3 and 4) contain a similar quantity of material, whereas the outlying one (1) consists of an anomalous broad armature with a length-width ratio close to 1:1. The armatures in the largest cluster have a relationship of nearly 3:1; the others range between 2:1 and nearly 3:1. This underscores the disparity in the metrical attributes between the main body of the blades and those selected for further production of microlithic armatures. To be sure, some relatively broad blades were selected, but the vast majority of those selected for manufacture into armatures were long and narrow.

Phase 2

The levelling deposits in Phase 2 contained most of the microlithic armatures; only 5 of the 18 complete microliths were encountered in other deposits. Such a small sample cannot be profitably investigated by cluster analysis and, moreover, any metrical characteristics identified would not be statistically significant. All the microlithic armatures, regardless of the deposit from which they derived, have therefore been collapsed together in this inquiry. One aspect of this assemblage is immediately apparent: there is no statistically significant linear correlation between the length and width of the microlithic armatures in Phase 2, when calculated by the Pearson Correlation Coefficient at a 0.05 level of significance. This might represent two phenomena, the first being that there is simply no correlation, the second being that two discrete clusters distinguish this assemblage. Both of these possibilities can be resolved through an analysis of the clusters into which the microlithic armatures might be arranged.

Of the four identified, only two clusters (2 and 3) are significant. The other clusters represent outliers that could not be encompassed in the first clusters mentioned above without skewing the results. It is apparent that the microlithic armatures in this assemblage tend to be long and narrow, with a ratio of between 4:1 and 7:1. Although no linear relationship could be seen in this assemblage, it corresponds well with the metrical attributes of clusters identified in the microlithic armatures from the other phases.

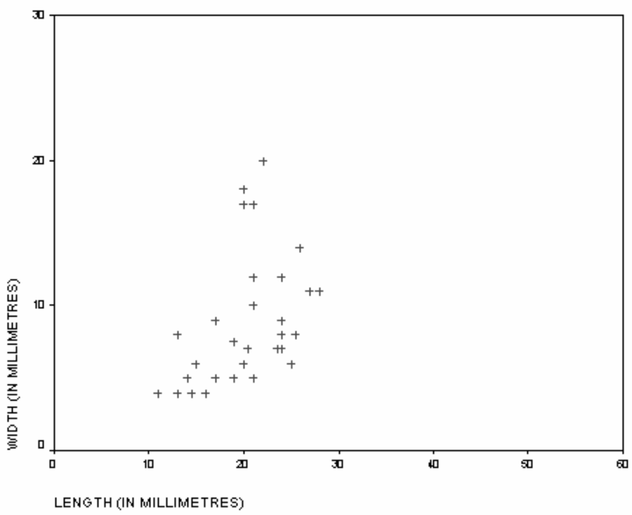


Figure 7.11. Length-width relationship of microliths, Phase 1 (Pearson Correlation = 0.429).

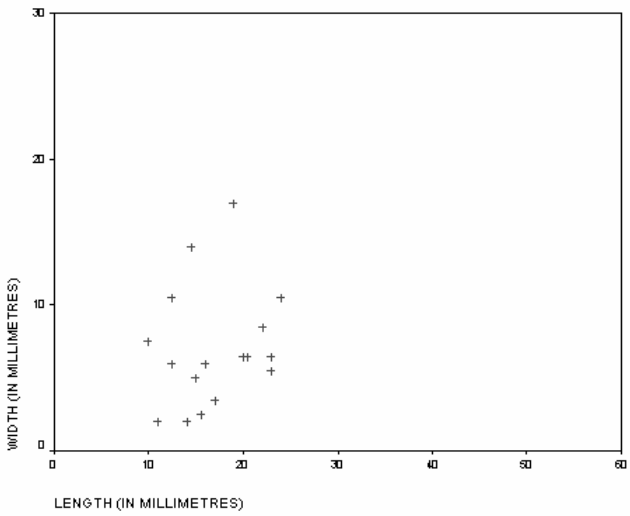


Figure 7.12. Length-width relationship of microliths, Phase 2 (Pearson Correlation = 0.212).

Phase 3

This phase is noteworthy for the lack of a statistically significant linear relationship between the length and width of the microlithic armatures. Since no microlithic armatures were forthcoming from Phase 3 apart from levelling deposit [049], this study concerns only what might possibly be a redeposited layer. The cluster analysis does differ significantly from that undertaken for the other phases: the largest cluster is centred on much broader armatures, with a length-width ratio of only slightly over 2:1.

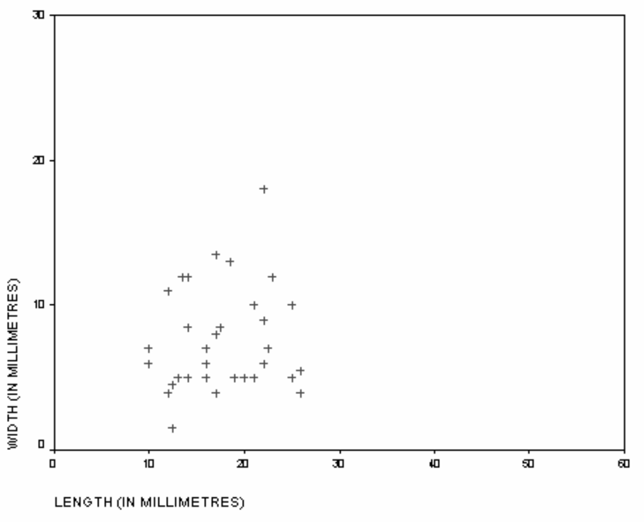


Figure 7.13. Length-width relationship of Microliths, Phase 3 (Pearson Correlation = 0.138).

Temporal Analysis

In this section, the composition of the assemblages from each phases of occupation is described and compared. This analysis relies chiefly on the presentation of the percentages of certain classes of artefact expressed as a proportion of the overall assemblage, or calculated against primary and secondary debitage. The artefact frequencies from each phase are presented together, to facilitate comparison in tabular form.

The most striking feature of the assemblage composition from each phase of occupation is their fundamental similarity. All the assemblages consist overwhelmingly of debitage, followed distantly by microliths, scrapers, cores and retouched flakes. The high counts of debitage are clearly related to the

Artefact Type	Number	Percentage of Assemblage
Nodules	1	0.03
Test Pieces	7	0.24
Cores	15	0.44
Debitage	2566	94.42
Retouched Flakes	21	0.74
Retouched Blades	3	0.13
Scrapers	20	0.73
Utilised Blades	6	0.22
Utilised Flakes	17	0.63
Awls	1	0.03
Microliths	62	2.28
Burins	3	0.11

Table 7.11. Occurrence of artefact types, Phase 2.

Artefact Type	Number	Percentage of Assemblage
Nodules	8	0.13
Test Pieces	5	0.08
Cores	61	1.02
Debitage	5616	94.27
Retouched Flakes	40	0.67
Retouched Blades	26	0.44
Scrapers	62	1.03
Utilised Blades	16	0.27
Utilised Flakes	6	0.1
Awls	6	0.1
Microliths	110	1.84
Burins	3	0.05

Table 7.10. Occurrence of artefact types, Phase 1.

Artefact Type	Number	Percentage of Assemblage
Nodules	2	0.08
Test Pieces	9	0.21
Cores	27	0.62
Debitage	4012	94.39
Retouched Flakes	29	0.68
Retouched Blades	18	0.44
Scrapers	25	0.62
Utilised Blades	16	0.38
Utilised Flakes	2	0.07
Awls	2	0.07
Microliths	96	2.25
Burins	7	0.19

Table 7.12. Occurrence of artefact types, Phase 3.

comprehensive sieving strategy that was implemented at Howick. Comparisons with other assemblages are thus inappropriate, leaving no directly suitable analogues for this particular study. The most obvious difference amongst the assemblages, showing a clear diachronic trend, is the proportion of primary and secondary debitage, calculated as a total of overall debitage. The association of the highest proportion of primary debitage with the highest occurrence of cores cannot be fortuitous. This is puzzling, principally because there is no other indication (apart from the proportion of the debitage assemblage comprised of primary and secondary) that the primary reduction sequence is more prevalent in Phase 1 than in other phases. Indications of this must be sought in the spatial analysis, since none are forthcoming in the metrical inquiries. The proportionate increase in secondary debitage is similarly explained, as the decline in primary flint working was accompanied by a corresponding increase in secondary reduction work. The only interpretation of these trends that immediately suggests itself is that primary reduction was undertaken more often in Phase 1 and that this subsequently declined. The only corresponding change is that microliths constituted an increasing proportion of the overall assemblage.

Phase 1 contains more material than any other structural phase, totalling 5964 lithic artefacts, the vast majority of which (94.27%) consisted of lithic debitage. This is consistent with the debitage proportions of the assemblages from the succeeding phases of occupation. The remainder of the assemblage consisted of tools and cores; only the microliths, scrapers and cores exceeded 1% of the total.

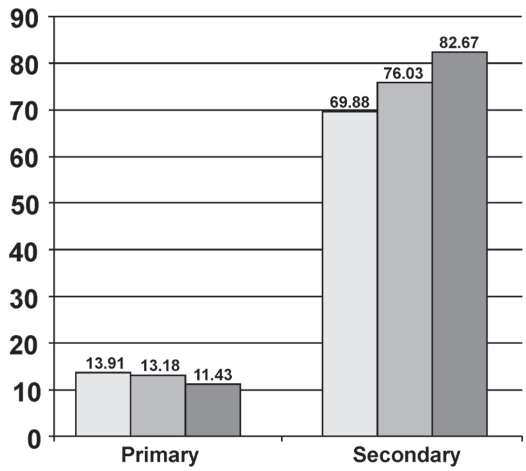


Figure 7.14. Relationship of primary and secondary debitage amongst phases.

Artefact Type	Phase 1	Phase 2	Phase 3
Nodules	0.13%	0.03%	0.08%
Test Pieces	0.08%	0.24%	0.21%
Cores	1.02%	0.44%	0.62%
Debitage	94.27%	94.42%	94.39%
Retouched Flakes	0.67%	0.74%	0.68%
Retouched Blades	0.44%	0.13%	0.44%
Scrapers	1.03%	0.73%	0.62%
Utilised Blades	0.27%	0.22%	0.38%
Utilised Flakes	0.1%	0.63%	0.07%
Awls	0.1%	0.03%	0.07%
Microliths	1.84%	2.28%	2.25%
Burins	0.05%	0.11%	0.19%
TOTAL	**100**	**100**	**100**

Table 7.13. Comparison between the three phases showing the percentage composition of the flint assemblages.

Spatial Analysis

Intra-site spatial analysis has developed largely through the investigation of Late Palaeolithic and Mesolithic sites in North-West Europe (e.g. Blankholm 1985; 1987; 1993a; 1993b; Grøn 1983; 1987; 1988; 1989; 1990; 1992; 1994; 1995; 1999; Grøn and Sørensen 1993; 1995; Karsten and Knarrström 2001; Lass Jensen 2001; Stapert *et al.* 1986; Stapert and Krist 1990;). Studies of forager sites in the Americas, Australasia and Africa, however, have also contributed significantly to the elaboration and refinement of methods and principles used in these analyses (e.g. Whallon 1973; 1974; Yellen 1977; Binford 1978a; 1978b; Price 1978;), as have those pertaining to the Lower and Middle Palaeolithic. The development of methods appropriate for the identification of patterns in the distribution of artefacts represents a preliminary objective, whereas the principal task of interpretation typically involves recourse to anthropological and psychological theories that might elucidate the behavioural significance of the patterns observed (Grøn 1989; 1995). It is worth emphasising that intra-site spatial analysis is not concerned exclusively with the interpretation of the spatial patterning of material occurring within domestic structures: it is more generally concerned with the identification of areas on sites given over to specific activities (e.g. Brinch Petersen 1989; Houtsma *et al*. 1996; Baales 2001;). Much of the discussion concerning the intra-site spatial analysis of dwellings has, however, been concerned with identifying huts through the distribution of lithics and the arrangement of this material around features such as hearths (Whallon 1978; Grøn 1983; Blankholm 1985; 1987; 1993b). The methods used in such analyses are of only tangential interest and relevance to the inquiries here because the presence of discrete features within a clearly delimited dwelling removes any need to use methods designed to infer the existence of a hut.

Ethnographic studies have, of course, figured prominently, but these are often of only limited value for the understanding of the use of space in domestic structures amongst hunter-gatherers because this topic has been of only marginal interest to ethnographers, with only occasional studies, such as those undertaken in Siberia (Jordan 2001; 2003). The ethnographic analogues that do exist are principally derived from the study of populations in the Northern Hemisphere, although an argument might be made that the traditions of people occupying the same basic environments are more relevant to the study of the North-West European Mesolithic than those of hunter-gatherers resident in the Kalahari or the Amazonian rain forest.

Statistical Methods

The discrimination of artefact clusters occurring in each phase of the occupation at Howick is attempted by using the *K*-means clustering algorithm. This method is appropriate for the analysis of large quantities of data that are distinguished by few variables, and when only a small number of clusters are expected (Hodson 1971, 31). As the distribution of lithic material is plotted according to only four variables (x,y,z co-ordinates and nominal scale identifier), few clusters are anticipated given that the domestic area is relatively small, and the range of activities undertaken within the structure is likely to have been limited and overlapped, this method was adopted for the following analyses.

In practice, the identification of clusters with regard to specific artefact types in some of the phases is quite simple, as these can be spotted visually with relative ease. Furthermore, the concentration of artefacts in some of the small and clearly delimited deposits provides a clear indication of their association with other artefacts. Material from the base of hearths, for instance, cannot justifiably be included in clusters of lithic material occurring in the occupation floors surrounding them at a higher elevation. The discrimination of discrete clusters in the dispersed material from the levelling/occupation deposits, however, requires the application of statistical techniques, as here there is no definite contextual association.

The *K*-means algorithm employed in this study consists of the following elements. Firstly, the 'split' phase at which clusters are formed, when the initial assemblage is divided into increasingly circumscribed clusters. Secondly, the clusters are then combined if their centres are close enough. This obviates the problems involved in producing many clusters with only small populations (Shennan 1997).

Phase 1a

A prominent central hearth complex is characteristic of Phase 1a. Around this complex formal tools are arranged in three clusters. The most obvious interpretation of these clusters is that they represent discrete activity areas. An anomalous feature [270] at the south-eastern extremity of the structure is also a focus for activity, and the distribution of the lithic material within it, and in its immediate vicinity, is quite similar to that at the hearth complex. The key aspect of the lithic distribution in this phase is that the two recurrent clusters seen in most classes of artefact are opposite one another.

Blades

The occurrence of blades, for reasons outlined earlier, are regarded as the best proxy indicator of the location of discrete flint knapping locales within the

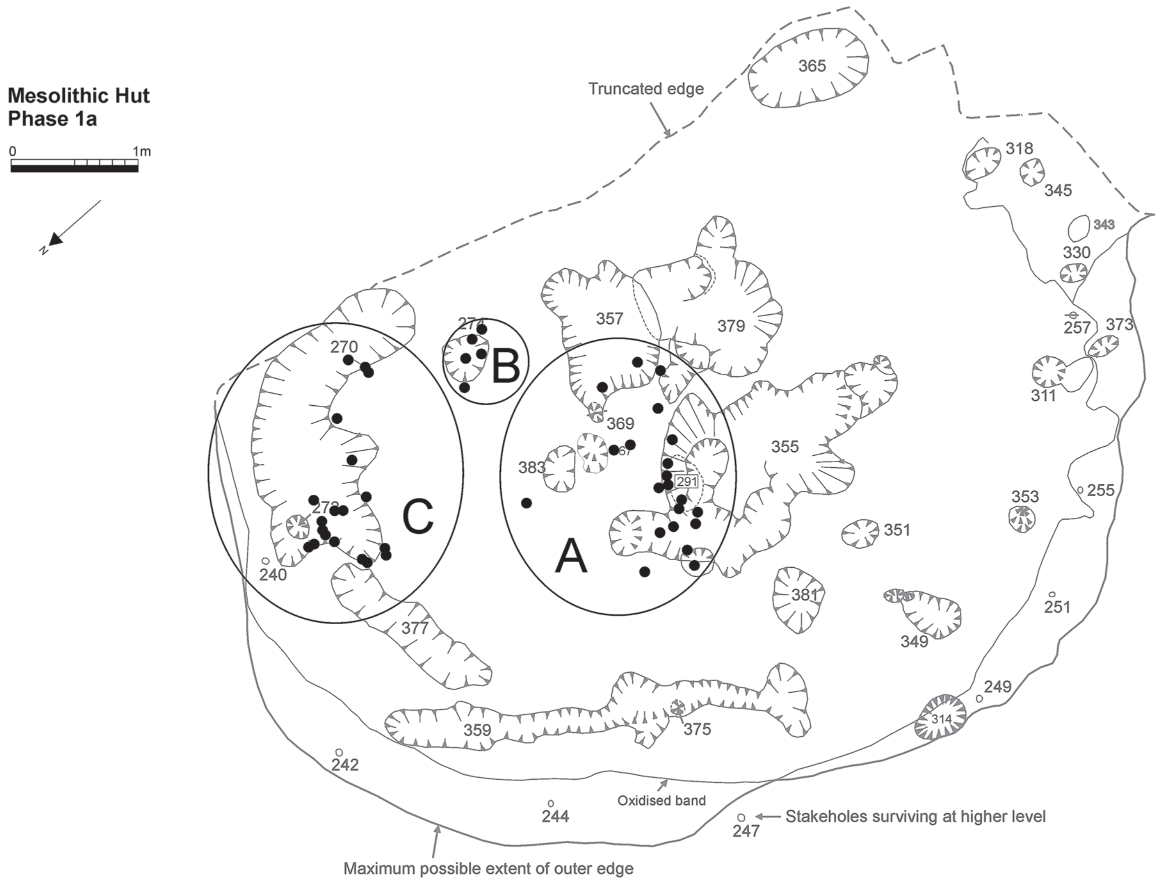


Fig. 7.15. Blade clusters in Phase 1a.

dwelling. The blades occur in three clusters, associated with specific features (Fig. 7.15). The first cluster is on the immediate periphery of the central hearth complex, the second occurs within and around a shallow pit [270], whereas the third is a modest cluster focussed on the circular feature [274]. Because of the obvious association of the blades with features, there was little need to employ statistical methods to identify patterns in their distribution. Instead, it is possible to move directly to interpretation of this pattern.

The concentration of blades around the central hearth complex is not altogether unexpected since the artisans undoubtedly sought to sit near the fire for reasons such as the light and the warmth that the fire would have provided while they produced the blades. It is important to remark on the concentric arrangement of the blades at the immediate margins of the hearth in Cluster A. The arrangement of the blades in this cluster suggests that an artisan sat facing the hearth complex, and laid out the blades as close to this feature as possible. There is no way of establishing which of the hearths was in use whilst these small concentric arrangements of blades were deposited. It might be inferred that each of these arrangements represents an individual knapping episode, focussed on different hearths, or perhaps these blades were all deposited at once.

The occurrence of blades in Cluster C is more puzzling. This is principally due to the uncertainty concerning the function of feature [270], in which they occur: this shallow pit is not a hearth, but the pattern of concentric arrangements of blades is quite similar to that seen at the hearth complex. The same concentric arrangement of blades on the margin of the feature occurs, but it is significant that a linear arrangement is also evident. Both of these patterns are typical of lithic artisans laying out blades during the knapping process. At the hearth complex, the heat and light provided by the fire were undoubtedly an attraction to the flint knapper, but no such utilitarian considerations are apparent for feature [270]. This matter is considered in more detail in the discussion of debitage distribution (see below).

Microliths

The microliths are more widely dispersed than the blades, although their distributions broadly agree (Fig. 7.16). Only a small segment of the overall microlith assemblage from Phase 1a had its location digitally plotted (as the rest were recovered from the sieving), which has reduced the utility of this class of artefact for identifying flint knapping locales. Nevertheless, the material recovered from flotation derives from the same deposits, that is to say, from the hearth complex and feature [270], so the material recorded

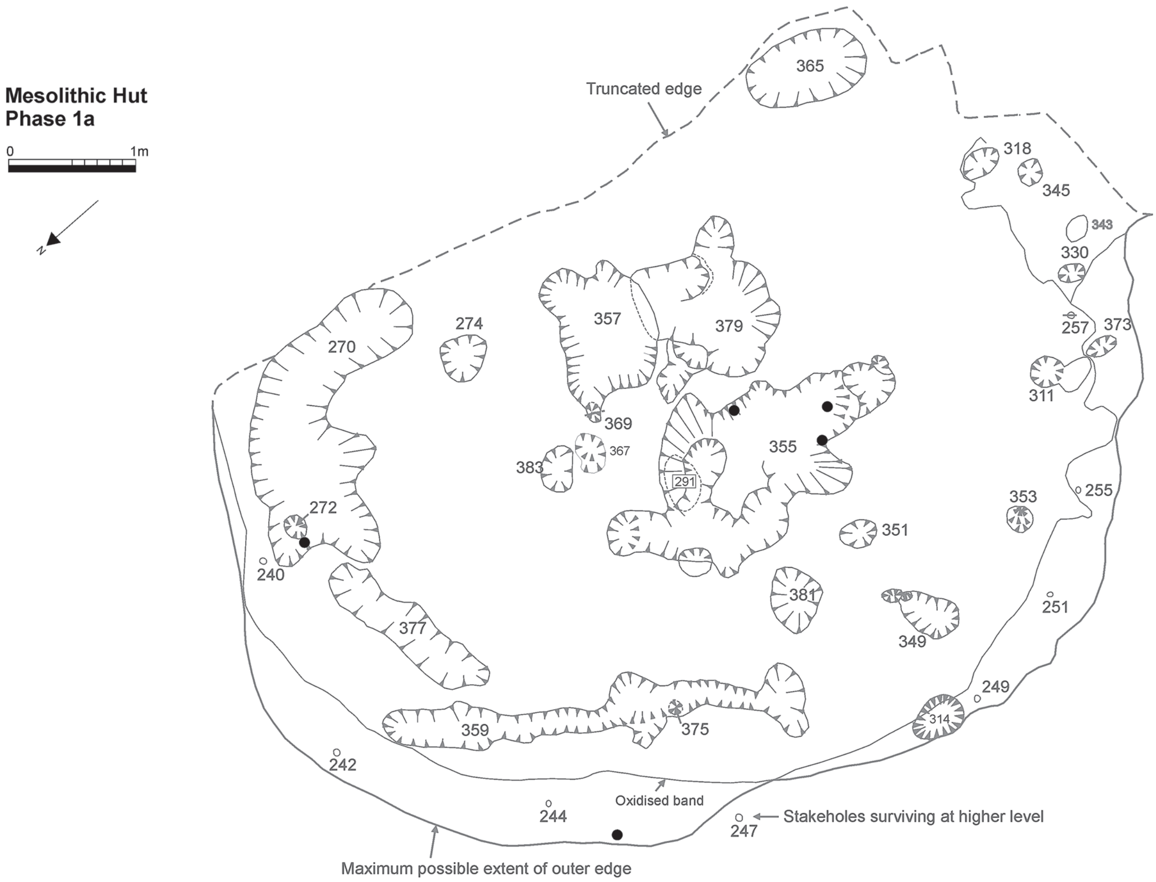


Figure 7.16. Distribution of microliths in Phase 1a.

is broadly representative of the location of the other microliths. The location of the microliths in the hearths causes some interpretive difficulties. This hearth pit complex was re-dug on several occasions, and therefore it is possible that they were indeed placed at the margins of the hearth during the knapping. Alternatively, once the microliths had been used some may have been discarded in the fire or become incorporated into the hearth deposits by accidental loss resulting from use of the tool in this locale.

Cores

The distribution of cores is almost identical to that of blades and microliths (Fig. 7.17), although the small quantity only permits generalisations based on their association with features in the hut. Nevertheless, the strong spatial associations amongst blades, microliths, cores and the debitage suggest that their distribution is a function of their involvement in the flint knapping process rather than the dumping of material in baskets or skins, as was documented, for instance, outside a quite similar Mesolithic structure at Tågerup in Scania (Karsten and Knarrström 2001). It is, however, important to remark on the relatively large concentration of cores in [270]: this is not associated with any correspondingly large concentration of either blades or microliths.

Scrapers

Only seven scrapers were digitally plotted from this phase of occupation, however the total occurrence of this class of artefact amounted only to sixteen (Fig. 7.18). The deposits from which the other scrapers derived are the same as those in which the digitally plotted artefacts occurred, so the distribution of the small amount of digitally plotted material seems to accurately reflect the distribution of this class of artefact. This material, like the microliths and blades, also seems to aggregate in, or lie immediately adjacent to, the central hearth complex and the shallow pit feature [270].

Debitage

The distribution of the primary debitage corresponds almost exactly with the distribution of blades and closely conforms to the distribution of cores (Fig. 7.19). This correspondence is largely explicable by the knapping process. Thus, the production of debitage would fall in the immediate vicinity of the blades and cores. The distribution of secondary debitage, being lighter, is presumably more dispersed, around the knapping zone.

This supposition agrees well with the distribution of the secondary debitage (Fig. 7.20). The material is only slightly displaced in relation to the primary debitage; the displacement occurs towards the south

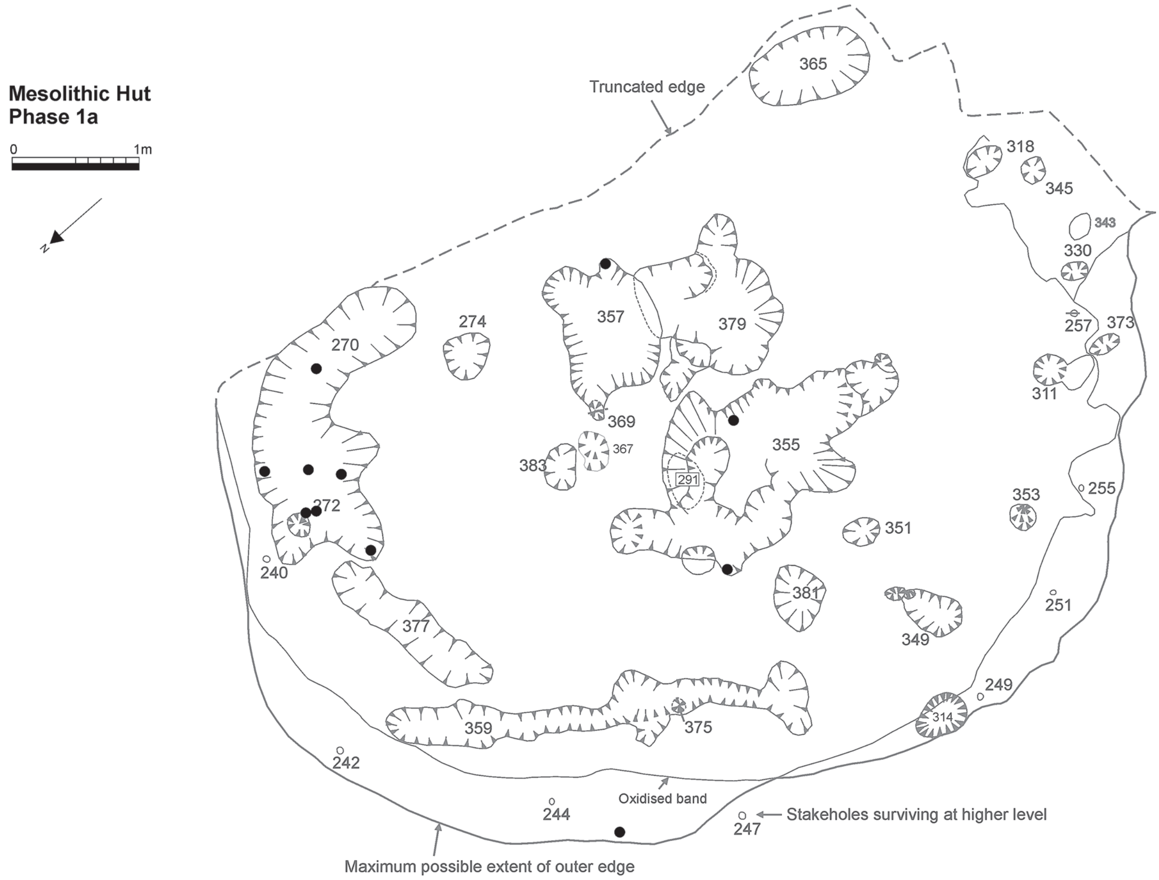


Figure 7.17. Distribution of cores, Phase 1a.

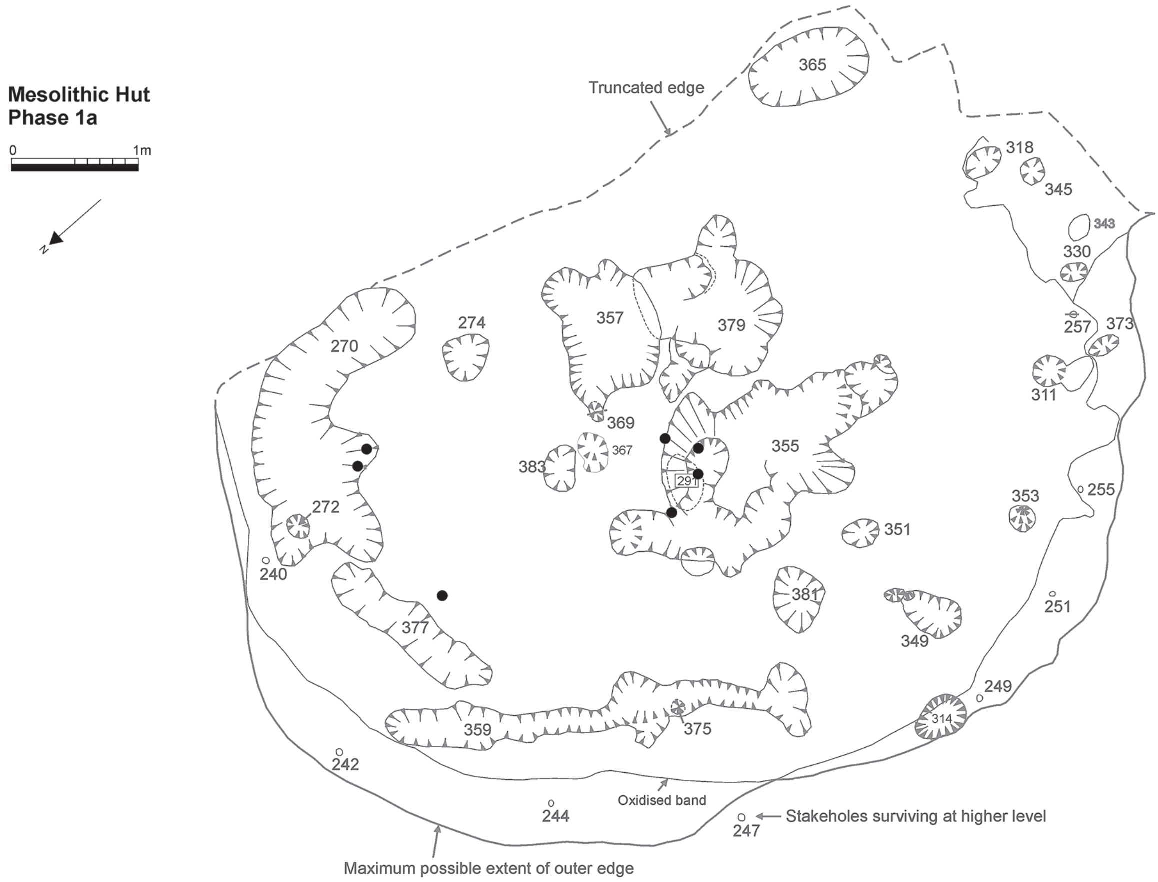


Figure 7.18. Distribution of scrapers, Phase 1a.

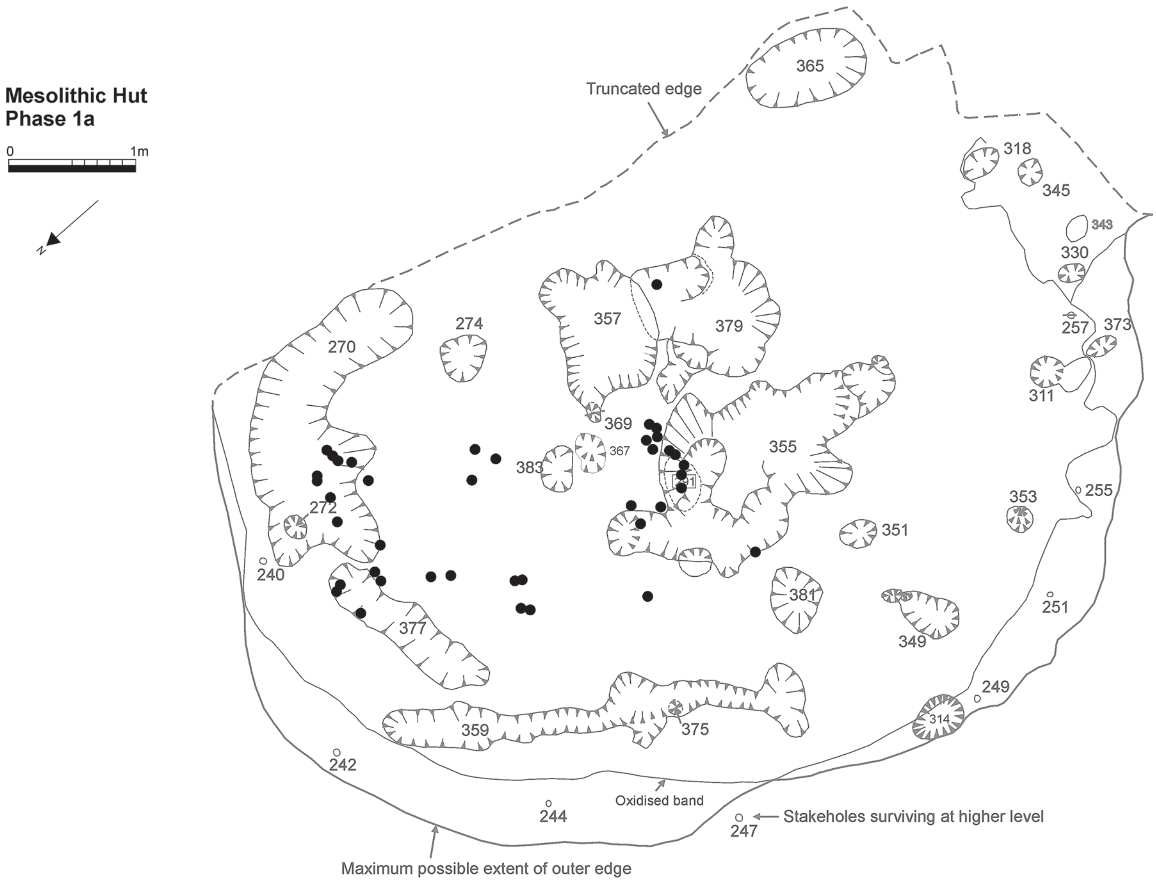


Fig. 7.19. Distribution of primary debitage, Phase 1a.

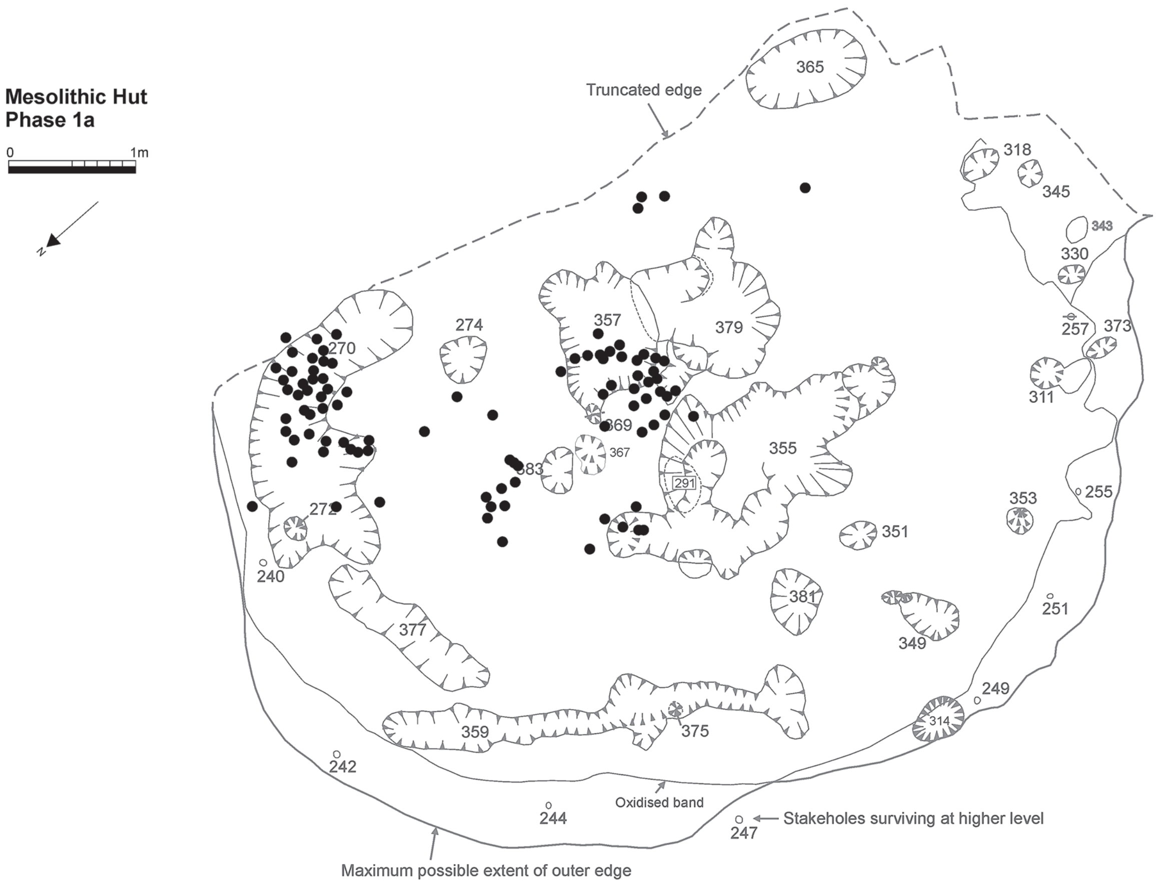


Figure 7.20. Distribution of secondary debitage, Phase 1a.

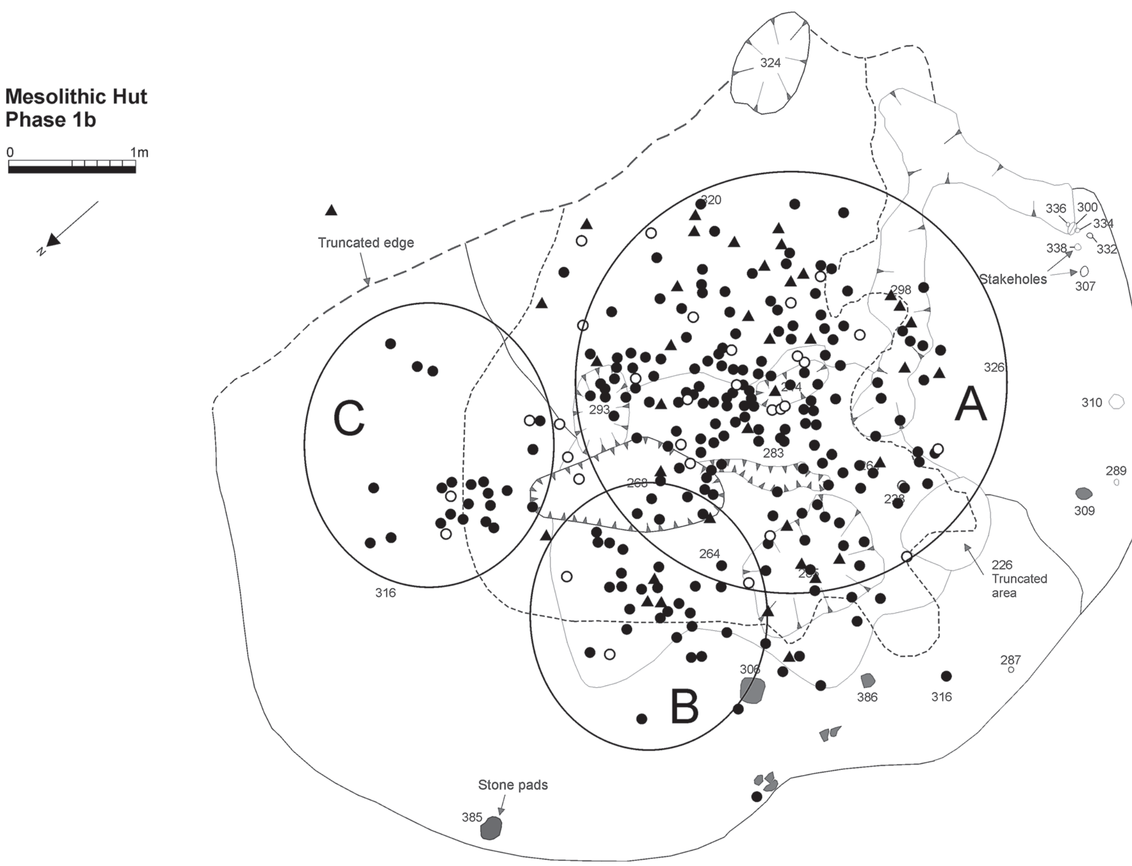


Figure 7.21. Distribution of blades, microliths and cores, Phase 1b (● = blades, ○ = cores, ▲ = microliths).

of the structure, which suggests that the artisan(s) faced southward whilst producing the implements. The orientation of the artisan(s), moreover, corroborates the assumption that the hearth was the focus of the activity, insofar as it provided light and warmth. It must be remembered that the hut was relatively dark throughout the day – the reconstruction of the hut, in which experimental flint knapping was undertaken, clearly revealed this. Perhaps the entrance was also situated towards the south, which might have provided even more light, but this must remain speculative. A far more intractable problem is presented by the clustering of material in [270]: this feature does not seem to be associated with any source of heat or light, nor does its form suggest any obvious function. All that might be said at the moment is that it was a focus for lithic production and the deposition/discard of tools.

Phase 1b

The distribution of material in Phase 1b is more difficult to interpret because of its quantity and the association of much of it with a wide range of features. Unlike Phase 1a, which was characterised by very discrete concentrations immediately visible on the plans, the material recovered from Phase 1b requires cluster analysis in order to identify any patterning in its distribution.

Blades, Microliths and Cores

The blades, microliths and cores occur in the central portion of the structure in this phase (Fig. 7.21). When compared with the distribution of the same artefacts in Phase 1a it is immediately apparent that there is a slight displacement towards the west, with the central hearths forming the sole focus for knapping and associated activities. Small concentric groups are visible in each of the identified groupings, which might reflect the deliberate arrangement of blades during multiple knapping events.

In each of the clusters identified (A, B and C), there were small concentric arrangements of blades and microliths (Fig. 7.21). These are most clearly seen in Cluster C, as the quantity of material occurring within this is not so high as to obscure the arrangements. Two arrangements might be noted here. Although concentric arrangements of blades are apparent in Cluster A, it cannot be determined whether these represent deliberately placed tools or fortuitous arrangements resulting from the volume of material deposited in this area. Nevertheless, it does seem apparent that there are at least three main knapping areas where blades were produced, but the main concentration of this activity seems to lie on the

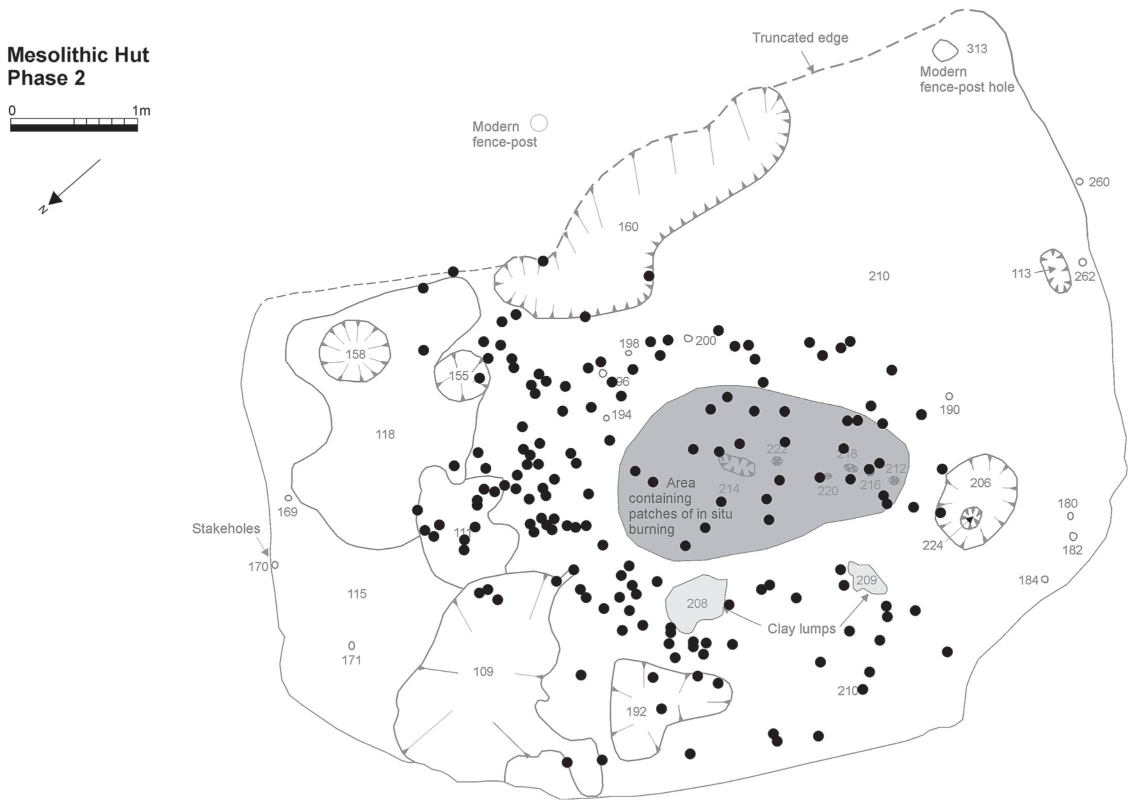


Figure 7.22. Distribution of blades, Phase 2.

south side of the central hearth pit area. The displacement of activity compared to the preceding phase is interesting. Does it suggest that domestic space was used differently when the hut underwent the structural modifications that separate these two phases? It is possible that as the position of industrial activities changed when the hut was modified this could be related to the repositioning of key structural features that may have affected task location, such as the doorway. As the knapping locale changed, this suggests that it is unlikely that a cosmological belief or taboo underpinned this positioning: if this were the case the activity could be expected to have remained in the same place. This does not of course preclude the latter interpretation but it is considered the less likely option here.

Phase 2

The spatial distribution of material in Phase 2 is more complex than in Phase 1a or Phase 1b (Figs 7.15–7.21), principally because of the existence of levelling/occupation deposits that might contain material that was introduced to the hut from outside. The confusion and problems arise because deposits [115], [118] and [210] were also occupation floors and some material appears to have been deposited whilst it served as such (see Chapter 5). Earlier it was mentioned that the metrical attributes of the blades and microliths could not resolve the issue of how much of this material was redeposited, and how much was likely to be *in situ*. The spatial analysis of the blade, microlith and core distribution does, however, strongly suggest that the majority of this material was indeed deposited whilst the aforementioned deposits served as occupation floors. The manner in which the blades surrounded the central hearth, rather than being spread across it, suggests that these features were respected. Of course, it is possible that small amounts of material were dumped around the burnt deposit deliberately, but such an argument would involve special pleading as it is a striking coincidence.

A slight displacement of activity to the east is apparent in this phase when compared to the central activity locales in Phase 1b. This pattern conforms more closely to that seen in Phase 1a, although there are some differences, namely, that all the clusters are arrayed around the central burning/hearth area. The hearths again form the focus of activity, but there is no secondary focus as in Phase 1a.

Microliths

A curious phenomenon is that the microliths are all arrayed to the immediate east of the central hearth area, and thus their distribution does not correspond

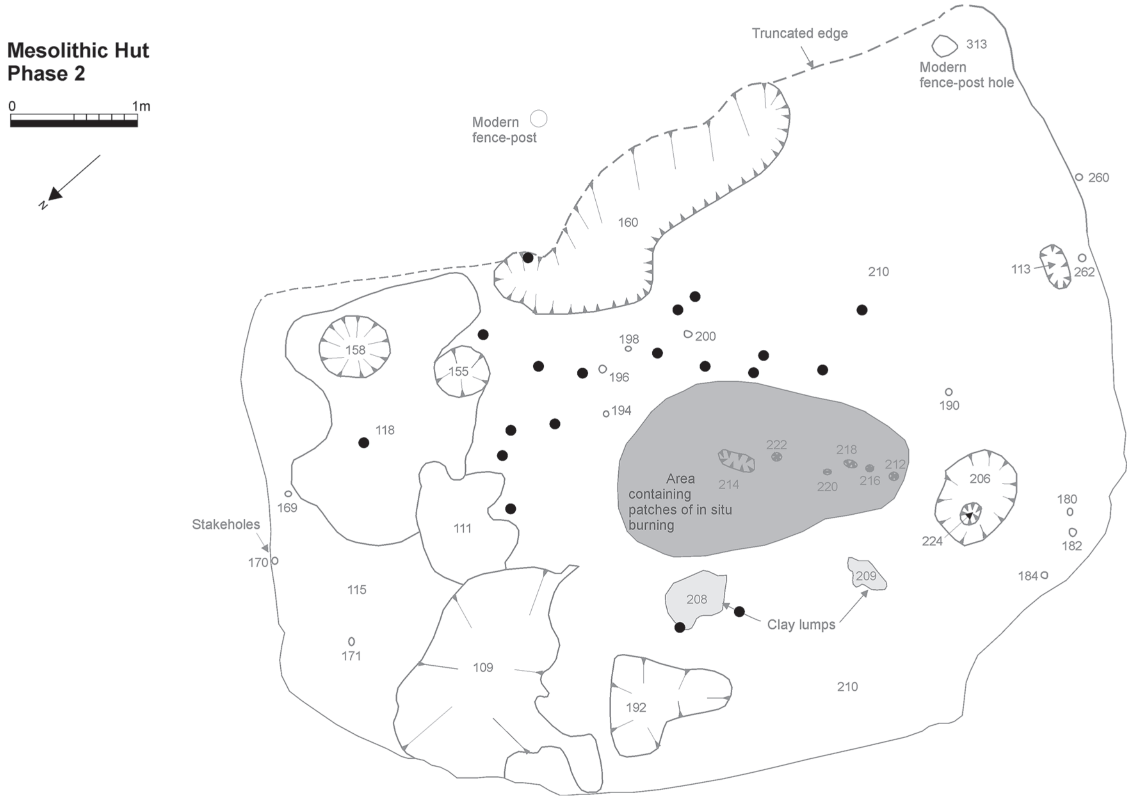


Figure 7.23. Distribution of microliths, Phase 2.

Figure 7.24. Distribution of scrapers, Phase 2.

with the general spread of blades. Moreover, it is also not in agreement with the distribution of the cores and test pieces that would, presumably, have been deposited in the immediate vicinity of flint knapping locales. The general distribution of cores and test pieces conforms better to that witnessed for the blades (Fig. 7.22). Interestingly, the distribution of microliths (Fig. 7.23) is broadly similar to that of scrapers (Fig. 7.24). This might suggest that the distribution of these two classes of artefact in Phase 2 does not represent production, but instead represents the location at which they were discarded after use. It is noteworthy that the residue and use-wear analysis showed that some scrapers and microliths may have been used on similar materials, ranging from raw meat and skin products to hard materials such as wood, bone, antler and horn (see Chapter 9).

Phase 3

Much of the material from Phase 3 occurred in levelling/occupation deposit [049], so the same problems that encumbered a consideration of the patterns of artefact distribution in Phase 2 are repeated here.

A large quantity of blades (198) was digitally plotted during the excavation of Phase 3. Their distribution generally agrees more with that seen in Phase 1b than in Phase 2, so there is a curious alteration in the main concentrations of blades in every horizon of occupation: from the east side of the central hearth, to the west, back to the east, and finally to the west again in Phase 3. This might have been governed by symbolic considerations, but it might equally have been a function of the situation of the entrance during these different phases. Similarities in the general distribution and quantity of blades and other tools are seen in Phase 3 (Figs 7.25–7.28) and are comparable with the patterns from the earlier phases, except that there is a displacement in the location of clusters. If the displacement is left aside the Phase 3 distribution most closely resembles that of Phase 2 where one large, dense cluster represents the main focus of activity around the centre of the hut, with other subsidiary clusters overlapping.

The scrapers do not occur in sufficient numbers to make a statistical analysis meaningful, but their distribution in three small clusters can be easily seen (Fig. 7.27). A central cluster is the only one of any size, containing nine specimens. Despite the small size of the assemblage, the distribution of scrapers is fundamentally similar to that identified for the microliths. This suggests that the centre of the structure was an area in which a variety of activities was pursued as well as at the margins on the north and west sides.

Summary

This analysis has presented the results from three discrete, but complementary, investigations. The metrical analysis confirms that although the assemblage belongs to a blade-based industry the attributes of the blades were also governed by the qualities of the available raw material, which tended to result in short, squat blade forms. The stability of the assemblage composition through time is also noteworthy. The assemblages from all phases are overwhelmingly dominated by debitage, with the remaining categories of artefact constituting less than 6% of the material. The majority of the latter portion of the assemblage is microliths, cores and scrapers; other classes of artefact are only nominally represented by several pieces and form less than 0.5% of the assemblage in each phase. Nevertheless, amidst the evidence for such considerable stability are indications of subtle temporal trends. The most noteworthy is the gradual rise in the proportion of secondary debitage through time, and a corresponding decrease in primary debitage. This phenomenon cannot be correlated with either an increase or decline in the quantity of cores present in each phase. When considered concurrently with the evidence from the metrical analysis, which suggests no fundamental difference in the production of blades or microliths through time, there is no basis for suggesting that a change in the *chaîne opératoire* occurred. It may simply indicate that there was a trend to undertake the curation and maintenance of tools within the setting of the hut, with the primary flaking taking place elsewhere outside the hut, presumably closer to the place of raw material acquisition. This may have arisen from practical necessity or could be related to a slight change in the organisation of the knapping routine as a result of personal preference.

The spatial analysis revealed clear knapping and activity zones throughout all phases, with the central hearths providing the key focus throughout the different phases of the hut. During Phase 1a there was a secondary activity focus centred on a shallow linear pit feature, [270], in the north-east quadrant of the structure. Both the linear feature and the central hearths served as flint knapping locales, but they also contained evidence for scrapers, suggesting the pursuit of other activities. The use of the domestic space seems to alter in the succeeding phase when a displacement of activity to the western side of the central hearth complex can be observed. A change in the spatial distribution of the artefacts occurs in Phase 2 where the material clusters around the central burning/hearth area, and presumably reflects activities undertaken by people sitting around a fire. The interpretation of this material is, however, more problematic than that occurring in Phases 1a and 1b, due to the presence of the levelling/occupation deposits that, probably in part, have been introduced from outside the hut.

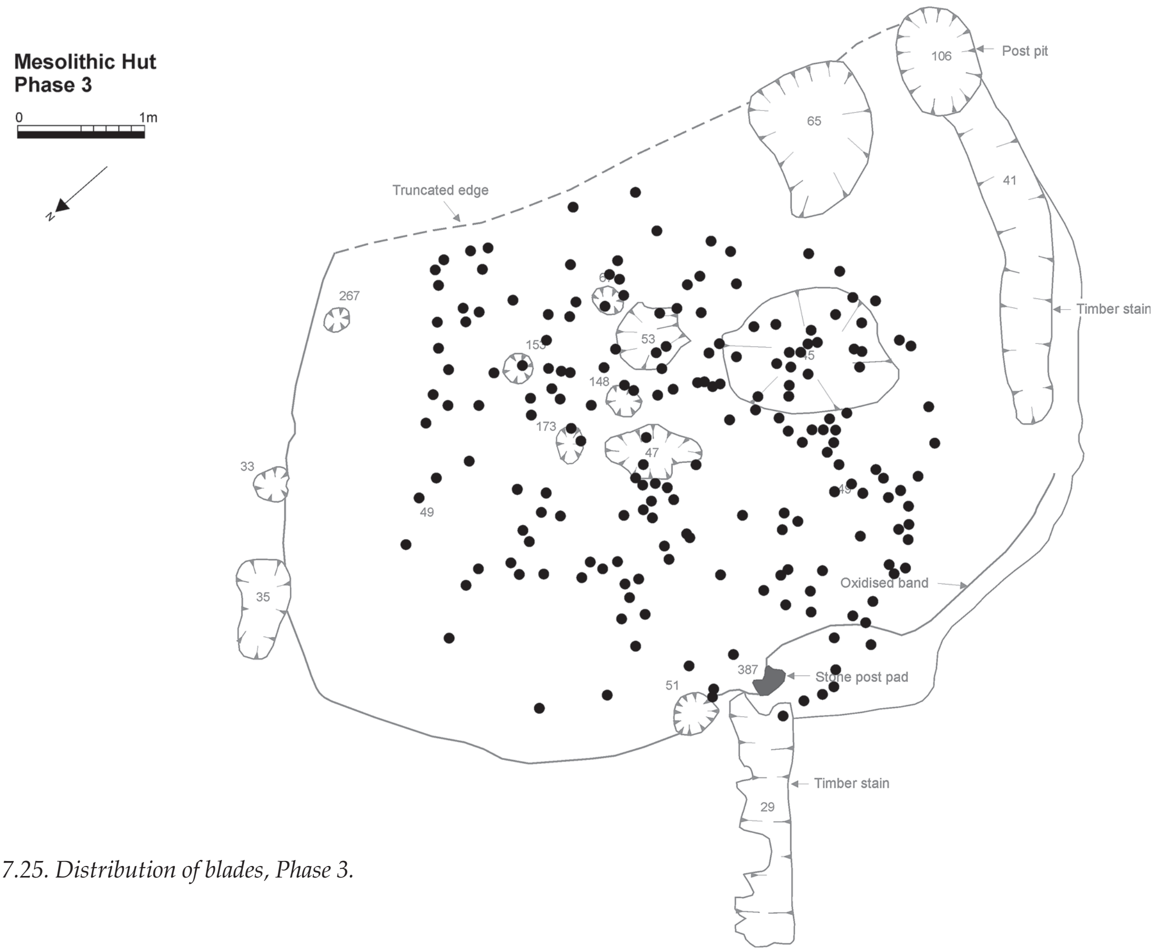


Figure 7.25. Distribution of blades, Phase 3.

Figure 7.26. Distribution of microliths, Phase 3.

Figure 7.27. Distribution of scrapers, Phase 3.

Figure 7.28. Distribution of burnt lithics, Phase 3.

Indeed, the distribution of the artefacts in Phases 2 and Phase 3 renders it possible that the material was dumped. Militating against this, however, are the general uniformity of artefact types in the composition of the material and the clear focus of material in and around the central hearth zone. Consequently this patterning is most logically explained as being formed, for the most part, by material discarded *in situ* during activities around the hearths. The existence of small concentric arrangements of blades, which are typically associated with discrete knapping episodes, supports the view that much of the material is from *in situ* discard and that the patterns observed for these two phases is largely representative.

Overall Summary and Discussion

Clive Waddington

The lithic assemblage from Howick is one of the largest discrete assemblages of stone tools so far recovered from North-East England. The date correlates well with those from two other dated North-East coast sites at Filpoke Beacon (Jacobi 1976, 71) and East Barns (Gooder in press) that produced narrow-blade assemblages typified by the presence of scalene triangles. However, these are not the earliest dates for the occurrence of what Jacobi has termed the 'narrow-blade micro-triangle techno-complex' in Britain, as dates from the recently excavated site at Cramond place this scalene triangle site in the last quarter of the 9th millennium cal BC (Lawson 2001; Saville 2004).

A key observation resulting from the examination of this assemblage is that it includes previously chipped, patinated and beach-rolled pieces which have been later modified into artefacts used in the Howick hut. This proxy evidence for Palaeolithic/Early Mesolithic occupation on what were likely to be coastal sites along the western shore of the North Sea Basin provides an important indication that North-East Britain experienced episodes of occupation during the Palaeolithic and early Post-Glacial periods. Not only is this Palaeolithic presence supported by Saville's recent survey of potential Palaeolithic hand-axes in Scotland (Saville 1997), but it also provides a logical counterpart to the early dates for initial occupation along the arctic coast of Norway (Bjerck 1995; Bang Andersen 1996; Waraas 2001). Evidence for what is likely to have been a fleeting Early Mesolithic presence on the site is provided by two tools: a heavily patinated obliquely blunted broad-blade microlith [1388] from the subsoil and a heavily patinated backed blade [2291], more than 41mm in length. Although these two pieces cannot be directly dated they do not fit with the rest of the assemblage and are conspicuous by their size, form and patinated condition. If nothing else they provide an indication of a much earlier presence in the area, just as the Neolithic leaf-shaped arrowhead, recovered from the subsoil to the north of the hut, is indicative of a post-Mesolithic presence.

The Howick lithic assemblage is characterised by the exclusive use of locally available material, in particular the small beach pebbles that can be picked up from the shore. This is indicative of opportunistic collection of an easily acquired resource with no need for wider collection or acquisition through organised exchange networks with more distant groups. The raw material, as we have seen, is a key determinant that has conditioned to some extent the size and shape of formal tools as well as the primary flaking of nodules by the use of bipolar (hammer and anvil) flaking. The net result is that although there is clearly a concern to maintain a narrow-blade tradition, the blades are generally squat and often retain areas of cortex due to the small size of the raw material. One possible reason for the lack of core-axes found in northern Britain at this time may be that such large pieces would not have been discarded at the end of their use life as they could have been more usefully remodified into new smaller tools. It is clear from the small size of all the lithics in the Howick assemblage that any large pieces of flint would have been at a premium and are unlikely to have been knowingly discarded.

Although all phases of the reduction sequence are present in the Howick assemblage it is clear that most primary working took place away from the site and it is most likely that this occurred close to the collection locales on the shore. However, there is a remarkable lack of microburins given the size of the microlith component and this suggests that the production of microliths, and probably other formal tool types, mostly took place at another location outside the hut. Based on ethnographic studies it is most common for flint knapping to take place outdoors, which is not surprising given the flying slivers of flint and production of large quantities of sharp debris littering the floor. In contrast, the Howick assemblage can perhaps be more accurately viewed as a 'working' assemblage that has accumulated as a result of processing tasks taking place in the hut, with only occasional curation and replacement of tools taking place as an adjunct to the processing tasks being undertaken. The arcs of microliths and blades, the clusters of scrapers, and the arcs of bevelled pebble tools (see Chapter 8) suggest the use of these tools for tasks undertaken in a sitting position. If the full production cycle of all the tools in the Howick assemblage took place within the hut then there would have been vastly more debitage recovered by the wet sieving, but as the volume of such material is simply not present it points to the conclusion that the debitage assemblage from the hut is largely that for the curation, and occasionally replacement, of tools. Moreover, these tools appear to have been used for a wide-range of processing tasks (see also Chapter 9), situated in a designated part of the hut, in front of a central hearth and carried out in a sitting position.

The presence of tool types that could be clearly differentiated on morphological grounds, together with the results from the residue and use-wear analyses, indicate that a wide range of specialist tasks took place in the hut. Based on the tool forms, residue and use-wear analyses and the types of material found within the hearths, we can envisage these tasks including the softening and/or smoothing of skins and furs, the stitching of these materials into clothes, bedding, coverings and containers, the processing of plant materials, such as nettles for making string, the processing of seaweed, hazelnuts, wood, antler and bone to make other required items, and the preparation of meat, fish, birds and plant foods for cooking.

Although the assemblage from Howick may be seen to contain a little bit of everything when it comes to the reduction sequence, it is clear that it is an assemblage that has accumulated over a prolonged period of occupation (see Chapter 6) and which, bearing this in mind, has a relatively low incidence of knapping debris. Consequently the assemblage can be characterised as having:

1. a disproportionately large number of formal tools and utilised pieces in relation to the amount of primary and secondary debitage;
2. a general absence, or very low incidence, of micro-burins;
3. a wide range of tool types (scrapers, awls, burins, blade tools, *etc.*);
4. a wide range of microliths (scalene triangles, backed blades, crescents, points, and occasional rods, *Lamelle á Cran*, obliquely blunted) and
5. a large proportion of broken tools as a result of use before discard.

These characteristics provide a tentative signature for lithic assemblages acquired from Mesolithic settlement sites. When the Howick assemblage is compared with the lithic assemblage from similar sites such as Mount Sandel, parallels are instantly recognisable, such as the wide range of tool types and narrow-blade microliths present (Woodman 1985), although differences between the Irish material and that from North-East Britain is evident, such as the presence of core, flake and polished stone axe heads on the Irish sites and their absence from the British sites. The Howick awls are broader than the Mount Sandel equivalents and the microlith points are also slightly different. Overall though, the similarities are greater than the differences and the lack of axes on Northern British sites is most likely accounted for by them being recycled during the Mesolithic rather than them not being used. This is supported by the fact that occasional Mesolithic axe heads and axe head fragments have been found in North-East Britain, including tranchet axes from Monkwearmouth and Seaton Carew (Weyman 1984, 39) and the Milfield basin (Waddington 1999). However, it remains to be seen if other dwelling structures, such as that at East Barns, produce a similar 'signature' for a hut site. By attempting to characterise the assemblage in this way, further refinement of this suggested signature is left open for future studies, which may look in more detail at the assemblages from hut sites. It is hoped that this characterisation of the Howick assemblage may aid the interpretation of Mesolithic lithic scatter sites where few, if any, structural remains survive.

Although it did not reveal a dwelling structure like that at Howick, and there was clearly evidence for the full quantity of knapping debris associated with all stages of the reduction sequence, the site at Kinloch, Rhum, holds other similarities. Not only does this site have comparable dates to Howick but the range of microliths present is also the same as those from Howick (Wickham-Jones 1990, 99). In the case of Kinloch we are also dealing with a coastal site whose inhabitants relied exclusively on locally available raw material in much the same way as those at Howick. As only a proportion of this site was excavated, the structural remains of a hut could yet be preserved there. However, an interesting distinction arises when it is considered that at Kinloch it was the chief knapping area that was excavated rather than perhaps the main dwelling area, whereas at Howick it was the dwelling area and not the main knapping area that was excavated. As the lithic assemblage at Kinloch was vastly larger, comprising 138,043 pieces of worked stone – which was only a fraction of the other debitage that littered the site (Wickham-Jones 1990, 57) – it is evident that this material represents an area where tool production took place. It is this stone tool production locale that is missing from the Howick site and, therefore, it is reasonably presumed that in the case of Howick this is likely to have been situated outdoors and closer to the raw material source. As the cliffs at Howick have eroded considerably since the Mesolithic, the survival of such a locale is unlikely.

The microlith types present in the Howick hut are conspicuous by their varied forms which contrasts with those sites where just one or two forms predominate, such as at the small temporary site at Fife Ness where crescents were by far the most common (Wickham-Jones and Dalland 1998). In the case of Fife Ness it was thought that this may indicate that the site was used for specialist activities such as the collecting of a particular resource (Wickham-Jones and Dalland 1998). In contrast, the wide range of microliths present at Howick, together with the evidence from the faunal, botanical, residue and use-wear analyses, make it clear that a much wider range of tasks took place, which is consistent with the view that the site was occupied for a sustained period, by a group numbering several people.

8 Bevelled Pebbles, Coarse Stone Tools and Ochreous Material

Ann Clarke and Clive Waddington

Introduction

A total of 19 bevelled pebbles (including four pieces that refit into two complete ones) and 15 bevelled pebble tool blanks was recovered from the Howick excavations. These bevelled tool forms, all made from the locally outcropping sandstone, dominate the coarse stone assemblage from Howick (see Table 8.1). The location of each of these tools can be seen on the phase plans that form part of the discussion in Chapter 14 (Fig. 14.2). A few other associated tool types were also present, including two faceted pebbles, two hammerstones and what appears to be a smoothing stone. A stone pad utilised as a timber support was recovered from the foot of timber stain [29] in the Phase 3 horizon and eight unused sandstone cobbles and burnt stone fragments were also found. Two quartz flint-knapping hammerstones were discovered within the hut deposits but these are discussed elsewhere in Chapter 7 as the form, material and crushing indicates these are knapping tools.

Bevelled Pebbles and Associated Tool Blanks

The bevelled pebbles form a discrete group of tools (Fig. 8.1) that share a number of common characteristics summarised here and discussed below:

i) They are made on narrow, elongated or finger-like pebbles.
ii) The bevels are usually formed on just one end, normally the broadest end of the pebble.
iii) The bevel is larger on one face and is convex in section. It has been smoothed and often striations are visible running longitudinally.
iv) More often than not this bevel is worn diagonally across the face, usually from left to right. Where the wear is light the left side has been more heavily used.
v) On the opposite face the bevel is narrower and rougher in character with some smoothing over chipping damage.
vi) Occasionally the pebble is turned over and both faces are worn.
vii) Occasionally both ends of the pebble are used.

All the pebbles are made on sandstones that vary in texture from fine- to medium-grain and these would have been available locally on the beach. The finer-grained sandstones exhibit more smoothly worn faces and the striations are more visible than on the coarser sandstones, but this is most likely to be related to rock hardness and homogeneity rather than any difference in their use. They all appear to have been used for the same activity since the wear traces are similar.

By shape and size the bevelled pebbles form a discrete group ranging from 95mm–140mm in length and 28mm–48mm in width (Fig. 8.2 and Table 8.2). The selection of a specific size for use is confirmed by the presence of the tool blanks, which are pebbles of the same size, shape and raw material as the bevelled pebbles but which bear no traces of wear (Fig. 8.2). These unused pebbles were undoubtedly collected from the beach and brought into the house with the intention of using them in a similar manner to the bevelled pebbles.

From observations of the 13 complete tools, the broader end of the pebble is preferred for use in most cases whilst the narrower end is used in only one case. A number of the tools have been used on both ends and the wear traces on four pieces indicate that the tool has been turned over so that a large bevel is worn on both faces at one end.

There is variation in the level of wear as some tools appear to be more lightly worn than others, indicating that the alteration to the surface of the tool was through use rather than manufacture. The bevels have been worn smooth by a grinding action which, given the unidirectional nature of the striations, was most probably in a forward or downward motion. The bevel itself is slightly convex in cross-section, which may suggest that the material upon which the tool was used was slightly concave in section or had a degree of elasticity allowing the bevel to form a rounded surface. The formation of the bevel on the opposite face is different in that it is usually narrow and there is often additional damage to the end of this bevel in the form of light chipping or pecking which has then been smoothed over.

The larger bevel is worked at an angle across the face, with most of the tools exhibiting a clear diagonal

Phase	Bevelled pebbles	Bevelled pebble blank	Faceted Pebble	Hammer-Stone	Smoothing Stone?	Timber Pad	Unused Cobble/ Fragment	Total
Phase 1a								
Pit	3	2	-	-	-	-	3	8
Hearth	1	3	-	-	-	-	1	5
Sub Total	***4***	***5***	***-***	***-***	***-***	***-***	***4***	***13***
Phase 1b								
Occ. Layer	5	2	2	-	1	-	1	11
Linear Spread/Pit	-	1	-	-	-	-	1	2
Hearth	-	2	-	-	-	-	-	2
Sub Total	***5***	***5***	***2***	***-***	***1***	***-***	***2***	***15***
Phase 2								
Occ. Layer	2	2	-	-	-	-	1	5
Burnt Material	2	-	-	-	-	-	-	2
Sub Total	***4***	***2***	***-***	***-***	***-***	***-***	***1***	***7***
Phase 3								
Occ. Layer	3	1	-	1	-	-	1	6
Post Socket	-	2	-	-	-	1	-	3
Sub Total	***3***	***3***	***-***	***1***	***-***	***1***	***1***	***9***
Others								
Unstratified	1	-	-	1	-	-	-	2
Outside Hut	2	-	-	-	-	-	-	2
Sub Total	***3***	***-***	***-***	***1***	***-***	***-***	***-***	***4***
Totals	**19**	**15**	**2**	**2**	**1**	**1**	**8**	**48**

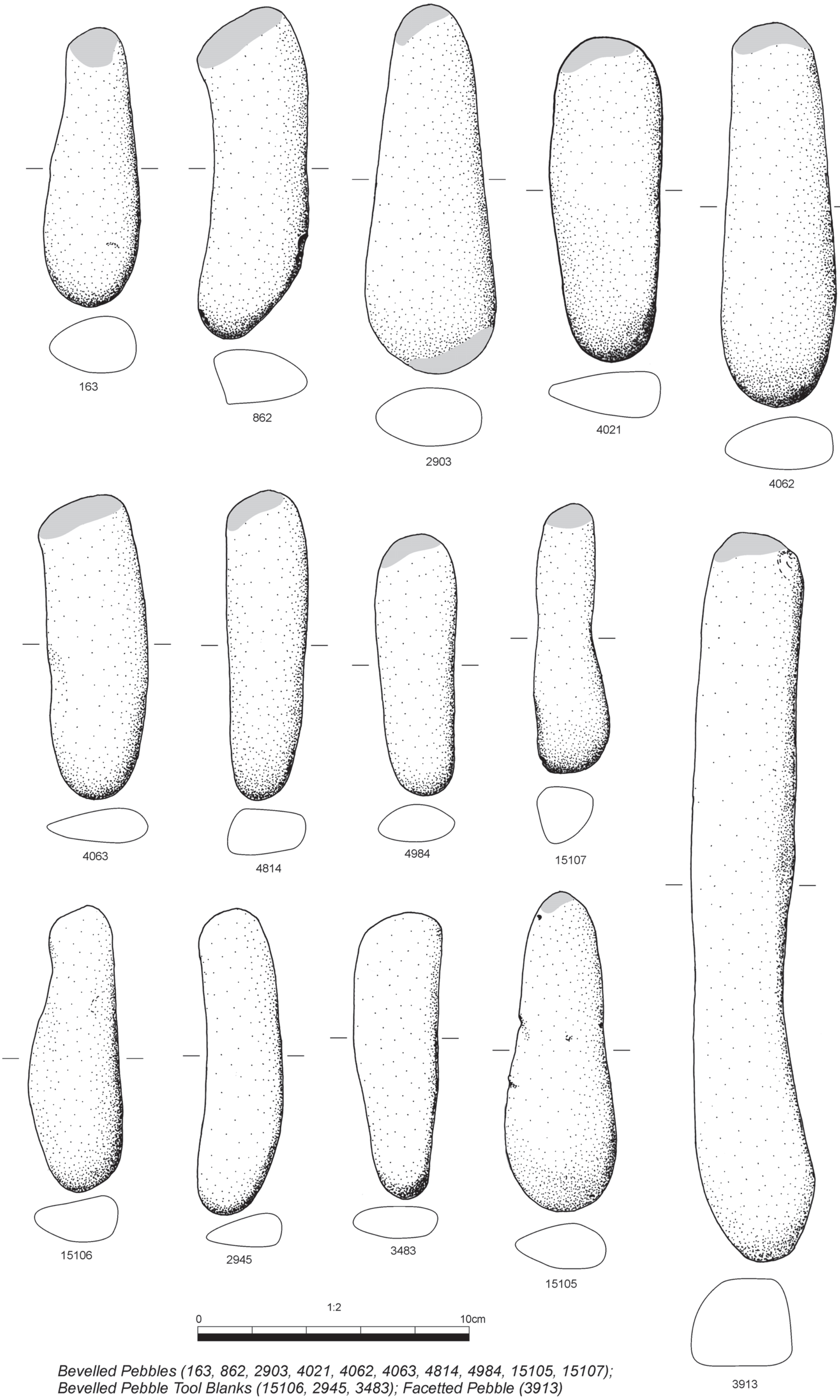
Table 8.1. Coarse stone tools by phase and feature type (including the broken segments of two refits in their separate phases, as in both cases they had been re-used).

bevel from left up to the right, and on an additional three pieces where the bevel is less developed, there is a tendency for the left side to be more heavily worn. On just two pieces the bevels are angled from right up to left and this most probably demonstrates at least a degree of left-handedness in the population at Howick.

Given the angle of the wear and the direction of striations running parallel with the length of the tools, they could have been held like a knife, angled towards the user (which would allow for the development of the angled bevel) and used in a downward motion (see Fig. 8.2). Possible uses for these tools are explored in Chapter 14.

There is a refit between broken fragments of a tool blank from hearth [357] in Phase 1a and burnt spread [320] in Phase 1b. This piece is badly burnt and abraded and the two fragments were clearly deposited separately in antiquity. Another refit, this time of a bevelled pebble, links two fragments from an occupation layer in Phase 1a, [232], and the Phase 3 occupation layer [49]. Abrasion over the broken ends indicates, again, that the tool was broken, each piece re-used and then discarded separately in antiquity.

It is clear from the Phase 1a and 1b plans (Fig. 14.2) that the bevelled pebbles were clustered around specific sectors of the hut and that the location of these activity areas was different in each of these phases. Perhaps this change in location is related to a change in the position of the hut entrance (see also Chapter 14). In general the tool blanks follow the same contexts of deposition as the bevelled pebbles and are present in all phases of the hut. A review of bevelled pebble tools is included in Chapter 14, together with a full discussion of the Howick pieces, including their relationship with the other excavated small finds and analyses.



Bevelled Pebbles (163, 862, 2903, 4021, 4062, 4063, 4814, 4984, 15105, 15107); Bevelled Pebble Tool Blanks (15106, 2945, 3483); Facetted Pebble (3913)

Figure 8.1 Bevelled pebble tools, tool blanks and a faceted pebble from the Howick hut.

Figure 8.2 Reconstruction of the way in which the Howick bevelled pebble tools are thought to have been used.

Faceted Pebbles

There were two faceted pebbles recovered from Mesolithic contexts. One, (3913), has a rounded pecked facet on one end of a finger-like pebble which resembles the rounded pecked facet on the end of the unstratified bevelled pebble (15107), suggesting that the latter piece was selected twice for different jobs. A tabular piece of sandstone, (4351), is badly heat-damaged but narrow ridged facets may have been worn on opposite faces.

Hammerstones

Both hammerstones have non-specific spreads of pecking on their surface. One, a limestone cobble, (15108), may also have a face which has been worn smooth, though like the other specimen it is not a confident assignation of type. The sandstone hammerstone fragment (4923) has the dimensions of a bevelled pebble and this may have been its original function.

Smoothing Stone?

The possible smoothing stone (4316) is simply a small oval limestone cobble with one face that may have been worn smooth from use. Such tools are difficult to identify confidently unless the cross-section of the surface has been altered and in this case it has not.

Unused Cobbles and Stone Fragments

Four unused sandstone cobbles and four unused sandstone fragments were found in the Mesolithic phases with six of the eight showing obvious signs of having been heat-affected. These rocks could have been used as cooking stones. As three of these stones were found in pit [270] from Phase 1a, it suggests that this pit may have been used for heating activities. It is perhaps notable that an arc of bevelled pebbles was also found in and around this shallow pit, implying a connection with an activity that required heat.

Ochreous Material

By Clive Waddington

The ochreous material from Howick was catalogued and briefly assessed to establish its possible uses with regard to the Mesolithic occupation of the hut. A total of 38 fragments of ochreous material was retrieved from the Mesolithic hut deposits, together with a further two from the subsoil horizon [3] above. The stratified fragments came from 11 different contexts across Phases 1a, 1b, 2 and 3. A variety of ochreous material was identified, including micaceous sandstone and haematised shale, which may have been available locally.

The ochreous material came in a variety of shades including red-browns and yellows. Ochreous material does not occur naturally in the sand substratum at Howick and therefore the material has evidently been collected and brought into the hut. The frag-

Context No.	Small Find No.	Phase	Feature	Type	Material	Max Length (mm)	Max Width (mm)	Max Thickness (mm)	Remarks
270	3487	1a	Pit	Stone fragment	Sandstone	130	110	43	Fragment from block of sandstone. Burnt.
270	3519	1a	Pit	Cobble	Sandstone				Fragment of unused sandstone cobble. Heat-cracked. No sign of use wear.
270	3572	1a	Pit	Cobble	Sandstone	66	53	27	Oval cobble of sandstone. Weathered. No sign of use wear.
5 (hut floor)	3407	1a	Pit	Tool Blank	Sandstone	115	31	20	Finger-like pebble of sandstone. Fragmented and very abraded, probably heat-damaged. Abrasion has obliterated wear traces.
5 (hut floor)	3483	1a	Pit	Tool Blank	Sandstone	105	32	16	Flat elongated pebble of sandstone. No clear signs of use. May be a blank for a bevelled pebble.
5 (hut floor)	3564	1a	Pit	Bevelled pebble	Sandstone	113	28	20	Finger-like pebble of sandstone. Heat damage, fragmented. Bevel worked on broader end. Larger bevel (13mm broad) on one face. Bevel appears smooth and is rounded. On opposite face bevel is narrower (6mm broad) and less worn.
270	4814	1a	Pit	Bevelled pebble	Sandstone	113	31	18	Finger-like pebble of sandstone. Bevel worked at broader, spatulate end. Larger bevel (11mm broad) is convex in section and very smooth as if from being rubbed. In plan the bevel is angled down from left up to right. On opposite face the bevel (10mm broad) is more rounded and smoothed over chipping damage. Width at bevel 25mm.
270	4984	1a	Pit	Bevelled pebble	Sandstone	95	32	17	Flat finger-like pebble of sandstone. Bevel worked on broader end. The bevel (9mm broad) is only lightly worked with smoothing and longitudinal striations visible. Similar bevel (7mm broad) on opposite face with some chipping damage. Light bevelling on both faces of opposite end too. Some pecking on one side also towards narrow end. The bevelling is less extensive than on other pieces. Width at bevels 22mm and 18mm.
355	4957	1a	Hearth	Stone fragment	Sandstone	140	115	50	Fragment from block of sandstone. Burnt.
5 (hut floor)	4732	1a	Hearth	Bevelled pebble	Sandstone	44	32	17	Elongated flat pebble of sandstone. Broken across width. Cracked from heat damage. Surviving end has a bevel worn on opposite faces. They are both 15mm broad and smoothed with longitudinal striations. They are both worked at an angle from left up to right. This tool has clearly been turned to use

Table 8.2. Catalogue of coarse stone artefacts. (Continued over the next four pages).

Context No.	Small Find No.	Phase	Feature	Type	Material	Max Length (mm)	Max Width (mm)	Max Thickness (mm)	Remarks
									opposite face. Width at bevel 26mm.
5 (hut floor)	4813	1a	Hearth	Tool Blank	Sandstone	83	44	20	Flat finger-like pebble of sandstone. Broken across width. Heat-cracked. No sign of wear on surviving end.
357	5158	1a	Hearth	Tool Blank	Sandstone	105	37	35	Elongated oval cobble of sandstone. Weathered with removal of cortical surface. No sign of wear.
320 and 379	5114/4812	1b and 1a	Hearth	Tool Blank	Sandstone	150	44	19	Refit. Elongated flat pebble of sandstone. Broken across width with each half having different find no and context. Clearly been burnt and then abraded afterwards. Broad end from 320, narrow end from 357. No definite signs of use wear but this may have been obliterated by weathering.
320/49	3911/1816	1b and 3	Occ. Layer	Bevelled pebble	Sandstone	65	27	16	Refit. Finger-like pebble of sandstone. Broken across width. Each half has different find no and context. On broader end a bevel (14mm broad) has been smoothed with visible longitudinal striations. Bevel worked at an angle from left down to right so held differently to other bevelled pebbles. Narrower bevel (5mm broad) slightly rougher worked on opposite face. Piece from C.49 is unworked end and abraded/weathered over broken end. Width at bevel 21mm.
118	4988	2	Occ. Layer	Tool Blank	Sandstone				Flat elongated pebble of sandstone. Fragment only, burnt. Breakage has obliterated any sign of wear.
160	4021	2	Burnt material	Bevelled pebble	Sandstone	118	43	26	Flat finger-like pebble of sandstone. Bevel worked on broader, spatulate end. On one face the bevel is narrow (9mm broad) and very smooth as if produced by rubbing. It is slightly convex in section and worked more on left side in plan and angled down from left up to right. Possibly some light insignificant bevelling on opposite face. Width at bevel 35mm.
160	614	2	Burnt material	Bevelled pebble	Sandstone				Broken, bulbous segment with a heat-shattered end. An angled facet survives, indicating this bevelled tool has been used.

Table 8.2. Continued.

Context No.	Small Find No.	Phase	Feature	Type	Material	Max Length (mm)	Max Width (mm)	Max Thickness (mm)	Remarks
210	2903	2	Occ. Layer	Bevelled pebble	Sandstone	135	48	27	Elongated flat pebble of sandstone. Bevel worked on broader end. Bevel (13mm broad) convex in cross-section and smoothed with visible longitudinal striations. Worn more heavily on left side of bevel. On opposite face the bevel (7mm broad) is more lightly worn over some chipping damage. Width at bevel 37mm.
210	2852	2	Occ. Layer	Stone fragment	Sandstone	83	80	48	Fragment from block of sandstone. Burnt.
210	2929	2	Occ. Layer	Bevelled pebble	Sandstone	111	40	20	Elongated flat pebble of sandstone. Possibly heat-cracked and surface abrasion. Bevel (11mm broad) on one end is smooth with visible striations and worked at an angle from left up to right. On tip and opposite face there is some chipping under the smooth bevelling. Possible light bevel worked on left side of one face at opposite end. Width at bevel 25mm.
210	3587	2	Occ. Layer	Tool blank	Sandstone	140	50	23	Flat oval pebble of sandstone. Weathered with onion-peel removal of cortex, obliterating any signs of use wear that may have existed. Possible tool blank.
232	3913	1b	Occ. Layer	Faceted Pebble	Sandstone	132	23	27	Finger-like pebble of sandstone. Rounded facet pecked on one end possibly from two faces. Some flaking from the edge of facet.
264	4361	1b	Burnt Spread	Tool Blank	Sandstone	150	54	17	Flat elongated pebble of sandstone. Heat-cracked. No clear signs of use. May be a blank for a bevelled pebble.
264	3673	1b	Burnt Spread	Tool Blank	Sandstone				Finger-like pebble of sandstone. Fragment surviving. Heavily burnt. No sign of wear on surviving surface.
285	3856	1b	Pit	Cobble	Sandstone				Fragment of unused sandstone cobble. Heat-cracked. No sign of use wear.
316	5085	1b	Occ. Layer	Cobble	Sandstone				Fragment of an unused sandstone cobble. No sign of wear on surviving surface.
316	4351	1b	Occ. Layer	Faceted Pebble	Sandstone	102	43	17	Tabular pebble of sandstone. Fragmented, heat-damaged, abraded. Surviving broad end may have narrow ridged facets worked on opposite faces. Difficult to tell with surface damage.
316	4095	1b	Occ. Layer	Bevelled pebble	Sandstone	119	35	22	Flat elongated pebble of fine-grained sandstone. Bevel worked on broader spatulate end. On one face the bevel (13mm broad) is very smooth over some flaking damage with visible longitudinal striations. On opposite face the bevel (12mm broad) is smooth with visible longitudinal striations. Smoothing over of chipping damage. Bevel in plan angled left up to right. Width at bevel 32mm.

Table 8.2. Continued.

Context No.	Small Find No.	Phase	Feature	Type	Material	Max Length (mm)	Max Width (mm)	Max Thickness (mm)	Remarks
316	3330	1b	Occ. Layer	Tool blank	Sandstone	125	37	21	Elongated oval pebble. Fragmented. Burnt/abraded. No sign of use wear.
320	4316	1b	Occ. Layer	?Smoothing Stone	Limestone	85	46	29	Oval cobble of limestone. One face may have been worn smooth from use.
326	4249	1b	Linear	Tool Blank	Sandstone	105	26	18	Finger-like pebble of fine-grained sandstone. Heat-damaged. Broken down length, destroying one end. No sign of working but this may have been obliterated by breakage. Probable blank for bevelled pebble.
326	4061	1b	Occ. Layer	Bevelled pebble	Sandstone	75	42	20	Flat elongated oval pebble of sandstone. Broken across width. Bevel end surviving. Larger bevel (14mm broad) on one face is very smooth as if produced by rubbing and convex in section with visible longitudinal striations. In plan the bevel is angled down from left up to right. On opposite face the bevel is narrower (7mm broad) and less heavily worn and is rubbed smooth with some chipping damage. Width at bevel 30mm.
326	4062	1b	Occ. Layer	Bevelled pebble	Sandstone	140	44	24	Flat elongated pebble of fine-grained sandstone. Bevels worked on narrower spatulate end. On one face bevel (11mm broad) is smooth and convex in section with visible longitudinal striations. The bevel in plan is angled left up to right. On opposite face the bevel (12mm broad) is smooth with visible longitudinal striations and worked more heavily on the left side. Width at bevel 29mm.
326	4063	1b	Occ. Layer	Bevelled pebble	Sandstone	111	40	13	Flat elongated oval pebble of sandstone. Bevels worked on broader, spatulate end. Larger bevel (12mm broad) is convex in section and very smooth as if from being rubbed and longitudinal striations are visible. In plan bevel angled down from left up to right. On opposite face the bevel is narrower (6mm), less heavily worn and rubbed smooth with some chipping damage. Width at bevel 34mm.
29	15109	3	Timber Stain	Stone Pad	Sandstone	190	160	63	Fragment from block of sandstone. Burnt. Used as timber support in base of C.29.
49	859	3	Occ. Layer	Stone fragment	Sandstone				Fragments of heat-cracked and surface damaged stone.

Table 8.2. Continued.

Context No.	Small Find No.	Phase	Feature	Type	Material	Max Length (mm)	Max Width (mm)	Max Thickness (mm)	Remarks
49	862	3	Occ. Layer	Bevelled pebble	Sandstone	122	40	22	Flat elongated pebble of fine-grained sandstone. Bevel worked at broader end. Larger bevel (15mm broad) is convex in section and very smooth with visible striations running parallel to the length of the tool. In plan the bevel is angled from left up to right. Some chipping damage on bevel ridge and over the opposite face where there is a very narrow bevel (4mm broad). The tool has been turned to use again. On opposite narrower end (on opposite face to big bevel) there is a rounded, smoothed bevel with visible striations and some chipping damage on bevel ridge – not so developed as opposite end. Width at bevels 38mm and 20mm.
49	1935	3	Occ. Layer	Bevelled pebble	Sandstone	82	43	19	Flat elongated pebble of sandstone. Broken across width. Heat-cracked and surface weathered. Possibly some light bevelling on surviving end but this is not clear through the surface damage.
49	1939	3	Occ. Layer	Tool Blank	Sandstone	60	23	15	Small finger-like pebble of limestone. No clear sign of wear but may be a tool blank.
49	4923	3	Occ. Layer	Hammerstone	Sandstone	103	43	29	Elongated pebble of sandstone. Broken across width. Heat-cracked. Small patch of light pecking on surviving narrow end.
49	2945	3	Post Socket	Tool Blank	Sandstone	113	31	15	Flat elongated pebble of sandstone. Heat-cracked. No clear signs of use. May be a blank for a bevelled pebble.
51	15106	3	Post Socket	Tool Blank	Sandstone	105	34	18	Elongated flat pebble of sandstone. No sign of wear.
21	15105	Meso	Pit	Bevelled pebble	Sandstone	118	42	26	Elongated pebble of sandstone. Weathered all over with some post-depositional damage. Bevel worn on broad end but obscured by weathering.
87	1188		Clay Spread	Bevelled pebble	Sandstone	97	31	21	Finger-like pebble of sandstone. Bevels on each face at either end. The bevels are 11mm-15mm broad and are smooth with visible longitudinal striations. The bevels tend to be more angled from left up to right. Width at bevels 21mm and 23mm.
Unstrat	15108		Subsoil	Hammerstone	Limestone	82	53	30	Oval cobble of limestone. Upper face with some light pecking from use. Opposite face may have been worn smooth from use.
Unstrat	15107			Bevelled pebble	Sandstone	99	30	25	Finger-like pebble of sandstone. On broader end a bevel (13mm broad) has been pecked and ground with visible longitudinal striations which run on for over 10mm past the bevel. Bevel worked at an angle from left up to right. On opposite face there is a smaller bevel (9mm broad), similarly pecked and ground. On narrower opposite end there is a rounded pecked facet. Width at bevel 28mm.

ments were fairly evenly distributed across the three main structural phases, with 14 occurring in deposits from Phases 1a and b, 10 from Phase 2 and 14 from Phase 3.

Ochre is frequently found on Palaeolithic and Mesolithic sites throughout Europe and it is clear that hunter-gatherer groups valued this material. Although it has healing properties and can be used in the preparation of hides, ochre is also used as a pigment (Isbister 2000, 191–95), presumably for art, body decoration or for its symbolic blood-like colour. The association of red ochre with Palaeolithic and Mesolithic burials is well attested in North-West Europe, from the well-known burials in Scandinavia such as Skateholm (Larsson 1989), to British sites such as the 'Red Lady' of Paviland (Aldhouse-Green and Pettitt 1998), where the ochre appears to have been included in the grave as part of a symbolic act. The discovery of ochreous material at Howick in what is considered to be ostensibly a domestic setting within the confines of a dwelling, is of particular interest because in this case the ochreous material is not linked to burial. This implies that ochre had wider uses outside the sphere of 'burial' and 'ritual' and that it could have also been used for symbolic purposes such as art and body ornament as well as more mundane purposes such as pigment for hide preparation and medicinal uses. One other interesting possibility is the use of ochre as a fixative in the mastic used to seal joints in light water craft. The American coastal Chumash tribe are recorded as having used ochre in this way and the presence of ochre and punching tools associated with hearths has led Cassidy *et al*. (2004) to interpret this as evidence for boatbuilding amongst the early Holocene coastal groups of California. At Howick, ochre was associated with the Phase 1a hearths as well as occupation layers abutting the hearth areas. Given that Howick is a coastal site, the use of ochre in boat construction must remain an important possibility.

9 Residue and Use-Wear Analysis of Stone Tools

Karen Hardy and Robert Shiel

Residue Analysis

Residue analysis involves the examination of residues that adhere to the surface of a tool. A sample of residue is extracted from the tool's surface. It is then dried, mounted on a slide and examined microscopically from a morphological perspective. Particular attention has been given to the detection of starch grains and phytoliths (e.g. Barton *et al.* 1998; Fullagar 1998) and it is sometimes possible to identify these up to species level.

A different method for examining residues was first tested by Jahren *et al.* (1997). This method involves semi-quantitative analysis of residues using an environmental or low-vacuum scanning electron microscope (SEM). Jahren *et al.* (1997) however, carbon coated their samples, which eliminated the possibility of identifying residues that contained carbon. In this experimental study, artefacts were not coated and were inserted without any special pretreatment. Jahren's method is a potentially valuable non-destructive way to obtain information regarding the use of a tool. Problems remain to be resolved, most notably with regard to the potential for post-depositional contamination, however. One potential for contamination comes from modern roots and this is something that affects all buried material. However, in this case, the C/N ratios that have been determined are widely different to the expected norm. In fact the deviation from the norm indicates the opposite of contamination with modern materials. It is probable though that material on the tools will have been affected by subsequent post-depositional diagenesis.

Method

A selection of tools were first examined using a Meiji ML 2305 incident and transmitted light microscope to identify tools with residues and to plan the location of the residues on the tools' surface. A small number of tools were then selected, based on the potential quality of the residue, for SEM analysis.

A Philips XL30CP SEM instrument with an analytical system capable of detecting light elements (down to C) was used. Imaging was carried out using back-scattered electron (BSE) mode, with point analyses made of features on the rough surface. Analysis was carried out using PGT (Princeton

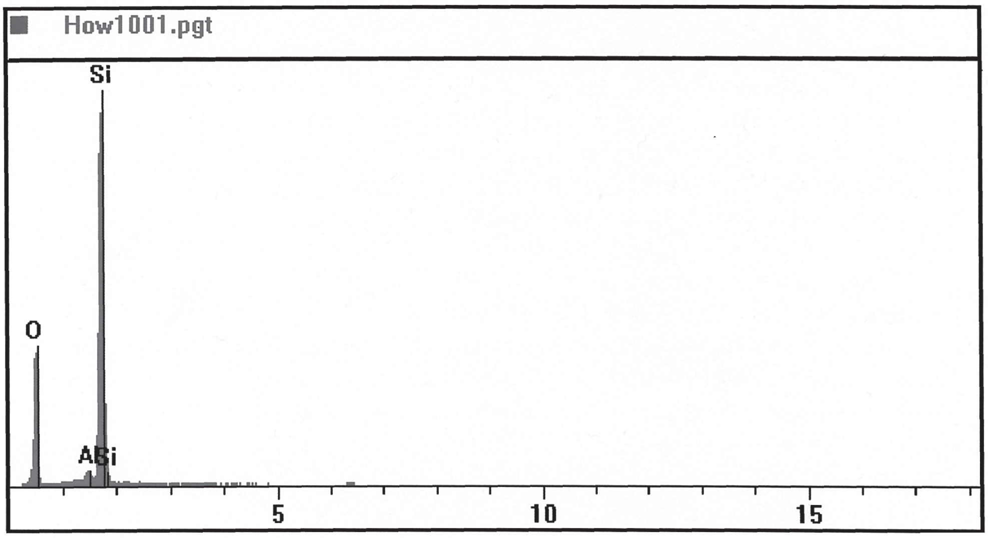


Figure 9.1. Tool 4395. Example of ED spectrum for background flint.

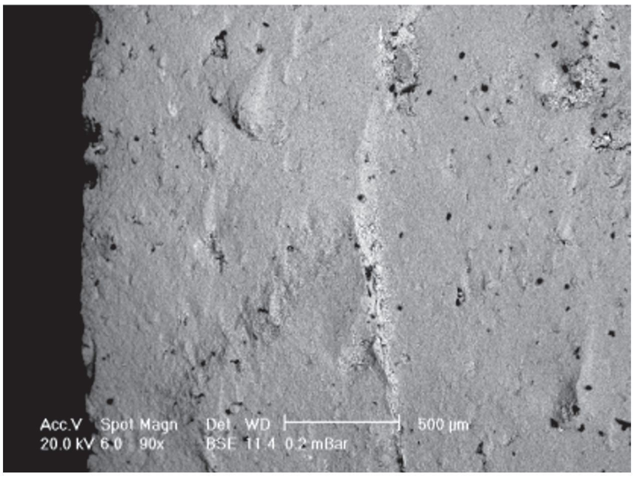


Figure 9.2. Tool 4395. Example of tool surface at low magnification (x90).

Gamma Tech) analytical software, which provided an energy dispersive (ED) spectrum that was used as a fingerprint, to distinguish different material types, supported by a semi-quantitative analysis (fully quantitative analyses are impossible with rough samples). A background analysis was made on the residue-free flint surface to permit comparison with spectra and analyses obtained from the residues. In all cases, peaks reported in the ED spectrum were identified using the analytical software, taking care to identify and label K_a, K_b, L_a and L_b X-ray peaks when observed.

Each artefact was examined across one surface and a series of spectra was taken. The first spectrum for every piece was a background spectrum of the flint surface, without residue, which was used as a control. Further spectra were then taken on a selection of different residue types located on the surface of the tool. At magnification, the surface of the flint is sometimes found to be pock-marked with small holes and often the residues could be found lying inside these minute holes. In Figure 9.2 the background flint can easily be distinguished from the black dots. These black dots are either empty holes, surface residues or holes filled with residue. Viewing at higher magnification enables a distinction to be made between these.

An interpretation was made as to the nature of the residue, based on the ED spectrum and chemical information. For mineral materials, the relative atomic proportions of Al, Si, Fe, K and Mg were used to identify tentatively silicates such as biotite, cordierite, feldspar and clay minerals. Spectra which showed both Ca and C were attributed to calcite. In other cases, spectra showing only strong C and N peaks were attributed tentatively (in the absence of Ca) to organic matter. Atomic proportions of C:N were determined to assess variation in the composition of the organic residues.

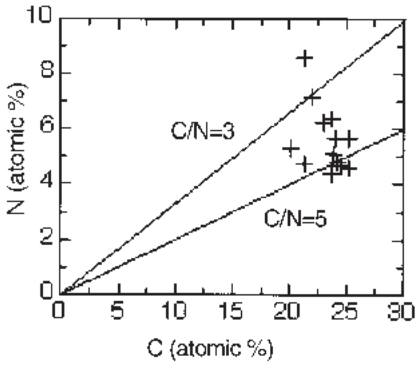


Figure 9.3. C and N proportions derived from energy dispersive analysis (all samples).

The observed values were compared with ratios calculated for typical natural materials:

- Wood, straw, oils and fats = C/N >30
- Green plant tissue = C/N around 25
- Wheat and other seed grains = C/N around 15
- Soil and fungi = C/N around 10
- Most animal tissues (excluding fatty acids), bacteria and actinomycetes = C/N 5 and below.

Animal protein (meat) is very unlikely to survive without being altered by bacteria. Its small C:N ratio is unlikely to alter substantially with time, whereas most plant material begins with a very wide C:N ratio and narrows progressively. Therefore a nitrogen-rich residue is an indication of protein-rich materials. Bulk soil C:N ratio is rarely much below 10 because of the predominance of resistant plant materials, such as lignin and cellulose. Ratios as low as 5 are only found in undisturbed soil at depths greater than 1m (Jenkinson 1988) and are usually associated with materials strongly absorbed onto clay surfaces. The samples analysed here came from lesser depths.

In this experimental study, two result groups emerged – one in which the C:N ratio was infinite, i.e. there was no N detected, and the other in which the C:N ratio lay between 2.5 and 5.5. Neither of these cases occurs in a normal terrestrial topsoil. Carbon without nitrogen is found in plant parts but not in whole plants and will not become attached to stones without human intervention. Equally, the narrow ratio falls outside the expected range of values. Anything below 5 is rare indeed and then is only found below 1m depth (Dyer 1902). It is therefore more likely that these materials are the result of the use of the tools and reflect two groups of uses – one associated with low C:N ratio materials such as meat or pulse seeds and the other working wood with its high to infinite C:N ratio.

Data for all samples containing both C and N are shown in Figure 9.3. Despite the limitations inherent in using semi-quantitative analytical information from EDS spectra, the data obtained in this study are consistent in the relative proportions of C and N.

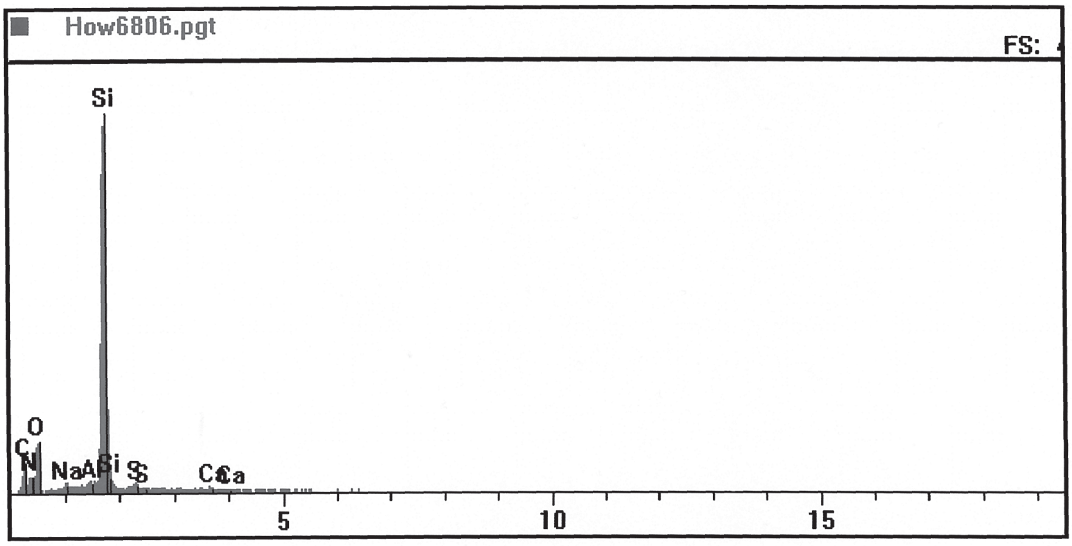


Figure 9.4 Example of a carbon/nitrogen-rich spectrum, Tool 3162.

Because other spectra were observed that give a C but no N signal, it is assumed that the spectra showing both elements reflect their presence in the sample, and that their relative proportions are consistent (although absolute reported quantities may have little meaning).

The underlying solid geology in the Howick area consists of a Carboniferous sequence of interbedded sandstone, limestone and mudstones; dolerite outcrops less than 1km along the coast. The bedrock is covered with a veneer of boulder clay that contains sand pockets, and it is in one of the sand pockets that the Mesolithic site is situated.

Results

Artefacts were placed into sealed bags immediately as they were being excavated to minimise the risk of contamination. Bags were not reopened until the artefacts were ready to be placed in the SEM at which point their surfaces were lightly brushed to remove any surface soil. In this section, only the positive, residue related results will be discussed. Of the numerous readings that were taken, many were found to be linked to the background soil while some were rejected due to poor quality of the spectrum (low total X-ray counts). These will not be included in the discussion.

Lithic No. 3162

Context 236/109. Roasting pit, Phase 2.
Unretouched blade.
Fifteen spectra.

Three spectra had counts of carbon and nitrogen that are as follows:

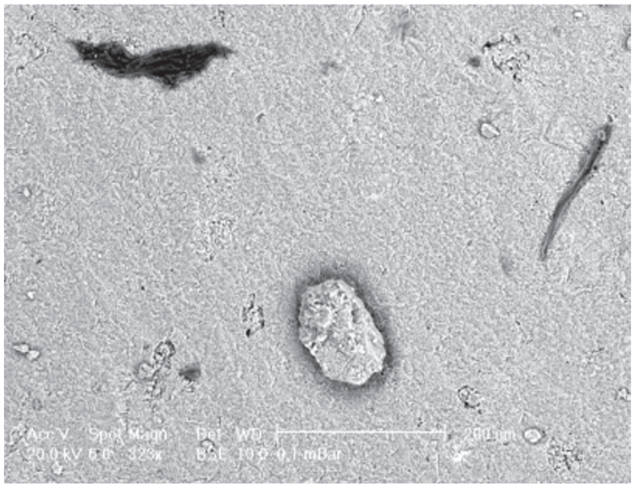


Figure 9.5. Tool 3162. Carbon/nitrogen-rich residue (323x magnification). The elongated black object at the top left is a hole containing a nitrogen-rich residue.

23.69/6.40 = 3.7
23.93/ 4.68 = 5.1
21.36/8.59 = 2.5

All three ratios are very low and fall into the category of animal protein or seeds. Fat tissue, oil, wax and carbonised organic material contain carbon but no nitrogen so they are excluded here.

Lithic No. 4697

Context 340. Hearth, Phase 1b.
Microlith, point.
Nine spectra.

Two spectra had carbon and nitrogen present and one spectrum had carbon alone.
Carbon/nitrogen ratios:

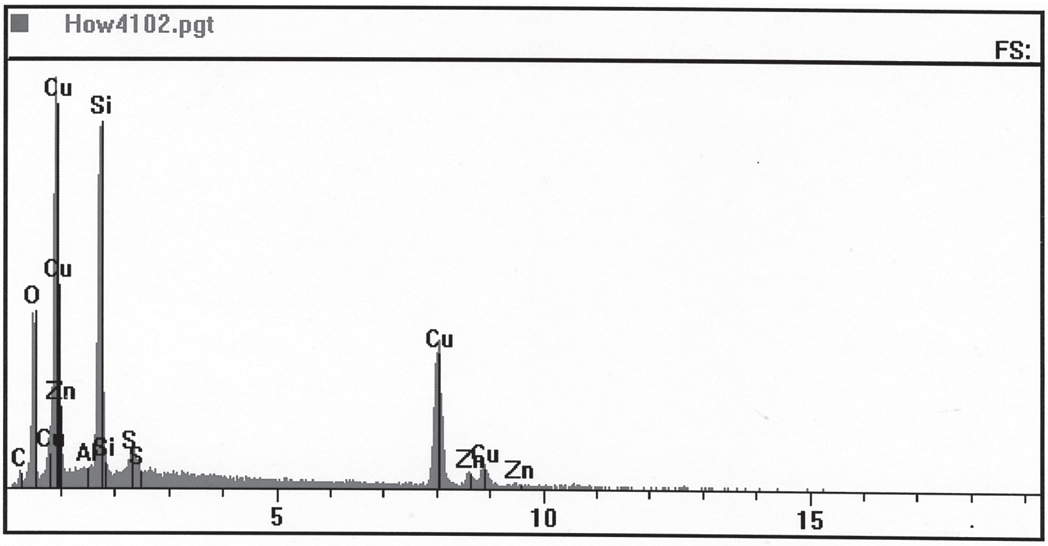


Figure 9.6. Copper-rich spectrum from Tool 4410.

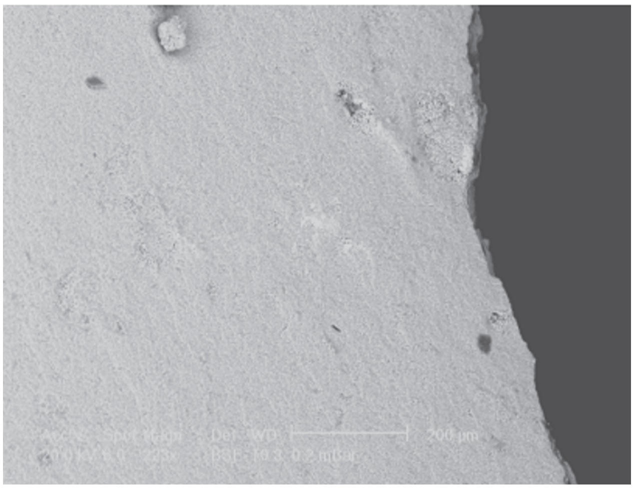


Figure 9.7. Tool 4410. Copper residue (223x magnification). The copper residue is the bright white mark to the centre right of the photo.

25.31/5.70 = 4.44
22.97/6.27 = 3.66

Once again the carbon/nitrogen ratios suggest the presence of protein-bearing material, which is consistent with the tool being in contact with meat or seeds. The presence of carbon without nitrogen can be attributed to several different things. It can be wax, oil, fat or burnt organic material. It is not currently possible to distinguish between these different materials.

Lithic No. 4410

Context 316. Occupation layer, Phase 1b.
Microlith, backed blade.
One spectrum.

The analysis is consistent with the presence of a copper (Cu) mineral in which zinc (Zn) is an impurity, and with the suggestion that the residue is a secondary hydrated copper carbonate mineral.

The copper is weathered; this may have occurred after the copper became adhered to the tool, or the flint could have come into contact with a weathered piece of copper ore.

Secondary copper mineralisation is reported to occur at outcrops in the Cheviot Hills some 24km due west, suggesting a possible source (Carruthers *et al*. 1932). Additionally, zinc minerals are exposed on the coast at Howick. Transport from the Cheviots could have been within glacial till (erratics from the Cheviots are common at Howick), or could have been brought by people during the Mesolithic for processing and use for colouring purposes. Copper carbonate minerals can be used as a source of green or blue pigment.

Lithic No. 4382

Context 320. Large burnt spread, Phase 1b.
Microlith, scalene triangle.
Ten spectra.

Five spectra produced evidence of cordierite, based on the relative proportions of magnesium (Mg), aluminium (Al) and silicon (Si). Cordierite is produced when Mg-bearing clay (a typical constituent of northern English boulder clay) is fired at high temperatures (over 800°C). This temperature can occur in the middle of a hot hearth fire where the underlying clayey sediment would turn, in part, to cordierite. The most likely explanation for this is that this tool inadvertently found itself in a fireplace.

Three spectra had evidence of organic material. The presence of carbon without nitrogen suggests that this is either oil, wax, fat or carbonised organic

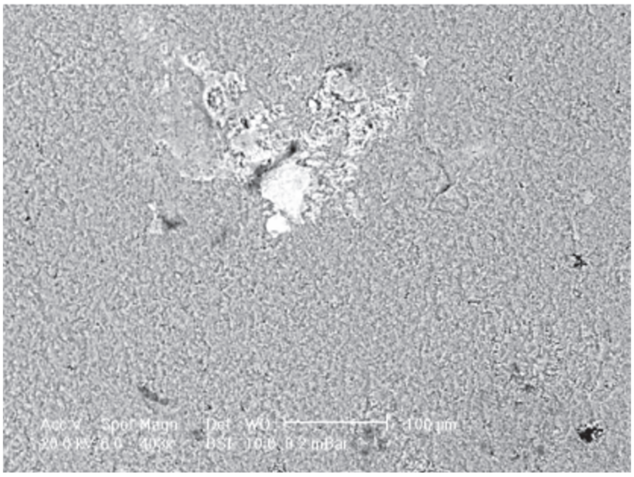


Figure 9.8 Example of cordierite on surface of Tool 4382.

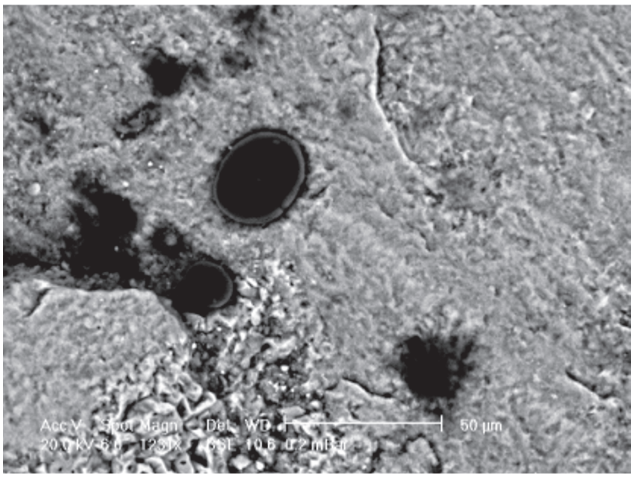


Figure 9.9. Tool 1621. Example of wood ash residue (black marks at upper left of image).

material, or that it is the carbonised (charcoal) remains after the more reactive nitrogen-containing compounds have been destroyed, presumably in this case by heat.

Lithic No. 4986

Context 118. Occupation layer, Phase 2.
Scraper.
Fifteen spectra.
Four spectra had carbon and nitrogen present and six spectra had carbon alone.

Carbon/nitrogen ratios.
21.38/4.75 = 4.5
24.55/4.67 = 5.25
24.23/4.81 = 5
24.03/5.68 = 4.23

For this piece, the carbon/nitrogen ratios suggest residues of meat or seeds, and the carbon-only readings suggest wax, oil, fat or carbonised organic material. Fat could be produced for example by scraping the inside of a hide, while wax could be produced as the result of a glue such as beeswax and resin. The carbon-only residues are spread across much of the surface, while the carbon and nitrogen-bearing spectra occur mostly on or near the edge of the tool.

Lithic No. 4395

Context 320. Large burnt spread, Phase 1b.
Scraper.
Six spectra.
Three spectra were carbon-rich, suggesting a wax, oil, fat or carbonised organic material.

Lithic No. 1621

Context 3. Unstratified subsoil.
Unretouched flake.
Seven spectra.
Four spectra were similar. They contain potassium (ash contains potassium carbonate), chloride and sodium. Potassium occurs in chemical fertilisers and as no fertilisers have been used near the site in recent memory, it is most likely that the potassium is derived from ash or charred timber. The presence of sodium suggests that the burnt woody material might be derived from or had contact with the sea, such as seaweed or driftwood.

Interpretation
This piece may have been used to work a piece of charred timber. Timber can be fired first to make it easier to work for example in digging out the inside of dugout canoes. Wood was undoubtedly a crucial raw material and is likely to have been used to make a wide range of items.

Lithic No. 2758

Context 49. Occupation layer, Phase 3.
Microlith, scalene triangle.
Six spectra.
Three spectra contained carbon but no nitrogen. This suggests wax, oil, fat or carbonised organic material.

Lithic No. 4548

Context 320. Large burnt spread, Phase 1b.
Microlith, backed blade.
Five spectra.
Two spectra contain potassium (as said, ash contains potassium carbonate), chloride and sodium, possibly suggesting wood ash or charred timber (see above Tool 1621).
The carbon and nitrogen counts are as follows:

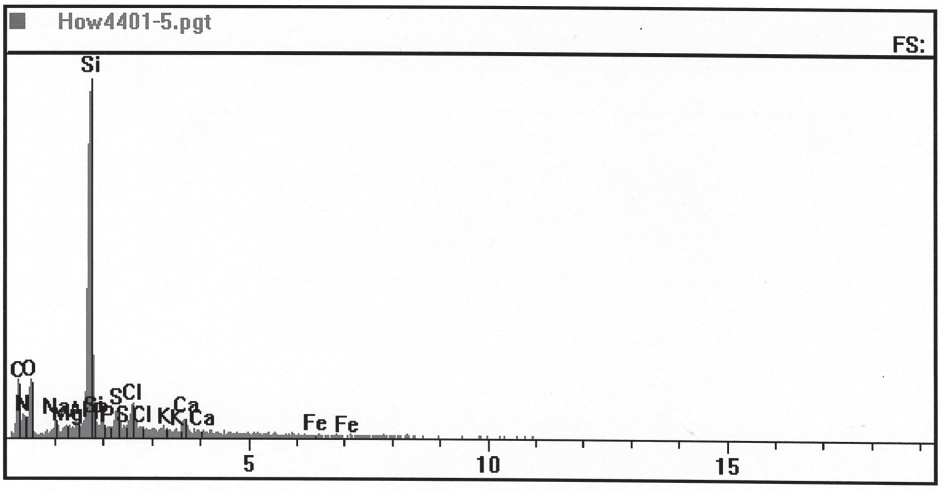


Figure 9.10 Tool 4548. Example of a wood ash residue spectrum.

23.69/4.36 = 5.4
20.09/5.30 = 3.8
These ratios suggest meat or seeds.

Lithic No. 4294

Context 316. Occupation deposit, Phase 1b.
Scraper.
Thirteen spectra.

Two spectra had carbon and nitrogen present, while one spectrum had carbon alone.

22.03/7.13 = 3.08
25.18/4.59 = 5.48
These ratios suggest meat or seeds.

Lithic No. 4652

Context 340. Hearth, Phase 1b.
Unretouched blade.
Five spectra.

Two spectra contain potassium, chloride and sodium, possibly suggesting wood ash or charred timber (see above Tool 1621).

Lithic No. 4063

Context 232. Occupation layer, Phase 1a.
Coarse stone elongated bevelled pebble tool.
Four spectra.

This is a siltstone. Four spectra were taken from this piece, three of the background and one from a residue spot. This produced carbon, suggesting wax, oil, fat or carbonised organic material.

Discussion

The residue analysis has produced a series of detailed findings that can contribute to building up a picture of Howick during the Mesolithic, though it is important not to forget the experimental nature of the study. The residue analysis has identified the possible use of either driftwood or seaweed. It has also suggested that copper-rich stones were brought to Howick, possibly for extraction of pigment. The number of tools with traces of narrow C:N ratio materials, typical of having been associated with much more protein-rich materials such as meat or seeds, is surprising, particularly given recent ethnographic evidence for the intensive use of lithics in the preparation of material culture items (Hampton 1999; Hardy and Sillitoe 2003) and the current focus on plants as an important food and raw material source during the Mesolithic (Juel Jensen 1994; Zvelebil 1994; Owen 2000). Tools that were used for working protein-poor materials have residues with a wide or infinite C:N ratio. This ratio has persisted in the residues (for example Tool no. 2758). The reason for the difference in residue composition between tools awaits further investigation. The presence of cordierite shows that the hearth fires sometimes had very intense heat. Though further work is required, the development of this method, to enable more specific and a wider range of interpretations of the chemical spectra, may provide a new opening for the study of the organic record, something that has hitherto been missing from much of the early prehistoric archaeological record.

Use-Wear Analysis

Introduction

The traditional system of classification of lithic artefacts is based on morphology and an understanding of the technological processes in the manufacture of lithics. Suggested artefact use is interpretative, and

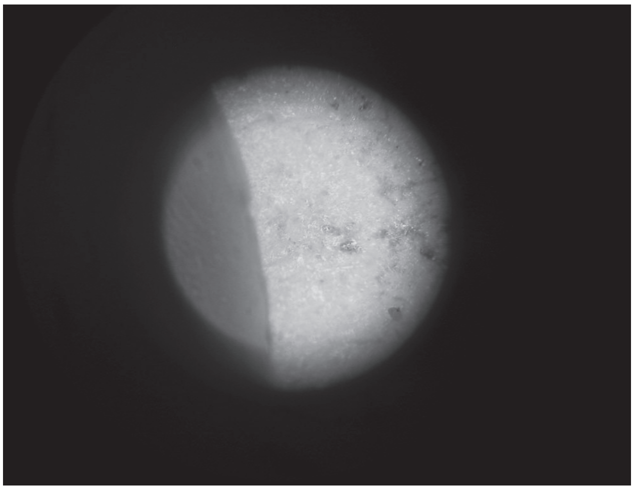


Figure 9.11. Example of an unpolished, probably unused edge at 100x magnification).

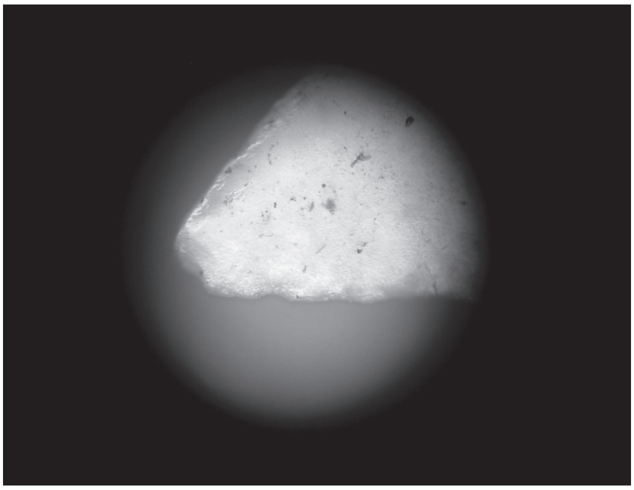


Figure 9.12. Example of a polished point at 50x magnification (artefact no 2309).

based on morphological characteristics. Use-wear analysis by contrast uses empirical, measurable and experimental evidence to examine artefact use.

Artefacts are examined both from a morphological and physical point of view, using a combination of measurements and high-power microscopy which has rarely been carried out on Mesolithic samples from northern Britain. When it has, there has been a tendency to concentrate on retouched artefacts, in particular microliths (Finlayson 1989, 1990; Finlayson and Mithen 2000) though it is clear that unretouched pieces were also routinely used (Knuttsson 1988 a and b, 1990; Hardy 2004, forthcoming a). Additionally, ethnographic studies have suggested that modern conceptions of what may be deemed a useful edge or artefact rarely correlate with the perceptions of the manufacturer/users (White 1968; White and Thomas 1972; Hayden 1979; Hardy and Sillitoe 2003; Sillitoe and Hardy 2003).

Use-wear analysis can provide a wealth of information that contributes greatly to the general interpretation of a site (e.g. Dumont 1985; Grace 1989). By providing information on artefact use, it can contribute information about site function as well as shed light on other elements such as the aims of artefact modification (were artefacts broken or modified for use in specific ways?), the knapping process in general (which unretouched pieces are waste products and which are not?) and post-depositional processes of artefact movement. One intriguing question that can be addressed is whether traditional classifications (scraper, serration, *etc.*) retain meaning at the level of functional use as opposed to classification.

There are several levels of use-wear analysis which can contribute a varying range of information on an assemblage of artefacts. At the most basic level, tools can be identified as having been used or not; information then increases to what type of motion they have been used in (cutting, scraping, *etc*.), the type of raw material they have been used on (e.g. soft material such as meat or hard material such as bone), and finally what the most likely function of the tool was (e.g. Keeley 1980; Dumont 1985; Grace 1989; Finlayson and Mithen 2000). In order to attain this final level of information, it is necessary to undertake experimental work in which a range of tasks is carried out, using a similar raw material. The use-wear traces are then compared between the experimental and archaeological assemblages, and a comparative judgement produces the most likely correlations.

Artefacts are examined first from a morphological perspective. Measurements are taken on the volume and shape of an artefact, and the angle of the used edge (edge angle) measured. Following this, the use-wear variables are measured. These include: the scope and type of edge fracturing, the extent of edge rounding, and polish. Polish is examined from the point of view of its intensity, its distribution and the extent of its invasiveness. Different types of fracturing patterns suggest different movement of the piece, and lines of polish point to the dominant direction of use, for example if they all lie perpendicular to an edge they indicate use in an up/down direction, rather than longitudinally. Polish that extends deep into an edge might have been used on a pliable material, such as hide, while polish that is restricted to the limits of an edge is more likely to have been used on a hard or brittle material, such as bone (Figs 9.11–9.13).

Edge fractures can be caused by factors other than use, notably the thinness of the edge, and stress, which may occur from being carried around in a pocket or pouch, being trampled, soil conditions or post-excavation abrasion, for example bagging with other artefacts. However, if an artefact shows a concentration of fractures, often combined with non-

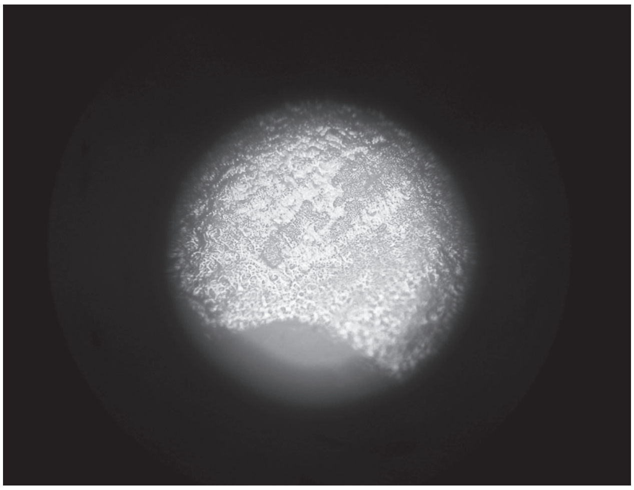


Figure 9.13. Example of same polished edge at 200x magnification (artefact 2309).

natural straightening on one edge, or part of an edge, then it is likely to be due to use. By contrast, if an artefact, particularly a thin one, has inconsistent or random fractures around all or most of its edges then it is more likely to be related to something other than use. Like edge fracture, polish may be due to many different factors. Spots of polish, or polish that occurs at random across a surface, are unlikely to have been caused by use. A consistent pattern of polish along an edge is more likely to have been caused by repeated motion, which usually signifies use. The main categories into which a tool's use can be placed include: cutting, piercing/boring, grinding, whittling, scraping, and pounding/percussion.

Many different methods have been used to assess most likely use based on experimental work. These range from individual, personal comparison of traces, artefact by artefact (e.g. Juel Jensen 1994) to expert systems (e.g. Grace 1989) designed to interpret a suite of variables directly, to produce most likely use. In this study a method is used that was developed using an ethnographic assemblage from Papua New Guinea (Shiel and Hardy 2003; Shiel and Hardy in prep.). Use-wear variables are numerically placed into a database, which is then analysed to produce clusters grouped by like use-wear traces, using a range of multivariate statistical techniques.

Aims

The aim of this use-wear analysis is to examine tool use from the Mesolithic site of Howick, using a small sample selected from the lithic assemblage in order to identify some of the raw materials worked at the site as well as some of the probable tasks that were carried out there.

Method

One hundred lithic artefacts from Howick were selected for use-wear analysis. Artefacts were selected from the assemblage found inside the hut. Selection was not random: artefacts that looked 'likely' to provide traces were picked out for use-wear analysis. The sample included 50 retouched pieces and 50 unretouched pieces.

Artefacts were washed by soaking in detergent. Where necessary, edges and surfaces were cleaned with alcohol. Morphological characteristics were recorded first, including length, width, thickness and shape of the artefact, the length and edge angle of likely used edges, and any non-natural straightening of an edge, or part of an edge. For the microscopic analysis, a Meiji ML 2305 incident and transmitted light microscope was used. An initial scan of the artefact's surface and edges was carried out at x40 magnification, followed, where necessary, by a more detailed examination at x100 and x200 magnifications.

Macroscopic and microscopic features examined included fractures, edge rounding and blunting, breakage and the development, invasiveness and distribution of polish. Examination of all these features together has resulted in a well-established method for undertaking use-wear analysis which is followed here (see Keeley and Newcomer 1977; Newcomer *et al.* 1986; Unrath *et al*. 1986; Grace *et al*. 1985, 1988; Bamforth 1987; Grace 1989; Hardy and Sillitoe 2003).

One of the problems with micro-analysis of light-coloured raw materials, such as many cherts and flint types, is that it is difficult to detect clearly the surface polish with the incident light needed for identification of edge damage like fractures, topography and striations. Incident light which comes from above at an angle of approximately 45° is reflected by the surface and is excellent for detecting irregularities in the surface and on the edge of the artefact, but it does not, except very faintly, reveal the presence and location of polish. Incident light can also detect polish on the surface of a dark raw material, but this method of detection becomes much more difficult for detailed analysis on any lighter raw material.

The polish was therefore examined both by incident light and using transmitted light through cross-polarisers. As the edges were normally thin, this enabled the polish to be clearly detected by showing it up as very bright, shiny patches along the used edge. The reason for this is that unpolished birefrigent, crystalline materials, such as flint and chert, scatter light such that their surface appears dull and dark through the microscope. When light emerges through polished surfaces, it does not scatter, resulting in these areas appearing brightly illuminated in contrast to the surrounding dark, unpolished surfaces. This method proved highly

Figure 9.14. Cutting grass as part of the experimental process.

Figure 9.16. Cutting seaweed as part of the experimental process.

Figure 9.15. Whittling wood as part of the experimental process.

Figure 9.17. Scraping dry hide as part of the experimental process.

effective for polish detection on all but the thickest of edges. Incident light was used in recording all micro-attributes and polish where possible.

The volume of a tool is determined by multiplying length x width x thickness. The tool's shape is determined by standardising the intermediate and shortest axes by dividing them by length. This gave lengths coded *I* and *S* respectively. The shape (*Z*) was then calculated as *Z=I2/S*, known as the Shiel ratio. This gives a range from >1, which is planar, ~1, which is cubic, and <1, which is columnar. The revised definition of shape gave a negative correlation with edge angle ($P<0.001$) and with edge thickness ($P<0.05$), which suggests that not only size but also shape is a factor in determining usable artefacts.

Once all the variables were examined and recorded, an estimate of use was also made and recorded. Using a range of techniques, including principal component analysis (PCA), chi squared tests, analysis of variance and cluster analysis, groups were distinguished and compared statistically. PCA provides information on which variables are related, while cluster analysis distinguishes groups, or clusters, of tools that have similar attributes across a range of variables. Examination of the variability of properties of tools within and between groups can then be carried out with ANOVA, if the measures compared are continuous, or with chi square if they are categorical. Using this approach, it is possible to determine whether a group is made up of tools that are similar morphologically or are linked by like use-wear traces. This enables objective examination of the way individual variables relate to one another.

Experimental Programme

The environmental record of a site and its surroundings provides a good basis for an experimental programme. A programme which includes working on a selected range of different raw materials enables much of the lost organic record, such as the use of plants, meat, *etc*., to be reconstructed by comparative methods, using the experimental tools as the basis for the use-wear interpretations. By basing the use-wear

Figure 9.18. Skinning a roe deer as part of the experimental process.

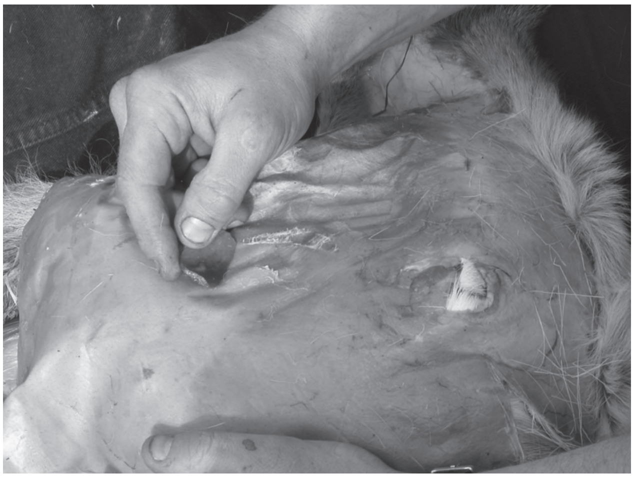


Figure 9.19. Scraping fresh hide as part of the experimental process.

Raw material worked	Type of work	Numbers of tools
Nettles	Cutting and shredding	4
Wood	Whittling and debarking	3
Seaweed	Cutting and slicing	4
Soaked antler	Grooving	2
Dry hide	Scraping and dehairing	3
Dry hide	Piercing	3
Fresh deer	Butchering and skinning	2
Fresh hide	Removing fat	1
Coarse grass	Cutting	6
Bone	Scraping and cutting	1
Shell	Cutting/piercing	2
Horn	Cutting	1
Fish	Removing scales	2
Multi-use	Grass cutting/piercing wood	1
Multi-use	Cutting wood, cutting hide on wood	1
Total		**36**

Table 9.1. Experimental artefacts.

programme on an experimental one, a database of probable raw materials and the way in which these were worked can be built up. For the Howick experimental programme, tools made from the local beach flint, identical to that used during the Mesolithic, were used. A range of tasks was undertaken using a mixture of retouched and unretouched tools. (Figs 9.14–9.19).

The aim of each task was to use the artefact for around 20 minutes; however, many artefacts became blunt before this time. By contrast, some artefacts were used for longer; for example one flake (HEP17) was used to cut coarse grass for over an hour and still did not become blunt. Artefacts were then washed and examined using the same methods as for the examination of the archaeological pieces.

Items studied	Number of pieces	Number of edges
Awl	1	2
Core rejuvenation blade	3	6
Microburin	1	1
Microlith	27	31
Retouched flake	4	4
Scraper	14	17
Unretouched blade	35	63
Unretouched flake	15	24
Total	**100**	**148**

Table 9.2. Artefacts examined.

Results

Many artefacts had macroscopic evidence of use on several edges. Seven artefacts were found to have no evidence of use while of the remaining 93 artefacts (65%) had more than one used edge. This brought the total number of edges examined to 148.

Artefacts with no evidence of use include the microburin, two microliths (one scalene and one broken), one retouched flake and three unretouched flakes. These items were removed from the database before statistical analysis took place. The final database that was subjected to statistical analysis consisted of 141 used edges. The very high percentage of artefacts showing evidence of use (93%) is unsurprising, both because they were all found inside the hut structure and also because of the non-random way in which the selection for use-wear analysis was carried out.

PCA analysis was undertaken using all morphological variables as well as the use-wear data. Following this, analysis of variance and chi-squared tests were undertaken to test the links between morphological and use-wear attributes. This suggests that the amount and type of fracturing on an edge is linked statistically to the size of edge angle and the

Cluster	Number of tools
Cluster 1	24 (17%)
Cluster 2	23 (16%)
Cluster 3	26 (18%)
Cluster 4	42 (30%)
Cluster 5	21 (15%)
Cluster 6	1 (0.7%)
Cluster 7	3 (2%)
Cluster 8	1 (0.7%)
Total	**141**

Table 9.3. Use-wear tool clusters.

Tool type	Numbers
Core rejuvenation blades	2
Microliths	4
Retouched flakes	0
Scrapers	1
Unretouched blades	13
Unretouched flakes	4
Total	**24**

Table 9.4. Cluster 1, tool types.

Length mm	Width mm	Thickness mm	Length Used Edge mm	Edge Angle °	Volume mm^3	Shape (See Shiel & Hardy 2003)
29.5	12.1	3.7	23.0	32.2	1676	1.45

Table 9.5. Means of measurements of tools in Cluster 1.

width of the edge. Secondly the extent to which polish extends into an edge (invasiveness) is linked to its edge angle, with thinner edges having a greater degree of invasiveness than thicker edges. Further work is required to determine whether these correlations are due to the morphology of the edge or due to differential selection for tasks.

Tool type	Numbers
Core rejuvenation blades	1
Microliths	1
Retouched flakes	2
Scrapers	4
Unretouched blades	8
Unretouched flakes	7
Total	**23**

Table 9.6. Cluster 2, tool types.

Cluster analysis

A cluster analysis was carried out only on the use-wear variables. The analysis was initially run with two to ten clusters and this showed that using eight clusters gave groups with relatively homogeneous tools and all containing more than one tool. The eight clusters of artefacts are linked exclusively by their use-wear characteristics and properties of each of the clusters are described below. Once the use-wear clusters had been created, the morphological data for each cluster were examined separately. In this way the morphology did not interfere with the creation of the groups.

Cluster 1

Cluster 1 consists of long, thin, small tools with thin edges covering a range of technological types, though with a majority of unretouched flakes and blades (core rejuvenation, plus unretouched flakes and blades = 79%).

Artefacts in this group were used exclusively along their sides, rather than on their ends and contain no cortex (inner flakes and blades). Edges tend to be straight. Use-wear characteristics include strongly fractured edges with multi-fracture patterns (flakes, snaps and steps), edges strongly rounded or ground down, strong and invasive polish distributed along the used edge in an even or uneven way. Almost all tools in this cluster have very heavy diagonal, parallel and perpendicular lines of polish over and above the broad stretches of polish along the tools' edges. The use assessment of tools in this group is that they were used for cutting strong grass or fibrous plants. The experimental data suggest that these use-wear traces correspond most closely to those observed on tools used to cut nettles.

At the Sands of Forvie (Hardy forthcoming a) it was noted that most of the observed inner flakes had invasive polish. This was interpreted as implying use on a soft or pliable material. At Forvie, very few other artefact types had invasive polish and it was thought possible that unretouched inner flakes were positively selected for use on soft materials. The evidence from Howick once again suggests this may be the case.

Cluster 2

Cluster 2 consists of large squat tools that are short-edged and wide, with a wide edge angle.

Length mm	Width mm	Thickness mm	Length Used Edge mm	Edge Angle °	Volume mm^3	Shape (See Shiel & Hardy 2003)
26.3	14.2	4.5	20.6	40.0	2100	1.91

Table 9.7. Means of measurements, Cluster 2.

Tool type	Numbers
Core rejuvenation blades	2
Microliths	0
Retouched flakes	1
Scrapers	0
Unretouched blades	17
Unretouched flakes	6
Total	**26**

Table 9.8. Cluster 3, tool types.

Length mm	Width mm	Thickness mm	Length Used Edge mm	Edge Angle °	Volume mm^3	Shape (See Shiel & Hardy 2003)
30.8	14.7	5.0	14.3	49.4	2784	1.57

Table 9.9. Means of measurements, Cluster 3.

Tool types in this group are again mainly unretouched flakes and blades (70%), though there are also a number of scrapers. Artefacts in this group were used mostly along their sides, though some were used on their distal ends. Most tools are non-cortical (inner) or have a small amount of cortex. Edges are mostly straight with heavy snap fracturing. Edges are rounded but rarely ground down and polish is spread continuously and invasively along the edge. Polish development is strong and a number of tools have diagonal lines of polish running away from the used edge. The use assessment of tools in this group is less clear, with a range of different uses being suggested. These include cutting hide, fibrous plants or fish, scraping hide and cutting wood. The experimental data suggest that these use-wear traces correspond most closely to those observed on tools used to scrape or cut hide.

Cluster 3

Cluster 3 consists of large, wide, thick tools with wide edge angles and short used edges.

Tool types in this group are almost exclusively (96%) unretouched. Artefacts in this group were used mostly along their sides, most edges were straight and tools were mostly non-cortical. They have slightly fewer fractures along their used edges than tools in clusters 1 and 2; fracture type was mostly snap. Edges are mostly rounded though not ground. Polish is spread unevenly and is quite invasive but polish development is weak and lines of polish do not occur.

The use assessment in this group is mainly for cutting or whittling wood. The experimental data suggests that these use-wear traces correspond most closely to those observed on tools used to cut or whittle wood.

Tool type	Numbers
Core rejuvenation blades	1
Microliths (+ 'awl')	7
Retouched flakes	0
Scrapers	12
Unretouched blades	20
Unretouched flakes	2
Total	**42**

Table 9.10. Cluster 4, tool types.

Cluster 4

Cluster 4 consists of quite small, wide, thick tools with quite wide edge angles and long used edges.

There are relatively fewer unretouched tools in this group (54%) and more scrapers. Artefacts in this group were used in a range of ways, along their sides, on their distal edges and sometimes all around the tool. Though many tools were non-cortical, some tools in this group were heavily cortical, suggesting some external flakes were used for tools in this group.

Length mm	Width mm	Thickness mm	Length Used Edge mm	Edge Angle °	Volume mm^3	Shape (See Shiel & Hardy 2003)
28.5	13.7	5.3	27.8	49.1b	2220	1.59

Table 9.11. Means of measurements, Cluster 4.

Tool type	Numbers
Core rejuvenation blades	0
Microliths	15
Retouched flakes	0
Scrapers	0
Unretouched blades	5
Unretouched flakes	1
Total	**21**

Table 9.12. Cluster 5, tool types

Length mm	Width mm	Thickness mm	Length Used Edge mm	Edge Angle °	Volume mm^3	Shape (See Shiel & Hardy 2003)
25.2	9.1	3.1	17.8	33.9	1087	1.14

Table 9.13. Means of measurements, Cluster 5.

Edges were straight or convex. Tool edges were on the whole heavily fractured with most edges having a mixture of flake, snap and step fracturing. Edges were mostly rounded but not ground, though a few are still sharp. Used edges have an even, non-invasive, intermittent spread of light polish and no polish lines.

The use assessment in this group is mainly for cutting/scraping wood or harder materials such as bone or antler. The experimental data suggest that these use-wear traces correspond most closely to those observed on tools used to cut or whittle hard material such as bone, antler or horn. It is important to note that the wide edge angles of many pieces in this group prevented microscopic analysis using transmitted light through cross-polarisers. For this reason, none of the scrapers has been given a specific use assessment due to the difficulty of analysing them.

Cluster 5

Cluster 5 consists almost entirely of microliths so unsurprisingly these come out as very small, thin tools with very thin edge angles.

Microliths in this group are all used along their unretouched side except for one tool that was used on its tip. Some of the unretouched blades were used on their distal edge. Tools are almost all non-cortical and edges are mostly straight. Tool edges were on the whole heavily fractured with a mixture of flake and snap fracturing. Edges are mostly rounded though some are ground. Polish distribution is mostly continuous and evenly spread across the edge. Polish is generally not invasive (<0.5). Polish development is average, lying between strong and weak polish (B), and a few tools have diagonal lines.

The use assessment in this group is mainly for cutting or grooving wood, though a few tools were assessed as having been used on a harder material such as bone and one artefact was used on its tip for piercing. The experimental data suggest that these use-wear traces do not fall easily into any experimental group. They fall between seaweed, wood and hard materials. It is possible that this group represents a use that was not carried out as part of the experimental programme.

Cluster 6

Cluster 6 consists of one tool, a scalene microlith that was used probably for piercing, on its point. It is in a group of its own mainly because the use-wear was noted but not recorded on the database due to it being on a tip rather than on an edge. It is one of two edges recorded for this tool, which was also used on its side. This tool should probably fit into Cluster 5.

Cluster 7

Cluster 7 consists of three microliths. These tools differ significantly from the rest in their use-wear

Cluster	Length mm	Width mm	Thickness mm	Length Used Edge mm	Edge Angle ^{o}	Volume mm^3	Shape (See Shiel & Hardy 2003)
1	29.5	12.1	3.7	23.0	32.2*<	1676	1.45
2	26.3	14.2	4.5	20.6	40.0	2100	1.91*>
3	30.8	14.7*>	5.0*>	14.3*<	49.4*>	2784*>	1.57
4	28.5	13.7	5.3*>	27.8*>	49.1*>	2220*>	1.59
5	25.2	9.1*<	3.1*<	17.8*<	33.9	1087*<	1.14*<

*Table 9.14. Means of properties and measurements not included in the cluster analysis. Key: * = significantly different to other groups; = less than the mean.*

Clusters	Numbers of microliths and percentage out of total	Total number and percentage of all tools per cluster
1	4 (13%)	24 (17%)
2	1 (3%)	23 (16.3%)
3	0 (0%)	26 (18.3%)
4	7 (23%)	42 (30%)
5	15 (50%)	21 (15%)
6	1 (3%)	1 (0.7%)
7	3 (10%)	3 (2%)
8	0 (0%)	1 (0.7%)
Total	**31 (100%)**	**141 (100%)**

Table 9.15. Microlith groups.

traces. They are heavily fractured with flake, snap and step fracturing. Their edges are all ground down and they have continuous invasive, uneven and heavy polish. They also all have diagonal lines of polish emanating from their edges. All three tools were interpreted as having been used for cutting or skinning in butchery or hide working. The experimental data suggest that the use-wear traces fall between those observed on tools used to cut shell and hide.

Cluster 8

Cluster 8 consists of one edge of an unretouched flake. This is a fairly large tool with a concave edge. It is heavily fractured with flake and step fracturing. Polish distribution is continuous, uneven and generally non-invasive. This edge differs from tools in Cluster 3 mainly due to its heavy fracturing. It is similar in all other respects to the tools in Cluster 3. The use assessment suggested this tool was used for woodworking and this corresponds well with the experimental data.

Though the clusters were formed using use-wear data exclusively, it is clear that they form clear morphological groups too (Table 9.14). The following morphological attributes are statistically significant:

Cluster 1 has a small edge angle;
Cluster 2 is square shaped;
Cluster 3 is thick with a wide edge angle and a short used edge;
Cluster 4 is thick with a wide edge angle and a long used edge;
Cluster 5 consists of long, thin pieces with short used edges.

This suggests that tools are selected for tasks based on a combination of their size and their edge angles. This is in keeping with data collected from ethnographic stone tool users (White and Thomas 1972; Hardy and Sillitoe 2003).

Microliths

The distribution of microliths suggests that while they may have been used for a range of tasks, there is clear differential distribution of them throughout the clusters, when compared to the overall numbers of tools. Microliths occur in substantially fewer numbers in Clusters 2 and 3 and in significantly greater numbers in Cluster 5. Clusters 5 and 6 are made up exclusively of microliths.

Cluster	Unclassified/broken	Point	Backed blade	Scalene	Crescent	Obliquely blunted point
1	1	1	1	1		
2			2			
4	2		1	2		
5	3	3	3	2	2	2
6				1		
7	1		1	1		

Table 9.16. Microlith classifications according to cluster.

Cluster	Unretouched flakes	Unretouched blades (incl. core rejuvenation)	Total number of all unretouched tools	Total and % of unretouched tools per cluster
1	4	15	24	19 79%
2	7	9	23	16 69%
3	6	19	26	24 92%
4	2	21	42	23 80%
5	1	5	21	6 40%

Table 9.17. Unretouched tools.

Microliths have traditionally been assumed to be armatures for projectiles of some sort. Recent work (Hardy forthcoming a; Finlayson and Mithen 2000) has suggested that, though some microliths may have been used to tip arrows and so forth, they were also used along their edges, probably as the cutting edge of a composite tool of some type. The evidence from Howick suggests not only that this is the case, but also that microliths may have been specialised tools for cutting wood and possibly harder materials, such as bone or antler, though the residue results suggest a wider range of uses for microliths.

Morphological classification of microliths into groups such as scalene, backed blade *etc*. appears less meaningful at the level of the use clusters, as the different types are spread across groups, with no obvious pattern emerging. However, this study only included a small sample of these tools (31 in total), so observations remain preliminary. Furthermore, the use associated with Cluster 5, which accounted for 50% of these tools, was probably one that was not undertaken as part of the experiment and so their true function remains somewhat speculative at this stage. The one microburin has no evidence of use. This ties in well with evidence from Sands of Forvie, where Hardy (forthcoming a) concluded that microburins were not routinely used as tools.

Scrapers

Of a total of 17 scrapers, most (12) fall into Cluster 4, though this is likely to be incorrect due to the lack of detailed use-wear data on them. All the remaining scrapers are in Cluster 2. The use assessment for this cluster is hide working.

Unretouched tools

An examination of all the unretouched tools together suggest they were multipurpose tools used in a range of different tasks, though certain differences do occur.

Table 9.17 documents the variability of unretouched tools in each cluster. Unretouched pieces are substantially less common in Cluster 5 than the average. Cluster 2 has relatively more flakes and fewer blades than the mean, while Cluster 4 has fewer flakes and more blades.

Core rejuvenation blades

The use of core rejuvenation blades is interesting in that it is a clearly defined technological piece linked to core working. Evidence for their use illustrates that tools could be selected from any level in the manufacturing chain.

Discussion

The use-wear results have produced some specific indicators about the assemblage, as well as providing information on the use of tools. Based on the information obtained here and at Sands of Forvie (Hardy forthcoming a), it appears that inner flakes and blades may have been selected for cutting soft, possibly plant, materials. Inner flakes, particularly blades, are usually thin with low edge angles. This makes them ideal for cutting as they tend to be very sharp.

It is becoming ever more apparent that microliths were not used exclusively to tip projectiles. Once hafted, microliths have strong edges. The different types of microliths do not appear to be linked to specific types of use and it is possible that these types are either a stylistic choice, or related to ways of hafting. Sites such as Fife Ness (Wickham-Jones and Dalland 1998), with a strong predominance of crescent microliths, may hold the key to a more detailed understanding of microlith form.

Scrapers, with their high edge angles, have very strong rounded edges. Those scrapers that were completely analysed all fell into the group interpreted as for hide working. Scrapers are ideal tools for scraping the fat off the inner part of the hide. Residue analysis was carried out on three scrapers and the results for these suggest that they were used on meat or seeds and fat, wax or burnt organic material. Though the residue work is still at an experimental stage, these results do not contradict the suggestion that scrapers may have been used to process raw animal hide.

Unretouched pieces are found across the clusters. This suggests that they were multipurpose cutting tools, though there is an indication that inner flakes and blades were used preferentially for cutting softer material, and that unretouched pieces were also used for wood working. The fact that core rejuvenation blades, which are well-understood as forming part of the technological process rather than being an end product, were used, suggests that artefacts were selected for use on the basis of their usefulness rather than where they occurred in the technological process. This has been observed ethnographically among stone tools users across highland Papua New Guinea, whose main criterion for selection was the edge angle (Hardy and Sillitoe 2003; White and Thomas 1972).

The use-wear analysis has suggested that a wide range of activities was taking place across the site, exploiting many different raw materials.

Certain experimental uses did not feature in the archaeological assemblage, for example fish de-scaling. This does not mean these activities were not carried out at the site; fish were very likely to have been eaten but the use-wear sample, which represents a tiny proportion of tools from the site, did not pick this up.

A comparison of the residue and use-wear results is not easy. One hundred artefacts were examined for use-wear while only ten were examined for residues, a sample size that was due largely to the level of funding available. Additionally, the results for the residue analysis are item-specific, while the results for the use-wear analysis are broad and spread across clusters of tools. For some tools, the results appear to correspond, for example tool number 4382 had residues suggesting it had been in a very hot fire (cordierite) and ED spectra suggesting that it had residues of a burnt organic material. The use-wear data suggest this tool was used to cut wood. It is possible that the tool fell inadvertently into a fire after it had been used on wood or that it was used to work burnt wood. By contrast, tool no 4410, a point microlith, had residues of copper, suggesting it was involved possibly as part of a process aimed at obtaining pigment. The experimental programme did not include this use and it was therefore not picked up in the use-wear analysis.

Tool use and activities at Howick

Fibrous plants such as nettles had a multitude of uses in the Mesolithic. Cordage, string and netting are known to have been manufactured since the Upper Palaeolithic (Wayland Barber 1994; Soffer 2000). String is the basic raw material for many items that would have been crucial during the Mesolithic. These include such items as clothing, belts, carrying nets, fish nets and twine for tying things together and lashing structural supports in place. In Denmark, fish nets made from plant fibre have been found at Ertebölle sites (Anderson 1995; Malm 1995; Skaarup 1995). String is also likely to have formed an integral part of many other items. String can be made with most types of fibrous plants and from different parts of plants, for example leaf fibres, bast fibres, root fibres, bark fibres or the whole plant stem (Westcott 1999). String making can be a long and laborious process that has been relatively ignored in attempts to reconstruct the Mesolithic way of life.

Phytoliths from grass and leaves, as well as wood, were found in hearths from the Mousterian and Natufian site of Hayonim Cave in Israel, suggesting that these were also used as fuel (Albert *et al.* 2003). Coarse grass may also have formed a fuel component at Howick. Coarse grass was used by the Inuit for such uses as thatching and for items such as bedding, matting, clothing and even children's nappies (Owen 2000). This is perhaps significant in understanding what type of material/s may have been used at Howick.

Residues on two tools had possible evidence for wood ash or charred wood. In both cases, residues of sodium and chloride suggest a marine origin though this may be the result of subsequent contamination.

Evidence for hide working (Cluster 2), wood working (Cluster 3) and working hard materials such as bone, antler and horn (Cluster 4) are present. These materials would all have had very important uses at Howick; hide was probably used for many things, such as to make clothing and shelter; wood is likely to have been used to manufacture many items of material culture as well as probably the frame for the hut at Howick. Skins of birds and fish, as well as animals, were widely used among the Inuit and Indians of northern North America (Owen 2000), while the use of birds has been documented both archaeologically and ethnographically in Tierra del Fuego (Mamelli and Estevez Escalera 2004). Bone, antler and horn would have also had many different uses and it is noteworthy that bone and antler tools are ubiquitous at Mesolithic shell midden sites on the west coast of Scotland.

One activity missing from the stone assemblage examined here is evidence for projectiles. Spears and arrows would probably have formed an important part of the hunting tool kit. Among the Wola of Papua New Guinea, stone was never used to tip arrows and spears. Extraneous bone causes septicaemia and the Wola use this for their most deadly weapons. The use of bone to tip arrows has not been explored for the Mesolithic in northern Britain, however this has been seen elsewhere in Europe (Oshibkina 1985; Zagorska and Zagorski 1985) and ethnographically (Lee and Devore 1976). It is also possible that arrow tips are found infrequently on sites. If they were used it is likely that many are to be found lying distributed around the landscape. Gould (1980) estimates that stone tools occurring at habitation base camps among hunters and gatherers in western Australia represent only 0.05% of used tools, with an estimated 99.95% of used tools discarded outside habitation zones.

The presence of copper is interesting as this suggests that copper may have been extracted to obtain green and blue colouring. The use of colour is also suggested by the presence of ochre, which produces a red colour, at Howick. Evidence for the use of colour in the Northern British Mesolithic is scarce but the finds from Howick complement the presence of ochre and haematite (producing black) from the Mesolithic site of Sand, Wester Ross (Hardy and Wickham-Jones 2003), and a copper residue found on a bone tool from the Mesolithic site of An Corran (Skye) (Hardy forthcoming b). Together, these finds form the beginnings of a body of evidence that points to the use of colour in the Mesolithic of Northern Britain.

It is therefore interesting to note that five small fragments of coarse-grained sedimentary rock with copper mineral visible on the surface were found inside the Howick hut from occupation layer [316] in Phase 1b. That this rock and the microlith with copper residue were found in the same deposit is tantalising. Though it is never possible to be absolutely sure, these finds suggest the deliberate collection of copper-bearing rock, perhaps with the intention of crushing and using the copper to make pigment or dye.

The lack of any specific evidence for the exploitation of marine food is a gap but is probably explained by the small sample of tools examined. People undoubtedly exploited the sea; the shell midden sites lying along much of the Scottish west coast are full of fish bones, shells and evidence for the exploitation of marine mammals (e.g. Mellars 1987; Hardy *et al*. forthcoming; Hardy and Wickham-Jones 2003). Sillitoe (1988) has shown that the Wola of highland Papua New Guinea, despite being sedentary horticulturalists, still collected and used every available raw material that was present in their region, often using them in ways that could not be imagined today. The people of Howick will have known their environment intimately and will undoubtedly also have used every bit of it, in one way or another. What remains for us to find today, is but a tiny glimpse into their material world.

Conclusion

The evidence from the use-wear and residue analyses suggests, when taken together, that Howick was a site where a wide range of different activities took place. Some of these activities are expected and form a part of everyday survival, such as making fires, while others such as the use of copper, probably for pigment, show us that the people of Howick did more than just survive; they lived. Although only a preliminary study on a small sample of the lithic material, this work has demonstrated the applicability of such analyses to lithic collections recovered from northern British settings.

10 Faunal Remains

Geoff Bailey and Nicky Milner

Introduction

The quantity of bone and shell material recovered at Howick is very small. In spite of the extensive excavations and careful recovery techniques used, including systematic flotation, the total haul of bone is approximately 1075 pieces, the great majority being broken fragments less than 5mm. This is a meagre collection by any standards and reflects highly unfavourable conditions of bone preservation resulting from the relatively acidic pH of the soil. Most pieces cannot be identified even to anatomical element, let alone to species or even to more general taxonomic categories, and this, together with the very small number of identifiable bones (11 in total that can be reliably associated with the Mesolithic deposits), puts severe limitations on the conclusions that can be drawn. We confine our observations below to the condition and distribution of the bone material and to taxonomic identification. The sample is far too small to allow any reliable assessment of the relative abundance of different species, or useful interpretation of the differential frequency of anatomical parts or butchery practices, and almost totally lacking in information on the age structure of the exploited animals or their season of exploitation. The shell assemblage is also relatively small and comprises shells and shell fragments widely scattered through the deposit rather than concentrations of shells that might deserve the description of a shell midden, or even isolated shell dumps. There are less than 1000 identified mollusc shells, many of which are whole or almost whole but some of which are small fragments. Here too analysis and discussion are largely confined to the distribution of the shell material and to taxonomic identifications and their palaeoecological and palaeoeconomic significance. This chapter will consider the bone and shell material in turn, with particular emphasis on taphonomic issues relating to the poor condition of the material and the likely influence of natural processes of deposition and post-depositional destruction. Notwithstanding the poor quality of the surviving evidence, it is possible to draw some useful conclusions about the likely palaeo-economy and function of the site.

Bone analysis

Condition of Bone

The great majority of the bones appear to have been burnt as well as fragmented, although it is often not possible with many of the very small fragments to be sure whether they are derived from burnt or unburnt bone, since light or partial burning may cause only slight changes of colouration. Many bone fragments are heavily burnt, showing the characteristic blue-white colour and cracking that is typical of material exposed to high temperature and/or prolonged periods of burning. Other bones are charred or more lightly burnt. Many have a whitish-grey colour and slightly chalky surface texture, which could represent either moderately prolonged exposure to high burning temperatures or chemical degradation by soil acids. No particular significance should be attached to the fact that so much of the bone appears to be burnt, since unburnt bone is likely to have been largely destroyed by a combination of biological and chemical degradation. However, the belief that burnt bone is more resistant to chemical attack in acidic soils than unburnt bone, though widely held, appears not to be supported by experimental data (Lyman 1994, 391). A small number of bones are unburnt and these include two whole vertebrae in fresh and undamaged condition of hare or rabbit, which are almost certainly recent intrusions. There are also eight thin, plate-like fragments of unburnt bone, obviously degraded but not burnt, heavily perforated and with a waxy surface texture, which were found in the vicinity of the burial cists. These range in size from <1cm to 3cm in the maximum dimension, and look like skull fragments, but it is impossible to say with confidence whether they are of human or non-human origin (see Waddington *et al*. 2005).

It is highly likely that we are dealing here with a tiny fraction of the bone material originally brought onto the site by the Mesolithic inhabitants. The high degree of fragmentation, the generally small size of the surviving pieces, and the widespread evidence of burning and/or chemical corrosion, all point in this direction. Even in more favourable conditions of soil

Phase	Hearth or Burnt Spread	Pit	Occupation Layer	Post hole/ Stake hole	Linear	Discrete Spread	Totals
Phase 1a							
Heavily burnt	100	33	-	10	20	-	163
Partly burnt	57	20	58	-	-	-	135
Sub Total	***157***	***53***	***58***	***10***	***20***	***-***	***298***
Phase 1b							
Heavily burnt	34	133	30	-	10	5	212
Partly burnt	308	-	2	1	-	-	311
Sub Total	***342***	***133***	***32***	***1***	***10***	***5***	***523***
Phase 2							
Heavily burnt	-	21	30	40	-	-	91
Partly burnt	-	8	10	-	-	5	23
Sub Total	***-***	***29***	***40***	***40***	***-***	***5***	***114***
Phase 3							
Heavily burnt	25	-	20	-	-	-	45
Partly burnt	25	2	3	-	-	-	30
Sub Total	***50***	***2***	***23***	***-***	***-***	***-***	***75***
Totals	**549**	**217**	**153**	**51**	**30**	**10**	**1010**

Table 10.1. Distribution of heavily burnt and partly burnt bone by phase and feature type in the Howick hut.

preservation, bone material would have been vulnerable to a heavy toll of damage and destruction before burial, especially if dogs were present, as seems likely at Howick (see below). Dog-feeding experiments have demonstrated that if dogs have access to the remains of the carcases of small and medium-sized mammals, they leave almost no bones except a few fragments (Payne and Munson 1985; White 1968). More general observations of modern hunting camps suggest that less than 5% of the bone material of animal carcases survives if dogs are present (Vereschagin 1967). Bones with large marrow cavities are particularly vulnerable to destruction by dog chewing, especially the limb bones and foot bones. Only the most resistant parts of the bone are likely to survive, such as the distal articulation of the humerus (upper front limb) or the phalanges and the articular ends of the metapodials (toe and foot bones) (Brain 1981).

Paradoxically, charred or burnt bones are of no interest to dogs and may be more resistant to destructive agencies after burial, but they are also likely, for the very reason that they have been burnt, to become more brittle and liable to fragmentation.

Bones discarded on human settlements can be burnt for a variety of reasons: because of exposure to fire in the course of roasting meat; because of disposal and burning of waste material; because fires are built on surfaces where bones have already been discarded or because of their use as fuel (David 1990). However, burning changes the composition of the bone. As the temperature increases, there is progressive loss of organic material (which comprises about 35 per cent by weight of bone and gives the bone its strength and elasticity), shrinkage, and increased brittleness and thermal cracking and splitting. Bone also goes through a characteristic series of colour changes with increasing temperature, from yellow to brown to black to grey and finally to a bluish-white, although the correlation between colour change and temperature is only approximate (Shipman *et al.* 1984; Lyman 1994). The critical temperature for the removal of all organic material is about 600ºC, and this stage marks the transformation of the bone from a carbonised state, with colouration in the yellow to black range, to calcination, with grey or blue-white colouration. Between about 600ºC and 950ºC, the mineral crystals fuse to create a porcelain-like condition, with melting of the bone occurring at about 1200ºC (McCutcheon 1992). Ordinary campfires can easily generate temperatures of up to 800ºC (David 1990; Robins and Stock 1990), and we should therefore expect bones assoc-

Taxon	Element	Feature	Context	Phase	Condition
Fox	1st Phalange	Hearth	268	1b	Partly burnt
Fox	Astragalus	Hearth	268	1b	Partly burnt
Canid	1st Phalange	Hearth	355	1a	Heavily burnt
Seal	2nd Phalange	Hearth	355	1a	Partly burnt
Seal	2nd Phalange	Hearth	268	1b	Partly burnt
Pig	2nd Phalange	Hearth	268	1b	Partly burnt
Pig	Distal Fibula	Hearth	355	1a	Partly burnt
Small mammal	Rib fragment	Hearth	355	1a	Heavily burnt
Small mammal	Distal Phalange	Hearth	268	1b	Partly burnt
Bird		Hearth	355	1a	Partly burnt
Bird		Hearth	355	1a	Partly burnt

Table 10.2. Provenance of identified bone specimens at Howick.

iated with domestic fires to show the full range of transformations in colour and composition, and this is what we find with the Howick material. The duration of burning is also quite critical. David (1990) has shown experimentally that bones left in a fire for as little as half an hour at temperatures below the critical threshold for calcination begin to crack apart. Long bones in particular show numerous small thermal cracks and major longitudinal and transverse fractures of the shaft bone. Some of these fractures mimic the morphological features associated with the breakage of bone during butchery of the carcase.

From all these considerations, it follows that burnt bone is especially vulnerable to fragmentation and to further physical damage caused by trampling and weathering on the surface, churning of deposits and mixing of materials during site maintenance such as periodic cleaning out of hearths, or subsurface movement and compression after burial. It is likely that the Howick bone has been affected by all these processes, further reducing the survival chances of any identifiable pieces of bone.

Distribution of bone

Table 10.1 shows the distribution of the bone material according to the various features and deposits from which it was recovered. The material that has been obviously heavily burnt is also distinguished from the partly burnt material, to see if the two categories show any evidence of differential distribution.

Most of the surviving bone, accounting for 81% of the total, and all the identified bones, come from Phase 1 (1a and 1b) rather than later phases, suggesting that preservation is better in the lower horizons. Moreover, the great majority of the bone in Phase 1, some 83% including all the identified bones, occurs in the hearths and associated pit features, implying that we are dealing with cooking activities. The occupation layers that account for most of the bone in phases 2 and 3 contain introduced deposits as part of their levelling layers as well as build-up of occupation debris, with the result that bone from these contexts cannot be relied on as an accurate indicator of animal processing and consumption activities within the hut.

Heavily burnt and partly burnt bones are present in about equal proportions throughout the excavated deposits, but there is no straightforward pattern in their distribution. In most deposits heavily burnt bones predominate, the notable exception being the hearth material in Phase 1, which has the highest quantity of partly burnt bone in the site and by far the highest ratio of partly burnt to heavily burnt bone (Table 10.1).

Identification

Table 10.2 summarises the identified material by provenance and condition.

Family Canidae, dogs

Two species are present. The first species is *Vulpes vulpes*, the fox, an animal useful for its pelt, but also known to have been hunted for its meat in prehistoric times from evidence of bones showing cut marks and burning in the Near East (Clutton-Brock 1987).

The 1st phalange of an unspecified canid in Table 10.2 could be either wolf (*Canis lupus* L.) or dog (*Canis familiaris*), but it is impossible to distinguish between the two on this element. The usual diagnostic criterion for the domestic dog is the foreshortening of the mandible and crowding of the teeth. Dogs may also be smaller than wolves, but not necessarily so, and no reliable inferences can be made from the size of the Howick bones because of shrinkage resulting from burning. Dogs are certainly known to be present at this time in Britain, the most famous example being the dog from Star Carr (Degerbøl 1961), belonging to a slightly earlier period of the Mesolithic than Howick.

Family Phocidae, seals

Seals are represented by two phalanges. It is not possible to be absolutely certain about the species, the one comparative specimen available for identification being a grey seal (*Halichoerus grypus*). Both grey seal and common seal (*Phoca vitulina*) have breeding populations in British waters and are especially common around the coastlines of Scotland, although both may be found on the east coast of England, and grey seals are present around the islands off the Northumberland coast today (Corbet and Harris 1991). Common seal are characteristically associated with sandbanks and estuaries, whereas the grey seal favours rocky shorelines and offshore islands for breeding and hauling out. The ringed seal (*P. hispida*) and the harp seal (*P. groenlandica*) both have more northerly distributions and are very rare visitors to British waters (Clark 1946, Corbet and Harris 1991).

Family Suidae, pigs

The distal end of the fibula and the 2nd phalange are certainly *Sus scrofa*, and presumably from wild boar. The common assumption is that pig remains in Mesolithic deposits represent hunting of wild boar. However, there is a long-standing opinion that in some areas of Europe, Mesolithic people had a closer relationship with pig populations than is implied by hunting of wild boar, even if the pigs were not biologically domesticated in the sense of being subjected to selective breeding (Rowley-Conwy 1995). The main criterion for distinguishing domestic pigs is their smaller size, but even that is unreliable, and the probable shrinkage of the Howick bone resulting from burning compromises any deductions drawn from the size of these specimens.

In addition there are at least two fragments of mammalian bone that can be identified to anatomical element though not certainly to species, and a number of bone fragments, nearly all from the main hearth area, that are clearly derived from the shafts or articular ends of the mammalian postcranial skeleton. There are also two potentially identifiable fragments of bird bone, one the size of a gull, the other the size of a bustard, but it has not proven possible to narrow down the identifications.

Interpretation

Species Representation

The small number of identifiable bones clearly limits the scope of interpretation, but the range of species is actually quite wide in relation to the very small sample size, with evidence of sea-mammal hunting (seal), hunting on land (boar), hunting for fur-bearing animals (fox), fowling (bird remains), and the probable presence of the domestic dog. This variety of activities is consistent with the interpretation of the Howick site as a residential settlement, rather than a specialised hunting encampment.

This diversity is also consistent with the range of opportunities available within the economic catchment of the site. Wild boar would have been attracted to feeding opportunities at the forest edge, along the shoreline and the banks of the Howick Burn, as would other land mammals. Seal are most vulnerable to human hunters when hauled out on rocky beaches or offshore islands, or during the breeding season, which also takes place on land or in the intertidal zone, when the seal pups are especially vulnerable. Small skerries are present just offshore opposite Howick. They are usually submerged except at very low tides today, but would have been more prominent small islands at slightly lower sea level, offering potentially attractive locations for seal haul-outs and perhaps for breeding. Bird life would also be more concentrated and accessible along the coastline, and sea birds in particular would be vulnerable to capture when nesting on rocky cliffs.

Two types of resources are conspicuous by their absence. The first is fish, which we might expect to be associated with maritime activities at a coastal settlement. No evidence of fish bone has been identified amongst the fragmentary remains, but this may be due either to the greater vulnerability of fish bone to the range of highly destructive processes that have affected the Howick bone, or to the small sample size, or to both factors together. The second absence is any evidence of deer. We would expect both red deer and roe deer to be present in the Howick environment, and to be favoured targets of human hunters in the Mesolithic. Again, however, their absence in the faunal remains may be due simply to the vagaries of preservation and the very small number of bones that have survived in identifiable form.

Representation of Anatomical Elements

Here too, the condition and small sample size of the bone material limits conclusions, but it is worth noting the bias towards anatomical elements from the extremities – foot and toe bones. Foot extremities are often associated with the removal of waste parts of the carcase, and hence with butchery sites or locations of food preparation within a domestic site, the more productive elements being taken elsewhere for cooking and consumption. Grigson and Mellars (1987) have noted that in the much larger sample of grey seal bones from the Oronsay middens (362 identifiable seal bones), only six are burnt and four of these are phalanges; they suggest that the seal claws may have been thrown on the fire as waste material. Foot bones are also sometimes left attached to a partially butchered carcase to provide 'handles' that make it easier to carry the carcase from the site of the kill to the home base, the so-called *schlepp* effect.

Species	Unstrat./ Surface	Topsoil (001)	Subsoil (003)	Stratified from Excavation	Stratified from Flotation	Stratified Total	Total
Dogwhelk	117	508	27	17	3	20	672
Flat periwinkle	29	44	11	5	0	5	89
Edible periwinkle	7	97	9	18	1	19	132
Limpet	2	34	8	20	8	28	72
Topshell	4	1	0	1	0	1	6
Cowrie	2	1	0	0	1	1	4
Mussel	0	1	0	1	2	3	4
Barnacle	0	0	0	2	1	3	3
Crab	0	0	0	0	1	1	1
Oyster	0	0	0	3	0	3	3
Total	**161**	**686**	**55**	**64**	**17**	**81**	**966**

Table 10.3. Species of shellfish identified from the Howick assemblage and their quantitative distribution by provenance.

However, neither of these interpretations is sustainable in the light of the small sample size and conditions of preservation of the Howick bone assemblage. It is more likely that the variable survival of anatomical elements is due to factors of differential preservation, rather than evidence of differential treatment of different parts of the animal carcase. The astragalus is a very dense, tough bone, while phalanges are also quite dense bones. They are also small, compact elements, easily pushed into the ground and more likely to gain protection by rapid burial from the destructive agencies operating at the surface.

It is also worth noting the complete absence of teeth or recognisable tooth fragments. These are usually quite dense elements and therefore ones that can be expected to be relatively resistant to most destructive agencies. We suggest that their absence from the Howick collection is probably due to the effects of burning. Differential shrinkage of the different layers of material that make up teeth, and cracking, have probably reduced any tooth material to unrecognisable fragments.

Shell analysis

Identification

The following shellfish have been identified:

- *Nucella lapillus*, dogwhelk. This species is found in the intertidal zone on rocky shores in crevices and rock pools.
- Family Littorinidae. *Littorina littorea*, edible periwinkle. This is found from upper shore to shallow sublittoral conditions on rocky shores, especially moderately sheltered shores with seaweeds.
- *Littorina littoralis (obtusata)*, flat periwinkle. Found in the mid-shore zone living on and among algae and weed, on which it feeds and lays eggs. The shell is small and flat-topped and usually colourful: yellow, green, orange, brown or red and sometimes even banded or chequered. It is unlikely that this shell would be collected as food because of its small size but it could be collected for its aesthetic qualities.
- *Patella vulgata*, limpet. These shells are intertidal and are found in abundance on rocky shores.
- *Gibbula sp.*, topshell. This is found in the mid-lower shore amongst rocks and seaweed. When damaged the shells have a mother-of-pearl lustre, which, as with the flat periwinkle, may be a reason for collecting dead shells found washed up on the seashore.
- *Trivia sp.*, cowrie. This is found on the lower shore and below in rock and weed.
- *Mytilus edulis*, common mussel. This species forms dense beds from the upper shore to the shallow sublittoral, often on rocky shores.
- *Ostrea edulis*, native oyster. These shells are found on coarse sediments in the sub-littoral, often attached to rocks or boulders. It is not certain that this species is present at Howick but a couple of fragments could possibly be oyster.

Quantification and spatial distribution

Table 10.3 presents the quantities of shellfish. These have been divided into unstratified and surface finds (found in molehills and during test pitting), finds from the topsoil (which was excavated by metre square), finds from the subsoil (again excavated by metre square), stratified contexts within the structure and samples from the flotation of stratified deposits. In all these contexts, there are small fragments of shell that have not been identified. Fragments and whole shells have been counted so the numbers represent the NISP (number of identified specimens) and not the MNI (minimum number of individuals). However with the main species, the dogwhelk, the vast majority of shells were found whole. Many unidentified fragments were found within the flotation samples and it should be noted that there are also 34 unidentified land snails in this sample.

It can be seen that dogwhelks are by far the most common species found at the site (c. 70%). Not all edible periwinkles or limpets were found whole and so the MNI is probably considerably lower, which means the dogwhelk is even more dominant in the assemblage than it appears to be on first glance. There are more flat periwinkles than limpets, which is perhaps surprising considering that this species is too small for consumption and is more likely to be collected for its aesthetic qualities. The topshell, cowrie, mussel, barnacle, crab (a small part of the claw) and oyster (tentative identification) are found in very small quantities.

The majority of shells (93%) comes from unstratified contexts. When looking at the distribution in the 2000 season, when the topsoil and subsoil were excavated in squares, the shells were found right across the excavated area. Shells were also found eroding out of molehills across the field away from the excavation.

Interpretation

The large quantity of dogwhelks found on the site is unusual and different from most other sites with a shellfish assemblage to the author's best knowledge (and Janice Light *pers. comm.*). Usually limpets are the dominant taxon in sites located near rocky shores. A notable exception is Ferriter's Cove in Ireland, where dogwhelks are the most common species, followed by periwinkle and limpet (McCarthy *et al*. 1999). It is also worth noting that dogwhelks are often present in small numbers in other Mesolithic middens, for example at Ulva Cave on Mull (Russell *et al*. 1995), at Morton (Coles 1971), and in the Oronsay middens, where damage and removal of the apex appears to be due to deliberate destruction to remove the meat (Andrews *et al*. 1985). It is often suggested in the literature that this is not an edible species, and the shells are even considered so unpalatable that fish do not take them as bait. This is actually a fallacy and they can be eaten (e.g. Fearnley-Whittingstall 2001). If they were collected for food, they were probably boiled, steamed or heated, which then makes it possible to extract the flesh. Another method is to break the apex, or the top of the shell, and although some of the apices have become eroded, it looks as if this is due to natural processes and not deliberate breakage as in the Oronsay case. Dogwhelks can also be used to create purple dye but it is more likely that they would have been found broken up if utilised in this way, in order to get to a small vein on the head of the animal which holds the dye (Gibbons and Gibbons 2004). It is considered unlikely that dogwhelks were used for this purpose in the Mesolithic. The limpets found are also an edible species; it is interesting to note that these are small and their morphology suggests they have come from the lower shore, where the more succulent specimens are usually found. This could indicate that if the limpets were being collected for food there was some selection for the more tender individuals.

The main species of shellfish found at Howick live on rocky shores and this is exactly the type of environment found below the archaeological site at present. Most of these species can still be collected here, with the exception of the dogwhelk. The lack of dogwhelk, however, could be a very recent phenomenon caused by the effect of tributyl tin, a toxic substance used in ship's paint, which causes sterilisation of the dogwhelk. What is interesting from an analysis of the modern shore is that there were large quantities of empty shells washed up onto the upper shore, representing all the species found at the site.

The flat periwinkles are very colourful (red, yellow, green, purple, orange) and sometimes striped and the topshells have a mother-of-pearl sheen. They are also very small shellfish and as said, are unlikely to have been collected for consumption. This is also likely to be the case with species such as the cowrie. One of the cowries does have a perforation in it. This can be caused naturally by boring predators, and several natural examples were found on the beach. However, even if the hole is natural it is possible that these could have been collected like that and used as ornamentation. There are parallels to this on several Mesolithic sites on the west coast of Scotland, such as the shell middens on Oronsay (Mellars 1987), although these are later in date. Shells are well known as having been used as currency, gaming pieces and ornamentation throughout antiquity.

The other possibility that must be considered is that some, or perhaps even all, of the shells appear on the site by chance and are not related to the activities of the Mesolithic inhabitants. One explanation for the presence of shells on the site is that the land has been fertilised with seaweed in the recent past, which is a well known practice, and that shellfish which were attached to, or scooped up with, the seaweed have ended up in the soil. The two key indicators are the spatial distribution of the shells and the level of preservation. The fact that the majority of shells comes from the topsoil and other unstratified contexts suggests that either there has been a lot of movement, particularly upwards from the archaeological strata since the Mesolithic period, or perhaps also downward movement from the topsoil. In addition, the fact that shells were found across the excavation area within the topsoil and in molehills in other parts of the field is suggestive that there is a continuous spread of shells across the cliff top, which is consistent with the idea of seaweed fertilising.

During the cataloguing of the shells, the level of degradation was noted using a basic scoring system of 1, 2 and 3, with 1 being well preserved and 3 being very degraded. Of the shells from stratified contexts, 22% were well preserved, 69% were slightly degraded, but only 9% were very degraded. In sandy conditions it seems unlikely that the shells would have survived so well, particularly the smaller fragmented examples such as the cowries. The mussel is usually the least resistant to taphonomic processes and yet here, although there are only a few small pieces of mussel, they are extremely well preserved and retain the purple colour, which is very unusual.

What is equally plausible is that there is a mixture of modern and archaeological shells at the site. Perhaps there has been some relatively modern fertilising of the land, which has resulted in the incorporation of shellfish and particularly dogwhelks into the soil, while some shellfish, such as those found within the structure, could have been deposited there in the Mesolithic period.

General Discussion

The small sample size of organic remains, the generally poor state of preservation, and the complex taphonomic history of both the bone and shell material clearly set limits on interpretation. Nevertheless, it is possible to draw certain general conclusions with reasonable confidence and to suggest additional possibilities. The material is of particular significance both because of its early date and geographical location, and because the bone material in particular is concentrated in hearth deposits associated with a substantial dwelling structure.

It is clear that the Mesolithic people living at Howick had easy access to a wide range of terrestrial and marine resources, to plants and animals on land, to fish in the nearby Howick Burn and in the sea, to birds, molluscs and crustaceans along the littoral, and to seal on rocky shores and offshore islets. In terms of actual evidence, we have indications of hunting of pig, fox and seal, of shell gathering and crab collecting, and of fowling. The domestic dog was probably present on the site. The remains thus indicate a range of subsistence activities, all the more significant given the small size of the sample, suggesting prolonged occupation rather than fleeting visits for specialist activities, and an interest in both the marine and terrestrial resources of the local environment. The concentration of bevel-ended stone tools in the area of the structure is also of interest. Although these are conventionally described as limpet scoops, Jacobi (1984) has noted a correlation between the distribution of these tools and the distribution of seal breeding grounds in Wales, and suggested that the tools could have been used for working seal skins. If correct, this would tend to reinforce the significance of this resource. Seals provide a range of materials including meat, skins and sinews. The blubber can be rendered down into storable food and fuel for eating, heating and lighting in winter. Grey seal are particularly vulnerable to predation during the breeding season in autumn, when the young seals are on shore and can be easily caught, and again during the spring moulting season when the adults tend to haul out on land (Clark 1946, Grigson and Mellars 1987). They are thus a particularly attractive target, providing resources that can be stored for use during winter, and again during the spring, a notoriously lean time of the year for many other food resources. Pig meat is easily cured on the bone and stored (Rowley-Conwy 1981), and shellfish can be taken at any time of year, providing a valuable fall-back when other foods are scarce. The fox provides fur ideal for winter clothing, although it could equally well have been hunted for its meat. All of these indications are consistent with the use of Howick as a major base in the winter months, although there are no direct indications in the surviving material that allow us to pinpoint seasonality of use, or to establish whether the site was used throughout the year or on a seasonal basis. It is tempting to conclude from the presence of a durable dwelling structure that Howick was a permanent site occupied throughout the year. However, ethnographic studies demonstrate that there is no necessary link between substantial structures and year-round occupation. On the Pacific North-West coast, for example, the classic example of a richly productive marine and coastal environment, economies dominated by fishing and sea-mammal hunting supported large villages with plank-built houses, which give all the appearance of permanence (Drucker 1955). However, it is also clear that the inhabitants of these villages moved around the wider landscape in smaller groups to a variety of locations at various seasons for other subsistence activities. These patterns of use range from fully permanent occupation at one extreme to seasonal mobility of the whole group at the other, and many are best described as sedentary-cum-mobile patterns of settlement (Murdock 1967, and see also Chapter 14).

The next nearest Mesolithic site with faunal remains, albeit of rather later date, is the Scottish site of Morton. This site, at the time of its use, was on a small offshore island near the estuary of the River Tay. The archaeological evidence suggests a series of relatively transient but regular visits at various times of year to collect cobbles from the shore for stone tools (Coles 1971, Deith 1983). Stake holes suggest structures no more substantial than a windbreak. Land mammals, fish, seabirds and molluscs are all well represented, with the dominant taxon in each category being red deer, cod, guillemot and cockle, respectively.

The Oronsay middens off the west coast of Scotland are the largest group of well studied shell middens in Britain, including some of the largest mounds, and with evidence of hearths and dwelling structures. Here limpets dominate the shell samples, with abundant evidence for fishing of saithe (a member of the same family as the cod), seal hunting, and deer hunting on larger islands nearby or on the mainland.

Mt. Sandel in Ireland is of comparable date to Howick, and has also produced evidence of substantial dwelling structures and features interpreted as storage pits. Pig bones dominate the mammalian assemblage and fish bones are also present in large numbers. The site is located some 8km inland from the coast on the River Bann, so that it is not well placed to access marine resources, but its riverside location is consistent with fishing for migratory species such as salmon and eel (Woodman 1978b, 1985, van Wijngaarden-Bakker 1985). The later site of Ferriter's Cove is a coastal midden, which also shows a dominance of pig bones in the mammalian remains, together with large numbers of fish bones, especially salmon, and marine molluscs (Woodman *et al*. 1999).

It is, of course, difficult to judge how far the differences between these various assemblages reflect differences of site location, of regional environment, of seasonality and site function, of taphonomic factors such as differential preservation and incomplete sampling of spatially heterogeneous deposits, or indeed of cultural attitudes. Some of the differences clearly relate to local environmental conditions, for example the presence of seal at Oronsay but its absence at Morton, or the dominance of limpets in the former case and cockles in the latter. The absence of red deer at the Irish sites is clearly not the result of small sample size, as we have suggested for Howick, but may rather reflect the rarity of deer in Ireland because of its early isolation from the British mainland (Woodman *et al*. 1997). In sites that have been extensively excavated with analysis of spatial variation in remains, notably at Morton and Ferriter's Cove, there are clearly considerable intra-site differences in the representation of different classes of food remains and different taxa, as between shell dumps and other sorts of surfaces, for example. Some of these differences reflect differences in the way different food remains were disposed of, others appear to reflect local variations in preservation conditions. Both these factors are likely to be of importance at Howick, and we have seen hints of such variation in relation to differences between hearth deposits and other surfaces and features.

The Howick material does not allow us to pursue the effects of intra-site spatial variation very far, but such factors are probably of considerable significance, especially in explaining some of the differences in faunal representation compared to the other sites we have mentioned. The two respects in which the Howick fauna stands out from the other sites are in the absence of fish bones and the relative rarity of molluscs. Given the fairly substantial and prolonged nature of occupation at Howick, as suggested by other lines of evidence, we think it unlikely that the inhabitants would have ignored locally available resources such as fish and molluscs. The absence of fish is probably due to the very poor conditions of bone preservation, reinforced by small sample size, though we cannot absolutely rule out other possibilities. It seems unlikely that fish were locally rare, but not impossible that people chose to ignore them. The rarity of the molluscs is less easily explained and calls for some further comment.

Molluscs are widely available in the intertidal zone as an easily collected complement to the more unpredictable and intermittent outcomes of hunting on land and at sea. Even though the shoreline was further away from the Howick site than it is today, it is unlikely to have been more than a few hundred metres away. It is well known that molluscs are quite expensive to carry any distance because of the high weight of the shell relative to the edible flesh, and that the molluscs are often cooked and the shells removed on the shore, even if the meat is then taken away for consumption at settlement sites further inland. However, numerous ethnographic and archaeological records (e.g. Meehan 1982; Bettinger *et al*. 1997; Bird *et al*. 1997; Bailey and Craighead 2003) show that molluscs in the shell are often carried at least 1km and sometimes more, the critical threshold being about 5km, depending on the particular species in question. Even if many shells are cooked on the beach, it is rare that some are not also taken back to settlements situated a little further inland, although there may be a rapid fall-off in quantity with increasing distance from the shoreline.

With the above considerations in mind, we suggest that there are five hypotheses that might account for the relative rarity of shells at Howick

1. Molluscs were collected in considerable quantities but the shoreline was further away than today because of lower sea level, and much of the processing of the shells and perhaps some of the consumption of the mollusc flesh took place nearer the Mesolithic shoreline, with relatively few shells being carried back to the Howick settlement. This remains a possible explanation as we have discussed above, but we think it insufficient by itself. The Asturian shell middens of northern Spain, which are of comparable age to Howick, are on a rocky coastline with similar molluscan habitats and potential productivity. They are also associated with a broad-based subsistence economy including hunting of deer and boar as well as fishing and shellgathering. There

are over 50 such sites, most formed in the mouths of small limestone caves or rockshelters. However, even though many of these sites are at least several hundred metres from the contemporaneous shoreline, and some up to 5km distant, the attractions of shelter and comfort afforded by the rockshelters clearly made it worthwhile to carry loads of limpets and topshells back to these locations. The great majority of the Asturian sites are proper shell middens, comprising thick deposits of concentrated shell, some forming quite substantial mounds that eventually filled the cave entrance (Bailey and Craighead 2003). However, we should beware of placing too much emphasis on analogies with other regions. The main reason why shells were carried inland from the shoreline in the Asturian case probably has to do with the shelter provided by the rockshelters and their attractiveness as bases for hunting and gathering on land. We are not aware of any similar examples in Britain, but we might suggest that the hut structure at Howick exerted a similar attraction to the rockshelters of Asturias in encouraging the occupants to carry back some of their mollusc shells from the nearby shoreline.

2. The Howick site was a specialised camp used for brief periods at a time to target one or two resources, ignoring others in the vicinity. We believe this to be highly unlikely, given the evidence for a wide range of subsistence activities and the investment in the building of at least one substantial dwelling structure that was clearly repeatedly used over a long period. It is worth emphasising the fact, noted above, that the Morton site has been interpreted as a task-specific site, primarily visited to collect stone material from the beach for artefacts. Yet mollusc shells were collected as food, along with other resources, even in seasons when the molluscs were not in their best condition for eating, precisely because they provided an easy and instant supply of food for people primarily engaged in other activities.
3. There was a cultural taboo against shellfood gathering or consumption. Moss (1993) provides a useful discussion of food taboos and shows that, amongst the Indians of the Pacific North-West Coast, there were widespread taboos against eating shellfish because of its association with disease, sexuality and low status. Nevertheless, the taboo was often relaxed, not only for people of low status with less access to high-status food, but also for people of higher status when other foods were scarce. As a resource that is easily accessible and easy to collect, shellfood is of particular value for the weaker members of the community – children, mothers with infants, and old people – and for all members of the community at times when other resources are in short supply (see also Meehan 1982). Also, notwithstanding the evidence of taboos on shellfish, the coastal settlements of the North-West Coast are associated with many substantial shell mounds that continued to be in use into the historical era. We therefore consider this hypothesis unlikely in the Howick context.
4. The shells were collected and brought back to the site in quantity but have been subjected to the same heavy toll of destructive agencies as the animal bone. Mollusc shells are usually regarded as being far more robust and resistant to destructive agencies than bone. Dogs have no interest in them, and if the shells are dumped in sufficient quantity or sufficiently rapidly in one place, they can create their own calcium-rich environment that neutralises the effect of acids in the surrounding sediment. Nevertheless, they are vulnerable both to fragmentation if burnt (Robins and Stock 1990), to deflation and dispersal if located on exposed sandy sediments, and to removal by chemical action and leaching out of organic material, even when accumulated as concentrated deposits. Stein (1992) provides examples and cogent evidence in support of the hypothesis that shells have been completely removed from the lowermost levels of some shell midden deposits in British Columbia because of post-depositional chemical action. Given the hostile conditions for preservation of organic materials at Howick, we think it quite possible that many shells have been destroyed, especially if they were originally accumulated in small concentrations or scattered through the deposit. The fact that dogwhelks are the most common species, a shell that has a particularly robust shell and compact shape, could be consistent with such an interpretation.
5. There was considerable spatial differentiation of activities and deposits, with concentrated shell dumps being located outside the area of the main hearths and dwelling structure in parts of the site that have now disappeared because of cliff erosion. In both the Oronsay shell middens (Mellars 1987) and the Ertebølle shell mounds of Denmark (Andersen 2000), there is good stratigraphic evidence to suggest a separation between hearth areas, associated in the Oronsay case with dwelling structures some 3m in diameter, and shell dumps situated outside this zone of intensive domestic activity. The hearth areas have slowly accumulating surfaces of heavily fragmented and compacted shell associated with high proportions of ash and sediments and abundant bone remains and stone artefacts, while the shell dumps comprise more rapidly accumulated concentrations of more loosely packed shells, with little sedimentary matrix and less cultural debris. This is particularly evident at the classic site of Ertebølle itself, a shell mound originally some 140m long by 40m wide and 2m thick. In addition, there is an area behind the mound and covering much the same area as the mound, which is full of bones, stone artefacts and cultural features, but completely lacking in shells, suggesting large-scale spatial differentiation of activities (Andersen and Johansen 1986). Similar variability in spatial patterning is present at Ferriter's Cove and at Morton, as noted earlier. It is possible that there was a similar spatial differentiation of activities and discard patterns at Howick, and that the areas of concentrated shell accumulation were on the seaward side of the dwelling structure, long since destroyed by erosion at the cliff edge.

We cannot be certain which of these hypotheses, or what combination of them, is most appropriate to the Howick case, but we believe that the factors associated with the last two hypotheses (4 and 5), perhaps reinforced by distance from the contemporaneous shoreline (as in hypothesis 1), provide the most plausible explanation of the relatively small amount of shell material, and that shellgathering was probably a regular part of the subsistence schedule, even though little evidence of it now survives.

Conclusions

In conclusion, we re-emphasise the wide range of subsistence activities represented at Howick, both marine and terrestrial, and the preponderance of activities that can be associated with the colder seasons of the year, or preparation for them. We highlight in particular the evidence for seal hunting. Sea mammals and abundant supplies of fatty fish such as cod and salmon play a crucial role in providing fat in the human diet, without which survival in cold, northerly environments is impossible, especially in sub-Arctic conditions. We suggest that this factor was of considerable significance in the Mesolithic of northern Britain, and that the local availability of such resources is likely to have played a key role in determining the attractiveness of particular locations for human settlement and the extent to which they were capable of sustaining prolonged occupation for long periods of the year, especially over the winter months. We consider it significant that all the sites we have discussed, and especially those with archaeological evidence for substantial occupation, show good evidence either for sea fishing (including salmon) or sealing, and in the case of the Oronsay middens, arguably one of the biggest concentrations of coastal middens in Britain, evidence of both subsistence activities.

Acknowledgements

We are indebted to the following individuals for access to comparative material and assistance with identifications: Umberto Albarella, Department of Archaeology, University of Durham; Hannah Koon, Department of Biology, University of York; Terry O'Connor, Department of Archaeology, University of York and Jessica Rippengal, Grahame Clark Archaeozoological Laboratory at the McDonald Institute for Archaeological Research, University of Cambridge. The Wolfson Bioarchaeology Laboratory, University of Newcastle upon Tyne, provided facilities for the analysis. We also gratefully acknowledge the support of the Leverhulme Trust for the award of a Major Research Fellowship to GB, which has facilitated the completion of the research on which this chapter is based.

11 Plant Remains and Charred Wood

Jacqueline Cotton

Summary

The initial evaluation of the Howick site during 2000 revealed large quantities of charred archaeobotanical remains in the Mesolithic hut deposits. This observation gave rise to the adoption of a 100% sampling strategy for all excavated Mesolithic deposits. The entire contents of each deposit identified within the hut were floated and sieved and both the resulting flot and residue were scanned for plant macrofossils. Initial assessment of the samples determined that vast quantities of charred hazelnut fragments were preserved within the Mesolithic hut. A detailed analysis of the data has been undertaken to ascertain the significance of the remains with regard to individual features, the status of the site and the exploitation of plant resources during the Mesolithic period. Few archaeobotanical remains were preserved in the upper stratigraphy of the hut.

The charred hazelnut fragments at Howick represent processing, waste and incidental deposits, indicating the deliberate and continual use of hazelnuts during the occupation of the site. Hazelnut shells may have been roasted and, after consumption of the nut, utilised as fuel. The quantities present in the hut suggest that nuts formed an important component in the inhabitants' diet. The presence of so many charred nut shells also suggests that nuts may have been regularly collected to be kept as a stored foodstuff for consumption during winter and spring months when food may have been less readily obtained. The absence of other archaeobotanical remains that may also have contributed to the diet is attributed to poor preservation conditions.

The presence of hazelnuts through all three phases of Mesolithic occupation implies that some degree of woodland management may have taken place to ensure a constant supply of nuts over the life of the hut – some 150 to 200 years (see Chapter 6). Analysis of the temporal pattern of waste from hazelnut usage indicated a decline over time. This could be attributed to a change in reliance upon hazelnuts in the diet, a reduction in their availability, or more likely, a shortening in the duration of occupation at the site as indicated by the radiocarbon dating.

Initial evaluation of the material determined the presence of large numbers of charred hazelnut fragments (hereafter termed CHF). The quantity and age of these remains are significant in the context of the socio-economic status of the site and with respect to the characteristics of British and North-West European Mesolithic settlements. Thus, a detailed analysis of the environmental data has been undertaken.

Method Statement

All samples of sediment from the hut were processed on site using a purpose-built flotation tank which had a mesh attached to obtain non-organic finds (such as flint) as well as a series of graduated brass sieves below the overflow in order to catch organic materials. The residue was collected in trays from the base of the tank. Each sample was floated and sieved through a 2mm mesh, with flot residues collected in graduated sieves with the smallest being 500m (0.5mm). Both flot and residue were retained, air-dried and scanned at x40 magnification for environmental remains. The compositions of the flot and residue matrix were recorded and total counts of the botanical remains were made. It is acknowledged that where thousands of CHF were preserved, there will be a small margin of error for the totals obtained, but this does not significantly affect the results and interpretations.

A quantitative assessment of the data has been undertaken with regard to the relative concentrations of CHF within each context. The number of CHF per volume of sediment processed from each context has been calculated. This produces information relating to the concentration of CHF in the deposits and provides an indication as to the nature of accumulation and whether remains are considered to be incidental deposits, deliberate dumps of material or the result of *in situ* activities. The number of CHF per volume of flot and residue has also been calculated. This records the concentration of CHF compared to other small finds and coarse material retained following sample processing.

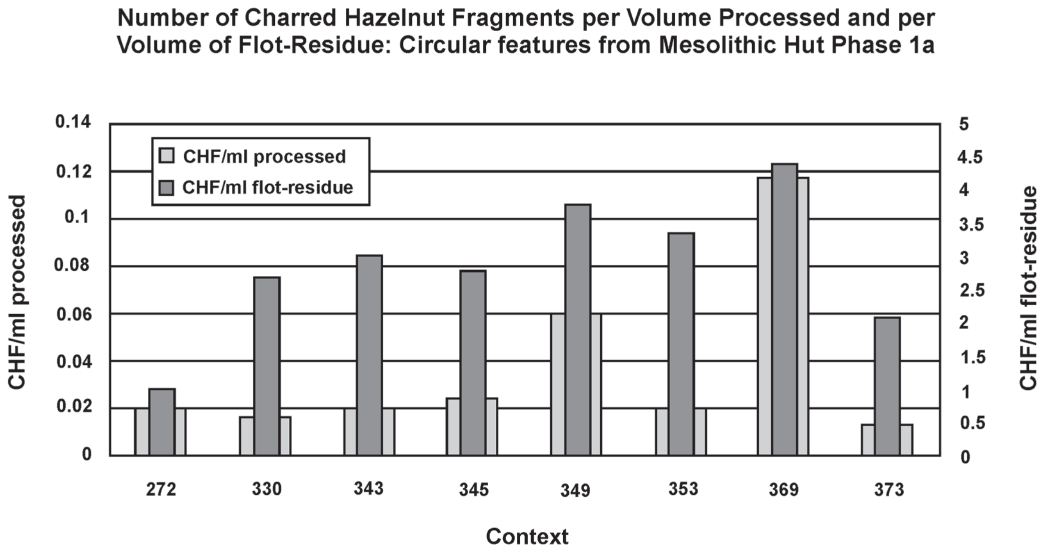


Figure 11.1. Charred hazelnut from the Mesolithic structure Phase 1a.

Archaeobotanical Residues

The complete set of results from the environmental analysis is provided in Table 11.1. The results are discussed below according to phase of occupation.

Phase 1a

Within the hut structure was a series of small circular features identified as post sockets. Nine fills from these circular features were sampled for environmental analysis. One of the nine features contained no charred archaeobotanical remains, while the remaining eight contained small to moderate numbers. The general trend of limited finds indicates that the charred hazelnut fragments preserved in the contexts resulted from the inadvertent deposition of residual waste, possibly transported into the contexts from more extensive waste deposition or hazelnut processing elsewhere inside the hut. The concentration of CHF in the samples was consistent (Fig. 11.1) suggesting similar rates of infilling with waste over time. Occasional charcoal finds were extracted from the context flots, but these were insignificant in number and, like the CHF finds, their presence may be inadvertent.

One of the stake hole features, context 244, was sampled for environmental remains. The processing of the sample produced a small flot, containing no CHF and small quantities of charcoal fragments.

One of two linear features, context 359, which is thought to have formed part of the structural remains, was sampled for environmental analysis. Little evidence of burning was observed in this feature, although processing of the sample produced a small flot containing 255 CHF. The volume of flot and residue remaining after processing was small, indicating that most of the fill was fine-grained sandy material, which was not retained. The relatively low numbers of archaeobotanical remains preserved indicate that waste was not deposited directly into this linear feature.

The central hearth [355] displayed evidence of multiple burning events and a series of different cuts resulting in an irregularly shaped pit. Analysis of the fill revealed the presence of over 42,000 CHF. This vast number suggests intensive use of hazelnuts while the evidence of multiple burning events indicates that hazelnuts were used continuously during the life of the hearth. To the east of the primary hearth were two further large hearth pits, [357] and [379], which also contained significant numbers of CHF (Fig. 11.2).

The quantity of archaeobotanical remains in the primary hearth suggests that it was the main area for roasting or cooking hazelnuts, while the similarly important quantities in contexts [357] and [379] indicate that these features were used for similar purposes. Very little charcoal was preserved in the samples when compared with the vast numbers of CHF. This absence is partly the result of the poor conditions of preservation which have encouraged degradation so that most charcoal remains are <2mm in size and were broken down instantly during excavation. The absence of other edible plant food items within the hearth is most likely due to the fact that hazelnut shell is strong and robust, especially when burnt, and survives well, whereas most other plant foods would have left little or no trace. However, it is noteworthy that this hearth [355] did produce many small burnt bone fragments.

Two later hearths were cut into the primary central hearth. The fills from these features, [291] and [367], contained 100 and 80 CHF respectively, indicating

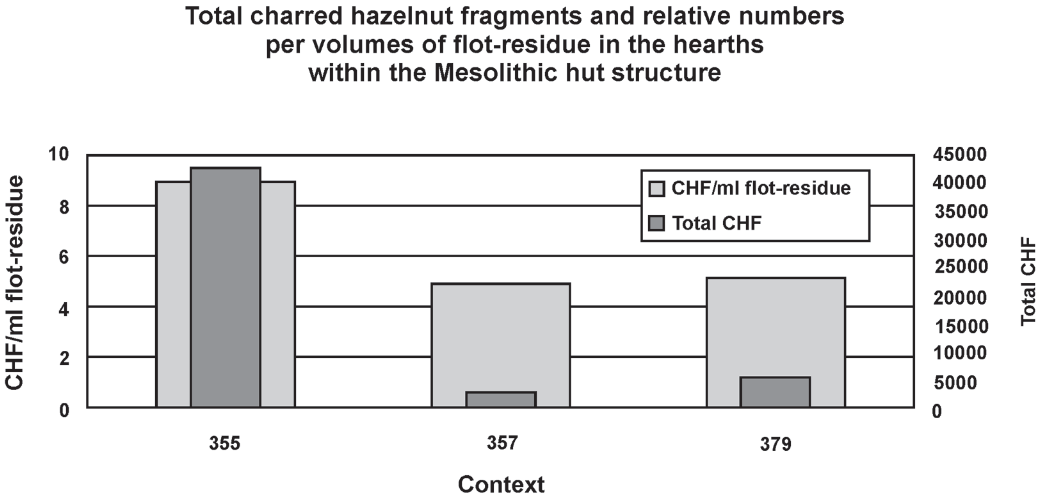


Fig. 11.2. Total charred hazelnut fragments from the Mesolithic structure hearths.

that hazelnuts may have been burnt or roasted in these hearths, but not on the same scale as the primary hearth [355].

The four other features preserved within Phase 1a of the Mesolithic structure were pits of varying size and of probable varying function. The two smaller pits, [274] and [351], contained 190 and 25 CHF respectively, while both contained occasional charcoal fragments. As no evidence for *in situ* burning was observed in these fills the presence of CHF and charcoal suggests that some waste material did accumulate in these pits. It is possible that the pits were used for food storage and preparation. The relatively low numbers of CHF in the pits indicate that either roasted nuts were not stored in the pits, or that charred waste fragments were separated from the edible nuts prior to storage. If food was prepared or stored prior to roasting then no evidence would be preserved as the acidic conditions at the site are not conducive to the preservation of organic material that has not been charred.

Two larger pits, [365] and [270], were also sampled for environmental analysis. From the 75 litres of sediment processed from [365], 2240 CHF were extracted. The large numbers of remains from [365] indicate that waste material accumulated within the pit. As there was no evidence for *in situ* burning, the hazelnuts will have been charred prior to deposition. A significant number of CHF were preserved in pit [270], 3275 from 68 litres processed, which is very high compared to finds in other socket or posthole fills, even when accounting for the large quantity of sediment processed. Finds in socket or post hole fills are often inadvertent remains, accumulating within the depression created by the timber by the actions of gravity, wind and accidental discard. The large numbers within [270], however, suggest that waste was purposely deposited in the pit. Therefore, it may be that the pit was originally used for storage or structural purposes and was then later filled in with debris associated with hazelnut roasting activities. At some point after this a post was inserted into the secondary socket.

Phase 1b

Samples [332], [334], [336], [338] and [342], from a group of small, shallow stake holes, preserved only low numbers of CHF in four of the stake holes and no charred remains in the fifth. The stake holes did contain mineralised wood, confirming their interpretation as the surviving tips of timber stakes, but this did not survive excavation and sample processing.

A larger stake hole fill, context [310], contained 101 CHF; a moderate number, presumably resulting from infilling with waste material over time. Charred birch wood fragments were found within the fill, while environmental analysis uncovered a single birch seed in the sample. Due to the aerobic conditions across the site and the acid nature of the substratum, it is unlikely that even hardy organic matter could survive for thousands of years. Birch seeds are particularly fragile and could not survive for long periods of time in an aerobic environment. Therefore, it is possible that the birch remains are intrusive. However, these deposits were deeply buried below the subsoil and may have experienced less acidic localised conditions resulting from the charred ends of the stakes that allowed for the survival of these botanical remains.

An 'r'-shaped shallow spread of material, context [298], contained a relatively large number of CHF, with 1165 present within the 210ml of flot and residue. These remains however, may derive from the underlying deposits within context 340.

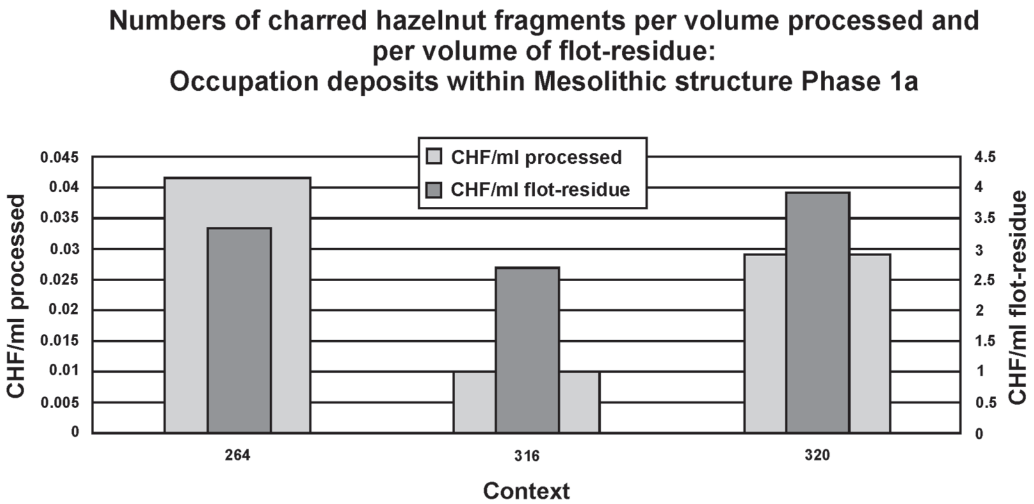


Fig. 11.3. Charred Hazelnut from the Mesolithic structure Phase 1b.

The occupation deposit, context [316], was extensively sampled and was found to contain 2065 CHF, together with small finds of charcoal, shell and waterlogged seeds. The latter are unlikely to be contemporary with the context and are likely to have been introduced by way of mole disturbance. The numbers of charred remains preserved in the occupation deposit are high, though it should be acknowledged that the remains were taken from 316 litres of sediment excavated from a deposit that covered a large area of the interior of the hut. Comparison of the numbers present in context [316] with spreads of burnt occupation deposits (Fig. 11.3) indicates that remains were uniformly spread across the hut floor.

Immediately overlying the central hearth [355] was context [340], an extensive spread of burnt material. Environmental analysis of the sample extracted from the spread has determined the presence of over 15,000 CHF. Located above this feature were two additional burnt spreads or hearth features. One spread, context [264], contained over 11,000 CHF. The other, [320], contained 2750 CHF. Together, these large numbers of hazelnuts represent waste material, perhaps from extensive processing, roasting and burning. Cutting into the north-east side of burnt spread [264] was a smaller burnt deposit or hearth feature, [293]. The volume of CHF deposition within this feature was lower than for the feature it cut into, with only 850 remains preserved. It is noted that the flot and residue from which these CHF were extracted were only small and therefore the concentration of remains was relatively high. Context [282], also associated with the stratified hearth features, produced 950 CHF from a relatively small quantity of sample.

Hearth feature [268] contained evidence for *in situ* burning and a significant concentration of CHF; 8340 from 91 litres of sediment were preserved in its fill. These remains indicate the continued exploitation of hazelnuts and the processing, burning and roasting of nuts within the structure. Bone and flint were also preserved in this hearth feature.

Pit [285] was cut into burnt spread [264] and contained 4073 CHF. The feature was initially interpreted as a raking pit associated with the hearths. Although additional degradation of CHF was not observed in the material from [285], the quantity of remains present suggests that waste material was deliberately deposited within this pit. The two other Phase 1b pits, [214] and [324], contained insignificant numbers of CHF. Due to the absence of further botanical remains or other small finds, environmental analysis cannot further the interpretation of these pits.

Phase 2

Environmental analysis of large volumes of sediment from context [210] revealed the presence of over 16,000 CHF. In addition, several other fill sediments and spreads of material associated with context [210] contained substantial numbers of CHF. The quantities of remains are presented in Figure 11.4. The total number of CHF within all of these contexts is c. 50,000.

The provenance of this large number of nut shells is not certain other than to say that they derived from occupation deposits and possibly levelling deposits introduced from outside the hut (see Chapter 5). If these charred hazelnuts derived from roasting and burning waste deposits outside the structure, then it is probable that they represent only a proportion of the full extent of nut waste that was originally produced.

Two of the perimeter stake holes contained mineralised wood, attesting to their interpretation as the

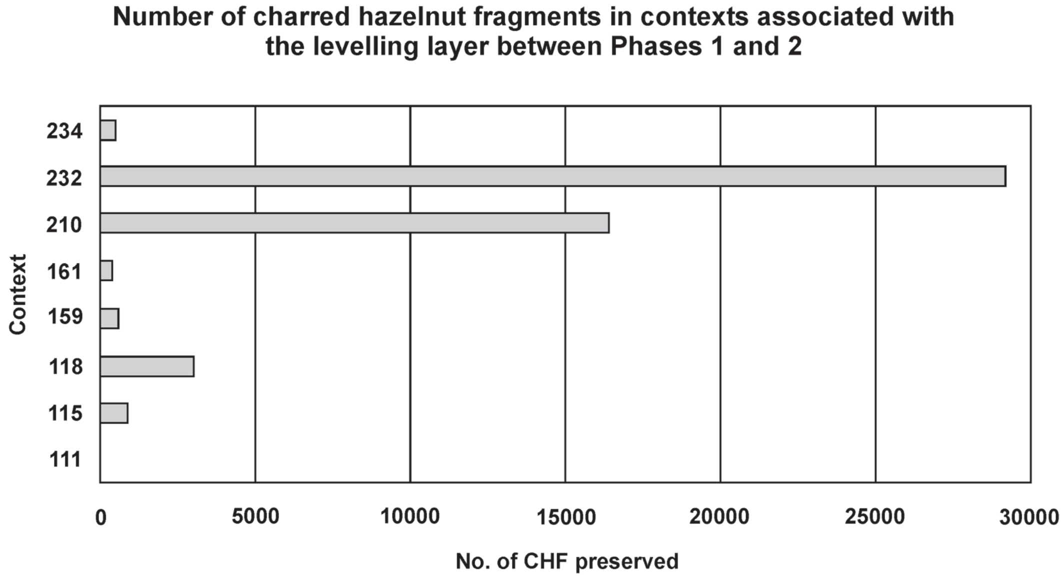


Fig. 11.4. Charred Hazelnut fragments from contexts associated with the levelling layer between phases 1 and 2.

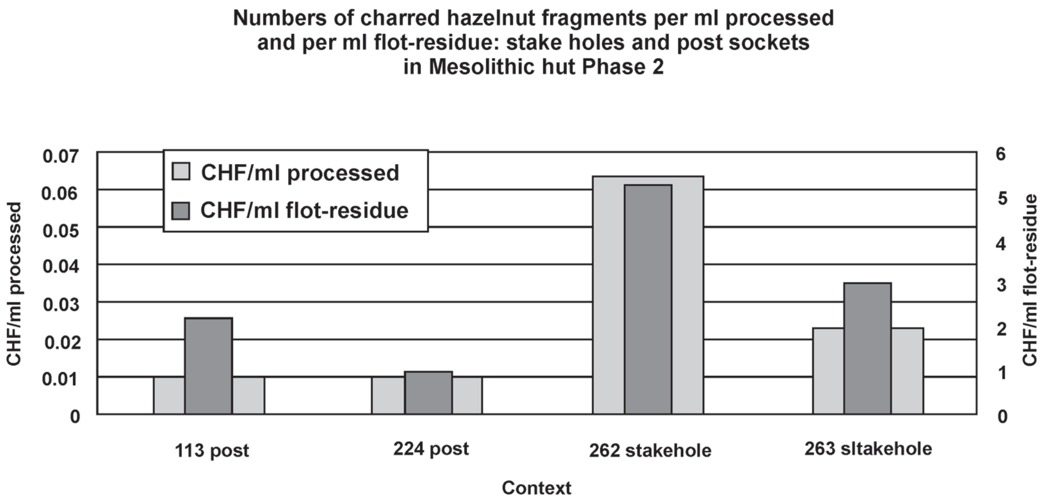


Figure 11.5. Charred hazelnuts from the stakeholes and post sockets of phase 2.

remnants of charred tips of timbers set into the ground, while the fills of two, [262] and [263], that were sampled for environmental analysis, contained 450 and 1047 CHF respectively. This large concentration of CHF suggests that these features were near to areas of cooking, processing or waste deposition. In comparison (see Fig. 11.5), two post sockets near to the stake holes contained low numbers of CHF. The insignificant quantities of CHF in [113] and [224] indicate the inadvertent accumulation of charred material.

Pit fill [160] contained 1910 CHF, a moderate number for the 43 litres of sediment that was processed. Context 276, a fill associated with this large pit feature, also contained a moderate number of CHF. A similar concentration of CHF was preserved in [206]. In contrast, the pit fill of [192] contained small numbers of CHF, while insignificant numbers were preserved in pit fill [214]. The variable quantities of CHF remains within these pit fills indicate that each may have performed a different function within the structure and that hazelnut waste was more frequent in pits [160], [206] and [276].

One dish-shaped pit, [109], had a clear heat-fused lining and contained a hazelnut-rich fill. The base of the pit included a fused surface impregnated with countless charred hazelnuts while the fill comprised heat-affected sand with clay fraction and charred remains. Environmental analysis of the lining and fill determined the presence of 2040 CHF in the former and 3590 CHF in the latter, although vast numbers of charred shells broke down into charred dust during excavation of these sediments, so the actual number of CHFs is substantially higher. Furthermore, fill

[236], which was found to be an extension of pit fill [109], also contained c. 3600 CHF. The preservation of the large numbers of charred remains and the evidence provided by the heat-affected base leads to the interpretation of this feature as a designated roasting pit. Hazelnuts can be roasted and dried in order to preserve them for longer periods. The exploitation of resources in this way is discussed further below. An additional fill, [259], associated with the roasting pit, contained a moderate quantity of CHF and charcoal, but also included a degraded charred seed that could be recognised from the morphology only as a member of a grass family. This poor state of preservation is an indication of why, other than hazel, charred species have not been found at the site.

Phase 3

Environmental analysis of a large volume of sediment from occupation/levelling layer [49] identified the presence of over 44,000 CHF. It was acknowledged by the excavators and during the environmental analysis that variation in charred nut shell densities occurred across this occupation layer. This may potentially reflect variability in the provenance of the deposits, in that some derived from waste deposits outside the structure, while others may have accumulated *in situ* as a result of activities within the hut.

A sample taken from post socket [148] contained 60 CHF. On the north-east side of the hut, post socket fills [35], [51] and [67] were sampled for environmental analysis. Each of these fills, like that of [148], contained few CHF, mostly derived from residual waste material that will have accumulated in the socket depressions. Post socket [35] also contained a moderate amount of charcoal, also likely to be residual fuel waste. The environmental sample from pit [67] contained an insignificant quantity of CHF. Post socket fill [266] contained a moderate number of CHF remains (455) although these may also be residual waste deposits that steadily worked their way into the socket depression.

Two major timber stains were preserved from Phase 3. The fill of one, context [41], included mineralised wood that was evidently a fallen former upright. The moderate volume of charcoal in the fill could have originated from some burning of the upright, or from fuel waste. Interestingly, the fill also contained c.2200 CHF. This substantial number of remains is unlikely to be residual waste, and suggests either that the depression created by the fallen timber became in-filled with waste material, or that, more likely, the CHF residues derive from material that had become worked into the area of the mineralised wood due to pedogenic processes and bioturbation over the ensuing 10,000 years.

The fill of the largest Phase 3 hearth, [47], included evidence for *in situ* burning, but only a relatively small number of CHF were present in the flot and residue; 890 from 20 litres of sediment. This could indicate that waste was removed from this hearth or that hazelnut roasting was not an important activity associated with the hearth. The fill of hearth [173] contained fused sand, indicating *in situ* burning, and contained a large concentration of CHF, although the numbers of remains are not as high as underlying Phase 1 hearth features.

Two pit features, thought to be associated with the hearths, were sampled for environmental analysis. Present in the fill of pit [45] were 1655 CHF and a moderate quantity of charcoal. The other pit, [53], contained few remains, but a relatively high concentration of CHF, similar to context [45]. This indicates that both pits were the recipients of hazelnut roasting, burning and processing waste, probably associated with hearth feature [47].

Two additional pits, located towards the edge of the hut, were also sampled for environmental residues. The fill of pit [65], an irregularly shaped pit with no evidence for *in situ* burning, contained a low number of degraded CHF and some degraded bone. The poor state of preservation of these finds suggests that the remains were moved or trampled prior to deposition. The fill of post pit [106] contained relatively few CHF, consistent with its interpretation as a structural pit for timber [41], and suggesting that waste from the hearth did not spread to the edge of the hut.

Phase 4

The Phase 4 occupation is believed to have been short in duration (see Chapter 6). A small burnt feature [55] from this phase was sampled. This contained c.170 CHF. This is a relatively low number of remains and could relate to the small size of the feature and the short period of occupation that comprised Phase 4.

Features outside the Mesolithic hut

Outside the hut a series of pits and scoops was located which may be linked to the Mesolithic occupation of the site. Scoop fill [13] was interpreted as archaeological in origin. Environmental analysis of the fill found no charred archaeobotanical remains or small finds that could indicate a chronology. Context 9 was the fill of a clay-lined pit within which stake holes were uncovered. Apart from the scorched and fused base of this pit, the only evidence of fire-based activity was 17 CHF, although this small number is not significant and could have blown or washed in from nearby areas of more extensive debris. Moreover, the presence of hazelnuts does not provide a positive indication of chronology, as hazelnuts have been preserved at sites dating from the prehistoric through to medieval periods in Northern England (Huntley and Stallibrass 1995).

The fill of a timber stain, Context 72, located outside of the Mesolithic structure, was analysed and found to contain 250 CHF alongside occasional flint and shell fragments. These waste deposits within the timber stain are similar to those found in the timber stains within the structure, and probably comprise residual waste material which slowly worked its way into the depression formed by the timber as a result of bioturbation and pedogenic processes.

Charcoal Analysis

Four samples of material from the Mesolithic hut believed to be charcoal were submitted for identification. Due to the poor preservation, two of the charcoal samples could not be identified. The two charcoal samples that could be identified were hazel (*Corylus avellana*). These samples could have been burnt as fuel, or could have been inadvertently collected with hazelnuts and charred when the nuts were burned or roasted. The issues surrounding the limited quantities of charcoal preserved at the Howick site are discussed below.

Discussion

Charred archaeobotanical remains at Howick

It is acknowledged that the presence of surviving charred archaeobotanical material at a site such as Howick is significant. At Mesolithic sites in the British Isles, significant quantities of archaeobotanical remains are rarely found (e.g. Cormack and Coles 1968; Huntley and Stallibrass 1995). This has proved a major limiting factor for developing an understanding of the extent of wild plant usage and exploitation as well as the impact on the landscape as a whole. In northern England, significant finds of charred plant material pre-dating the Iron Age are seldom found (van der Veen 1982; ASUD 2000), further enhancing the importance of the finds at Howick.

Beyond the importance of the preservation of charred hazelnuts there is a need to address the question of whether the remains represent debris from the opportunistic consumption and use of hazelnuts, or whether they reflect intensive exploitation of a resource (Zvelebil 1994). The sheer quantity of hazelnut residues at Howick, together with the roasting pit feature, are suggestive of intensive exploitation, though given the duration of the site the volume of nut debris may instead just reflect a steady accumulation over a century or two. Charred hazelnuts preserved in Mesolithic features at Thatcham, Berkshire were estimated to constitute c. 120 nuts and suggest opportunistic usage or "snack food" (Healy *et al*. 1992). In contrast, the several thousand remains at Staosnaig, Scotland are interpreted as deliberate plant usage (Mithen *et al*. 2001). As the numbers of fragments at Howick are probably present in higher numbers than at Staosnaig, and in some cases occur in concentrated masses in a range of deposits (e.g. roasting pit, hearths, occupation layers), they are considered likely to represent 'intensive' exploitation of wild plant resources (cf. Zvelebil 1994).

Charred hazelnut fragments were preserved in the full range of features at Howick, including hearths, pits, stake holes, post sockets, timber stains and occupation debris layers. Analysis of the quantities of finds, in conjunction with evidence of *in situ* burning and the possible function of features leads to a division of the context fills into three modes of CHF deposition.

1. Processing deposits. Features where hazelnuts are burnt or roasted *in situ*. Large numbers of fragments are often preserved.
2. Waste deposits. These are features without evidence for *in situ* burning where used or 'failed' hazelnuts are deposited. They could also include areas of storage. Moderate to large numbers of fragments are preserved.
3. Incidental deposits. Depressions or occupation layers into which fragments have inadvertently accumulated with no evidence for *in situ* heating and usually associated with structural features. Small to moderate numbers of fragments are preserved.

Nearly all the contexts from the hut fall into one of these three categories, implying that hazelnut exploitation took place on a significant scale. It creates a picture of the floor area being permanently covered with scatters of charred hazelnut fragments. The presence of the dish-shaped feature with a heat-fused base with an uncountable quantity of associated nut shells from the phase 2 hut suggests that hazelnut roasting was a formalised process that involved an organised routine for dealing with this plentiful food. Furthermore, from the fact that hazelnut roasting appears to have taken place it can be reasonably inferred that hazelnuts were being prepared for long-term storage, perhaps over the winter months after nut collection in the autumn. This seasonal indicator is important in helping to build up a picture of when the Howick site was occupied, as well as providing evidence for what may have been large-scale harvesting of resources. Given the duration of occupation indicated by the radiocarbon dating, the possibility arises that long-term management of the surrounding woodland may have taken place in order to propagate hazel growth and avoid over-exploitation. However, at present this remains only speculative in the absence of further independent evidence.

Charcoal

Charcoal was commonly preserved in the Mesolithic features but never in significant quantities. There were only rare finds of charcoal large enough to enable identification. Ideally, at least $1cm^3$ of charcoal should be used for identification. This ensures that most diagnostic features are preserved and recognised to allow a confident identification. Positive identifications can be made on smaller fragments but in the case of many of the Howick samples they were still too small. Numerous features at Staosnaig also had a limited presence of charcoal (Mithen *et al.* 2001). The excavators attributed this to the function of the features, which were not thought to have experienced *in situ* burning. In contrast, many features at Howick contained heat-fused and fire-reddened fills but still very little charcoal that did not disintegrate on excavation. The excavators noted that although charred wood could clearly be seen in the Howick deposits, as soon as it was touched, scraped or moved it disintegrated into powder and consequently few pieces could be salvaged for identification or dating purposes.

The low quantities and small sizes of fragments of charcoal at Howick could be attributed to a number of causes, the first of which is taphonomy. Flecks of charcoal were observed in many contexts but not preserved in the flots. This could suggest that the fragments were small and degraded and thus not retained during the processing procedure. Moreover, when charcoal is saturated it becomes more friable or 'crumbly'. Thousands of years of wetting and drying could have restricted preservation.

Secondly, it may be that charcoal was not the sole source of fuel. Hazelnuts are thought to burn well and may be used in areas where hazel is the main tree species and needs to be retained as a food resource (Mason 1996). Consequently, both the hazelnuts and the charcoal could be viewed as fuel waste.

The use and exploitation of hazel (*Corylus spp.*)

As we have seen, the majority of Mesolithic deposits at Howick contained charred hazelnut fragments, in varying quantities and in varying states of preservation. In many contexts, thousands of CHF were present. The primary question is why and how the hazelnuts came to be charred. Following the discovery of thousands of hazelnuts at Staosnaig, Scotland, Mithen *et al.* (2001) proposed three ways in which hazelnuts became charred. Firstly, shells from nuts opened in a raw state are unintentionally charred in hearths. Secondly, hazelnuts are used as fuel. Lastly, charred hazelnuts represent burnt residue from areas of roasting. A fourth possibility is that none of the above occurs exclusively and debris results from a combination of the processes.

If the debris represented shells from already opened nuts, burnt in hearths, this would suggest that the majority of fragments would be preserved in hearth features. At Howick, this is not the case. Vast numbers of remains are also present in pit fills (e.g. contexts [206] and [270]), burnt spreads of material (e.g. context [118]) and in debris layers (e.g. contexts [49], [232] and [210]), suggesting that no single process such as inadvertent charring in hearths could have occurred. Furthermore, this explanation fails to account for the roasting pit that had charred hazelnut shells embedded in its heat-fused lower lining.

The second suggestion was that hazelnuts were used as fuel (Mithen *et al.* 2001). As discussed above, this is likely given that hazel wood was also present in the hut deposits. Indeed the dried-out shells may have provided a good source of fire-lighting material. However, to use hazelnuts solely as a fuel source would be wasteful and the kernels will have been consumed prior to burning the shell. Considering the vast numbers of hazelnut shells in features where *in situ* burning has occurred, it is probable that the shells were used, either incidentally or deliberately, as a fuel.

The third possible reason for the charring of hazelnuts is for roasting. Mason (1996) lists the reasons why hazelnuts may have been roasted during the Mesolithic. These include:

1. Storage. Hazelnuts can be stored for up to 6 months if fresh, or longer if dried. It is likely that roasting would not significantly prolong the storage period, but may still have been seen as worthwhile.
2. Releasing oil or changing the oil structure. Hazelnuts are high in fat and protein, although some of the fat may not be digestible. It is thought that roasting can reduce some of the indigestible fat content, and can also enable oil extraction.
3. Flavour. Roasting can improve the flavour of nuts and makes them pleasant to eat.
4. Grinding. Nuts may be easier to grind if roasted, although if left for too long the kernel becomes a greasy pulp (Mithen and Score 2000).

Each of the above could provide a valid reason for hazelnut roasting. Furthermore, it is possible that roasting was done to serve more than one purpose. The true purpose for the roasting, which has evidently taken place within the hut, can only be speculated upon. However, the vast quantities of hazelnuts at Howick, and the array of features in which the remains were preserved, suggest that the

Context	Feature	Phase	Vol^ flot (ml)	Vol* residue (ml)	Composition (abundance)		Contents (number)	
232	Occupation layer	1a	709,000	8050	Hazelnut frags. (ch) Coarse sand Gravel Modern roots Fine sand Shell Charcoal Coal Bone Flint Ball bearing Insect fragments Ochre?	3 3 2 2 2 1 1 1 1 1 1 1 1	Hazelnut frags. (ch) Poaceae (w) Polygonum persicaria (w) Chenopodium/Atriplex spp (w) Aethusa sp. (w)	29,219 1 12 6 2
270	Linear pit	1a	68,000	1215	Gravel Hazelnut frags. (ch) Fine sand Modern roots Coarse sand Charcoal	3 3 3 2 1 1	Hazelnut frags. (ch)	3257
272	Post socket	1a	1000	20	Fine sand Modern roots	4 2	Hazelnut frags. (ch)	20
274	Pit	1a	4000	57	Hazelnut frags. (ch) Gravel Fine sand Charcoal Coarse sand	3 3 1 1 1	Hazelnut frags. (ch)	190
291	Hearth	1a		31	Hazelnut frags. (ch) Gravel Fine sand	4 2 1	Hazelnut frags. (ch)	100
318	Post socket	1a	2500	2	Fine sand Charcoal	5 1		
330	Post socket	1a	1000	6	Hazelnut frags. (ch) Gravel Fine sand	4 2 2	Hazelnut frags. (ch)	16
343	Post socket	1a	1500	10	Hazelnut frags. (ch) Coarse sand Gravel Fine sand Insect fragments	3 3 2 1 1	Hazelnut frags. (ch)	30
345	Post socket	1a	2000	16	Gravel Hazelnut frags. (ch) Coarse sand Fine sand	3 3 2 1	Hazelnut frags. (ch)	45
349	Post socket	1a		32	Hazelnut frags. (ch) Gravel Coarse sand Shell Modern roots Fine sand Insect fragments Charcoal	3 2 2 1 1 1 1 1	Hazelnut frags. (ch)	120
351	Pit	1a		5	Hazelnut frags. (ch) Gravel Coarse sand Modern roots Fine sand Insect fragments Charcoal	3 2 2 1 1 1 1	Hazelnut frags. (ch)	25
353	Post socket	1a		12	Hazelnut frags. (ch) Gravel Coarse sand Flint Modern roots Fine sand Insect fragments Charcoal	4 2 2 1 1 1 1 1	Hazelnut frags. (ch)	40

Table 11.1. Plant macrofossil data by phase. (Continued over the next six pages).

Context	Feature	Phase	Vol^ flot (ml)	Vol* residue (ml)	Composition (abundance)		Contents (number)	
355	Hearth	1a		4780	Hazelnut frags. (ch) Gravel Flint Shell Bone Charcoal	4 2 1 1 1 1	Hazelnut frags. (ch)	42750
357	Hearth	1a	75,000	590	Hazelnut frags. (ch) Gravel Modern roots Fine sand Charcoal	4 2 1 1 1	Hazelnut frags. (ch)	2900
359	Linear feature, prob timber stain	1a	40,000	89	Hazelnut frags. (ch) Gravel Coarse sand Flint Shell Fine sand Modern roots Charcoal	3 2 1 1 1 1 1 1	Hazelnut frags. (ch) Chenopodium/Atriplex spp (w)	255 2
365	Pit	1a	75,000	540	Hazelnut frags. (ch) Gravel Modern roots Coarse sand Charcoal	3 2 2 1 1	Hazelnut frags. (ch) Chenopodium/Atriplex spp (w)	2240 2
367	Hearth	1a		32	Hazelnut frags. (ch) Gravel Modern roots Fine sand Coarse sand Insect fragments Charcoal	4 2 3 3 2 1 1	Hazelnut frags. (ch)	80
369	Post socket	1a		54	Hazelnut frags. (ch) Coarse sand Gravel	5 2 1	Hazelnut frags. (ch)	235
371 same as 357	Hearth	1a		290	Hazelnut frags. (ch) Gravel Coarse sand Flint Fine sand Modern roots Charcoal	4 2 2 1 1 1 1	Hazelnut frags. (ch) Polygonum persicaria (w)	1520 1
373	Post hole	1a		12	Hazelnut frags. (ch) Gravel Coarse sand Fine sand	3 3 1	Hazelnut frags. (ch)	25
379	Hearth	1a		1060	Hazelnut frags. (ch) Gravel Modern roots Fine sand Flint Ochre? Shell	4 2 1 1 1 1 1	Hazelnut frags. (ch)	5390
264	Hearth	1b	273,000	3410	Fine sand Hazelnut frags. (ch) Coarse sand Modern roots Gravel Charcoal	3 3 2 2 1 1	Hazelnut frags. (ch)	11380
268	Hearth	1b	91,000	1605	Coarse sand Hazelnut frags. (ch) Gravel Fine sand Modern roots Bone Flint Charcoal	3 3 3 2 2 1 1 1	Hazelnut frags. (ch) Poaceae (w) Chenopodium/Atriplex spp (w)	8340 4 1
282	Burnt fill of linear [283]	1b	5000	159	Hazelnut frags. (ch) Gravel Fine sand	4 1 1	Hazelnut frags. (ch)	950

Table 11.1. Continued.

Context	Feature	Phase	Vol^ flot (ml)	Vol* residue (ml)	Composition (abundance)	Contents (number)
					Charcoal 1	
285	Pit	1b	36,000	950	Hazelnut frags. (ch) 4 Gravel 2 Fine sand 2 Coarse sand 1 Charcoal 1	Hazelnut frags. (ch) 4073 Chenopodium/Atriplex 1 spp (w)
293	Hearth	1b		155	Hazelnut frags. (ch) 4 Gravel 2 Fine sand 2 Charcoal 1	Hazelnut frags. (ch) 850
298	Linear feature	1b	29,000	210	Hazelnut frags. (ch) 3 Gravel 2 Modern roots 2 Fine sand 2 Flint 1 Charcoal 1	Hazelnut frags. (ch) 1165
310	Post socket	1b	2000	17	Hazelnut frags. (ch) 3 Gravel 2 Coarse sand 2 Fine sand 1	Hazelnut frags. (ch) 101 Betula pubescens (w) 1
316	Occupation layer	1b	215,000	775	Gravel 3 Hazelnut frags. (ch) 3 Modern roots 2 Fine sand 1 Coarse sand 1 Charcoal 1 Flint 1 Shell 1	Hazelnut frags. (ch) 2065 Chenopodium/Atriplex 4 spp (w) 1 Betula pubescens (w) 1 Poaceae (w)
320	Hearth	1b	95,000	700	Gravel 3 Hazelnut frags. (ch) 3 Modern roots 2 Fine sand 2 Charcoal 1	Hazelnut frags. (ch) 2750 Chenopodium/Atriplex 1 spp (w)
324	Pit	1b	7000	27	Hazelnut frags. (ch) 3 Gravel 3 Coarse sand 2 Fine sand 1	Hazelnut frags. (ch) 70 Chenopodium/Atriplex 1 spp (w)
332	Stake hole	1b	200	5	Hazelnut frags. (ch) 4 Gravel 2	Hazelnut frags. (ch) 14
334	Stake hole	1b	100	5	Hazelnut frags. (ch) 3 Gravel 2 Coarse sand 2	Hazelnut frags. (ch) 10
336	Stake hole	1b	100	5	Gravel 3 Coarse sand 2 Fine sand 2	Hazelnut frags. (ch) 15
338	Stake hole	1b	200	<5	Coarse sand 5	
340	Hearth	1b	510,000	3095	Hazelnut frags. (ch) 3 Coarse sand 2 Modern roots 2 Fine sand 2 Coarse sand 1 Insect fragments 1 Charcoal 1 Gravel 1	Hazelnut frags. (ch) 15021 Chenopodium/Atriplex 6 spp (w) 1 Polygonum persicaria 1 (w) 7 Aethusa sp. (w) Betula pubescens (w)
342	Occupation layer	1b		30	Hazelnut frags. (ch) 4 Gravel 2 Coarse sand 2 Modern roots 2 Fine sand 1 Insect fragments 1 Charcoal 1	Hazelnut frags. (ch) 50
107	Roasting pit fill 109	2	46,000	445	Hazelnut frags. (ch) 4 Coarse sand 2 Gravel 2 Fine sand 2	Hazelnut frags. (ch) 2040
109	Roasting Pit	2	162,000	970	Hazelnut frags. (ch) 3 Gravel 3 Coarse sand 2 Fine sand 2	Hazelnut frags. (ch) 3590 Cirsium spp (w) 1

Table 11.1. Continued.

Context	Feature	Phase	Vol^ flot (ml)	Vol* residue (ml)	Composition (abundance)	Contents (number)
					Flint 1 Shell 1 Charcoal 1	
111	Occupation layer	2	5000	15	Gravel 3 Hazelnut frags. (ch) 3	Hazelnut frags. (ch) 50 Chenopodium/Atriplex 1 spp. (w)
113	Post socket	2	25,000	105	Modern roots 3 Fine sand 3 Coarse sand 2	Hazelnut frags. (ch) 231
115	Occupation layer	2	17,500	227	Hazelnut frags. (ch) 3 Coarse sand 3 Gravel 2 Modern roots 2 Flint 1 Shell 1 Bone 1 Clinker 1 Charcoal 1	Hazelnut frags. (ch) 762
118	Occupation layer	2	183,000	1107	Hazelnut frags. (ch) 3 Modern roots 3 Gravel 2 Coarse sand 2 Fine sand 2 Flint 1 Bone 1 Shell 1	Hazelnut frags. (ch) 2966 Aethusa sp. (w) 3
159	Occupation layer	2	11,000	735	Gravel 3 Hazelnut frags. (ch) 3 Modern roots 2 Coarse sand 2 Fine sand 1 Charcoal 1	Hazelnut frags. (ch) 555 Rubus fruticosa (w) 1 Chenopodium/Atriplex 1 spp (w) 5 Polygonum persicaria (w)
160	Pit	2	43,000	600	Hazelnut frags. (ch) 3 Modern roots 3 Fine sand 3 Coarse sand 2 Insect fragments 1 Charcoal 1 Gravel 1	Chenopodium/Atriplex 8 spp (w) 1910 Hazelnut frags. (ch)
161	Occupation layer	2	9500	95	Gravel 3 Hazelnut frags. (ch) 3 Modern roots 2 Fine sand 2 Charcoal 1 Coarse sand 1	Hazelnut frags. (ch) 310
192	Pit	2	3000	45	Hazelnut frags. (ch) 4 Gravel 2 Fine sand 2 Modern roots 2 Flint 1 Shell 1	Hazelnut frags. (ch) 200 Poaceae (w) 2
206	Pit	2	50,000	527	Gravel 3 Hazelnut frags. (ch) 3 Coarse sand 2 Modern roots 2 Fine sand 2 Charcoal 1	Hazelnut frags. (ch) 1402
209	Clay lump	2	1000	7	Hazelnut frags. (ch) 4 Coarse sand 2 Modern roots 1	Hazelnut frags. (ch) 8
210	Occupation layer	2	373,000	4620	Fine sand 3 Hazelnut frags. (ch) 3 Soil aggregates 2 Coarse sand 2 Modern roots 1 Insect fragments 1 Gravel 1	Chenopodium/Atriplex 1 spp. (w) 16413 Hazelnut frags. (ch) 1 Aethusa sp. (w) 1 Poaceae (w)
214	Pit	2	1000	15	Hazelnut frags. (ch) 4	Hazelnut frags. (ch) 40

Table 11.1. Continued.

Context	Feature	Phase	Vol^ flot (ml)	Vol* residue (ml)	Composition (abundance)	Contents (number)
					Modern roots 2 Coarse sand 2 Gravel 1 Fine sand 1	
224	Post socket	2	3000	30	Hazelnut frags. (ch) 3 Gravel 3 Coarse sand 2 Fine sand 2	Hazelnut frags. (ch) 30 Chenopodium/Atriplex spp (w) 1
228			250	5	Hazelnut frags. (ch) 4 Gravel 3	Hazelnut frags. (ch) 40
234	Occupation layer	2	10,000	135	Modern roots 4 Hazelnut frags. (ch) 3 Coarse sand 1 Fine sand 1	Hazelnut frags. (ch) 475
236 same as 109	Roasting Pit	2	64,000	660	Coarse sand 3 Hazelnut frags. (ch) 3 Fine sand 2 Modern roots 2 Gravel 2 Bone 1 Charcoal 1 Shell 1	Hazelnut frags. (ch) 3595
244 same as 115/210	Occupation layer	2	23,000	25	Fine sand 4 Modern roots 2 Charcoal 1	
259 same as 111	Occupation layer	2	2000	20	Modern roots 3 Hazelnut frags. (ch) 3 Gravel 2 Fine sand 2 Coarse sand 2 Charcoal 2	?Charred grain 1 Hazelnut frags. (ch) 45
262	Stake hole	2	7000	85	Gravel 3 Hazelnut frags. (ch) 3 Coarse sand 2 Fine sand 2	Hazelnut frags. (ch) 450 Chenopodium/Atriplex spp. (w) 1 Polygonum persicaria (w) 1
262	Stake hole	2	45,000	345	Gravel 3 Hazelnut frags. (ch) 3 Coarse sand 2 Fine sand 2 Modern roots 2	Hazelnut frags. (ch) 1047
276 same as 160	Hearth	2	6000	65	Gravel 3 Hazelnut frags. (ch) 3 Coarse sand 1 Fine sand 1	Hazelnut frags. (ch) 320
35	Post Socket	3	10,000	100	Fine sand 3 Hazelnut frags. (ch) 3 Modern roots 3 Coarse sand 2 Charcoal 2 Gravel 1	Hazelnut frags. (ch) 150 Chenopodium/Atriplex spp. (w) 6 Aethusa sp. (w) 1
41	Timber stain	3	52,000	480	Modern roots 3 Hazelnut frags. (ch) 2 Fine sand 2 Coarse sand 2 Charcoal 2 Flint 1	Hazelnut frags. (ch) 2226 Chenopodium/Atriplex spp. (w) 1
45	Pit	3	28,000	250	Modern roots 3 Coarse sand 2 Hazelnut frags. (ch) 3 Charcoal 2 Flint 1	Hazelnut frags. (ch) 1655
47	Hearth	3	20,000	325	Hazelnut frags. (ch) 5 Coarse sand 1 Flint 1 Bone 1	Hazelnut frags. (ch) 890
49	Occupation layer	3	1164,500	14495	Gravel 3 Hazelnut frags. (ch) 3 Coarse sand 2	Hazelnut frags. (ch) 44367 Chenopodium/Atriplex spp (w) 1

Table 11.1. Continued.

Context	Feature	Phase	Vol^ flot (ml)	Vol* residue (ml)	Composition (abundance)	Contents (number)
					Modern roots 2 Fine sand 1 Flint 1 Shell 1 Bone 1 Ochre? 1 Insect fragments 1	
51	Post socket	3	3000	10	Hazelnut frags. (ch) 3 Gravel 3 Coarse sand 2 Fine sand 2 Modern roots 1 Charcoal 1 Insect fragments 1	Hazelnut frags. (ch) 62 Poaceae (w) 1 Urtica dioica (w) 1
53	Pit	3	7500	90	Gravel 3 Coarse sand 3 Fine sand 3 Modern roots 1 Charcoal 1 Flint 1 Shell 1	Hazelnut frags. (ch) 450
65	Pit	3	56,500	480	Coarse sand 3 Modern roots 3 Gravel 3 Fine sand 2 Flint 1 Degraded bone 1 Coal 1	Hazelnut frags. (ch) 230 Poaceae (w) 1
67	Post socket	3	3000	150	Fine sand 2 Gravel 2 Coarse sand 2 Flint 2 Hazelnut frags. (ch) 1 Modern roots 1 Mollusc 1	Hazelnut frags. (ch) 10
106	Pit	3	24,000	325	Hazelnut frags. (ch) 4 Gravel 3 Coarse sand 2 Fine sand 1 Flint 1	Hazelnut frags. (ch) 515
148	Post socket	3	3000	25	Hazelnut frags. (ch) 4 Gravel 2 Flint 1	Hazelnut frags. (ch) 60
173	Hearth	3		25	Hazelnut frags. (ch) 4 Gravel 2	Hazelnut frags. (ch) 150
266	Post hole fill of [267]	3	5000	105	Coarse sand 3 Hazelnut frags. (ch) 3 Modern roots 2 Modern wood 1 Fine sand 1 Flint 1 Mollusc 1	Hazelnut frags. (ch) 445
55	Burning pit	4	5000	20	Hazelnut frags. (ch) 3 Gravel 3 Coarse sand 2 Fine sand 1 Flint 1 Modern roots 1	Hazelnut frags. (ch) 170
9	Clay-lined pit	Outside Hut	10,000	22	Gravel 4 Fine sand 3 Coarse sand 2 Hazelnut frags. (ch) 2	Hazelnut frags. (ch) 17
13	Pit	Outside Hut	70,000	60	Fine sand 3 Coarse sand 3 Gravel 3 Flint 1 Shell 1 Coal 1	
21	Pit	Outside	50,000	90	Gravel 3	

Table 11.1. Continued.

Context	Feature	Phase	Vol^ flot (ml)	Vol* residue (ml)	Composition (abundance)	Contents (number)
		Hut			Coarse sand 3 Fine sand 1 Flint 1 Shell 1	
57	Clay lining for truncated clay-lined pit	Unstrat outside hut	5000	10	Coarse sand 3 Fine sand 2 Coal 1 Insect fragments 1	
72	Linear timber stain	Unstrat outside hut		55	Gravel 3 Hazelnut frags. (ch) 3 Modern roots 1 Flint 1 Shell 1	Hazelnut frags. (ch) 250

Table 11.1. Continued.

nuts may have been roasted, consumed *and* used as fuel.

Mithen *et al*. (2001) assert that charred hazelnut fragments that derive from roasting events are 'failures'. Experimental roasting has determined that such failures constitute only 12–25% of the original total roasted (Mithen and Score 2000). If the hazelnuts at Howick solely represent failures then 75–88% of the hazelnuts collected have not been preserved and the magnitude of exploitation is greater than that implied by the data. It is acknowledged that some of the CHF may have been roasted, then used as fuel, and hence the numbers preserved will represent a higher proportion of the original total. Even with this in mind the hazelnuts at Howick still represent the collection of perhaps many thousands of nuts each season. Consequently, it can be concluded that hazelnuts constituted a significant component in the Mesolithic diet and will have formed a major source of protein and fat with special importance as a food source over the autumn and winter months.

It is somewhat striking that charred hazelnut shells were virtually the only identifiable archaeobotanical remains preserved. A single charred seed, possibly a grain, was found but this was too degraded to identify and therefore the provenance of the grain cannot be assured. This absence of other remains is in contrast with other British Mesolithic sites, where charred plant material has been preserved. At Staosnaig, Scotland, the large numbers of charred hazelnut shells were complemented by finds of charred crab apple seeds (*Malus* spp.), which may have been exploited as a food resource (Mithen *et al.* 2001). Other charred seeds from local vegetation that may have been inadvertently charred were also preserved. At Star Carr, charred starchy plant roots from emergent aquatic species such as reeds (*Phragmites australis*) and rushes (*Typha* spp.) were preserved (Hather 1998; Mellars 1998). It is likely that similar plant resources were available at Howick, specifically in the nearby valley floor habitats. Could the absence of such plant remains be the result of taphonomic processes? It is acknowledged that charred hazelnut shells are very hardy and may withstand poor preservation conditions that more fragile charred material could not. The absence of other remains could also alternatively result from the hut deposits accumulating indoors where only foodstuffs brought into the house could be expected to survive, and in the case of Howick, only if they were charred. The presence of a wider range of species on the other sites could therefore be associated with them accumulating outdoors where more material is likely to become incorporated into the archaeological deposits.

Conclusions

Analysis of the archaeobotanical remains from Howick has demonstrated the presence of around 200,000 charred hazelnut fragments and an unquantifiable number that disintegrated on excavation in features that date to all four phases of the Mesolithic occupation. The quantity of hazelnuts preserved suggests the possibility that organised exploitation of the resource took place. As the charred fragments uncovered at the site may represent failures, the original number of hazelnuts collected could have been many times the number preserved, together with the unknown quantity that were no doubt processed and consumed outside, and those fragments that disintegrated during trowelling.

A combination of the limited quantities of charcoal and the preservation of charred shells in areas of *in situ* burning leads to the conclusion that hazelnuts were, incidentally or purposely, used as a fuel source.

It is also probable that the hazelnuts were roasted, although the purpose of roasting, whether for taste, extraction of the oil or storage, remains unknown.

The continued presence of hazelnuts throughout successive hut phases suggests that the acquisition of large quantities of nuts was sustainable, which in turn implies that strategic husbanding of the woodland resource may have taken place.

Context	**Feature**	**Phase**	**Identification**
049	Occuptn. layer	3	Hazel (*Corylus avellana*)
049 (1960)	Occuptn. layer	3	Clinker
210 (2939)	Occuptn. layer	2	Too little charcoal available for identification.
232 (3700)	Occuptn. layer	1a	Hazel (*Corylus avellana*)

Table 11.2. Charcoal identification results.

12 Geomorphology and Paleoenvironmental Analysis

Ian Boomer, Robert Shiel and Tony Stevenson

Geomorphological Setting

Introduction

A survey was undertaken to produce a broad classification of the coastline adjacent to the excavation site. This included an assessment of the geomorphology, distribution of potential archaeology-bearing deposits and identification of erosion threats. The survey encompassed a 2.5km stretch with a range of coastal landforms and possible erosion threats.

In summary, the hinterland is generally low-lying with a very gentle (about 2°) slope (Fig. 12.1). The buffer zone between land and sea ranges from soft dunes to weakly consolidated glacial deposits (often expressed as eroding cliffs with significant rotational slumping in places) and in some areas the local country rock, Carboniferous Millstone Grit, is exposed as steep cliffs. The intertidal zone is usually represented by either sand flats or extensive intertidal wave-cut platforms of the country rock.

This section concerns the geomorphology of the coastline immediately to the north and south of the Mesolithic site. A strip of coastline from Longhoughton Steel (2km south) to Seahouses Farm (1km north) is described in terms of the main geomorph-

Figure 12.1 View south from the site looking towards Boulmer showing three distinct exposures of wave-cut Carboniferous sediments exposed at low tide. Note also the slump-edged cliffs and gentle seaward dip of the hinterland.

ological units, and the potential archaeological importance highlighted.

Overview

This coastline is characterised by a repeated bay and headland pattern, with low tide revealing sandy bays separated by often extensive seaward exposures of the local Carboniferous country rock (these platforms are known locally as 'hards' or 'steels'). The hinterland predominantly comprises agricultural land on a relatively planar, gently seaward-dipping surface. This is particularly well seen to the south of the archaeological site, looking towards Boulmer (see Fig. 12.1). The major geomorphological feature, which bisects the coastal plain, is the valley of the Howick Burn, to the north and east of which the land surface becomes somewhat more uneven.

The Howick Burn lies in an incised river valley (by as much as 20 metres) and probably follows a natural pattern of drainage on the Late-Glacial surface relief. The burn has quite large valley dimensions for the relatively small present-day discharge (usually 1–2 $m^3 s^{-1}$). This may be taken to indicate higher discharge in the past, possibly the result of significant quantities of local surface water, following the wasting of the last ice masses after the last deglaciation. Coring investigations have revealed that below the valley floor up to 8m of intertidal and fluvially derived sediments rest upon the bedrock (see below).

Description and Classification of Shoreline and Coastal Plain Morphology

Much of this coastline has a wide intertidal zone (200–300m at lowest tide). Above the high-tide mark the beach width varies from a few metres to some tens of metres. The beach is usually backed by a low cliff line of hard country rock or, more usually, softer glacial or wind-blown sediments. These latter two types are often affected by wave-driven undercutting, causing rotational slumping and failure, the most significant cause of land loss along this stretch of coast. The low cliffs are usually between 4m and 10m in height, although the tallest can reach heights of 15m, with a general increase in height northwards. South of the Howick Burn the coast is dominated by relatively soft sediments with the occasional appearance of 1–2m of Carboniferous sediments at the cliff base (often showing evidence of glacial and periglacial disturbance such as frost shattering and sediment mobilisation). North of the Burn, however, the Carboniferous rocks become more significant, creating solid vertical cliffs, particularly at Seahouses Farm, topped by up to 5m of till.

There are no significant sea defences along this part of the coast although the remains of some Second World War anti-tank defences remain near point 'E' on the accompanying map.

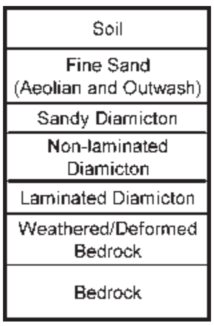


Figure 12.2. Schematic representation of the main sedimentary units exposed on the Howick coastline (not all units necessarily present throughout study area).

Summary of Sedimentary Units

The main sedimentary units exposed along this coastline comprise, in decreasing age:

1. Carboniferous Rocks (Oldest)
2. Late Quaternary glacial sediments
3. Late Holocene Dunes
4. Soil profile (Youngest)

A summary of the main exposed units is shown in Figure 12.2.

1. Carboniferous, Millstone Grit Series (approx. 320 million years old). These rocks are relatively robust compared to the younger, overlying material and are the most resistant to erosion seen on this coast. They form extensive seaward platforms, exposed by low tide, but also form cliffs up to 6m in height along some sections (particularly at Seahouses Farm). The rocks represent a series of cyclic deposits of mudstones, sandstones, limestones and coals or seat-earths. These diverse lithologies erode at different rates and are, to some extent, responsible for the variable shore face erosion rates along this coast. The extensive platforms seen at low tide are important in limiting coastal erosion as they serve to attenuate some of the wave energy before reaching the shore/cliff line.

2. Late Quaternary glacial deposits (age approximately 18–12k cal BC). This unit comprises at least two diamictons, the lower being predominantly fine-grained, clay to silt grade (laminated in some sections), but incorporating significant quantities of larger clasts of up to cobble and boulder size. The upper (younger) subunit is predominantly sandy and caps some of the headland cliffs as well as comprising much of the material excavated on the main site (for further discussion of these deposits see Fig. 12.3).

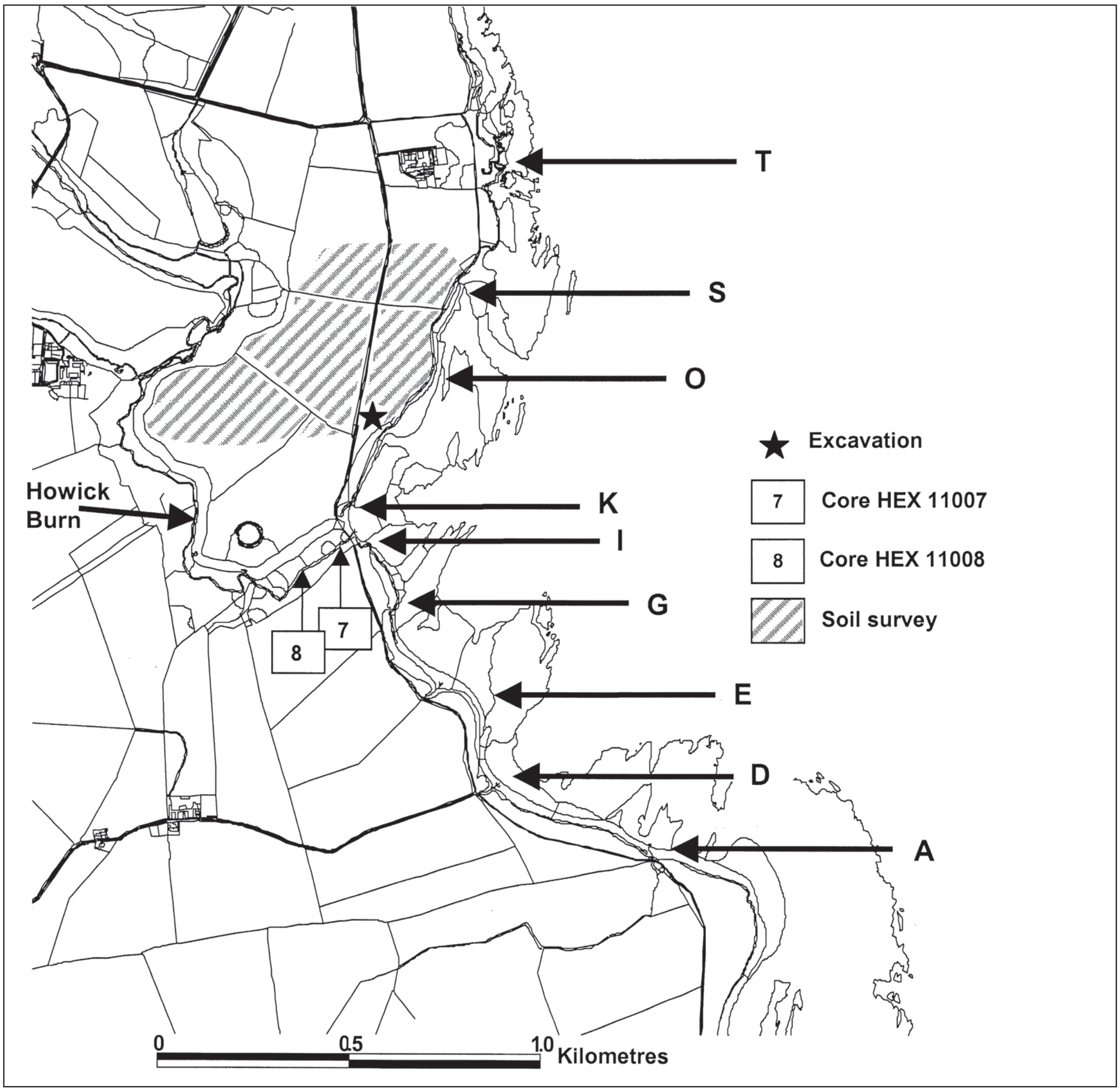


Figure 12.3. Location map of the coastline between Seahouses Farm and Boulmer with the Howick excavation and site of the two Howick Burn cores indicated. The letters A to T are reference points along the coast and are referred to in the text. © Crown Copyright Ordnance Survey. An EDINA Digimap/JISC supplied service.

Both of these units appear to be of glacial or glaciolacustrine origin and were deposited towards the end of the last climatic cool phase (Devensian). They result from the deposition and possible reworking of material from the retreating ice sheets which had covered the region between about 22,000–16,000 cal BC. There is evidence, during the latest period of that cool phase, of localised periglacial and glacio-tectonic processes (possibly resulting from the glacial re-advance during the Younger Dryas stage, between 8500 and 9500 cal BC) which resulted in the deformation of the underlying Carboniferous rocks and intermixing of the recently deposited glacial diamicton and sandy, glacial outwash sediments.

There is also a suggestion, in the area immediately inland from the Mesolithic site, that some glacial 'drumlin-like' features may have been deposited along this otherwise planar coastal strip. This is suggested by the occurrence of the steep, natural high ground upon which the hillfort rests immediately to the north of the Howick Burn about 500m west of the excavation. A number of other glacial deposition features (kames) are also known from the adjacent coastline, for example at Embleton to the north. The marked northward-sloping landscape to the south of the Howick Burn suggests that the course of the river may have been determined during the Late Glacial period as it followed, and subsequently enlarged, a natural feature of the landscape.

The glacial history of this part of the UK remains poorly understood but a recent review can be found in Teasdale and Hughes (1999).

3. Dunes (less than 500 years old). Coastal dune systems are recorded above the high water mark in

Figure 12.4. Detail of shattered country rock immediately below overlying diamicton.

Figure 12.5. Detail of possible palaeosol developed between the upper diamicton and sandy sub-soil.

some of the embayments to the south of the Howick Burn. Evidence from a number of dune systems along the Northumberland coast (Knight *et al.* 1998; Orford *et al*. 2000) indicates that the oldest of these date to about the 15th century AD. The dune systems in the Howick area are less well developed than those investigated in the Orford study and may, therefore, be even younger.

4. Soil profile (age uncertain but probably <1000 years). The depth of the soil profile along the coast varies from a few centimetres to as much as two metres. This description is based on observations from the excavation site and from the coastal exposures. The soils observed in the area are generally loamy and largely derived from the underlying glacial deposits. Further details of the soils from the excavation area are described below.

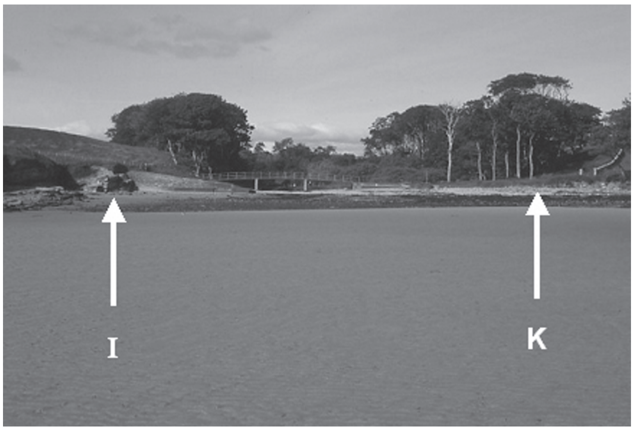


Figure 12.6. View westward at low tide across the foreshore in front of Howick Burn.

Description of the Geomorphological Units

The coastline has been spatially divided into a number of sections for ease of description, although these do not comprise distinct geomorphological units; the units are marked on Figure 12.3. Seven sections of this coast are described below.

A–D: Rock platform to seaward, less significant towards point D. Sandy beach backed by relatively low cliffs (generally 3–4m high). The whole section has a 2–3 metre thick diamicton overlying up to one metre of Carboniferous sediments. The diamicton is generally sub-divided into an upper sandy unit and a lower blocky unit that at its base incorporates large (10–40cm) clasts of disturbed country rock (sandstone, shale; see Fig. 12.4), associated with evidence of periglacial activity. Localised sections of the lower diamicton also show evidence of laminations, suggesting sub-aqueous deposition. The southern part of this section is backed by sand dunes; towards the north, dunes are recorded on top of the cliff.

D–E: Situated in a relatively sandy embayment, the cliffs backing this beach are relatively high, rising to approximately 10 metres. No country rock is visible in this section; this may explain why the coastline has eroded more significantly. The section shows significant slumping from the higher diamicton. The sequence is capped by about one metre of possible aeolian sediments resting on a palaeosol formed on the diamicton (see Fig. 12.5).

E–G: The section comprises 10m high cliffs of the diamicton with profiles ranging from quite steep in fresh sections to about 45° where slumping occurs, this is most significant in the central part of this section. There are at least two ‘cuts’ through this relatively soft sediment; both are probably of anthropogenic origin and are currently used as pathways to the beach. Exposures of the local country rock are

Figure 12.7. Massive sandstone country rock overlain by diamicton.

visible at the base of the cliffs where they form the headland at point G. The sequence at the headland is topped by up to 2m of light buff, fine sand.

G–I: A relatively short section of coastline just to the south of Howick Burn. Similar to the preceding unit, this section is mainly composed of 10–12m cliffs of diamicton overlying country rock. The vertical extent of the Carboniferous sediments increases northwards from approximately 1m initially until it reaches about 5m in total. The 'hard rock' cliffs are generally vertical, while the diamicton is usually more gently sloped.

I–K: A short stretch which effectively encompasses that part of the coast which the Howick Burn flows across (Fig. 12.6). Gently sloping flanks of the local landscape both to the north and the south of the burn. Figure 12.6 shows the footbridge that spans Howick Burn. The local country rock is exposed at the base of the cliff on both sides of the burn. The cliff sections are generally vertical with up to 4m of diamicton resting upon the Carboniferous sediments. The mouth of the burn itself is fronted by a sandy beach with rock platforms exposed to the north and south during low tide.

K–O: The coastline north of Howick Burn is dominated by significant exposures (up to 7m) of the hard country rock, making much steeper cliff lines than those to the south. This area of the coast north of the Howick Burn is recognised by local farmers as being particularly prone to land loss through erosion. This section includes the coastline immediately below the main excavation. The cliffs generally comprise a 1–2m thick diamicton on top of the Carboniferous sediments, topped by approximately 1 metre of sandy soil. The excavation was made in this upper horizon. Progressing northwards, this section becomes increasingly covered by heavily vegetated, slumped sections of the overlying diamicton. It is difficult to discern whether the base of the cliff is *in situ* or slumped diamicton. The foreshore here is dominated by a wave-cut rock platform.

O–S: Evidence of significant slumping continues along this section and is supported by the presence of a number of minor 'faults' in the diamicton along the cliff line. The cliffs range in height from about 6–10m. The diamicton includes many glacially striated boulders. Towards the north of this section the Carboniferous sediments appear once again and become a dominant feature of the coastline. At some sites, where the diamicton is seen directly in contact with the underlying country rock, water is seen emerging along a spring line. This almost certainly acts to enhance slumping along this and probably other parts of this coastline. Further north from points S to T the coastline is dominated by vertical rock cliffs of up to 10m with varying thicknesses of overlying diamicton and soils (see Fig. 12.7), while a wave-cut platform is present seaward.

Archaeological Potential and Erosion Threats

The rich archaeological heritage of this coastline, particularly in the immediate vicinity of the Howick excavation, suggests that ongoing erosion in the area will inevitably lead to loss of archaeological remains in the short, medium and long term. The Mesolithic site was at extremely high risk of loss due to coastal erosion in the short term.

This mosaic of sediment types and geomorphology make suggesting broad-scale management options from a heritage perspective a complex business, and one that requires a full study in its own right. However, future strategies might consider focussing on surveying headlands similar to the Howick site (although not strictly on a 'promontory', the site is on a local topographic 'high' and is protected seaward by a wave-cut platform). Such prominent sites would not only have had cultural attractions as landscape features but may also have suffered lower erosion rates over time thanks to the 'protective' effects of their associated wave-cut platforms, and may therefore have greater archaeological potential. The

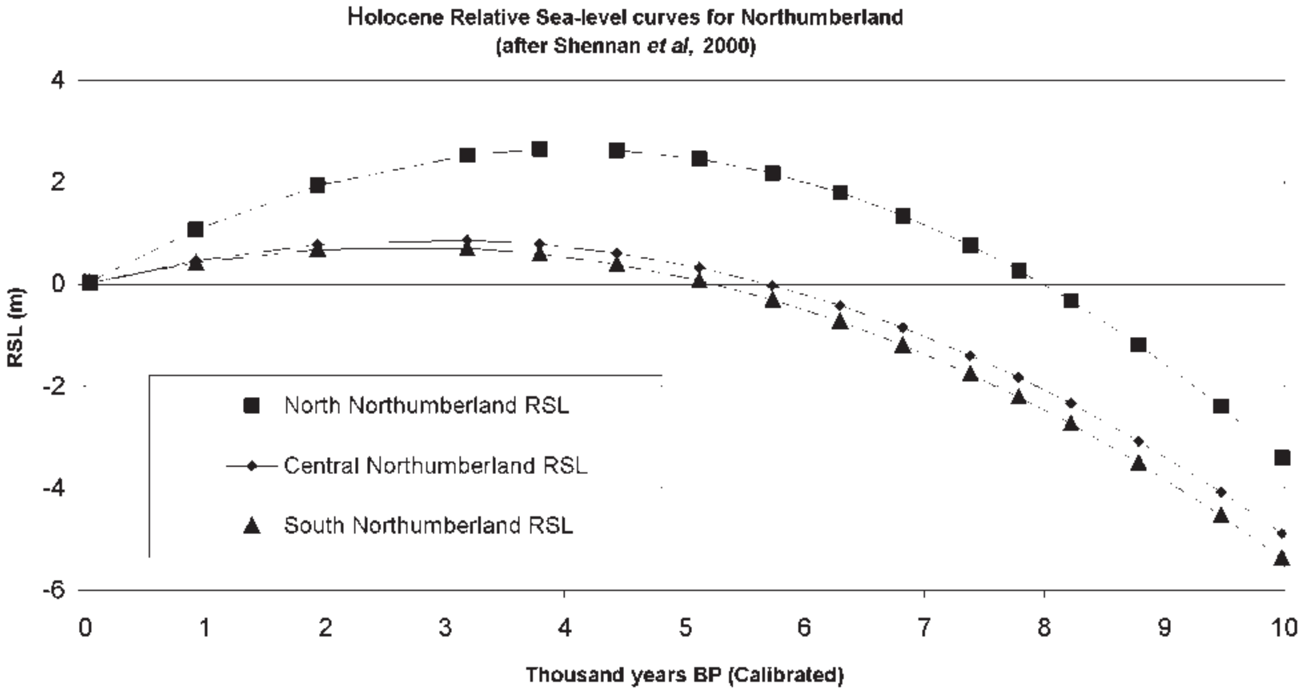


Figure 12.8. Illustrating the modelled relationship between changing sea levels and time for three areas of the Northumberland coast during the Holocene.

actively slumping sections of the coastline and the eroding soft sediments by direct wave action remain the most significant areas for the potential loss of archaeological remains.

The bay and headland morphology of this coastline is largely the result of differential erosion rates of the country rock. The chief forms of erosion at Howick are either rotational slipping of the unconsolidated diamicton or mass failure of the Carboniferous sediments; in both cases these result from undercutting of the cliffs by wave and/or storm action. Even within the relatively robust Carboniferous rocks the great variety of lithologies can cause preferential erosion of one or more layers, which ultimately undermines the entire section. Some exposures show evidence of severe frost shattering/brittle deformation and degradation near the contact with the overlying diamicton and these sediments would be readily dissociated by long-term wave/storm action.

In those areas where the cliffs have a good exposure of Carboniferous rocks at their base, erosion rates are generally less dramatic than those where the entire cliff line is composed of softer, non-consolidated glacial sediments. Anecdotal evidence from local farmers indicates farmland has been lost along this coastline during the last century, although the scale of such loss is difficult to assess accurately. This is clearly an ongoing, natural process, which is bringing about loss of archaeological features. A Victorian carriageway that ran along the Howick Burn and up the coast below the excavation site has now all but disappeared.

The cliff profile along the coast varies depending on the nature of the sediments; however, most of this coastline has significant volumes of slumped material (comprising the unconsolidated glacial material and soil), with the result that much of the 'natural' or *in situ* cliff material is obscured. It is therefore difficult to make detailed surveys of the cliff line for evidence of archaeological remains along much of this coast.

Late Glacial to Holocene Palaeogeography and Sea Level Change

A number of research studies over the past 10 years have detailed the Holocene response of this coastline to the twin processes of Post-Glacial regional crustal rebound and rising global sea levels. These studies indicate that much of the southern North Sea formed a land bridge across to North-West Europe until about 5500 cal BC. The 'Northumberland' coastline during the early Holocene, while similar to its modern outline, would have been several hundred metres further seaward than it is today, with the current coastline having been reached by approximately 5500 cal BC. These results are broadly supported by evidence from the Howick Burn sedimentary cores outlined below.

Precise reconstructions of Holocene sea level change in Northumberland have been made possible by the careful recording of 'sea level index points' based on a combination of sedimentary and microfossil characteristics of sediments from along the coast. The altitudes of these samples, above or below ordnance datum, are measured to an accuracy of a few millimetres while the samples are dated using radiocarbon techniques. The results are given as an age/altitude curve for a given location. In the example below (Fig. 12.8, taken from Shennan *et al*. 2000), the reconstruction of mean tidal level is shown for south, mid- and north Northumberland during the Holocene. The results come from a model based on a large number of sea level index points from the east coast of England.

In the context of this model, Howick is close to the central Northumberland line. Therefore, at the time the Mesolithic site was occupied, about 8000 cal BC, the sea level would have been approximately 5m lower than it is at present. Sea levels would have first reached their modern position at about 3000 cal BC, but reached a maximum of about 1m higher than today by about 2000 cal BC before subsequently declining to their modern levels. The phenomenon of gradual Post-Glacial sea level rise is recorded at many sites throughout the UK and beyond. The increase above modern levels during the Middle to Late Holocene is largely a function of the crustal response of northern Britain following the loss of the ice masses in Scotland and Northern England. Therefore, we might expect continual changes in coastal morphology and the local environment throughout the Holocene. In the following sections we discuss the evidence for environmental change in the immediate vicinity of the Mesolithic site from the sediments within the excavation itself as well as sedimentary, floral and faunal archives from the river valley immediately to the south of the site.

Sedimentary Analysis of the Site

Late Glacial to Holocene deposits

The material underlying the excavated site consists of a chaotic mixture of 'blocks' of stratified diamicton in a substantial matrix of fine sands and silts containing discontinuous silt/clay-rich planar layers of 1–3cm. The blocks are typically about 1m across and the original bedding has been totally dislocated, although it remains clearly visible within blocks. The deposit is of limited extent since across the track to the west, at a distance of less than 20m, the reddish purple upper till forms a uniform parent material for the modern soil. As the land surface slopes downwards from the excavation site towards the tills to the west it would appear that the processes forming the coastal strip of mixed material are very localised.

Robson (1966) provides an illustration of the shore at Howick, which is now not so well exposed, that indicates that the underlying solid rocks, and perhaps the overlying till too, are jumbled, probably as a result of glacial action which has disturbed the, presumably frozen, earlier glacial deposits and the underlying weathered solid rocks. Presumably glacial outwash, sand and clays, was then washed into the interstices between the blocks before they fully thawed. It would appear that the site consists of a low mound of jumbled sandy diamicton and sands of probably outwash origin, which provided a freely drained habitable location convenient to the coast. This chaotic material across the exposed excavation trench initially proved problematic to the excavators until it was appreciated that it was of natural origin.

It appears that in the Late Glacial phase, possibly during one of the re-advances (such as the Younger Dryas, or even due to final movements of the Scandinavian ice), the frozen material of mostly local origin with a high sand content (possibly combined with later outwash material) was jumbled together to form a low ridge or possibly a series of hummocks along the coast. As this material is somewhat higher than the surrounding surfaces, and has a relatively high sand content, it would have been freer draining than the undisturbed materials to the west and, in spite of its currently exposed location, would have formed an attractive settlement location. The lack of an obvious local source for large amounts of sand and its absence from nearby areas, together with the abrupt change to finer-textured deposits inland, is adequately explained by this origin for the deposits. The highly mixed nature of these deposits means that particle-size analysis would not achieve anything that description alone failed to provide. The former extent of this deposit seaward of the modern coast remains unclear. If, as described above, the sea level was up to 1m above the modern level at about 2000 cal BC, then a considerable extent of pre-Early Bronze Age coastal deposits may have been lost. This loss results from the foreshore being gently sloping and the early 8th millennium cal BC sea level being c. 5m lower than at present (see Fig. 12.8). Taking cognizance of such landscape change during the Holocene it can be inferred that the coastline contemporary with the Mesolithic hut lay a hundred metres or so further out than the present shore. However, the hut site should still be considered a coastal settlement although it did not occupy a cliff edge situation as it does today. This kind of position, set back from the shore by a short distance, is directly comparable to the East Barns Mesolithic hut site near Dunbar where this structure was set back from the cliff edge by several hundred metres (see Gooder 2007). This type of setting can be considered advantageous as it shelters the structure from the full impact of coastal wind and weather.

Soils

The soil was initially believed, on the limited evidence of the 2000 excavation, to be developed in blown sand overlying glacial till; the till was visible in the scarp slope down to the shore and in the surrounding fine-textured soil in the field to the east. However when the larger area was exposed in 2002 it became immediately apparent that the underlying material was much more heterogeneous than had been suspected. There were patches of reddened till interspersed between areas of sand. As the area exposed was enlarged it became clear that there was a chaotic distribution of areas of sand and till; some of the till was stratified but the blocks of till were randomly aligned as described above. Much of this till contained reddened material and was quite sandy. The soils of the Howick area had been surveyed by Payton and Palmer (1990) and those surrounding the site were delineated as the Salwick Series. However, due to the scale of soil mapping (1:50,000) the units depicted are likely to include parts of other soil series. In 2002 the examination was extended outside the immediate vicinity of the archaeological investigation to help interpret the site's current and past physical conditions (see survey area marked on Figure 14.3). The total area covered was about 50ha.

The survey examined both Field 1 (see Fig. 1.4) immediately east of the archaeological site and the excavation field in which the site was located. Due to the standing wheat crop, the auger samples were taken within 1m of the tramlines in Field 1. There were no such restrictions in the grass field and so augering occurred along transects covering all the topographic variation within the grass field.

In the Howick interim report (2000), it was suggested that soils around the archaeological site itself may have formed from windblown sands in which Wilsford Series soils, described by Payton and Palmer (1990), had formed. If this is the case then it could be expected that soils would form a coarse –to fine texture pattern from the coast going inland as the finer-texture glacial till comes to predominate, resulting in a transition to the finer-texture Salwick Series soils mapped by Payton and Palmer. However, no such pattern was observed in the field survey. Essentially only two different soils were found while texturing within the top 20cm. These were one varying between sandy clay loam and silty clay loam, and the other a sandy loam.

Field 1 (see Fig. 1.4)

Textural variation in the topsoil within this field (Centre point Grid Ref. NU 256 167) appeared to be very small. Sandy clay loam was the dominant texture but with slight variation in the coarseness of the sand and quantity of silt. However there was not a significant enough change to map patterns over the field. There was no notable soil colour change over the field, which could indicate a variation in texture and associated change in the soil water regime. The soil colour observed was dark brown (Munsell colour 10YR 3/3 moist).

Cracks in the topsoil were common throughout the field, frequently 1cm width with a depth of about 10cm. This confirmed the presence of a significant quantity of clay, which is likely to have a considerable influence on the soil characteristics such as drainage. The soil over the whole of the wheat field seems to fit within that described by Payton and Palmer (1990) as the Salwick Series. The regular cultivation of this soil has mixed in any windblown material and obscured any minor surface accumulation that could have developed.

The Excavation Field (see Fig. 1.4)

Some variation in soil hand texture was found in the excavation field (Centre point Grid Ref. NU 260 168) but dark brown (10YR 3/3 moist) sandy clay loam dominated. However, along a low ridge, between grid refs NU 2620 1705 and NU 2600 1690, the soil was slightly coarser than in Field 1. For a few metres around grid ref. NU 2610 1700 the texture was fine sandy loam over sand at 20cm depth. Within this small area, from a depth of 20cm to 1.2m (the length of the auger) the soil was reddened sand (7.5YR). On the surface this area was distinguished by a concentration of molehills. Moles are an indicator of the presence of earthworms, which are sensitive to soil acidity and are generally not found in soils below pH5, indicating a moderate pH within soils of this area. This reddened material may be till transported down the coast from Berwickshire by the predominant glacial movement. Reddened soil predominates further north in Northumberland and Berwickshire and the colours of the local reddened material are typical of the widespread Whitsome Association in the Merse (Ragg 1960).

The texture of the rest of the field, heading south towards the archaeological site, and towards the wheat field, was sandy clay loam, with a possible increase in silt and fine sand, similar to the wheat field. The only other very slight variation was in a small depression at about grid ref. NU 260 167, with an increase in clay, but not significant enough to mark a textural change.

The Salwick Series are said to have reddish brown clay loam sub-soils (Payton and Palmer 1990), and this was observed on the cliff edge between the excavation trench and Sugar Sands. Darker brown – reddened (nearer 7.5YR hue) patches of soil were

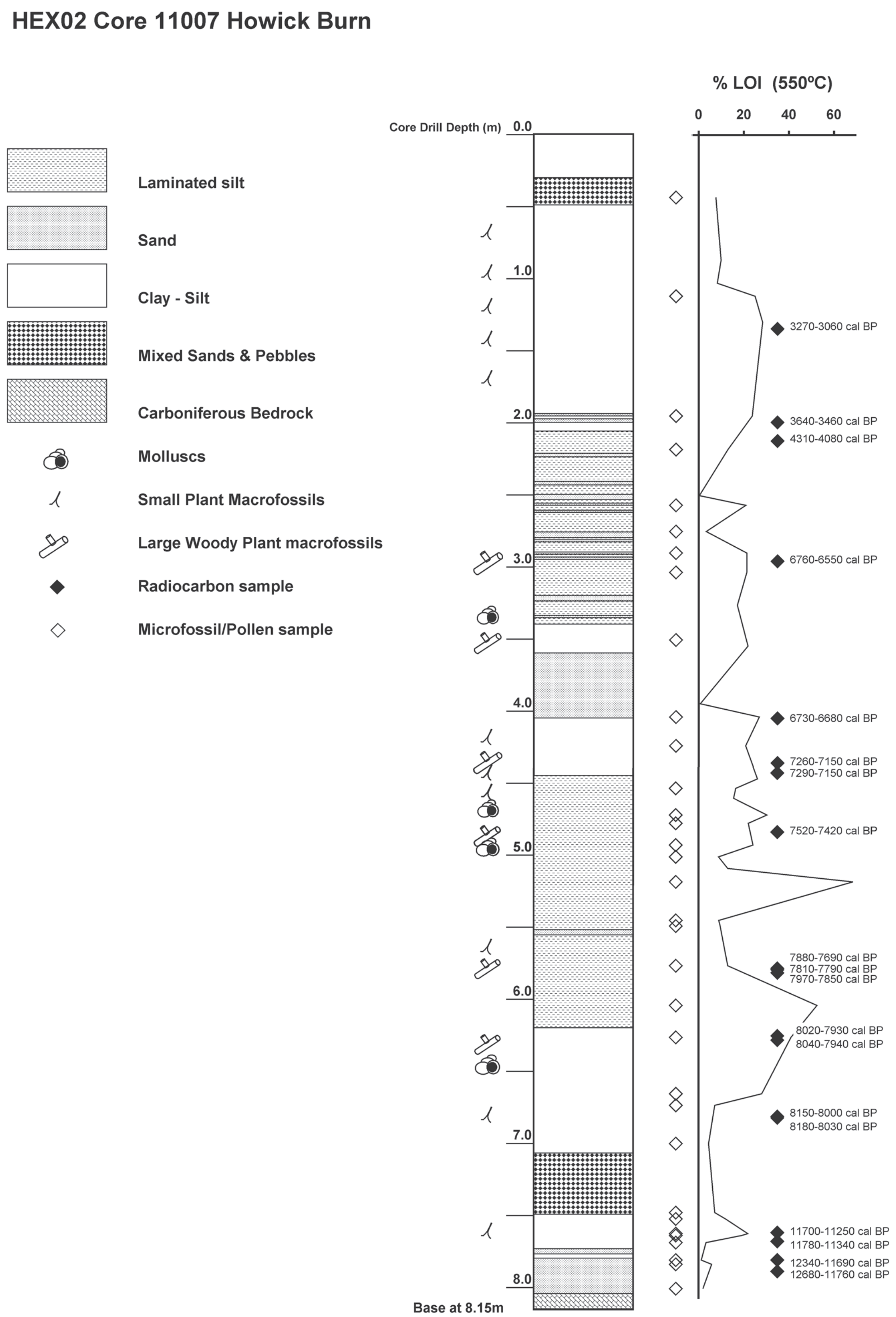


Figure 12.9. Sedimentary log and LOI (loss on ignition) record of core HEX 11007 from Howick Burn.

observed in the excavation trench. The sandy Wilsford soil, common further along the coast, and which appeared to occur on the original Howick excavation site, is in fact rare.

The Salwick Series is referred to by Payton and Palmer (1990) as a stagnogleyic brown earth, developed on slightly reddened upper till, and is usually a sandy loam texture but may be sandy clay loam or clay loam. It seemed initially that the Salwick Series soils had been covered with variable amounts of blown sand, which thins inland, and within which soils of the Wilsford Series, or intergrades with

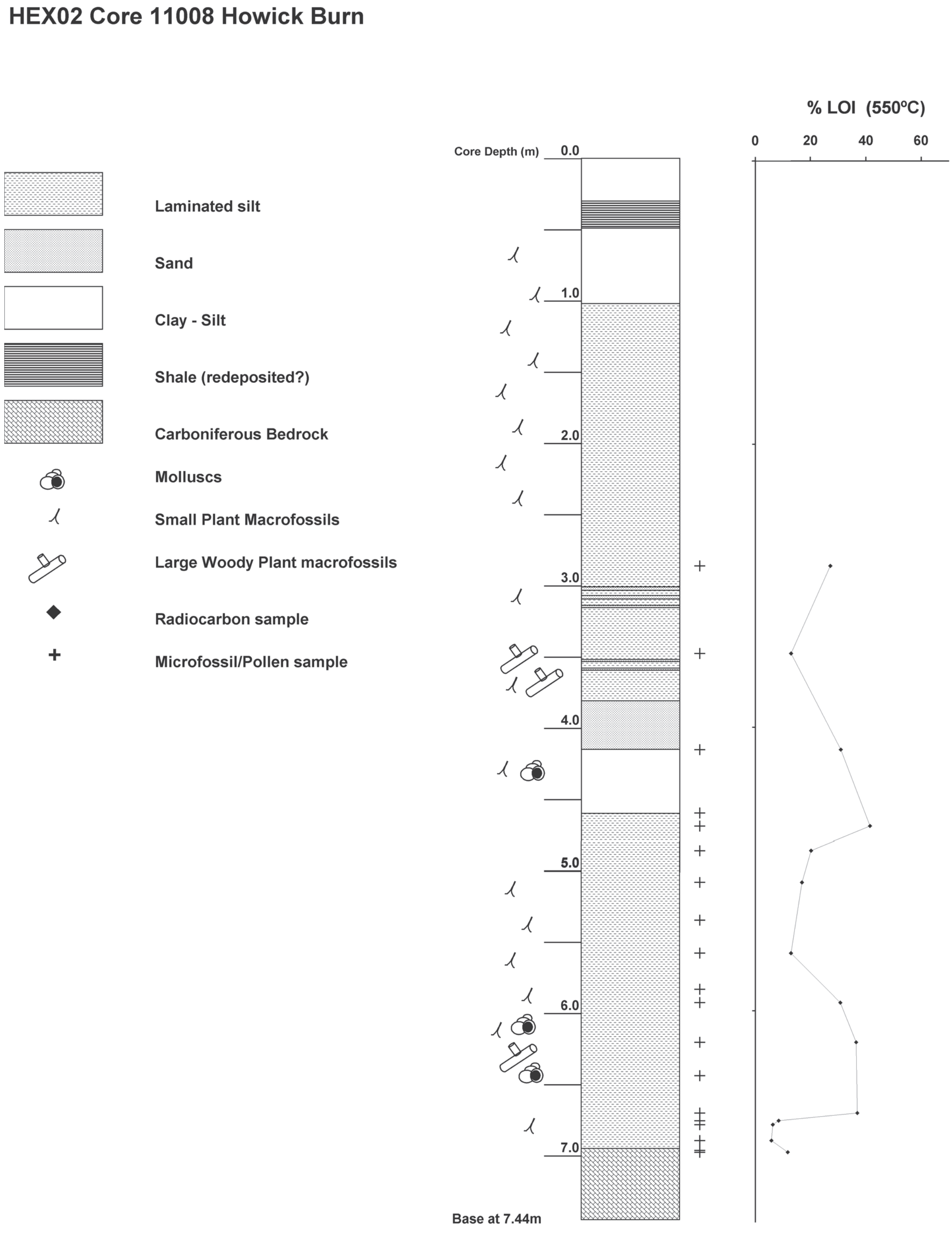


Figure 12.10. Lithological and LOI (loss on ignition) record of core HEX 11008 from Howick Burn.

Salwick Series, had developed, but latterly it has become apparent that the soil over the settlement is closer to a micro-scale complex of the two soils because of the local variation in parent material.

Other factors important in soil development include the pH of both the environment and the parent material. Wilsford Series are described as being inland of coastal dunes but it seems that the Howick soils are not derived from past coastal dunes as there is no windblown sand containing carbonate-rich shell fragments only a few metres inland of the dig. The elevated pH is less due to this source than to the alkaline influence from the sea. Sea spray has a high pH and the alkalising effect can extend some distance inland and would help to slow down the formation of acid soils along the coastline. Therefore these soils may be expected to have a weak acid to alkaline pH. Evidence for a slightly acid soil was initially thought to come from the presence of iron movement in the form of common reddened mottles but this is more likely due to the admixture of parent materials, some of which are geologically rather than edaphologically reddened. As the soils are not strongly bleached there is no good evidence for more intense soil acidity. There may have been some spreading of shell sand in the past to raise pH but this does not seem to have been extensive on the inland clayey soils where the advantage would have been greater.

The soil water regime of the Wilsford Series is described by Payton and Palmer (1990) as deeply permeable and well drained, but they may suffer from drought in the dry summer months. Water retention may be a problem in these soils and this will have affected plant development. The Salwick Series has a more problematic water regime because of restricting downward movement of water. In a complex of the two the good properties of both, for once, dominate. So, the sandy area provides good water movement and the finer textured blocks provide water retention.

Summary

The sediments immediately below the excavated Mesolithic structure must be at least 10,000 years old. They rest upon Devensian tills, suggesting an age of approximately 14–8000 cal BC. The occurrence of fine laminations within these sediments strongly indicates sub-aqueous deposition. It is suggested that these sediments filled a minor topographic depression during the Late Glacial as a result of outwash at some distance from the retreating ice. It has not been possible to determine whether these relate to the Devensian retreat (*sensu stricto*) or that of a younger stadial. However, there is clear evidence of Late Glacial glacio-tectonic action causing different units to be thrusted as blocks on a metre scale.

The matrix containing the Mesolithic structure may be an aeolian reworked derivative of the underlying sediments, indicating a change to much drier and presumably warmer conditions. However there is evidence that some of this sequence was deposited under aqueous conditions.

Holocene Palaeoenvironmental Reconstruction

The discovery of significant deposits of fine-grained Holocene sediments beneath the valley floor of the Howick Burn provided an invaluable opportunity to reconstruct not only the vegetation record of the region through the Holocene but also gave an indication of the influence of changing sea levels along this coastline. In addition to pollen, the sediments have yielded calcareous microfossils (ostracods and foraminifera; aquatic Crustacea and Protista), large plant macrofossils and molluscs, which together provide a wealth of environmental detail as well as valuable material that allows the sequences to be radiocarbon dated.

Howick Burn Sediments

Two cores were recovered (HEX 11007 and HEX 11008, see map, Fig. 12.3) using a modified Stitz percussion corer, which allows the sediment to be recovered in one-metre lengths and extruded into plastic pipes for subsequent logging and analysis under laboratory conditions. The cores were split, photographed and logged at the University of Newcastle. Subsequently, key horizons were identified for palaeoenvironmental analysis. Sediment samples of about 3–4cm^3 were taken along the core with a view to interpreting the observed changes in lithology, sediment colour and grain size. From each sample, separate sub-samples were made available for pollen analysis, loss on ignition (LOI) and microfossils (pollen and calcareous microfossils).

The two cores are composed of mainly clay – silt grade material with occasional sandy horizons (about 1cm thick, either marine storm or high-discharge erosional events) and more significant sand – pebble grade material near the base. Both cores HEX11007 and HEX11008 (Figs. 12.9 and 12.10) are rich in organic remains, which has allowed for a detailed multi-proxy palaeoenvironmental reconstruction. A reconstruction of the depositional environment of these sediments is fundamental to the interpretation of the archaeological record, particularly in the context of sea level change, since this coastline is known to have witnessed mean sea levels 1m higher than today at about 2000 cal BC, and sea levels 2 to 4m below present mean sea level between 6000–7000 cal BC. According to Shennan *et al.*'s model (2000) the total possible sea level range during the Mesolithic would have been around 4.5m in the Howick area (see Fig. 12.8). It is known from studies elsewhere in Britain that changes in coastal environments can have significant impacts on patterns of human settlement and subsistence strategies (Bell 1997).

Core HEX 11007

Core 11007 was situated on the floodplain of the Howick Burn about 30m upstream from the footbridge and about 5m north of the modern river channel. The base of the sequence was reached at 8.15m below the floodplain surface and included

Depth (cm)	Sediment description	Microfossil description	Environmental interpretation
Unit I 0-190	Very fine sediment, very compact almost exclusively clay. Sandstone 'Cobbles' near surface have anthropogenic origin.	No Microfossils recorded	Floodplain. Irregularly flooded
Unit II 190-291	Predominantly laminated fine sands and silt with significant sand layers of up to 2cm throughout this unit.	No Microfossils recorded	Floodplain. Irregularly flooded. Subject to extreme events mobilising sand.
Unit III 291-502	(291-410) Mainly fine-grained sands and silts but with distinct 45cm medium-coarse sand deposit (at approx. 360-405cm). Two sand layers (1-2cm) occur towards the top. Organic content generally 20-30% throughout this whole Unit. (410-502) Mainly fine-grained sediments continued from Unit 3 although laminations disappear at about 445cm.	Foraminifera rare in this unit but Ostracoda at their most abundant and are dominated by brackish water taxa although there are also a significant number of freshwater forms.	This unit is interpreted as a lagoonal phase, with marine influence perhaps restricted by a physical barrier. The thick sand layer suggests fluvial event.
Unit IV 502-667	Fine-grained sediments ranging from grey silts thorough to organic rich (dark grey-black) silts with up to 70% organic composition at some horizons. Sediments show evidence of lamination down to about 620cm. These may indicate either tidal marine rhythms or episodic fluvial events. Chaotic mix of woody debris at 570-580cm.	Microfossils rare in this part of the sequence, but those present are indicative of brackish water and a proximity to the Mean High Water Springs mark.	Indicates decreasing marine influence due either to a seaward 'barrier' or a sedimentation rate greater than sea-level rise.
Unit V 667-705	Dominated by coarse clastics including a basal medium to fine sand. The sand grains are entirely composed of quartz (i.e. no marine carbonate) and are predominantly angular and are considered to represent re-deposited local glacial deposits rather than being marine derived.	Dominated by Foraminifera, particularly marginal marine or estuarine forms. The lowest sample (702cm) contained 8 specimens comprising 4 taxa, 3 of which are lower marsh forms.	Marginal marine conditions. Good connections with open marine water but probably close to Mean High Water
Unit VI 705-750	A layer of coarse sand and pebbles (including a large number of angular fragments of local country rock)	Not sampled	Sediments deposited after a high-energy erosional event.
Unit VII 750-802	750-774 Medium to dark-grey silts, some dark-brown spots, possibly plant remains. 802-774 Medium to coarse grey sand with occasional dark-grey rounded clasts	Barren	Decreasing energy suggests change from fluvial to lagoonal/marsh conditions
Unit VIII 802-815	Mid-grey to yellow sandstones, some shales, largely degraded	Barren	Local Carboniferous country rock

Table 12.1. Summary of the sedimentary and microfossil record from Core HEX 11007 together with an interpreted palaeoenvironment. All depths are drill-depth below surface. Further interpretation of the sedimentary sequence based on dating evidence can be found in chapter 6.

Depth (cm)	Sediment description	Microfossil description	Environmental interpretation
Unit I 0-110	Very fine sediment, very compact almost exclusively clay. Flat shale 'slab' near surface may have anthropogenic origin.	No Microfossils recorded	Vegetated floodplain. Irregularly flooded
Unit II 110-300	Weakly laminated mid-grey to brown silt.	No Microfossils or molluscs recorded but high quantities of plant macrofossils.	Floodplain-wetland. Heavily vegetated by *Phragmites* stands.
Unit III 300-415	Medium-grey laminated silts with sand layers up to 1cm thick. Significant sand body at 382-415cm.	No Microfossils recorded	Flood pulse deposits in otherwise low-energy, estuarine environment.
Unit IV 415-702	Fine-grained sediments, mainly brown-grey to medium-grey silts. Sediments show weak lamination. Plant macros, throughout, occasional molluscs visible.	This Unit contains all of the microfossil recorded in the core. With three sub-units 415-509 Dominated by brackish ostracods, some freshwater. No foraminifera, uppermost 50 barren. 509-585 No Microfossil recovered. Rich *Phragmites* remains may indicate high pH sediments. 585-702 Lowest samples barren. Assemblages initially dominated by brackish foraminifera, with brackish ostracods appearing towards top of sub-unit.	Weakly laminated sediments dominated by brackish water organisms indicates estuarine/lagoonal conditions with decreasing marine influence through time, probably as a result of sediment accumulation.
Unit VI 702-744	Dominated by sandstones, sub-ordinate shales, largely degraded	None	Local country rock

Table 12.2. Summary of the sedimentary and microfossil record from Core HEX 11008 together with an interpreted palaeoenvironment. All depths are drill-depth below surface.

13cm of what were considered to be *in situ* Carboniferous sediments (local bedrock) at the base, ensuring that the oldest possible sediments of archaeological interest were recovered. The succeeding 8m are therefore considered to be of Holocene (and possibly latest Glacial) age. A total of 33 microfossil/pollen/LOI samples and 22 radiocarbon samples was selected from core 11007. For details of the radiocarbon analyses see Chapter 6.

The sediments recorded in 11007 are illustrated in Figure 12.9 together with an indication of the occurrence of organic remains (both woody plant macrofossils and molluscs) and a record of the changing LOI values through the core. A brief sedimentary description of the core and interpreted environment of deposition is given in Table 12.1. Figure 12.9 also gives an indication of the calibrated ages of the radiocarbon samples taken from the core.

The sedimentological, faunal and dating evidence from this core allows us to build a picture of changing environmental conditions at this site through the Holocene. Dating indicates that although the record is reasonably complete for the past 11,000 years, there is a marked discontinuity of approximately 3000 years near the base of the sequence (Fig. 6.7), which unfortunately coincides with the dated occupation

Depth (cm)	FORAMINIFERA					OSTRACODA																		
	Jadammina macrescens	*Haynesina depressula*	*Haynesina germanica*	*Elphidium williamsoni*	*Ammonia beccarii*	*Cypridopsis vidua*	*Sarscypridopsis aculeata*	*Cyclocypris ovum*	*Heterocypris salina*	*Cyprideis torosa*	*Candona candida*	*Hemicythere villosa*	*Pseudocandona* sp.	*Leptocythere lacertosa*	*Elofsonia baltica*	Total number of ostracods	% freshwater ostracods	% marine ostracods	% brackish water ostracods	Ostracods /g dry sediment	Total number of forams	% brackish/upper marsh forams	% marine intertidal forams	Forams /g dry sediment
43																								
112																								
195																								
219																								
258																								
276																								
291																								
304			100					1	85	6	9					175	9	91		113	1		100	1
351								18	38		44					88	63	38		63				
405																								
425								3	37		61					71	63	37		23				
455						16	1	33	48		3					185	52	48		179				
473						3	41	36	21							39	38	62		13				
479						8	28	11	48		5					158	23	77		102				
494								25	50		25					12	50	50		4				
502	50		50																		2		100	2
520	50		50																		2		100	1
547										100						1		100		0.3				
551		9	91																		11	9	91	8
578			100																		2		100	1
606																								
628			100																		13		100	4
667										100						1		100		0.3				
675		1	88		11																221	12	88	78
702		78	6	16								13	13	13	63	8	13	13	75	3	157	94	6	51
750																								
754																								
765																								
766																								
771																								
783																								
786																								
803																								

Table 12.3. Numerical and percentage abundance data for all ostracod and foraminifera recorded in core HEX 11007

levels in the adjacent Mesolithic structure; the occupation of the Mesolithic hut dates to the middle of the missing period. This coincides with the occurrence of a 45cm thick deposit of sand and sandstone pebbles, probably derived from local country rocks rather than from modern intertidal processes.

The discontinuity is most likely the result of a relatively short-lived erosional event (possibly high-energy flood) within the river valley. Dating of the sediments almost immediately overlying the erosional phase suggests that this event occurred just prior to about 6100 cal BC. Although there is no direct evidence as to what might have caused such a significant event there is widespread evidence of a marked climatic deterioration at about 6300 cal BC across northern Europe, Greenland and North America (Klitgaard-Kristensen *et al*. 1998). Whether these two events are linked cannot be conclusively proven.

Following the deposition of the coarse sand and pebble layer, most of the rest of the section comprises fine-grained, blue to grey sediments ranging from clay to silt grade. Towards the top of the core, particularly between about 3.5 to 2m core depth, the clay – silt is developed with small layers of silty sand (ranging from fine to medium sand). The origin of these sands is unclear but sedimentologically they appear to be the result of relatively common marine incursions into the valley, although there is no supporting evidence from the faunal records. The upper 2m of sediments comprise clay and fine silt with sporadic remains of

Drill Depth (cm)	FORAMINIFERA					OSTRACODS												
	Haynesina depressula	*Haynesina germanica*	*Jadammina macrescens*	*Ammonia* sp.	*Miliammina fusca*	*Sarscypridopsis aculeata*	*Cyclocypris ovum*	*Heterocypris salina*	*Candona candida*	Other Freswater species	**Total number of ostracods**	**% freshwater ostracods**	**% brackish water ostracods**	**Ostracods /g dry sediment**	**Total Number of forams**	**% brackish/upper marsh forams**	**% marine intertidal forams**	**Forams /g dry sediment**
286																		
348																		
416																		
461																		
470						0.5	3	74	20	1		25	75	120	210			
487						5	2	85	8			10	90	73	144			
509			100								1					100		0.2
536																		
559																		
585		100									1					100		0.6
594	100						71	26	3		21	74	26	89	35		100	53
622		80		20			100				5	100		2	1	80	20	12
646								88	13			13	88	21	8			
672																		
678		96		4							157					96	4	43
681		97		1	1						78					99	1	6.7
692																		
699																		
700																		

Table 12.4. Numerical and percentage abundance data for all ostracod and foraminifera recorded in core HEX 11008.

Phragmites plant macrofossils, and these sediments were almost certainly deposited in a floodplain setting similar to that of today.

Core HEX 11008

Situated approximately 50m upstream from 11007, this core was also taken on the floodplain immediately adjacent to the present-day river channel. A total of 19 microfossil samples was selected and analysed from this core, from a total core recovered of 7.44 m. The sedimentary log of the core and the LOI record are shown in Figure 12.10.

This core yielded a more homogeneous sequence than that of HEX 11007, with fewer distinct sedimentary events. The core has not been radiocarbon dated and therefore it is not possible to establish a detailed chronology of events. The core is not discussed further in detail but a summary of the sedimentary and microfossil record is shown in Table 12.2, together with an interpretation of the depositional environment.

Calcareous Microfossil Analysis

The record of calcareous microfossils in these cores includes ostracods, foraminifera and micro-gastropods. The palaeoenvironmental reconstruction is based on the former two groups. The ostracods (Crustacea; Ostracoda) are small (usually 0.5–1.5mm long) bivalved organisms inhabiting almost every aquatic habitat on earth although most are not able to survive more than a few hours without water. They are known to be particularly sensitive indicators of salinity levels and variability and as such are useful indicators of changing marine influence in this marginal marine setting. The foraminifera (Protista) are small (usually 0.3–2.0 mm) single-celled organisms that secrete a calcareous shell or test (although some taxa form a test by directly agglutinating siliceous mineral grains to form their protective test; these are particularly common in upper saltmarsh environments). The foraminifera are restricted to marine and brackish water habitats. Although they may be of use in reconstructing past salinity changes they are of particular interest in studies of sea level change since certain species have become adapted to different levels of exposure during the tidal cycle and are therefore indicative of particular elevations within the tidal frame. They form the main biological index of past sea level in marginal marine settings.

Although both ostracods and foraminifera are present in cores 11007 and 11008, they are absent from about half of the samples studied; this may be interpreted in one of two ways. Either they were not originally present (the environment was inimical to their survival, e.g. irregularly flooded floodplain) or they were present but have not survived as fossils.

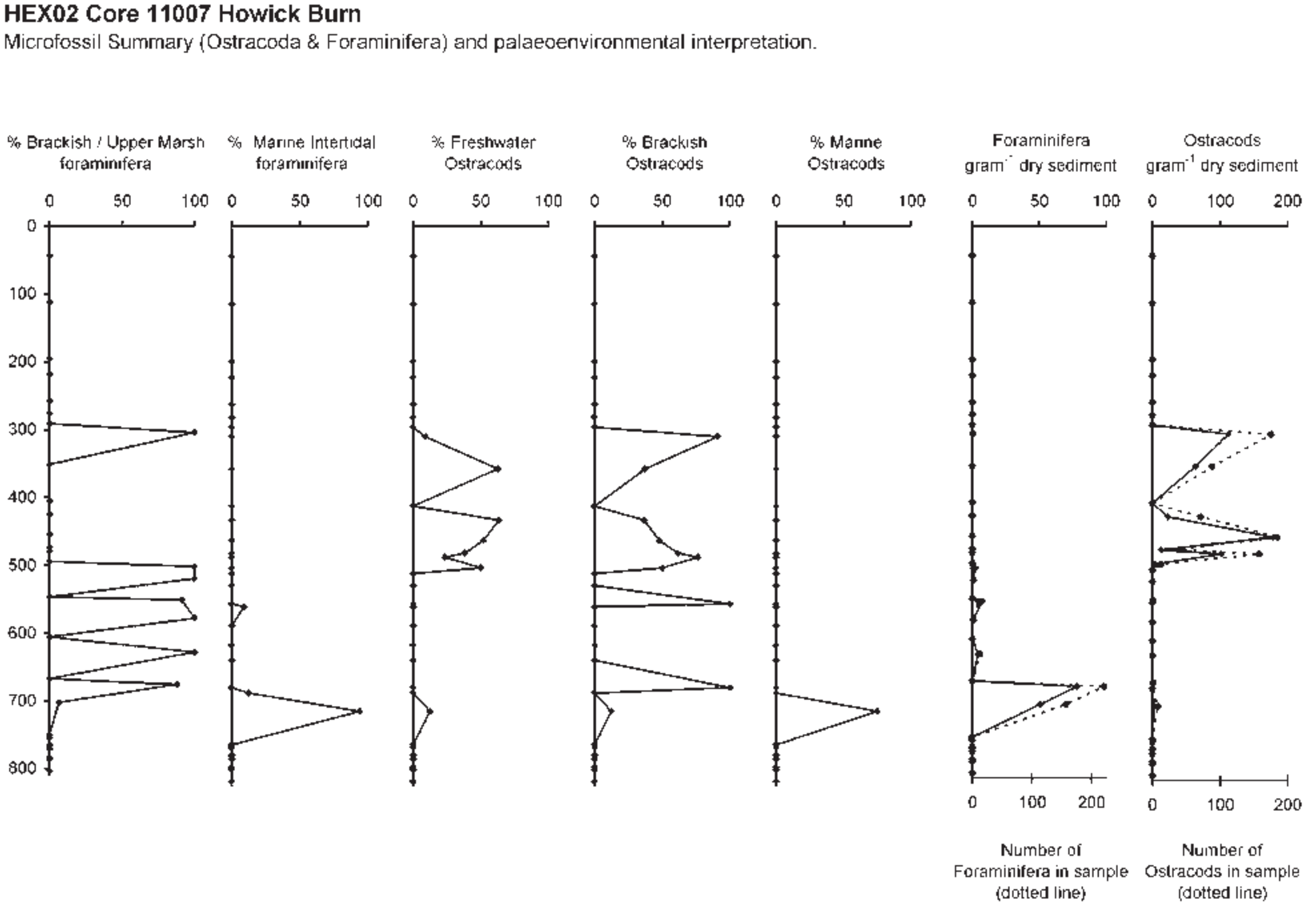


Figure 12.11. Summary of calcareous microfossil data from core HEX 11007 with suggested interpretation of depositional palaeoenvironment.

The latter case is a problem in sediments with high concentrations of organic material (i.e. high LOI values) where post-depositional processes result in elevated pore water pH due to the release of significant quantities of humic acids from the organic remains. This results in the loss of most carbonate remains. (It should be noted that many of the upper saltmarsh foraminifera species form their shells by agglutinating detrital quartz grains onto their organic matrix; these are not affected by dissolution.)

In the faunal analyses the Ostracoda have been split into 'freshwater', 'brackish' and 'marine' taxa; although these are not strict definitions, they serve to indicate the most likely environment of deposition for a given assemblage. The foraminifera have been designated as 'brackish/upper marsh taxa' or 'marine intertidal' to indicate relative position within the tidal frame.

Detailed microfossil records from 11007 and 11008 are presented in Tables 12.3 and 12.4 respectively, while summary plots are given in Figures 12.11 and 12.12 respectively. Combined microfossil and sedimentological interpretations from the two cores are summarised in Tables 12.1 and 12.2, together with an interpretation of the changing depositional environments through time.

Pollen Analysis

A total of 26 sub-samples was taken from the fine-grained sediments in core HEX 11007. Samples of 2–3g were prepared for pollen using a standard acetolysis method following sodium polytungstenate gravity flotation and hydrofluoric acid digestion (Moore *et al.* 1989). For most samples at least 400 pollen were enumerated although in a limited number of samples where pollen concentrations were extremely low the total fell below this level. The pollen counts are presented in Figure 12.13 (prepared using *Tilia 2.0* and *TGView 1.3.1.1*; Grimm 1991).

A total of five local pollen zones is recognised in this core, zoned by eye. Dates for the zone boundaries were interpolated from the composite dating model developed for the core (see Chapter 6). The zones are numbered from the base to the top.

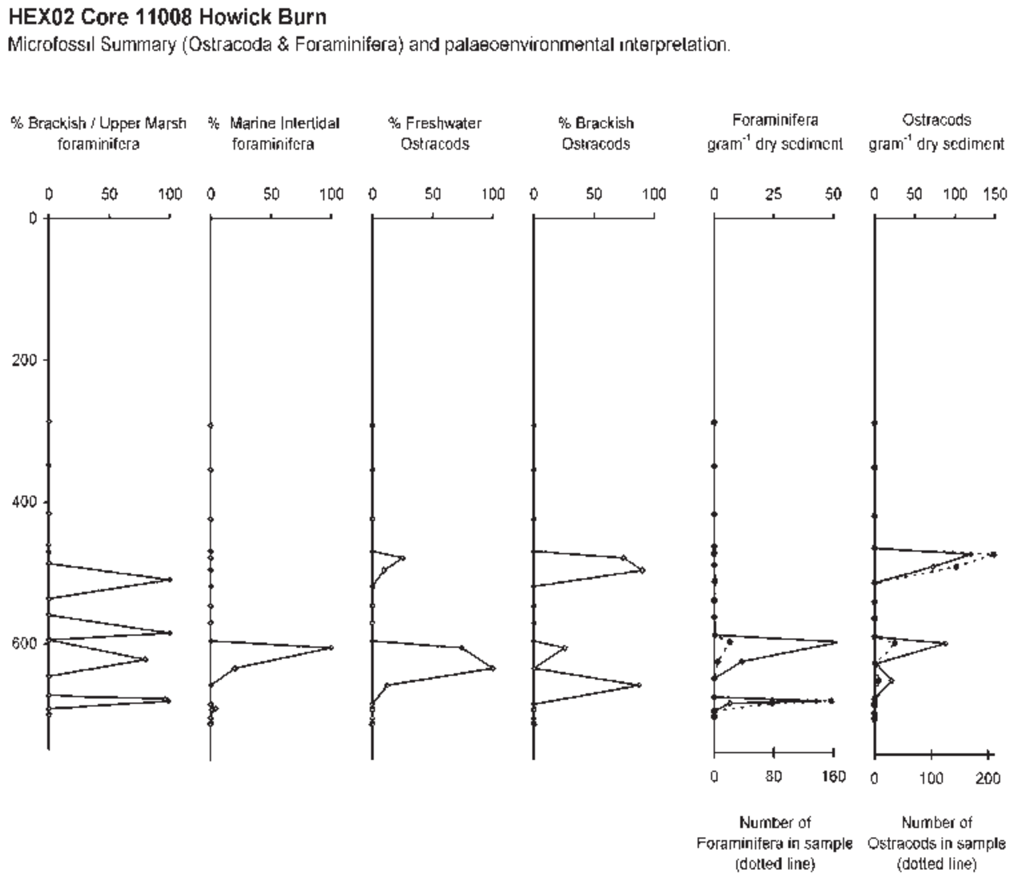


Figure 12.12. Summary of calcareous microfossil data from core HEX 11008 with suggested interpretation of depositional palaeoenvironment.

Interpretation of Pollen Analysis

Howick Zone 2-1: 775–610cm (c. 9800 cal BC to 5950 cal BC)

The beginning of the zone is characterised by the latter stages of the Late Glacial period with an open Gramineae (30%)/Cyperaceae (50%) and fern-covered (40%) landscape, together with other ruderal taxa such as Liguliflorae and Caryophyllaceae. The initial warming at the beginning of the Holocene is seen with the increase in *Corylus* pollen to c. 45%, although this is interrupted by an expansion of *Pinus* and concomitant increases in spores. The stratigraphic record at this time (750–705cm) indicates a significant erosional phase, presumably of the local Carboniferous Fell sandstones, given the large amount of spores which are characteristic of these deposits. Unfortunately, this erosional phase produces a hiatus, which coincides with the period of Mesolithic occupation of the site and hampers efforts to produce a detailed floral environmental context for the occupation and its impact upon the landscape.

Further increases in temperature are seen with the increase in oak species (*Quercus,* c. 20%) from c. 700cm to the extent that the river valley appears to become dominated by a hazel (60%)/oak woodland with a small amount of elm by the end of the zone. Small traces of ruderal taxa indicate woodland disturbance but because of the coring site's location this may be linked to instability in the river channel and creation of open habitats linked to erosion events rather than anthropogenic activity. Water ponding in the valley leads to the establishment of *Typha latifolia* communities during the mid-part of the zone.

Howick Zone 2-2: 610–550cm (c. 5950 cal BC to 5700 cal BC)

This zone is marked by a significant increase in *Alnus* pollen (85%), probably dating to c. 5500 cal BC, which comes to dominate the valley floor, and slope vegetation with an extensive development of local alder carr. The decreases recorded in the other taxa probably reflect concomitant percentage effects from the large rise in alder. A peak in spore values at the end of the zone indicates another, albeit small, erosion event, matching an event in the sedimentary profile, at the same time as the alder peak collapses.

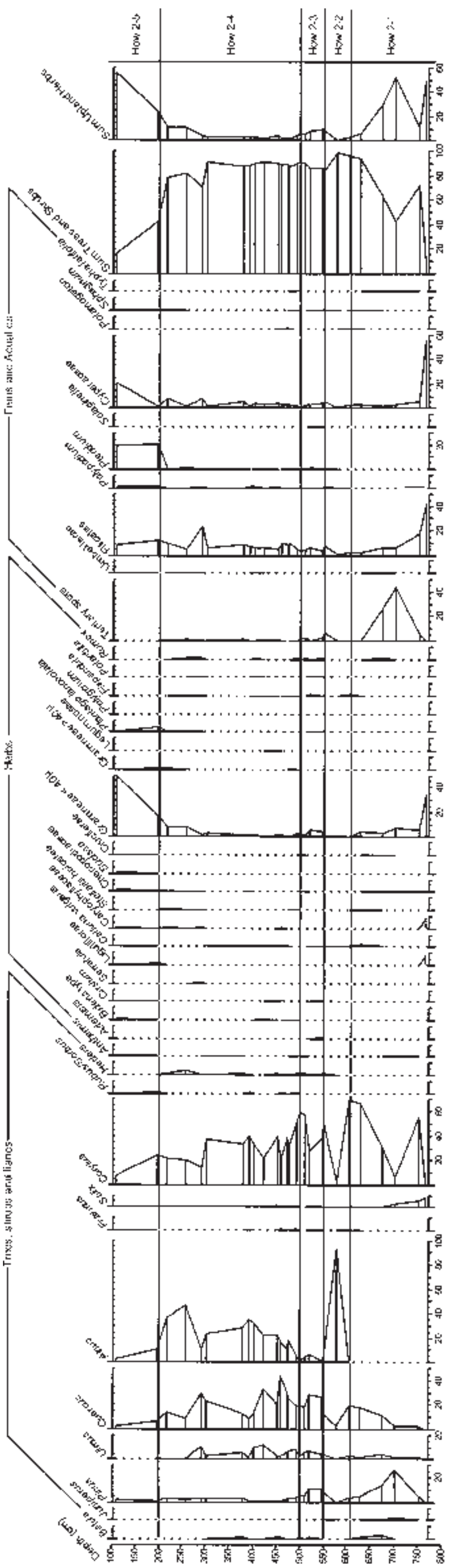


Figure 12.13. Summary pollen diagram from core HEX 11007 with local pollen zones.

*Howick Zone 2-3 550–500cm (*c*. 5700 cal BC to *c*. 5500 cal BC)*

The woodland vegetation (chiefly *Quercus* (25%) and *Corylus* (40%), together with small amounts of *Ulmus)* seen at the end of How 2-1 re-asserts itself at the beginning of this zone. However, the woodland appears to become far more disturbed as evidenced by increases in traces of many ruderal taxa – *Artemisia*, *Cirsium*, Gramineae < 40μm, *Plantago lanceolata*, *Potentilla* and *Rumex*. Although this may be due to human interference in the woodland, the geomorphological instability of the site would tend to suggest that there may be alternative 'natural' explanations.

*Howick Zone 2-4: 500–200cm (*c*. 5550 cal BC to *c*. 1930 cal BC)*

This zone exhibits the same aspect of woodland vegetation as the previous zone, with the addition of significant amounts of alder, probably dominating the valley floor and indicating relatively stable conditions. The early part of the zone has much evidence of disturbance from the many ruderal indicators present – *Bidens*, *Cirsium*, *Stellaria holostea*, Cruciferae – and may be linked to the first cultivation of cereals as evidenced by the presence of some large graminoid pollen at c. 480cm. The presence of sporadic peaks in spores suggests occasional geomorphological instability in the river valley as a result of floods and consequent bank erosion and re-vegetation.

The woodland vegetation seems to fluctuate in composition throughout the zone, with the most notable feature being the loss of elm from c. 300cm and probably dating to c. 5000 BP. Another erosional phase is recorded in the stratigraphy from c. 300–250cm and coincides with a temporary reduction in alder. Increasing evidence of woodland disturbance, probably anthropogenically determined, is recorded in the latter third of the zone.

*Howick Zone 2-5: 200–0cm (*c*. 1930 cal BC to present)*

This zone sees the valley side and hill top vegetation in the vicinity cleared of its woodland cover, with much evidence of ruderal taxa like *Plantago lanceolata*, *Pteridium* and cereal cultivation (Gramineae > 40μm). In addition, the large Gramineae < 40μm peak, together with the macrofossil remains of *Phragmites*, indicates the formation of reed swamp within the valley.

Comparison with other sequences

There are surprisingly few other well dated pollen sequences from the lowlands of East Northumberland, unlike the better studied upland areas (e.g. Clapperton *et al*. 1971; Borek 1975; Davies and Turner 1979; Rowell and Turner 1985; Tipping 1996,1998a, 1998b; Moores 1999; Simmons 1996; 2003). Of the sequences that are available, the study by Bartley (1966) comes from a series of undated sequences from a low-lying site at Bradford Kaims, just to the south of Bamburgh, and would appear to record the infilling of a Late Glacial and Early Holocene wetland.

The early Post-Glacial parts of the Bradford Kaims sequences compare well with the results observed at Howick, with the dominance of oak, elm, hazel and eventually alder. Due to the poor resolution of these sequences it is difficult to ascertain whether these early Post-Glacial woodlands were subject to disturbance. The only other studied sequences of significance are those examining the buried coastal peat bands at Druridge Bay (Innes and Frank 1988; Farrimond and Flanaghan 1996). The peat sequences from Druridge Bay only span the latter part of the Holocene sequence (3430–1000 BC) seen at Howick (approximately 225–0cm), making detailed inter-site comparisons difficult.

Although this is a relatively low-resolution study, it provides an important lowland/coastal palynological record for the Late Glacial and Holocene of north-east Northumberland. The geomorphological setting in an incised coastal river valley means that the pollen record may well have been more strongly influenced by local vegetation changes than would have been the case for open, upland sites.

Latin Name	Common Name
Gramineae	Grasses
Carophyllaceae	Carnation family
Liguliflorae	Dandelion
Cyperaceae	Sedges
Cruciferae	Cabbage family
Pinus	Pine
Quercus	Oak
Alnus	Alder
Corylus	Hazel
Ulmus	Elm
Artemisia	Mugwort
Cirsium	Thistle
Plantago lanceolata	Narrowleaf Plantain
Potentilla	Tormentil
Rumex	Sorrel
Bidens	Marigold
Stellaria holostea	Greater Stitchwort
Pteridium	Bracken
Typha latifolia	Broadleaf Cattail
Phragmites	Common Reed

Table 12.5 Latin pollen identifications and their common names.

Environmental Summary

The area bears evidence of significant glacial influence towards the end of the Devensian cold period. Glacial sediments (diamictons) of three distinct types are recorded along this coastline. Between the disappearance of the last ice cover and the end of the glacial period, a series of fine-grained sands was deposited above the diamictons. These may have initially been deposited under water, possibly associated with glacial outwash, but there is also a suggestion that these were in part later re-mobilised by aeolian action. It is into these sediments that the Mesolithic structure was built.

The Late Glacial to Holocene period is represented by open grassland. Sedge and fern vegetation predominated, with aquatic sediments deposited in the valley adjacent to the site. Thus the area was ice-free by at least 10,800 cal BC, according to the age of the oldest organic material recovered in core 11007, and shortly after, a more typical Early Holocene vegetation pattern became established.

Apart from the pollen record there is little other environmental evidence available to reconstruct conditions in the Early Holocene. The palaeoenvironmental record in the cores is unfortunately interrupted by the deposition of a coarse layer of eroded country rocks. These are interpreted as the final record of a marked erosional event, which appears to have removed 3000 years of accumulation, including the interval that the hut was occupied. The dating of core HEX 11007 (Chapter 6) indicates that the erosion event probably occurred at about 6100 cal BC.

Subsequently the Early to Middle Holocene environment at Howick was strongly influenced by the Post-Glacial eustatic rise in sea levels through to a peak at about 2500 cal BC when sea levels would have been up to 1m higher than at present. Sedimentation in the valley of the Howick Burn during the Early to Middle Holocene appears to have kept pace with sea level rise, even exceeding it, since the environments evolve from marine through brackish to freshwater by about 4500 cal BC. After this time, no aquatic microfossils are recovered, suggesting that by this time conditions in the valley floor were independent of sea level, either through a seaward barrier or high accretion rates.

The Late Holocene record is poorly resolved due to the lack of suitable dating material, the intermittent nature of sedimentation in a floodplain environment and the occurrence of anthropogenic alteration of the valley floor in recent centuries. This sequence remains one of the most significant, and certainly the most comprehensively dated palaeoenvironmental records in Northumberland.

13 Experimental Construction

Clive Waddington

Introduction

During this study an opportunity arose to 'reconstruct' the Howick hut as part of a BBC documentary for the 'Ancestors' series and, two years later, to build a second experimental hut on the actual site itself with the aid of a grant from the Northumberland Coast Area of Outstanding Natural Beauty. Although the primary reason for building the first structure was to visualise what one of the huts may have looked like for television, it also provided the chance to undertake an experimental approach to understanding how the hut was made. The second hut was built for experimental and interpretive purposes and is considered the more faithful of the two, particularly as it was made having learnt lessons from the initial construction. Relating observations of the constructed huts to those provided by the archaeological excavations has provided important feedback for understanding the structural form and appearance of the hut.

The notion of archaeological 'reconstructions' has recently been called into question by Stone and Planel (1999), who instead advocate the use of the term 'construction', as this better describes the result of building archaeological experimental structures. The term 'reconstruction' is considered loaded as it implies that the final outcome is the realisation of a wholly known design whereas in reality it is, in most cases, a best guess interpretation of the archaeological remains. Accordingly, the use of the term 'construction' is followed here.

Construction 1

The first construction took place during late October and early November 2002, less than two months after the excavations had been completed. This allowed only a limited window of time to assess the results from the excavation and to propose the structural form for the construction. All the experimental work was undertaken by the author and volunteers, who included staff from the original excavation, students from the University of Newcastle and members of the public, over a two-week period. The constructed hut was built at the Maelmin Heritage Trail in north Northumberland, a free-access archaeological interpretation site named after the (royal) early medieval town of 'Maelmin', which lies immediately next to the site (see Waddington 2004 for review and rationale of the site). The trail is located at the south end of Milfield village immediately off the A697 trunk road at NT 940 336 and can be visited any time of the day, the year round.

It was decided to attempt to construct the Phase 1a hut as this was considered to be the hut that provided the least ambiguous archaeological evidence as to how it was built. Based on the excavated evidence, the overall design of this hut was considered to comprise the following:

- A sunken-floored circular pit measuring a maximum of 6m in diameter and averaging around 0.5m deep.
- An internal ring of vertical timber supports, each measuring c.0.15m–0.2m diameter, set within the inner edge of the sunken floor area.
- A series of roofing poles measuring around 0.05m diameter, angled towards the apex of the roof and set in the ground outside the edge of the sunken floor area.

On the basis of these design principles, evidenced by the archaeology, the following interpretations were made:

- It was thought that the inner ring of uprights must have supported continuous lintels in some form, as these would provide additional support for the roof poles and provide stability to the ring of upright timbers. This type of lintel structure is sometimes known as a 'roof plate'.
- The angled roofing poles, as evidenced by the stake holes, were thought to have been laid against the roof plate so that they formed an apex above the centre of the hut. This creates a conical-shaped structure when viewed from the outside, with short vertical walls provided on the inside by the sunken floor edge.
- As the hut had to have an entrance, a single, speculative entrance was to be made on one side of the hut.

This overall design was considered to fit best with the observed archaeological remains for the Phase 1a hut. One of the issues arising from the observed

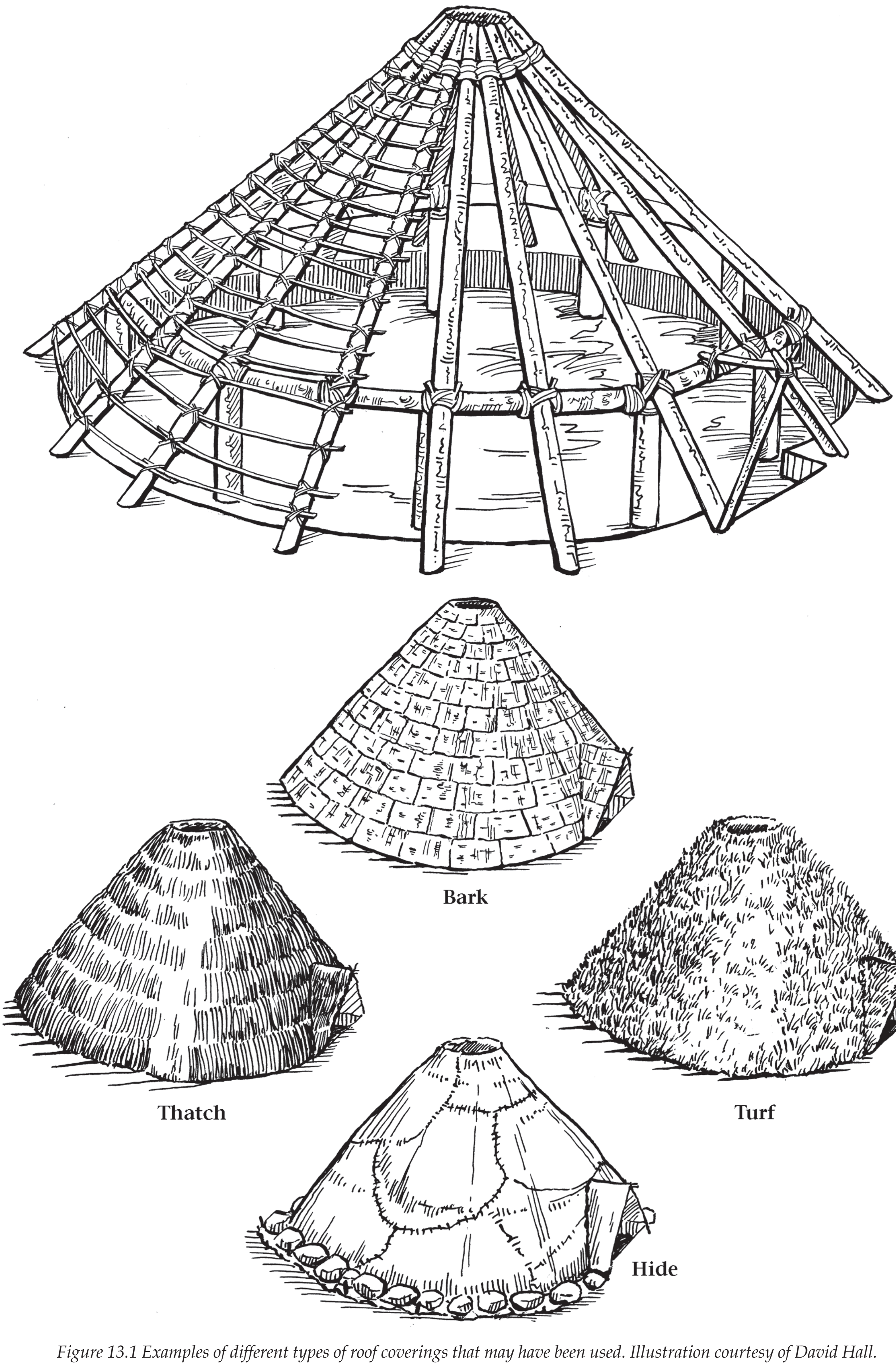


Figure 13.1 Examples of different types of roof coverings that may have been used. Illustration courtesy of David Hall.

Figure 13.2 The sunken floor area with surrounding mound after excavation by machine. The construction of the Milfield North henge is located in the background.

Figure 13.3 The hut after erection of the timber uprights, lintels and roofing poles

archaeology, however, was the fact that the stake holes around the hut edge were generally small in diameter measuring just 3–5cm. Although these were clearly the sharpened ends of stakes driven into the ground at an angle between c.60° and 65°, these are rather thin for large roofing poles. On the other hand, as they only represent the very charred ends it is probable that these sharpened ends continued into more substantial timber poles, but it is only the very tips of these stakes that have survived in the archaeological record, giving these small diameters.

No evidence of the roofing materials was discovered as a result of the excavations, leaving this component of the structure open to greater speculation. A variety of roofing materials may be considered including hides, thatch and turf (Fig. 13.1). Considering the sturdy nature of the timber uprights it was considered unlikely that the structure was roofed with a light covering, such as hides, as this would not have necessitated stout timber uprights within the hut. The presence of these timbers therefore implies that the roof was constructed of heavier and more durable material/s. Given the choice between turf and thatch it was decided to opt for thatch as it was thought that this material would prove better at keeping the rain out. Although reed would almost certainly have been readily available to the inhabitants of the site, from areas such as the nearby burn, the thatch used for the construction consisted of wild grass and straw as this could be acquired at virtually no cost, whereas reed thatch would have been expensive to purchase.

The materials utilised for the construction consisted of fast-growing softwood timber, kindly supplied by Forest Enterprise, together with wild grass and straw supplied by Durham Wildlife Trust and the local farm. In the event, the roofing poles were too short to achieve the required 65° angle and as a result the pitch of the roof was much shallower than would have been the case with the original hut. Also, the timbers used as the roofing poles were much thicker than those suggested by the stake holes in the archaeological excavation which are more likely to have been about half their diameter. Obtaining such slender poles was certainly possible, as fast-growing hardwood timber, such as birch, can reach heights of 6–7m with trunks only around 0.1m thick. However, as softwood of only certain sizes was available we had to settle for thicker poles. Despite this, the overall principle of the building design could be retained and it is not thought that either of these compromises made any particular difference to the functional qualities of the structure other than to give it an apex some 2–3m lower than the original and the inclusion of overly thick roofing poles. The roofing poles were secured in place by a latticework of thin coppiced poles tied on to them with plant fibre cord (sizel). The coppiced poles had been taken from stands of hazel and alder that had been felled by the group in conjunction with Durham Wildlife Trust. This lattice provided a series of concentric rings around the roof poles on to which the bundles of thatch could be tied.

Constructing the Hut

The sunken floor area was excavated by machine to save time and the resulting upcast made into a mound around its edges.

The next stage was to set up the timber uprights inside the sunken floor area and attach the timber lintels. This involved shaping the ends of each lintel to assist with lashing them on to the uprights using plant fibre cord. A total of 18 timbers was used with nine used as uprights and nine as lintels, each measuring around 1.5m in length. The fallen timber [029] from the phase 3 hut had an observed length of 1.6m and therefore a similar length for the phase 1 timbers can be reasonably suggested. Once the uprights and lintels had been assembled the timber roofing poles were erected so that they rested on the

Figure 13.4 Lashing the coppiced poles (purlins) on to the timber frame.

Figure 13.6 Detailed view of lashing the thatch on to the purlins using plant fibre cord.

Figure 13.5 Adding the first layer of thatch starting from the base of the roof.

Figure 13.7 The completed hut with entrance

ring of lintels. Based on the measurements from the excavated hut the apex of the roof would have measured around 7.2m high, though it would have only stood 6.8m above ground as it was built over a 0.5m deep sunken floor. The poles supporting the conical roof would measure around 7.6m in length. These nine poles had had their ends charred prior to being set up in order to preserve the wood and prevent the ends in contact with the ground from rotting. They were then lashed onto the lintel frame using plant fibre chord to keep them stable. Erecting the frame of the hut took a group of six people one day once the timbers had been felled, cut to size and brought to site.

At this point it was realised that the ends of the stake holes would not have survived in the archaeological horizons if the surrounding upcast mound had been in place so it was decided to spread the upcast out around the hut rather than keep the surrounding mound.

Once the roof supports had been secured in place a frame to attach the thatch was added. This involved cutting lengths of coppiced hazel and alder to size and then lashing them across the roofing poles to form 'purlins'. A speculative doorway was added on to the south-east side of the structure consisting of a triangular opening that ran straight back into the cone of the roof. This was the simplest way of attaching an opening to the cone shape and was thought to represent a minimalist, but adequate, entrance.

The next stage of the work involved tying the thatch into bundles ready for tying on to the purlins. One group of people prepared the thatch while another tied it on. Once consecutive layers of thatch had been added, twisted hazel spikes (spars) were used like large staples to further secure the thatch. A small gap was left at the apex of the roof for smoke to escape. Approximately 1 ton of thatching material was used to cover the roof.

The bundles of thatch were far shorter than would have been the case if they had been made from reeds, with each bundle covering an area of about one tenth of a square metre. This made the covering of the roof the most time-consuming part of the construction and it took a team averaging six people five days to complete.

Once the hut had been constructed it took on the appearance of a large haystack; however, inside the hut it was found to be incredibly spacious and warm. Lighting only a small fire in the centre of the hut kept the interior at a very agreeable temperature despite there being inclement weather outside, which reached winter temperatures on occasions.

The interior of the hut was fairly well lit with an open door and small fire going. Once the eyes were adjusted to the slight gloom, tasks requiring detailed work could be undertaken inside with ease. The spatial dimensions of the hut work well, as the floor space can be used right up to the eaves thanks to the sunken floor edges acting as walls. Being located partly within the ground, the hut is well insulated and draughts from below the eaves could be easily shut out by wedging thatch material or earth between the eaves and the ground surface.

The hut looks something like a tepee but it is made from timber and thatch rather than poles and skins. Indeed this early hut could be considered to be a more robust form of a tepee or skin tent. This observation supports the notion that the original hut may have resulted from the translation of tepee architecture into a more solid form and therefore the hut may have its origins in tepee/tent architecture. At a height of c.6.8m above ground this hut would have had a striking visual appearance and would have stood out as a conspicuous human construction amongst the rest of the surrounding landscape, even it was located in a clearing within woodland.

The size and shape of the hut may be described as ergonomic in the sense that the hut feels very well suited to the human scale. It provides space to live, work and sleep around the central focus of the hearth. The floor space lends itself to a group of around half a dozen adults and adolescents, and perhaps one or two more if infants are included, with space left over for storage, the central hearth area, and a gap in front of the entrance. It can be aptly described as a family-size hut and this is significant for gaining a sense of the size of social units using these types of structures.

The hut survived two winters with no repairs required. However, an accident during Spring 2004 led to the roof catching fire. A fire was lit by the author to dry out the damp roof on a day with exceptionally strong winds. Some sparks got into the roof thatch and the wind soon brought this to a full blaze with flames consuming almost the entire thatch cover. Since then the roof has been repaired using reed thatch as an alternative. Given that it was always known that the roof apex was too low this accident further emphasizes why the original stake holes indicated such a steep angle of pitch. The taller apex would not only have reduced the risk of fire but would also have made a more satisfactory angle for the thatch to work properly.

Construction 2

The second construction took place during March 2005 immediately next to the site of the excavated hut. The timber was carefully selected so as to include long, slender poles of native silver birch together with timber uprights of the same dimensions as the timber stains found in the hut. The wood used for the spars included a mixture of alder, hazel and willow and the cover, this time of turf, was taken from the ground immediately next to the hut site. The hut was built in the same basic way as construction 1. A pit measuring 6m diameter was excavated by hand and the surface trowelled back in case any new archaeological remains came to light: none did. The timber uprights were secured in position by lashing timber lintels between each upright using plant fibre cord. The birch poles were then laid against the uprights and wedged into the ground (Fig. 13.8). This produced a much taller conical frame than construction 1 with the apex positioned 6m off the hut floor. Digging out the hut floor and erecting the timber frame took a group of 6 people two days to complete.

Timber spars were lashed to the birch poles to create a latticework for supporting and securing the turf cover. As the conical frame was connected together by the spars, the weight in the roofing poles shifted so that some uprights were pressed into the ground while others were lifted. This did not cause a problem other than the need to wedge supports under those timbers that had lifted so that they bore some of the weight again. This was most simply achieved by gathering some flat sandstone pads from the shore below and wedging them underneath the lifted timbers. The stone pads found in the excavated hut would therefore seem to have been wedges rather than pads for spreading the weight as originally thought. The sides of the sunken floor area were somewhat unstable at first but by placing flat timbers

Figure 13.8 Construction 2 used long slender roofing poles made from birch providing a steep pitch around 60

Figure 13.9 The birch pole superstructure gained immense stability once the spars were tied across them.

Figure 13.11 Despite initial concerns the turf stayed in place and was made secure by using twists of willow to peg them over the underlying lattice.

Figure 13.10 The hut begins to take shape as an entrance is attached and the turfing begins.

Figure 13.12 Looking south to the completed hut, which is situated between the site of the excavated hut and the public footpath

against the sides this stabilised the soil. Again parallels for this can be suggested in the excavated remains such as the timber stain [359] found near to the edge of the Phase 1a hut. The soil that gradually falls in from the sides, however, quickly covers up the floor areas immediately below the eaves and blurs the original hut edge. This largely explains the difficulty encountered trying to determine the hut edge during excavation.

Attaching the lattice was a time-consuming process and took nearly three days to complete, although at times only two people worked on this task. During this time a simple triangular doorway slightly taller than that on the first construction was attached (Fig. 13.10). With the help of an additional ten volunteers, an area measuring c. 5m by 14m was deturfed over two days and the turfs piled up next to the hut ready for setting in place. The upcast from the sunken-floored area was mounded up around the side of the hut and used to help bed in the roofing poles. It also provided an ideal base on which to lay the first row of turfs and in so doing created a useful windbreak below the eaves of the roof cover.

The turfs were attached by laying them on to the latticework and wedging them onto protruding ends of the lattice. The turfs were further secured by twists of willow jammed through the turf to rest above the timber supports (Fig. 13.11). Attaching the turfs and finishing the hut off took eight people three days to complete. This made the second construction a five-day process involving eight people over its duration, plus the help of ten people to deturf. This is roughly twice as fast as the first construction and what is more, the second experimental hut is larger, more fire-proof and more robust than the first.

The completed hut lies immediately next to the

Figure 13.13 The construction team charring the end of one of the timber supports before the horizontal snow set in.

excavation site (Fig. 13.12) and can be visited at any time. It is located adjacent to the coastal path and National Cycle Route 1. An information panel has been installed at the site and a self-guide walk leaflet can be obtained free of charge from most local outlets. Further information panels explaining the archaeology of the Howick area can be found at Craster Tourist Information Centre further along the coastal path. The second construction was also filmed for the BBC as part of the 'Coast' series, making another useful record of the construction process.

The second hut construction is more in keeping with the evidence recovered from the excavation. Indeed there were no archaeological signatures produced during the second construction that could not be directly related to the archaeological remains observed in the excavated hut. Nearly all the core team who built the second construction (Fig. 13.13) excavated on the actual site and so it was important to note that all of those involved were convinced that the second construction related well with the observed remains, while the first construction clearly contained several discrepancies. One of the chief results of this second construction was production of a structure that is thought to accurately capture the scale of the original. The striking proportions of this hut convey not only the durability and permanence of the structure, but also its significance as a man-made feature in the landscape. Whether it was located in a clearing, open woodland or open ground, this is a large and imposing feature that would have not gone unnoticed by other visitors to this area.

Conclusions

The constructions have prompted much discussion as to how the hut was built amongst a wide range of people and this has proven enlightening in itself. One of the most useful comments was made by Roger Miket who observed that one method of roofing that he had encountered in parts of Scotland uses a turf inner and a thatch outer. This system requires the turf to be inverted and laid on the roof. This serves to insulate the roof, protect the interior from catching fire and provide a surface into which the thatch can be pegged. A thatch cover is then laid over the sods and pegged into position with spars. Such a roof would be both proofed and insulated and provide an extremely durable and effective covering. However, it would also be heavy, perhaps weighing up to two tons or so when the thatch is sodden, and this would require the type of heavy supports indicated by the inner ring of posts evidenced by the excavation. On reflection it seems, to this author at least, the most convincing interpretation of the roof cover so far.

Partly as a result of the construction, and partly as a result of reflections on the excavated evidence, some concluding remarks can be made.

- Slender roofing poles 6m long set at c.60° would have been required and this may have meant careful timber management prior to the building of the hut.
- Likewise the poles for creating the framework on which the roofing materials could rest (whether thatch and/or turf) could have been obtained from coppiced woodland.
- The final form of the hut would have resembled, in shape and size but not in its covering, mobile tent structures. It raises the possibility that the design of this hut had its origins in tepee-style architecture.
- The presence of a surrounding upcast mound is considered likely as it provides a good base for the roof cover and deflects draughts from entering the hut below the eaves.
- Despite some deficiencies in our knowledge of the hut form it remains clear from the position of the stout timber uprights that these had to be secured in some way and this could only be achieved if they bore the weight of a heavy roof. Evidently this was a substantial, well built and robust structure that required a degree of planning to construct.
- On the basis of the survival of the constructed huts it is evident that an aerodynamic hut of this sort will stand up to northern winters with minimal maintenance.
- The scale of the hut is ideally suited for accommodating a family-sized group.

14 Howick: Discussion and Interpretation

Clive Waddington, Geoff Bailey and Nicky Milner, with a contribution by Ann Clarke to the bevelled pebble discussion

Introduction

Prior to the discovery at Howick, evidence for Mesolithic activity in Northumberland consisted almost entirely of stone tool artefact scatters, some of which were discovered by fieldwalking (Weyman 1975; 1980; Davies 1983; in press; Tolan-Smith 1997a; Waddington 1999a, 2004), others as clusters of tools and knapping debris from old land surfaces (Buckley 1922; 1925; Raistrick 1934; Tolan-Smith 1997b; Young 2000a), and yet others from the base of rock shelter sites with a few structural features (Burgess 1972; Beckensall 1976; Davies pers. comm.;Waddington 1999a; 1999b). A single midden-type deposit was partially recorded at Low Hauxley below Bronze Age burials, situated in an eroding cliff edge at the north end of Druridge Bay (Bonsall 1984). This is the only archaeological site to have produced a Mesolithic radiocarbon determination in the county prior to the work at Howick. In Bonsall's short note he states that it dates to "*c*.5000 bc" (Bonsall, 1984, 398), but no further information is given, suggesting this deposit belongs to the period around 5800 cal BC. Bearing in mind this somewhat limited understanding of Mesolithic settlement and chronology in the North-East region, it is rather ironic that the Howick site now provides the most comprehensively dated site of this period in the British Isles. However, Howick has far more significance than just pushing back the chronology of the Mesolithic in Northumberland; it has provided evidence for a largely intact structure that can be confidently described as a 'home base' (see Smith 1992, 28–32), as well as demonstrating the potential for Mesolithic structural remains to survive in unlikely locations, such as beneath a ploughed field surface. Armed with the data from Howick we are now in a position to be able to put forward interpretive models of human settlement during part of the Mesolithic in this region (see below). Moreover, the discovery of a directly analogous, and virtually contemporary site, further up the same stretch of coast at East Barns near Dunbar (Gooder 2007), will add yet more to the picture of Mesolithic settlement during the 8th millennium cal BC in this region.

Site Taphonomy

The Mesolithic hut site at Howick, although truncated by cliff collapse on its eastern side, is of particular significance as the deposits within the hut had experienced relatively little disturbance as a result of later human activity on the site. All too often early prehistoric lithic scatters are mixed with later lithic material, or Mesolithic sites with structural remains are situated below later features, as was the case at Mount Sandel (Woodman 1985). In contrast, the surviving deposits at Howick have only been disturbed by the natural processes of pedogenesis, bioturbation (particularly mole holes) and cliff collapse, together with the limited impact of human interference in the form of sheep burials along the truncated cliff edge, and the shallow ploughing of the topsoil that had accumulated over subsequent millennia. This has meant that the structural features and finds from within the hut all relate to the Mesolithic occupation of the site and are not mixed with later material. These fortunate circumstances of preservation mean that the recording and interpretation of the site were not clouded by the effects of intrusive activity that could otherwise contribute to obscuring understanding of the archaeological remains. It also meant that the finds assemblages and burnt bone could be analysed as discrete and coherent assemblages. The key challenge faced in the field recording of the Howick deposits was the widespread presence of mole holes. Their occurrence across the site necessitated careful sampling so as not to include material from within these holes in samples used for dating and so forth.

Horizontal ferruginous bands were recognised in the hut deposits and at first it was thought that these could represent occupation horizons within the hut. However, when it was realised that these horizons not only passed through features, but all the way out of the hut deposits into the surrounding natural sand, it was realised that they were in fact the result of natural iron staining. A similar effect was also observed around the edge of each of the hut floors. Along the edge of the cut for the sunken floor areas could be observed a slight 'halo', which appeared as a ginger-coloured iron-stained contact lens. Such effects have been noted at other sites in the North-East, such as the purple staining that had formed along the cut of the ditch terminals at the north entrance of the Coupland Henge (Waddington in prep.). Despite these potential corruptions to the archaeological sequence, the Howick deposits were remarkable for their integrity, especially given their age, and their location in what was otherwise a fragile and acidic environment.

Site Recording

The complex stratigraphy could only be recorded in full by slow and methodical excavation using a single-context recording system; the employment of a grid system of excavation would have proven unsatisfactory, particularly as each deposit had to be removed in its entirety in order to comprehend the stratigraphic order of the site. Although grid systems still tend to be employed for the investigation and recording of hunter-gatherer sites, usually because of the large number of lithics associated with them, this study has shown that full open-area investigation is a more suitable method for teasing out the complex relationships of a substantial built site with discernible contexts, and multiple phases of occupation. If a test pit or a box had been cut through the hut deposits as part of an exploratory investigation, this intervention would have undoubtedly destroyed relationships between features. As a result of the independent testing of the recorded stratigraphy provided by the dating programme it is clear that open-area excavation can be a highly effective way of maximising information gained from hunter-gatherer sites. A further demonstration of this has been provided by the East Barns site near Dunbar where open-area investigation has also been used to successfully excavate and record another complex Mesolithic hut site that has evidence for multiple structural phases (Gooder 2007).

The Huts

Three successive huts were constructed on the Howick site (Fig. 14.1). The size of the huts became slightly smaller on each occasion, with the Phase 1 hut measuring 6m across, the Phase 2 hut 5.9m across and the Phase 3 hut 5.4m across. The Phase 1 and 2 huts approximate most closely to a circle in plan whereas the Phase 3 hut, although sub-circular, appears to have a slightly squared shape. Another important design difference between the Phase 1 and 2 huts and the Phase 3 hut is the form that the roof supports took. The Phase 1 and 2 huts appear to have had a ring of uprights set inside the hut edge, presumably to support some form of roof plate, together with poles set around the outside edge of the hut scoop, angled in towards the apex of the roof to produce a conical shape around 60º. The roof covering/s remain/s unknown but is/are likely to have included one or more of the following: turf, thatch (which could be made from a variety of materials such as reed or grass), bark, green foliage or skins (see Fig. 13.1). Taking into account the substantial nature of the timbers, the result of the experimental work and the likely materials available at the time, it is thought most likely that the hut had a turf roof, possibly with an outer layer of reed thatch.

Although the details of how the superstructures fitted together and the way they were roofed remain open to debate, the overall conical roof design with hefty internal supports remains a reasonably secure interpretation of the observed archaeology. This structural form contrasts, however, with the Phase 3 design, which included what may be a centrally located post hole, together with evidence for a series of substantial timber supports set on the edge of the scoop, with no evidence for angled roofing poles surviving. Taking into account the rather squared outline of this hut, the implication in this case is for some kind of vertical-walled structure rather than the large conical tent-shaped structure of previous phases. It would seem that a hut of different constructional form and physical appearance was built in this phase. Why this is the case remains problematic as it could result from any number of reasons. Possible explanations include: change in use, the personal preference of the Phase 3 residents, or the type of materials available to hand at the time of its rebuilding. The key point, though, that ties all three phases of hut construction together is the robust nature of each building and the use of substantial timbers to support what must have been a permanently standing structure.

Phase Summaries (see Fig 14.1 for exploded view of the phase plans)

Phase 1a Summary

The Phase 1a hut is broadly circular in plan containing a central setting of hearths. Structural features are located around the inner edge of the sunken-floored area, which averages 0.5m below the contemporary land surface, and give the impression of a sturdy superstructure with upright timber supports, together with slight roofing poles set at an angle to form a conical roof. Other features include pits of various shapes and sizes situated around the central hearth area and towards the edge of the hut. The

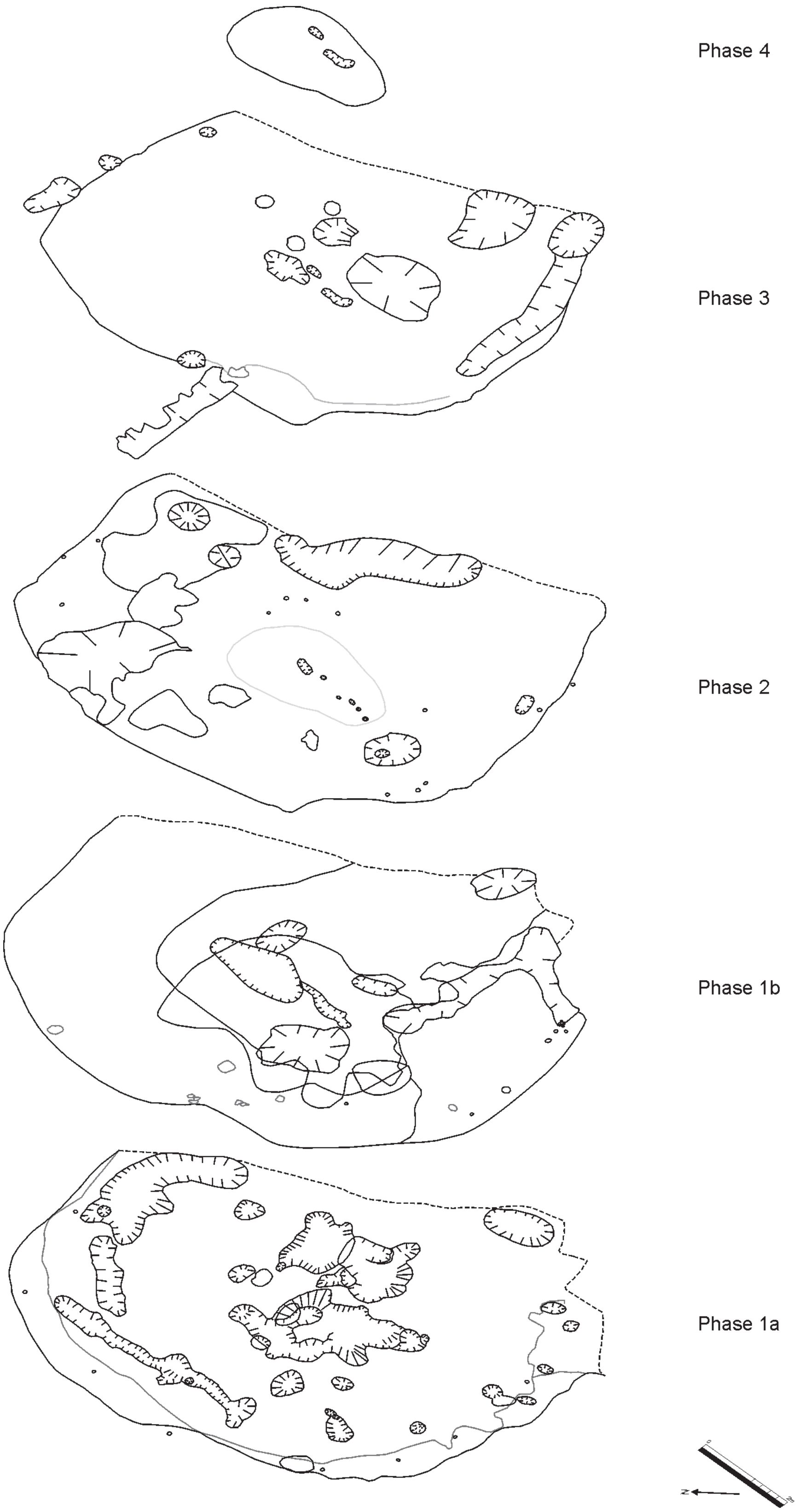


Figure 14.1. Exploded view of the Howick hut phase plans positioned above each other.

function of these pits is uncertain but the position of elongated pebble tools, microliths and blades in the north-east area of the hut suggest pit [270] may have been associated with a range of processing/manufacturing tasks. The large number of hazelnut shells, together with small pieces of charred bone within the hearths, indicates the cooking of a variety of foodstuffs in the central area.

Phase 1b Summary

The Phase 1b deposits, like Phase 1a before it, consist of a central hearth area with evidence of features associated with other activities set around the hearth area and close to the hut edge. There is evidence to suggest localised rebuilding or repair of the hut on its west side, in the form of stone pads and stake holes. The elongated pebble tool distribution is focussed more on the south and west areas of the hut rather than the north-east area as in Phase 1a. This suggests that certain activity loci may have changed position during this phase of occupation, and this could relate to structural modifications such as the repositioning of a door. The large burnt spreads [340], [264] and [320] have areas of discrete burning visible within them, suggesting that many fires had been lit around this central space during the occupation. In addition to these open fires, hearth pits [293] and [268] had been cut into the central area and these had evidently been used on many occasions. According to the dating model (Chapter 6), the occupation of the Phase 1a and 1b hut lasted for *40–160 years (68% probability; use 1*; Fig 6.4.)

Phase 2 Summary

The Phase 2 hut differs from the Phase 1 hut on several counts. Firstly, it does not have the same obvious evidence for the constructional form of the hut, but just a few small stake holes and two post sockets. As with the Phase 1 remains, these are located around the internal edge of the hut but they are clearly insufficient to have supported the roofing structure. Secondly, the Phase 2 hut provides evidence for a hearth pit, [158], away from the centre of the hut, which together with the roasting pit abutting the north-west edge indicates that heating, and possibly even burning, was taking place at the hut margins as well as in the burning area at the centre. This must surely have produced a fire hazard unless the outer walls of the Phase 2 hut were set further back than the sunken floored area, or earth walls were built vertically around the edge and the timber superstructure set into that. This latter idea gains further support from the analogous site at East Barns near Dunbar (Gooder 2007). Here, a dark deposit was considered to have been the remains of a turf/earthen wall that had collapsed into the hut. The evidence for a dedicated hazelnut roasting area is another special feature apparent in this phase at Howick, whereby sand and clay had been mixed together in a way that directly compared with the hazelnut roasting remains identified at the contemporaneous Mesolithic settlement at Duvensee in Northern Germany (Lage 2004). The clay lumps situated close to the central hearth area are interpreted here as raw material brought into the hut for use as part of hazelnut roasting activities. Overall though, the Phase 2 hut still retains many of the same basic structural principles that governed the Phase 1 hut: the sub-circular shape of the sunken-floored area, a diameter of 5.9m compared with 6m for the Phase 1 hut, a central burning/hearth area that contained cooking debris, together with the remains of a few slight stake hole tips around the hut edge. According to the dating model (Chapter 6), the occupation of the Phase 2 hut lasted for *10–80 years (68% probability; use 2*; Fig 6.4).

Phase 3 Summary

The Phase 3 hut had a different structural form from the two previous structures, consisting of very substantial timber uprights set around the edge of the sunken-floored area, together with some smaller posts. The Phase 3 hut was smaller than the preceding huts, having an internal diameter of 5.4m. Although only some of the structural evidence is available to understand how this hut was built it clearly made use of large upright timbers around its edge. The use of the central area of the hut for hearth and fireside activities was once again in evidence together with pits suggestive of earth ovens. Elongated pebble tools were clustered in the north area of the structure, suggesting, as with Phase 1a, that processing activities took place in this zone of the hut. According to the dating model (Chapter 6), the occupation of the Phase 3 hut lasted for *1–60 years (68% probability; use 3*; Fig 6.4).

Phase 4 Summary

The modelling of the radiocarbon dates has shown that around *130–280 years (68% probability; gap*; Fig 6.4) after the hut was abandoned (see Chapter 6) it was utilised again by Mesolithic people, forming the fourth phase in the stratigraphic sequence. The radiocarbon dates from the latest burnt features cut into the upper hut deposits suggest that one or more short-term re-occupations of the site took place. As there are no structural remains that can be directly associated with these latest features it is likely that this final phase of use relates to (a) short stay/s and the lighting of fires in the hollow left by the hut, rather than lengthy occupation inside any kind of built structure. This is confirmed by the ^{14}C dates (Chapter 6). As only the uppermost lenses (0.06m and perhaps up to a maximum of 0.1m) of the Mesolithic hut deposits appear to have been truncated by natural weathering of the subsoil it is highly unlikely that a third rebuilding of the structure took place. It is testament to the quality of the dating programme that this phase of activity has been recognised, as it could not otherwise be separated out from the recorded stratigraphy.

External Activity

Although a large excavation trench was cut, there was very little surviving evidence for external activity around the hut, primarily because of later disturbance and truncation. However, the few pits that were found on the south side of the hut indicate that this area formed a focus for other activity. As none of these features could be dated they could not be reliably linked to contemporary occupation of the hut. However, those that contained Mesolithic artefacts are considered likely to be associated. As discussed previously (Chapter 5), it is unlikely that there were many, if any, more huts immediately associated with the excavated one, as the geophysical survey and extensive excavation trench and test-pitting revealed no further structures. The only possible area where other huts and structures could have been located is to the east of the hut where the cliff has eroded away. Other than the meagre evidence for a few truncated pits, the fieldwalking indicated that other Mesolithic foci exist in the surrounding landscape at a distance of a km or so from the excavated hut. Like the hut, these lithic concentrations tend to be on land above the freshwater stream but still close to the shore. A pattern of dispersed family-sized settlements can be envisaged (see also below, Settlement Organisation and Economy).

Bevelled Pebble Tools

Bevelled pebbles, variously referred to as 'bevel-ended tools, 'bevelled tools', 'limpet hammers', 'limpet scoops' or 'elongated pebble tools', have been recorded at many British Mesolithic sites, particularly those on the western shores of Britain, in Scotland (Mellars 1987; Clarke 1990; Barlow and Mithen 2000), England (Berridge and Roberts 1986; Palmer 1999) and Wales (Jacobi 1980), with examples also known from the Isle of Man (Woodman 1987) and Ireland (Woodman 1978; 1985). The varied terminology illustrates the confusion surrounding the study of these tools and this confusion has been exacerbated further by the search for single-function explanations. Certainly, amongst the Obanian sites of the west coast of Scotland, pieces of split bone and antler as well as pebbles had similar bevels formed on one end, which indicated that these elongated bevelled tools were most probably all used in the same way regardless of material type (Connock *et al.* 1992). However, the stone tools from Bolsay Farm, Islay, and Staosnaig, Colonsay, though of elongated form, demonstrate a variety of wear patterns, including chipping and flaking damage, which was not present on the bevelled pebbles from Howick (see Barlow and Mithen 2000). In general, there is a lack of rigour across the board in describing the wear patterns on the tools as well as poor, or even no, accompanying illustrations, and this has made it difficult to identify and compare the traces of use-wear left on these tools from other sites.

A look at some previously published pieces shows that very few demonstrate the wear patterns found on the Howick bevelled pebbles. In fact the bone and antler tools from Druimvargie Rockshelter and Macarthur's Cave, Oban and Risga (Lacaille 1954, fig 102; Griffitts and Bonsall 2002, figs 1 and 2), have a bevel that is worked evenly from left to right across the face of the tool. Even the bevelled pebbles from Cnoc Sligeach and Caisteal-nan-Gillean, Oronsay (Lacaille 1954 figs 94 and 88) look different as they are quite heavily flaked or else bevelled evenly from left to right across the tool face (with the exception of fig 94 top row, far right). From Kinloch, Rhum the bevelled pebbles have rougher bevels with some flaking and the bevels are worked evenly across the tool face (Clarke 1990, ill 81). An experimental study by the Southern Hebrides Mesolithic Project explored a variety of possible functions for such tools, which they termed 'elongated pebble tools', including their use as limpet hammers and scoops, knapping hammerstones and hide softeners (Barlow and Mithen 2000). These experimentally produced wear patterns replicated to a certain degree the wear traces that were present on some archaeological examples from Islay and Colonsay, which most likely indicates that the Mesolithic populations, at least at these sites, used these elongated pebble tools for a range of activities. These examples serve to illustrate that there is considerable variation in the wear patterns on these tools between, and even within, stone assemblages from a single site, and that interpretations of their use on one site should, on the basis of wear patterns, only be applied with caution to other assemblages.

Jacobi has made the key observation that these bevelled pebble tools are, with just a few exceptions such as Farnham in Surrey (Clark and Rankine 1939), confined to coastal or near-coastal settings (Finlayson 1995, 262) and this implies that they are directly associated with processing raw materials associated with coastal economies (Jacobi 1980). The main suggestions for the use of bevelled pebble tools include shellfish hammers and processing tools (Lacaille 1954, Griffitts and Bonsall 2002), hammerstones for manufacturing flaked tools, and smoothing tools for the preparation and softening of hides (Finlayson 1995). The experimental work undertaken as part of the Southern Hebrides Project revealed that the effectiveness of these tools as limpet hammers was reliant on shape and lithology, with thick pieces of hard rock being most effective (Barlow and Mithen 2000, 516–7). These experimental pieces produced a number of wear patterns including longitudinal and transverse fractures, crushing, pitting and flake removal but it is noteworthy that this activity did not produce a bevelled shape, nor require a bevelled shape, to be effective. The Howick bevelled pebbles exhibit very little or no evidence for flaking or crushing and their use as limpet hammers can be reasonably discounted.

The absence of shellfish from the archaeological deposits in the Howick hut suggests it is unlikely that these tools were used as 'limpet scoops' or for otherwise processing shellfish. They are clearly too large for limpet scoops and they do not have any remnant polish or gloss on the surface of the tool which is an observed consequence of scooping limpets from shells using bone and antler tools (Griffitts and Bonsall 2002, 211), though such traces of use may not form on sandstone pebbles in the same way. The presence of a number of tool blanks inside the hut at Howick raises the question as to why they should store these inside the hut, which was set back from the cliffs and the shellfish beds beyond, when they were clearly readily available from the local beaches where the limpets could also be found. This point is also raised by Roberts regarding a similar distribution of bevelled pebbles and tool blanks at a site in Cornwall (cited in Connock *et al.* 1992, 33).

Consideration of the Howick bevelled pebble tools as hammerstones for use in the flaking of tools also fails to stand up to scrutiny as they are all made from the local coarse-grained sandstone that fractures easily and is much softer than the beach flint worked at the site. The experiments undertaken by the Southern Hebrides Mesolithic Project showed that the elongated pebbles provided only a limited degree of control as knapping tools and that those made from softer rock tended to be ineffective as hammers (Barlow and Mithen 2000). The wear patterns resulting from the experimental use of elongated pebbles as hammerstones were similar to those identified for limpet removal, including pitting, flake removal and fracture, although the level of crushing was more acute and some pieces showed the bevel development (Barlow and Mithen 2000, 517–20). Again these wear patterns are at odds with those identified on the Howick bevelled pebbles (see Chapter 8). Two typical knapping hammerstones were found in the Howick deposits (see Chapter 7) and these were made from hard stone (quartz), were rounded in shape, and had evidence of crushing and pitting on the favoured striking surfaces. With the availability of suitable hammerstones it is unlikely that specially bevelled tools made from the softer sandstone were also being employed for this purpose.

Hide working has been suggested by Jacobi (1980), and more recently by Finlayson (1995), as another use for bevelled pebbles. Finlayson's research on bevelled tools, including those made from bone, antler and stone, from Obanian sites led him to suggest that they represented a labour-intensive craft-working industry, the presence of which could indicate a degree of social stratification through the production of prestige hides. Using Hayden's ethnographic work on the various stages of hide working, and the accompanying illustrations of some coarse stone spalls that were used for hide softening by British Columbian Indians, Finlayson concluded that the bevelled pebbles from Obanian sites may have been formed through their use as hide rubbers/scrapers (Hayden 1990, ill 5; Finlayson 1995, 263). However, the illustrations are not actually of whole pebbles but of split cobbles and spall scrapers, which would most likely have had a more acute edge angle than the elongated pebbles. It can also be noted that based on the, admittedly poor, illustrations the wear on these tools does not appear to be bevelled so much as edge-rounded with polish. Experimental hide softening by the Southern Hebrides Mesolithic Project also resulted in this activity producing a polish as opposed to an altered bevelled end (Barlow and Mithen 2000, 519–20).

Without recourse to a controlled experimental study it is not possible to interpret the nature and extent of wear patterns on the bevelled pebbles from Howick with certainty, although it remains clear that they were not used as hammerstones or limpet hammers/scoops. However, consideration of the contextual evidence from the site, together with the result from the residue analysis, presents an argument for considering their role in relation to skin softeners.

The Howick site has proven exceptional in providing not only one of the largest assemblages of bevelled pebble tools and associated tool blanks, but in this case the bulk of the tools comes from within a discrete activity setting: a dwelling. Apart from one bevelled pebble tool found in external pit [21], one from clay spread [87] and an unstratified piece, all of which were close to the hut, the other bevelled pebbles and tool blanks were found inside the Mesolithic hut, implying that they were used indoors and close to a fire. The analysis of these specimens (see above) has shown that they all appear to have been used in a similar way, suggesting a particular specialist task.

The bulk of the Howick bevelled pebble tools was discarded within the confines of the hut structure, with most of them belonging to Phases 1a and 1b (18) where the contexts were secure. It is not possible to reliably infer any significance from the distribution of the 11 pieces from the upper deposits as these were found in the occupation and levelling layers [210] and [49], which may contain material introduced to level the hut floor.

Consideration of the distribution of the 18 pieces from Phase 1 is instructive as it reveals a distinct arc of tools in the north-east sector of the hut floor in

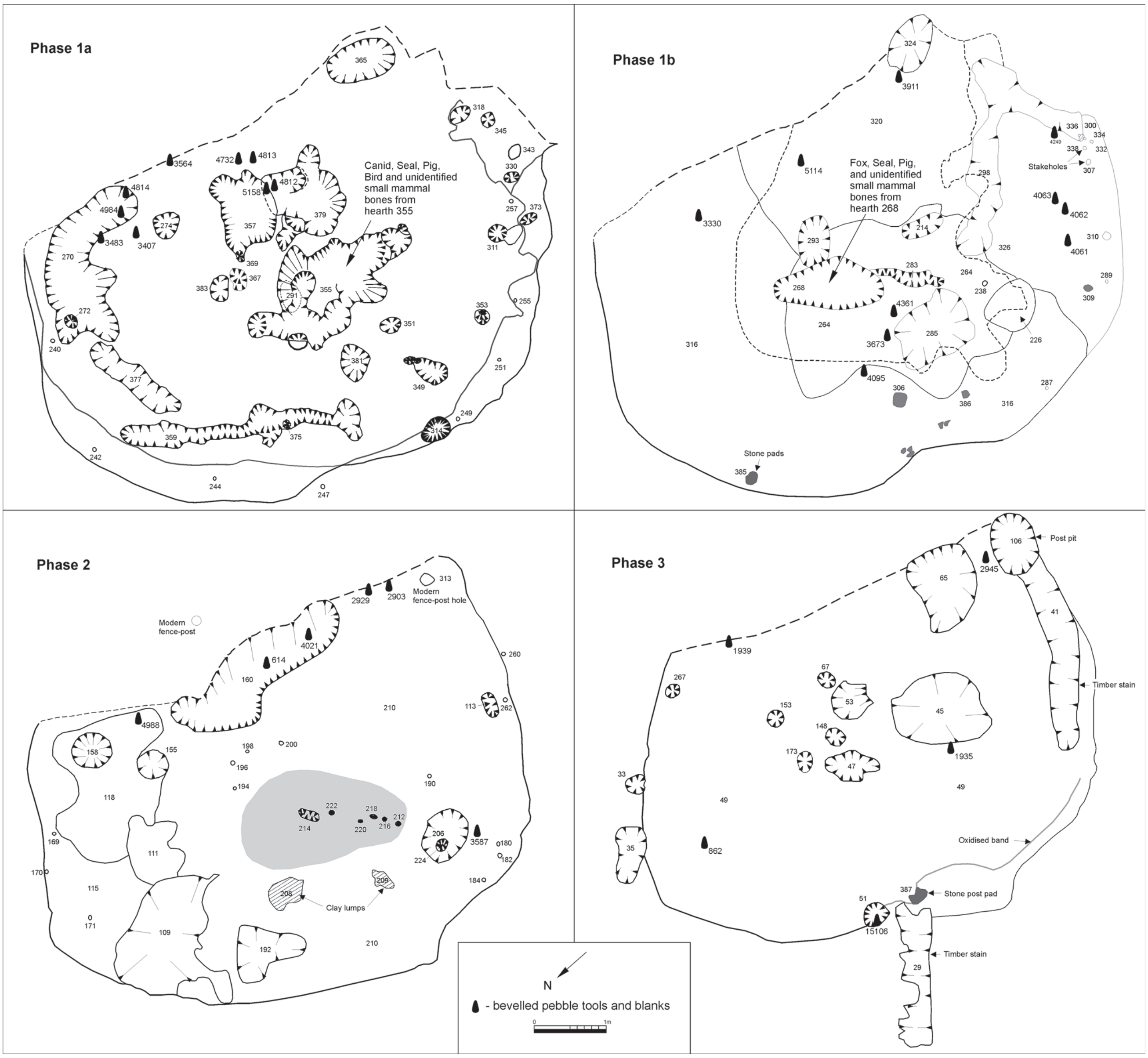


Figure 14.2. Distribution of bevelled pebble tools throughout the different hut phases.

Phase 1a (see Fig. 14.2), suggesting that the activity for which they were used could be undertaken inside, where warmth was preferred. Given the size of the arc, which has a diameter of around 2.5m, this suggests an activity undertaken by one or possibly two people at a time. During Phase 1b the distribution of the bevelled pebbles is not quite so concentrated although it is clear that there was a preference for the south sector of the hut and the central hearth area (see Fig 14.2). This change in the location of the activity could be associated with structural repairs that took place and which mark the transition from Phase 1a to Phase 1b. Perhaps the location of the door was changed. The group of small stake holes observed in the south sector of the Phase 1b hut could potentially be associated with the bevelled-pebble activity in this area.

It appears that the Howick bevelled pebble tools were associated with a specialised activity that took place inside, in a specially dedicated part of the hut where light and heat were important. It is unlikely that a messy job such as the removal of fat from skins took place inside, as this is more likely to be an outdoor task. However, the further working and softening of skins or furs, in preparation for use in the manufacture of clothing and bedding, could easily be undertaken indoors. Such a use gains further credibility when it is considered that the bevelled pebble tool examined as part of the residue analysis (see Chapter 9), which came from the Phase 1a cluster, had carbon residues on it, indicating that the residue had formed by the tool being in contact with either fat, oil, wax or a burnt organic residue. Such a finding is consistent with the use of these tools for softening, or possibly scraping, skins.

Observing the distribution of bevelled pebble tools in Wales and South-West England, Jacobi has made the point that the coastal distribution of these tools can be correlated closely with the breeding colonies of grey seal (Jacobi 1980, 189) and draws attention to the high meat and fat content of these mammals, as well as the suitability of their pelts for skin boats. Sealskins are also very warm and make particularly good clothing. The rock 'steels' that lie off the Howick coastline are well known grey seal basking and breeding grounds and it is surely noteworthy that in the limited faunal assemblage recovered from Howick, grey seal phalange bones were recovered from hearths [355] in Phase 1a and [268] in Phase 1b. When the above arguments are considered in combination, together with the wear patterns, residue analysis, stratigraphic distribution and proximity to hearths that contain evidence for seal processing, a case for the preparation of seal skin seems a reasonable interpretation of the function of the Howick bevelled pebble tools. If they were used for such a purpose then it may be surmised that one reason for the discard of these tools, once they had become smooth and developed a bevel, was that a certain degree of roughness was required on their surface in order to carry out the softening task. This would account for the accumulation of the tools inside the hut and their discard, even though they were not necessarily broken.

The interpretation of the Howick bevelled pebble tools as tools for hide preparation should not, however, be considered a certainty, as the presence of visible striations on the bevels would suggest that either an additional abrasive was used, such as sand, or else the tool was used on a coarser or harder material, perhaps with the skin in between. Although the Howick bevelled pebble tools were not examined microscopically there were no macroscopic traces of a polish or gloss which could be interpreted as a by-product of hide rubbing, though the post-depositional conditions may not have been conducive to their survival or indeed they may not have formed on the surface of sandstone pebbles. Also, the smaller, more damaged bevel present on the opposite face of these tools requires explanation. Since these bevelled pebbles appear to have been used in a downward motion angled slightly away from the body against something that would have enabled the formation of a slightly convex face on the bevel, perhaps other uses such as bark stripping, hollowing the inside of wood or bone for containers, or for some use in basketry may be other possible functions. However, these are not tasks that can be considered exclusive to the coastal economies with which bevelled tools are associated.

There is a growing body of evidence for individual Mesolithic sites having areas for specialist processing activities. At Sand, Skye, another recently excavated Mesolithic site (Hardy and Wickham-Jones 2003), the coarse stone tool assemblage showed a preference for the use of one specific tool type; in this case a facially dished or dimpled stone, the function of which can only be guessed at but which would appear to have been used in a percussive manner, possibly to split bones, crush nuts and seeds, or as a hammer used against a narrow tool such as a chisel or borer (Clarke forthcoming). In contrast, at Kinloch, Rhum, a large assemblage of 59 coarse stone tools contained a variety of types, including bevelled pebble tools and cobbles with ground sides (a type not yet seen from other sites) (Clarke 1990, table 16), indicating that a variety of processing activities took place there. Interestingly too, there was a cache of coarse stone tools found in a pit which included six bevelled pebble tools, four plain hammerstones and four unused cobbles (Clarke 1990, ill 83), suggesting the storage of specific tools for future use. With the discovery of activity areas within the hut at Howick, specific processes also appear to have been spatially delimited within the structure as well as in outdoor settings elsewhere.

Permanency

Consideration of the hut sequence is crucial for understanding the significance of the Howick site. The lack of any visible hiatus in the huts' stratigraphy, together with the precise respect shown by each hut for the position of its predecessor, imply that there was no period of sustained abandonment during the occupation of the huts. Likewise the radiocarbon results show a smooth curve in the dating sequence from Phase 1a to Phase 3, which also suggests that occupation was continuous and not interrupted by phases of abandonment. In addition the charring of the roofing pole tips demonstrates the intentionality of preserving the timbers and thus long term use. These are significant observations as it means that a hut was standing on this site for a period of several generations. Indeed, according to the chronological modelling presented in Chapter 6, a hut stood on the site for *100–300 years (68% probability; use hut*; Fig 6.4). Although the hut was rebuilt on two occasions, and no doubt its appearance changed throughout this period, the key point is that a substantial timber building appears to have stood on this site for at least three, and probably more, generations. In human terms this is a permanent structure as it outlived the life of the individuals who used it. It is plausible that some people may have been born there, lived much of their life there, and ultimately died there. This sense of permanence is further attested by the substantial size of the timber uprights used in its construction.

By erecting a permanent structure, intended to remain standing for generations, this is at one level a physical expression of the social and economic organisation of its residents, and in the case of Howick this points towards a settlement system that involved not only residential stability over generations but also one that did not require significant mobility. At another level, the permanency of the hut signifies an expression of attachment to a particular tract of landscape by the group residing there. This reflects not only on the social organisation of the group and their wider pattern of settlement, but also on the reasons for why the construction of permanent structures was desirable at all at this time. Any permanent structure signifies the presence of people in that place and their attachment to it and as such the Howick huts must have functioned, to some extent at least, as territorial markers, although the extent to which it was visible in a probable woodland setting remains unknown.

The existence of built structures that can be reasonably considered to have been permanent has not been previously acknowledged in the periods prior to the Neolithic in the British Isles. Indeed much has been made of the emergence of permanent built monuments in the Neolithic, and particularly with respect to linking this phenomenon with sedentism and the emergence of social institutions and organisation (e.g. Bradley 2001). The linkage between permanent constructions and a greater degree of sedentism, or a reduction in residential mobility, is surely of significance with respect to understanding residential occupation at Howick.

Site Type

The Howick huts all comprise sunken-floored subcircular features between 5.4m and 6m in diameter. Such huts, often with slightly sunken floors, are common elsewhere in northern Europe during the Mesolithic, particularly in Sweden (e.g. Larsson 1996; Kaliff *et al.* 1997), Denmark (e.g. Grøn and Sørensen 1995; Sørensen 1996) and Norway (e.g. Hesjedal *et al.* 1996; Karsten and Knärrström 2001a). However, other sites directly comparable to Howick have been recorded in the British Isles at Mount Sandel (Woodman 1985), Broom Hill (O'Malley and Jacobi 1978) and at East Barns (Gooder 2007). All the Howick huts have a central hearth area where burning pits and scoops were situated. Within these burnt deposits was debris typically associated with cooking activities including the charred bones of mammals and bird as well as large quantities of charred hazelnut shell. Storage of foodstuffs is attested on the site by the presence of what can best be described as a hazelnut roasting pit in the Phase 2 hut, and possibly a second in the Phase 3 hut. Concentrations of lithic artefacts made from locally available beach flint were distributed across the hut floors and in the fill of features within each hut. The range of stone tool types and their possible uses, as indicated by the morphological, residue and use-wear analysis, are consistent with their utilisation in a wide range of tasks that on other Mesolithic sites are typically associated with processing and butchery activities. The location of the site in an ecotonal setting, overlooking a small estuary, makes it ideally placed for the exploitation of a wide range of food, clothing and building resources throughout the year. Bearing these observations in mind the Howick site can best be perceived as a settlement where long-term residence took place that may or may not have been continuous. Consideration has been given to whether the hut functioned in a different kind of way from a residential site, such as a sweat lodge or ceremonial hut and such questions were in the minds of the excavators from the outset. However, the lack of any evidence for ritual deposits or disposal, the inability of the structure to have performed a function as a sweat lodge and the lack of any human burials leave no direct evidence to support such ideas.

Considering the site from an ideological perspective it is of course possible that the location, form and activities that took place at the hut included ideological, religious and symbolic components, indeed it would be surprising if they did not. Careful excavation and recording, though, failed to produce any evidence for specially placed deposits (as occurred at Culverwell for example, see Palmer 1999, 139–40), stone tools made from exotic materials, unusual made artefacts or structural details inconsistent with domestic occupation, or any evidence for human bones or burial. The presence of small quantities of ochreous material can be interpreted variously, but is most likely to have been used either as a source of mastic in boat construction, as pigment, as part of the tanning process, or perhaps for its medicinal qualities, or perhaps all of these uses. Likewise the evidence for copper exploitation, as indicated by the residue analysis and small amount of copper ore, is perhaps also best considered as a way of acquiring a pigment source. Such pigment could have had a multiplicity of uses ranging from body painting and boat caulking to the dyeing of skins and ritual activities. However, such uses, whether functional, symbolic, ritual or otherwise, remain entirely speculative. The lack of any clear evidence for symbolic or ritualised behaviour does not mean that the Howick hut did not possess such qualities or that associated rites and activities did not take place there. Rather, such elements of the human occupation of the site remain steadfastly elusive even though concerted efforts were made throughout the excavation to identify any signatures that could imply such behaviour. Taking such considerations into account the physical evidence remains consistent with that of domestic occupation. It is therefore fair to conclude that the Howick site is primarily a settlement and that although activities and structural features may have occurred with symbolic, religious and/or ideological concerns in mind, such practices can at this stage only be surmised and not demonstrated.

Settlement Organisation and Economy

One of the key issues that remain is the question of whether occupation at Howick was continuous, seasonal or perhaps periodic. Although the structure appears to have been permanent this does not mean that permanent and continuous residence necessarily took place. Moreover, as we are dealing with such a sustained period of use, over perhaps a couple of centuries, the nature of residency at the site may have changed through time with duration of occupation fluctuating according to social, economic and environmental considerations. According to the current data available, three broad scenarios can be advanced.

Scenario 1 would view the site as a home base with occupation taking place on a seasonal basis for only part of the year (Fig. 14.3). This view conforms to the traditional understanding of Mesolithic settlement patterns in the British Isles, which are thought to have been structured around the seasonal availability of resources across different tracts of landscape. Scenario 2 views the site as being permanently occupied on a continuous basis throughout the year in what amounts to fully sedentary occupation with only occasional overnight forays outside the home base ambit by one or two group members (Fig. 14.3). Scenario 3 views the site as being permanently occupied by some members of the group while other group members moved to temporary camps to exploit seasonally available resources in the surrounding landscape (Fig. 14.3). Variations of all these scenarios are of course possible, such as continuous occupation for several years followed by abandonment and then re-occupation, but at a general level these three scenarios represent the main ways in which settlement organisation can be interpreted at the site.

Given the wealth of resources available at the coast, members of the group would not have had to travel far to acquire food and other resources. This is borne out by the fact that shellfish, marine fish, seals, freshwater fish, nesting birds and their eggs would have all been available within a few hundred metres of the site. Furthermore, all the flint utilised on the site was beach flint and this could also be collected within a short distance. It is likely that the gathered hazelnuts did not come from far away either. This kind of economic strategy whereby most of the group is involved in hunting, gathering and fishing within the area around the camp is usually termed 'residential foraging' (see Smith 1992, 17), and it is this strategy that probably best describes, in broad terms at least, the economic organisation of the Howick occupants. This is not to say that some members of the group did not move further afield from time to time, but that the general pattern was for most of the group to be involved with the exploitation of resources close to the main camp. The kind of more distant trips that may have been undertaken include the hunting of deer, pig and other mammals in the woodland of the interior as well as following salmon runs up the rivers and streams, taking migrating wildfowl along the inland river banks and making contact with, and presumably exchanging goods and news with, other groups who occupied the interior and the higher ground inland.

Currently, there is no compelling evidence either way to determine which of the scenarios represents the most accurate interpretation of settlement organisation at the site and any of the three could be true. What can be concluded is that the site is likely to have formed the main dwelling site utilised in an annual pattern of settlement, and that a considerable portion of yearly residency took place there. If residency was seasonal then the storage of hazelnuts implies occupation during autumn/winter and possibly into the spring.

The lack of any hiatus in the stratigraphic sequence and the absolute dating programme imply that episodes of prolonged abandonment did not occur at the site. Therefore, it is most likely that we are dealing with a structure that was utilised for much of each year. The resources available in the area of the Howick estuary make provision for a wide range of foodstuffs that may have allowed for year-round occupation in the same place. There is also evidence for food storage, as represented by the charred hazelnut shells mentioned above. The estuarine location of the Howick site is a remarkably rich and diverse setting, providing access to the full range of resources available at this time. Figure 14.4 shows the distribution throughout the year of selected resources on this stretch of the coast based on modern patterns of availability.

The types of resources available can be divided into different categories for convenience. Non-food resources such as freshwater, flint, timber, reed and clay were all available locally as well as beach-rolled pebbles that could be utilised as pebble tools. Ochre may also have been obtained from the till deposits. The foodstuffs can be broken down into the following categories: fish, shellfish, mammals, birds and plant foods. A wide range of fish has always been available in the rich fishing grounds of the inshore waters of the North Sea. These include many varieties of sea

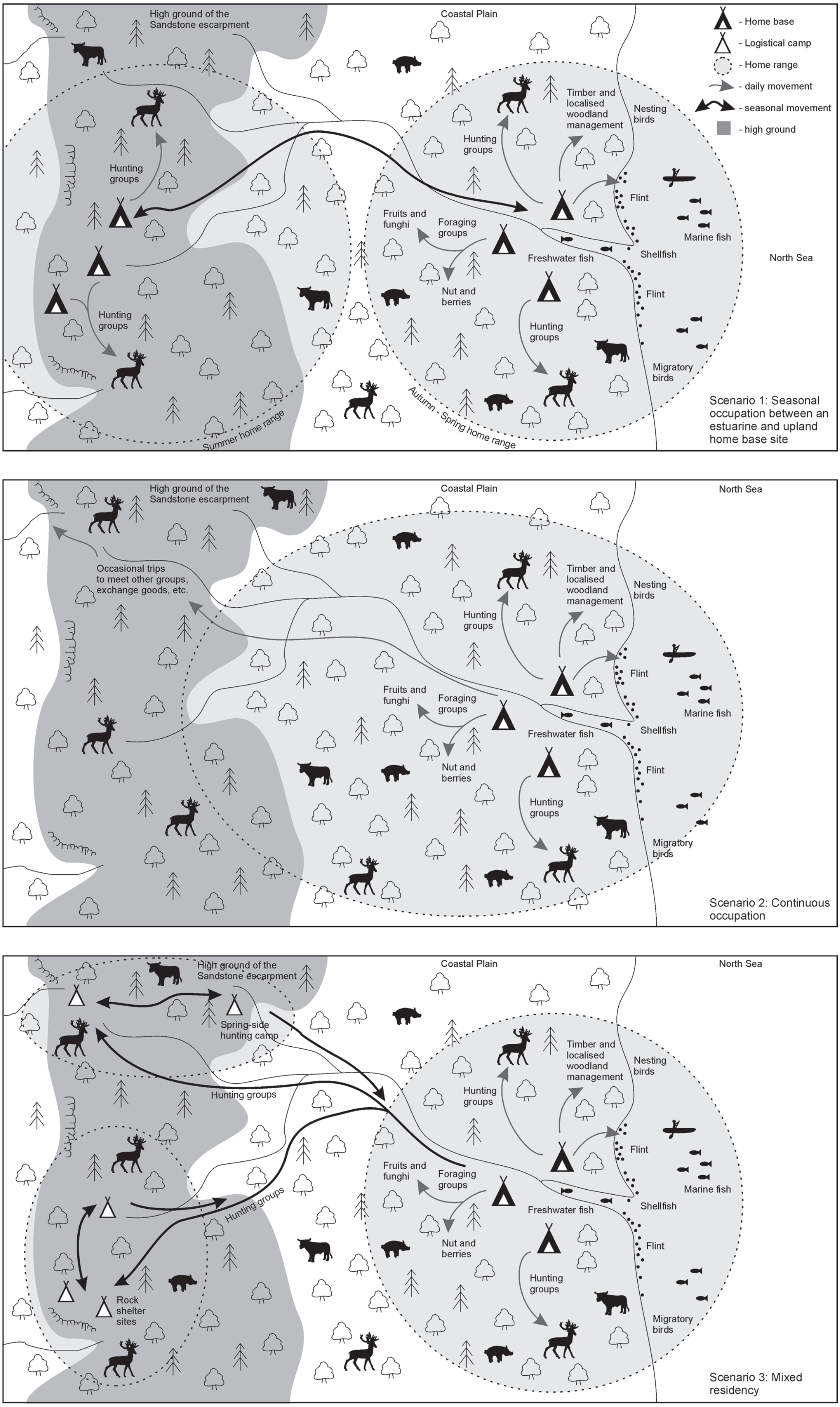


Figure 14.3. Schematic models of early 8th millennium cal BC settlement at Howick.

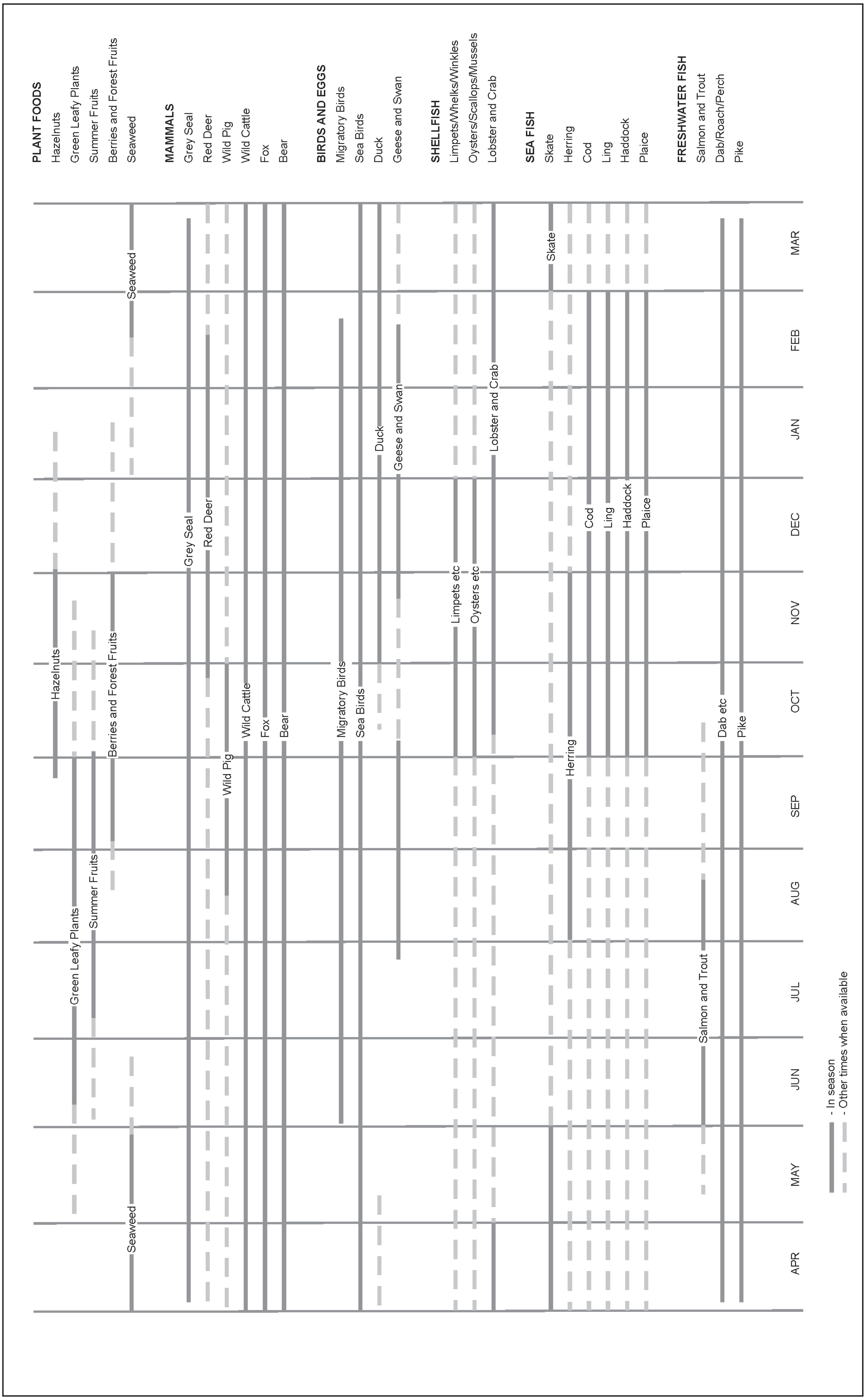


Figure 14.4. Distribution of resources throughout the year based on modern patterns of availability.

fish ranging from herring and white fish to more exotic varieties. Freshwater fish would also be important, and relatively easy to take, in this estuarine location. The type of fish available would include not just the typical freshwater varieties such as pike, perch and dab but also anadromous fish such as salmon and sea trout. Shellfish remain common in these parts and the rock steels give rise to large beds of molluscs and bivalves including limpets, whelks, winkles, scallops, mussels, lobster and crab. The Northumberland coast hosts large colonies of birds as well as the large flocks of migrating birds and fowl. It is no surprise, therefore, that the remains of a large bird, possibly a gull, were identified in one of the hut deposits. The species present on this stretch of coast include the usual range of coastal birds, together with colonies of puffins, eider ducks, geese and swans. Bird eggs may have also featured in the Mesolithic diet and these would have been available in abundance along this stretch of coast, particularly during the nesting seasons. The proximity of woodland would have attracted a different range of woodland species and these may also have featured in the Mesolithic diet. The type of mammals that would have been available include sea mammals such as grey seal, the presence of which is documented in the Howick hearths, and which can still be found basking on the rock steels today. However, the terrestrial fauna may also have featured as a significant resource for the Mesolithic inhabitants, who could not only consume the meat but also use the horn, bone, skins and sinew of these beasts. Although wild pig, fox and dog/wolf were evidenced in the Mesolithic hearth deposits, the other types of fauna that are likely to have been exploited include red and roe deer, wild cattle, brown bear and possibly beaver. Other smaller mammals such as pine marten may also have been taken from time to time. Plant foods, which have been argued as playing a more important role in Mesolithic diets in recent years (e.g. Clarke 1976; Zvelebil 1994), certainly did so in the lives of the Howick residents as attested by the huge quantity of charred hazelnut shell fragments present. However, the role other foods such as fruits, berries, fungi, seaweed and green leafy plants played in the diet of the Howick residents remains unknown. All of these foods would have been easily available, albeit on a strictly seasonal basis, but it is worth mentioning that recent carbon and nitrogen isotope studies indicate that some Mesolithic people appear to have consumed very heavily fish or meat-dominated diets (e.g. Schulting and Richards 2000; 2002, but see Milner *et al*. 2004 for a critical assessment of this method).

It is clear that an ecotonal setting was the favoured location for home base sites during the Mesolithic in North-East England. The Mesolithic flint scatter sites identified in the Milfield basin, and more recently in the Lower Tweed valley, are also positioned on the cusp between diverse areas of the landscape where seasonally available resources from the different ecological niches would have been in easy reach from the centrally located sites (Waddington 1999a, 171–2). However, Howick is not the only site situated in an estuarine setting. The prolific flint scatter site at Crimdon Dene (Raistrick and Westoll 1933; Raistrick *et al.* 1935) on the County Durham coast was also situated above a small estuary and other Mesolithic flint scatters have been found clustered around the shallow waters of Budle Bay to the north (Buckley 1922; 1925). Further afield the site at Mount Sandel may also be considered estuarine, being in easy reach of the coast by way of the River Bann (Woodman 1985, 159).

The Howick hut can be described as a family-sized dwelling that would have accommodated a group of around 6–8 individuals, presumably belonging to the same family group. Indeed the size of the site is directly comparable to Mount Sandel, Broomhill and East Barns, which all have a floor area of about 30 square metres. At these sites only a single structure exists, or only a single structure was thought to be a dwelling, and this also appears to have been the case at Howick. Noting the pattern for the occurrence of single huts, Tolan-Smith has noted that "most of the time people seem to have lived in small, isolated groups" (Smith 1992, 172) and this seems to be the case at Howick. However, given the results of the fieldwalking, which suggest that other settlement foci may exist nearby in locations proximal to the freshwater stream, it is thought likely that a cluster of family groups may have lived in isolated huts around the estuary of the Howick Burn, but spaced several hundred metres or perhaps a few kilometres apart. This pattern of dispersed individual settlements, forming clusters around resource-rich locales, implies the use of specific tracts of land, and sea, by family groups related to each other through kinship ties. Such groups are likely to have had wider kinship connections and cultural affinities with neighbouring groups who may have, together, formed a larger band. It would therefore be expected that aggregations of the larger groups did occur from time to time to reaffirm social and cultural bonds, as well as to exchange news, goods and obtain marriage partners.

The Mesolithic Environment

The sea level model developed by Shennan *et al.* (2000) suggests that the sea was around 4.5m lower than today in the Howick area during the period when the hut was occupied and this would have placed the hut in a more sheltered setting than it is today, set back perhaps a few hundred metres from the shore. As the section of the sediment sequence contemporary with the Mesolithic occupation at Howick appears to have been eroded away by an event that took place close to 6100 cal BC (see Chapter 12), little can be said with certainty regarding the contemporary environment around the Howick settlement. However, it is likely that a mixed tree cover had developed by this time, as the pollen diagram shows that species such as hazel, pine, juniper, willow and even small amounts of oak and elm were present prior to the occupation of the hut. Smaller plants present prior to the Mesolithic occupation included grasses, sedges, ferns and dandelion amongst others (see Fig. 12.13). The presence of hazel and birch together with a range of smaller plants including grasses, flowering plants, goosefoot, stinging nettles, thistle and weeds was identified by the macrofossil analysis. The weeds and disturbed-ground indicators show that the area around the hut is likely to have been cleared back and the prolific presence of charred hazelnut shells shows that the woodland under-storey must have contained a large number of hazel stands. Indeed the volume of nuts is such that it suggests deliberate propagation and management of hazel stands for the production of food, although coppicing for timber poles may have also been important. Taken together it can be expected that the Howick settlement occupied a clearing in an area of relatively open woodland that included a diverse range of species even by this early period. Hazel appears to have been dominant and widely available but other timbers, including some broad-leaf deciduous trees, were also present by this time. Summer temperatures had risen to the same as today's, or slightly higher, by the time the first hut was built and the upward trend in temperatures continued throughout the entire period of occupation and beyond.

In terms of landscape location the Howick settlement would have occupied a sheltered location on a kind of peninsula formed by the sea to one side and the deeply incised valley of the Howick Burn on the other. It would have overlooked an estuary and would have been set back from the shoreline by a few hundred metres. Situated on sandy deposits the site would have been dry, with relatively mild weather resulting from the ameliorating effects of the sea. The wind was probably the key cause for concern, much as it is today. Inland the gently sloping land of the coastal plain is likely to have been wooded, with changes in tree species no doubt taking place when the coastal plain met the more sharply rising ground of the Fellsandstone dip slopes that rise up to the crag lines at 150–200m AOD. In many ways the inhabitants at Howick occupied a very attractive landscape; they would have normally had access to plentiful and tasty food, the climate was good and getting better, the scenery, as today, would have been breathtaking and perhaps more so given the proximity of rich woodlands. It is therefore fitting that today this landscape falls within an area designated as an Area of Outstanding Natural Beauty and a Site of Special Scientific Interest.

Conclusions

The longevity and structural form of the settlement at Howick, together with the evidence for the exploitation of a wide range of resources and diverse activities, suggest a level of complexity rarely evidenced on Mesolithic sites in the British Isles. Furthermore this site is early, belonging to the centuries around 7800 cal BC, making it almost 10,000 years old. This pushes back the emergence of complex hunter-gatherer groups who built permanent structures within Britain to an earlier stage than has previously been thought. Such complexity is usually thought to have emerged in the latter stages of the Mesolithic when it is traditionally thought that settlement became less mobile in the lead up to the introduction/uptake of farming around 4000 cal BC. Such gradualist notions of increasing sedentism and socio-economic complexity fail to account for the ebb and flow of hunter-gatherer organisation and adaptation in different landscape settings, in different climates, with different social and religious trajectories, and at different times. It is possible that in the centuries around 8000 cal BC, groups living along the North-East coast of Britain, as evidenced by the sites at Howick and East Barns, occupied coastal areas near to estuaries with only limited mobility into the uplands, whereas other groups occupying the interior proper may have adopted a more mobile settlement pattern and economic strategy, which involved ranging over wider tracts of land. Acknowledging the potential for diversity in the settlement, economic and social organisation of Mesolithic groups across the British Isles at any one time is key to advancing our understanding of this period. The British Isles is a hugely diverse and ecologically rich area with great variations in geology, topography, vegetation and climate and it must surely follow that the settlement patterns, economic strategies and social values of hunter-gather groups occupying this landmass must have also shown considerable variation. In order to gain more detailed insights into the kind of lifeways hunter-gatherers pursued it is appropriate that we should seek to recognise patterns of hunter-gatherer behaviour at the regional scale.

15 Howick in its North Sea Context

Clive Waddington, Geoff Bailey, Alex Bayliss and Nicky Milner

Setting the Scene

In recent years there has been a rapid growth in the quantity of known Mesolithic settlements around the North Sea Basin with the excavation of hut sites in Britain (Woodman 1985; Green 1996; Gooder in press), Norway (Hesjedal *et al.* 1996; Karsten and Knärrström 2001), Sweden (Larsson 1996; Kaliff *et al.* 1997; Carlsson *et al.* 1999), Denmark (Grøn and Sørensen 1995; Sørensen 1996) and the Low Countries (Crombé 1998), as well as the documentation of underwater sites in the shallow seas off the Danish coast (see Fischer 1995). Building on the earlier work of Newell (1981), and more recently Wickham-Jones (2004), there is a need for a North Sea Basin-wide review of the structural evidence for Mesolithic settlement sites that considers issues such as variations in size, layout, organisation, landscape setting and duration of occupation. There is not space in this volume to tackle this huge topic but it is hoped that the information presented here will go some way to informing that future debate.

It was somewhat serendipitous that the East Barns site should have been found and excavated within a month of completing the Howick excavations. Full dialogue between the excavators has ensured that the sites were compared and the significance of each recognised. With two sites of virtually identical size, basic structural form, date, and position on the same stretch of the North-East British coast, there can be no question of these sites simply being explained as anomalies. They are the two best-preserved Mesolithic dwellings so far discovered on the British mainland, and as the significance of their remains filters through, these sites will reshape our understanding of Mesolithic settlement in Britain. One of the sites was excavated as part of a conservation-recording project (Howick), while the other was excavated as part of a developer-led project (East Barns). Both sites have produced high-calibre output, demonstrating that both conservation-led and developer-led archaeology in the UK can produce important results for hunter-gatherer archaeology.

One of the key features of the 8th millennium cal BC hut sites of the British Isles is the striking similarities between all the known sites (Fig. 15.1). The hut sites which date from this period include Howick, East Barns (Gooder in press), Mount Sandel (Woodman 1985) and Broom Hill (O'Malley and Jacobi 1978). Although a later (c. 6500 cal BC) and considerably smaller site (around 4m diameter with a corresponding floor space of 13 square metres), the hut eroding from the cliff edge at Cass-Ny-Hawin on the Isle of Man (Woodman 1984) has a similar, though less robust, structural form and layout to these sites. As can be seen in Figure 15.1, with the exception of Cass-Ny-Hawin, all these sites are of similar size measuring between 5.5m and 6m in diameter. They all have a floor area in the region of 30 square metres as well as a sunken floor with a central hearth area. Furthermore they all have evidence for internal settings of posts located close to the hut edge as well as clusters of stake holes. Although the Broom Hill site is located inland it is within a relatively short distance of the coast, while all the other sites can be considered either coastal or estuarine.

The North Sea Basin in the Early 8th Millennium cal BC

Although Ireland had become separated from the rest of Britain by c. 9000 cal BC as a result of rising sea level, Britain remained connected to the European mainland by way of a land bridge, connecting the area from Flamborough Head southwards with the German Bight and the Low Countries. This North Sea Plain was probably extensively settled by human groups who would have had rich pickings in the wetlands, mudflats and sandbanks of this low-lying expanse. However, during the time of the Howick settlement, the sea level rose rapidly (see Smith 1992; Coles 1998; Shennan *et al.* 2000), resulting in large tracts of land being inundated, and this is likely to have led to settlement contraction, and ultimately population dispersals, from this once vast North Sea Plain.

During the period the Howick site was occupied, Britain was not an island but a western and northern

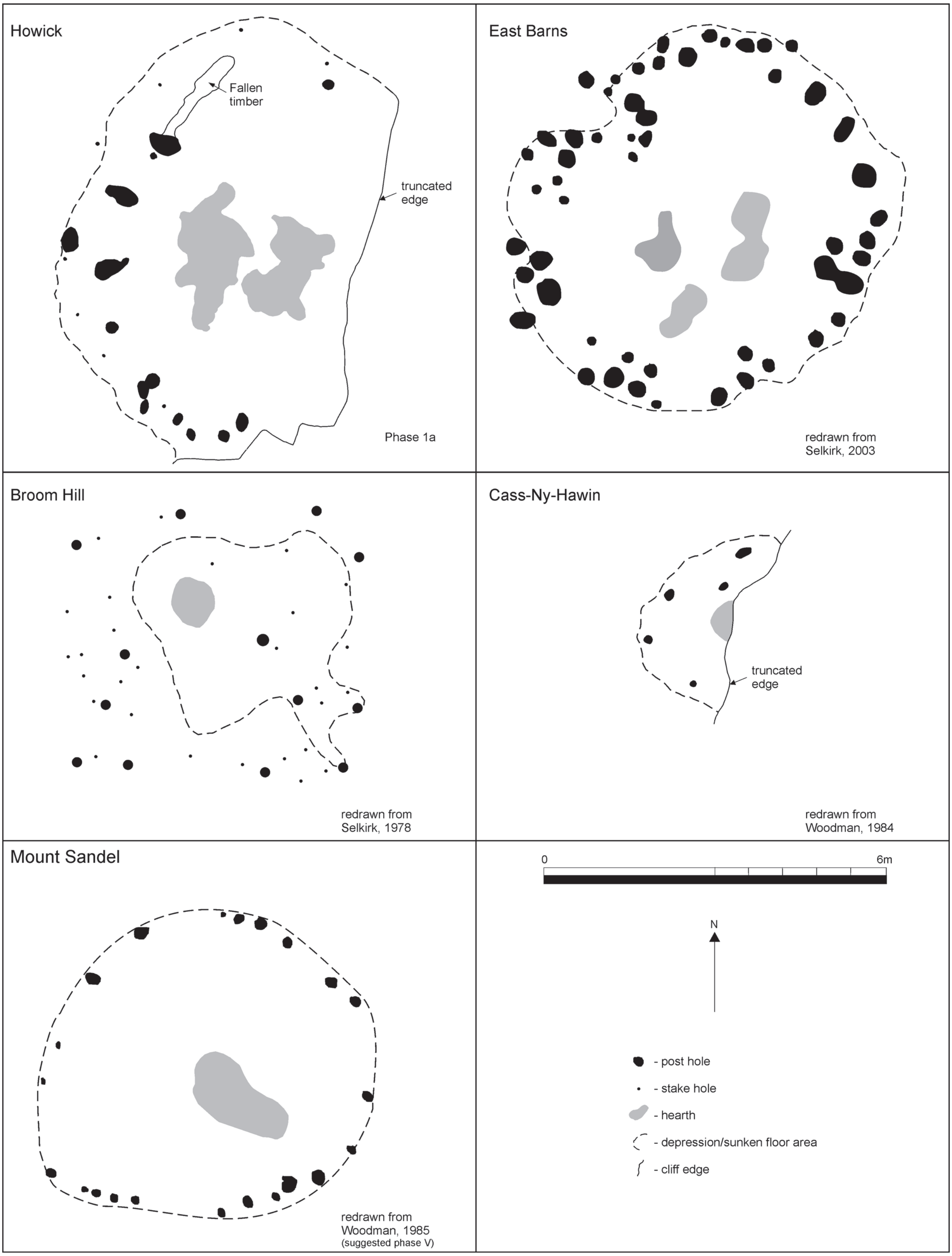


Figure 15.1. Mesolithic hut sites recorded in the British Isles. All date from the 8th millennium cal BC with the exception of Cass-Ny-Hawin on the Isle of Man which is later and dates to c. 6500 cal BC.

extension of the European landmass. It formed the western side of what was a North Sea Basin, open only to the north. Looking out on to this basin from Howick, the inhabitants of this site must have had a very different sense of geography than later generations, who may have become aware that they had become cut off from the rest of Europe when the land bridge was breached. Today in Britain the sense of being an island nation is so deeply rooted in our psyche that it is difficult to conceptualise being attached to Europe. For the residents at Howick, sea level change was happening around the North Sea Basin at a very rapid rate that would probably have been observable within an individual's lifetime. This knowledge of a rising sea and loss of land, particularly in the areas to the south of Howick, may have been a widely known and perhaps feared process. Not only would this have led to visible changes in the coastal landscape and river valleys of the surrounding lands, but it would also have caused populations occupying the lowest-lying areas to be displaced. One of the authors (CW) contends that a consequence of this may have been the exertion of pressure on surrounding areas as groups competed for space and resources, or else looked to colonise under-populated or empty areas. With movement across the North Sea Basin, by way of coast hugging and/or island hopping in skin boats, the Mesolithic people inhabiting this coastline may have been able to travel relatively rapidly across long distances. This could have led to swift information exchange and rapid movements of people. Rather than being seen as a barrier, the North Sea may have provided the means by which groups were able to interact, share ideas, build reciprocal relationships, exchange goods, resolve disputes and maintain allegiances on a regular basis. If people around this vast basin looked towards the North Sea as the hub around which their lives were structured, then the cultural and geographic milieu (as implied by the narrow-blade micro-triangle techno-complex and its distribution around this area) in which the Howick people engaged was one that linked them with groups in modern-day Scandinavia and the Low Countries and areas that now lie beneath the North Sea. Rather than being considered an extension of the Mesolithic settlement of southern England and part of that broader cultural and economic milieu, the northern British, and possibly the early northern Irish sites, can be better considered as part of a different cultural and economic sphere centred on the North Sea Basin.

Mesolithic Settlement

Understanding the Howick settlement in relation to contemporary settlements in the British Isles suggests it is not as anomalous as perhaps first thought, particularly in the light of new sites reported in the companion volume to this monograph (Waddington and Pedersen 2007). It forms one of a number of known hut structures in the British Isles that date to the first half of the 8th millennium cal BC (see Figs. 15.3–15.20b and Table 15.1), all of which are within short distances of their respective coasts, and all for family-sized social units. Within the more specific context of North-East Britain, other dated sites of similar age to Howick are known at Filpoke Beacon in County Durham, East Barns near Dunbar, Cramond near Edinburgh and at Fife Ness in Fife (Fig. 15.2). Excepting East Barns, these sites are smaller than the Howick site, consisting of a few pits, stake holes and hearths suggestive of small temporary camps. Although it belongs to the same narrow-blade industry as the Howick and East Barns material, the flint assemblage from the Fife Ness site appears to be highly specialised, with the emphasis on crescentic microliths, which implies that this was a specialist extraction/hunting camp of some sort (Wickham-Jones and Dalland 1998). Other sites with similar lithic assemblages to the Howick and East Barns settlements, though not yet radiocarbon dated, include the scatter of material from an eroding land surface at Ness End Quarry on Lindisfarne (Young 2000a), as well as the sites known around Newbiggin (Raistrick 1933), Hart (Weyman 1984) and Crimdon Dene (Raistrick *et al.* 1935). Therefore, the 8th millennium cal BC settlements of the North-East British coast appear to have been home to a variety of different sites including home-bases in the more resource-rich settings such as estuaries, and specialist small-scale temporary camps in other areas where a particular resource may have been available at certain times of the year.

Inland there are few dated Mesolithic sites that can be compared with the dated coastal settlements. However, flint scatters containing directly analogous narrow-blade forms have been found along the major river valleys of the Tweed (Mulholland 1970), Till (Waddington 1999a) Tyne (Tolan-Smith 1997) and Wear (Young 1987), suggesting the spread of narrow-blade traditions inland from the coast. Rock shelter sites are known at various points on the sandstone escarpments of Northumberland (Burgess 1972; Beckensall 1976; Waddington 1999a; John Davies pers. comm.) and these may have formed logistical short-stay camps that worked in association with home base sites located on river valley gravel terraces, such as those in the valleys of the Till and the Tweed (Mulholland 1970; Waddington 1999a), or those in similar locations to that at Howick such as Newbiggin (Raistrick 1934), Lyne Hill (Raistrick 1933; 1934) and Crimdon Dene (Raistrick and Westoll 1933; Raistrick *et al.* 1935).

Although definable classes of 8th-millennium

1 Sand, Lochalsh
2 Kinloch
3 Fordhouse Barrow
4 Morton
5 Fifeness
6 Druimvargie
7 Staosnaig, Colonsay
8 Lussa 1
9 Cramond
10 East Barns
11 Auchareoch, Arran
12 Daer Resevoir
13 Castleroe
14 Mount Sandel
15 Newferry
16 Lough Boora
17 Howick
18 Filpoke Beacon
19 Stump Cross
20 Warcock Hill 3
21 Broomhead Moor 5
22 Wetton Mill Minor
23 Rhuddlan
24 Trwyn Du
25 Aveline's Hole
26 Marsh Benham
27 Prestatyn
28 Tolpits Lane
29 Broxbourne 5
30 Caldey Island sites
31 Kettlebury
32 Greenham Dairy Farm
33 Broomhill
34 Oakhanger VII
35 Longmoor

Figure 15.2. Radiocarbon dated 8th millennium cal BC sites and shoreline of the British Isles. The palaeoshorelines are derived from Shennan et al. *2000.*

settlement types are now emerging in the North-East region (such as home bases, small specialist coastal camps, and perhaps some of the undated rock shelter sites), this patchwork of sites suggests that settlement systems operating over this region included a range of strategies that may have differed between different sub-regions. Although potential home base sites have been identified inland on the raised gravel terraces of the rivers Till and Tweed, they are currently thought to have functioned within settlement systems that involved logistical foraging in the uplands (e.g. Waddington 1999a). This would contrast with the settlement pattern suggested for the coast where the annual range of movement appears to have been rather restricted and set within a more tightly defined area. Acknowledging the landscape-specific dimension of Mesolithic settlement systems in North-East Britain allows for a more nuanced understanding of both individual sites and groups of sites within the widely varying topographies of this region. This stands in contrast to the use of generic models that conflate settlement patterns throughout the Mesolithic into one model and which also fail to account for the variation and subtleties that can be seen in both the archaeological record and the configuration of what is a highly varied landscape.

Until recently it has been widely understood that the human colonisation of northern Britain first occurred on the west side of the country. Smith accurately summarised the evidence available in the early 1990s in the following passage from his synthetic work on the British Mesolithic (Smith 1992, 172):

> "The main development during this period [8999bp–8000bp = 8200 cal BC–7000 cal BC] is the spread of settlement up the west coast as far as Kinloch, on the island of Rhum and to Mount Sandel and Lough Boora in Ireland. No such movement is recorded in eastern Britain, the most northerly site dating from before 8000bp [7000 cal BC] being Filpoke Beacon in County Durham. The explosive settlement of north-western Britain and Ireland merits special attention."

The figures in square brackets have been added so that it is clear which periods the author is referring to.

The explanation given by Smith at the time for this 'explosive' settlement expansion up the west coast was considered to be the increasing marine biomass made available by the warmer temperatures of the western seas as a result of the North Atlantic Drift. This in turn would have attracted human groups further northwards as they pursued maritime-oriented economic strategies. This explanation fitted well with the available data at the time, but given the new dates that are now available for sites on the North-East coast of Britain this pattern has now been entirely reversed.

Based on the currently available radiocarbon determinations, the earliest dates for northern Britain are now on east coast sites (see below and Figs. 15.3–15.20b). The sites at Cramond, East Barns and Howick are all earlier than any of the North-West coast sites by several centuries, while other sites such as Fife Ness and Filpoke Beacon have similar dates to the North-West sites. The earliest dated site is that at Cramond, where a series of reliable radiocarbon determinations has been obtained (Ashmore 2004; Saville 2004). Modelling of these dates shows this site is most likely to have been occupied in the centuries before 8000 cal BC (see below, Fig. 15.12). It now appears that the initial colonisation, or infilling at least, may have taken place on the east side of northern Britain in the coastlands bordering the North Sea Basin. However, penetration inland along river valleys to upland locations is perhaps suggested at this time by the single early date from the Daer Reservoir site in the Lowther Hills above Nithsdale near Dumfries (Ashmore 2004; Saville 2004; Figs. 15.2 and 15.4), although this is just a single date on *Pomoideae* charcoal from a pit fill associated with a flint scatter site that also has a later date implying that this early date could be from residual material.

Why Mesolithic Hut Building in the 8th Millennium cal BC?

It is perhaps no coincidence that permanent hut sites were constructed around the British Isles in the first half of the 8th millennium cal BC during precisely the same period that the North Sea Plain was being rapidly inundated by rising sea levels. In the view of one of the authors (CW), the displacement of human groups by the rising sea is thought to have prompted movement away from the drowned areas of the North Sea Plain to higher land, which in turn could have led to population pressure on neighbouring areas. One response to such pressure may have been to build permanent huts, possibly as territorial markers, in order to protect access to the rich and already inhabited lands around the North Sea margin. Once Britain was finally isolated from the continent, the pressure and stresses resulting from the presence of incoming groups would have lessened and this could account for the absence of huts of Howick, East Barns, Mount Sandel or Broom Hill proportions after this time. It remains interesting to see whether future discoveries will fit into this pattern or whether they will show permanent huts of these proportions being built over a much longer span. Presently, however, these huts remain a tightly dated phenomenon and as such may reflect a particular response to a specific set of historical, social, economic and environmental circumstances. Once competition for resources had settled down the need for permanent structures that signalled access to territory and resources would have diminished. Although this explanation for Mesolithic hut building in the 8th millennium cal BC may be somewhat simplistic and environmentally linked, it nevertheless acknowledges the correlation between the timing of the known hut sites in the British Isles and the single most significant change to affect the British landscape since the end of the last Ice Age, namely sea level rise and the separation of Britain from the European landmass.

Re-calibration of other 8th Millennium cal BC sites in the British Isles

By Alex Bayliss and Clive Waddington

In order to place the Howick site in its broader temporal context, the radiocarbon determinations from potentially contemporaneous British archaeological sites have been assembled (Table 15.1). These results have been re-calibrated as described above for the Howick site (see Chapter 6), allowing for

Site	Material and context	Laboratory Number	$\delta^{13}C$ (‰)	Radiocarbon Age (BP)	Weighted mean (BP)	Calibrated date range (95% confidence)	Reference
Auchareoch	hazelnut shell from pit in quarry face	OxA-1601	-25.0 (assumed)	8060±90	-	cal BC 7320 – 6680	Affleck *et al.*1988 Hedges *et al.* 1989
Aveline's Hole	human bone, disarticulated right distal humerus	OxA-1070	-21.0 (assumed)	8740±100	-	cal BC 8210 – 7580	Hedges *et al.* 1987 Jacobi 1987
Aveline's Hole	human bone, disarticulated right distal humerus	OxA-800	-21.0 (assumed)	8860±100	-	cal BC 8270 – 7600	Gowlett *et al.* 1986 Jacobi 1987
Broomhead Moor Site 5	charred wood fragments from the archaeological layer	Q-800	-25.0 (assumed)	8573±110	-	cal BC 7940 – 7370	Radley *et al.* 1974 Switsur *et al.* 1975
Broom Hill	charcoal from the base of pit 3	Q-1192	-25.0 (assumed)	8540±150	8459±87 cal BC 7610 – 7210 T'=1.3; v=2; T'(5%)=6.0	cal BC 8160 – 7190	O'Malley and Jacobi 1978
Broom Hill	replicate of Q-1192	Q-1383	-25.0 (assumed)	8315±150		cal BC 7600 – 7040	O'Malley and Jacobi 1978
Broom Hill	replicate of Q-1192	Q-1528	-25.0 (assumed)	8515±150		cal BC 7960 – 7180	O'Malley and Jacobi 1978
Broom Hill	charcoal from clay in the top of pit 3	Q-1460	-25.0 (assumed)	7750±120	-	cal BC 7040 – 6390	O'Malley and Jacobi 1978
Broom Hill	hazelnuts from 5cm above pit 3 infill	Q-1191	-25.0 (assumed)	7220±120	-	cal BC 6380 – 5810	O'Malley and Jacobi 1978
Broxbourne Site 105	wood (? *Pinus* sp.) from below the Mesolithic horizon	Birm-343	-25.0 (assumed)	8700±170	-	cal BC 8270 – 7380	Shotton and Williams 1973
Castleroe	bulk charcoal from occupation layer	UB-2171	-	8755±135	-	cal BC 8270 – 7540	Woodman 1978a: 13-4
Castleroe	bulk charcoal from Pit 1	UB-2172	-	8560±75	-	cal BC 7750 – 7480	Woodman 1978a: 13-4
Cramond	hazelnut from pit 1430	OxA-10178	-23.3	9105±65	-	cal BC 8530 – 8230	Lawson 2001
Cramond	hazelnut from pit 1425	OxA-10144	-23.1	9110±60	-	cal BC 8520 – 8230	Lawson 2001
Cramond	hazelnut from pit 1430	OxA-10179	-24.0	9130±65	-	cal BC 8530 – 8230	Lawson 2001
Cramond	hazelnut from spread 1409, sealing pit 1425 and scoop 1432	OxA-10143	-23.5	9150±45	-	cal BC 8530 – 8260	Lawson 2001
Cramond	hazelnut from spread 1409	OxA-10145	-24.9	9230±50	-	cal BC 8610 – 8280	Lawson 2001
Cramond	hazelnut from scoop 1432, cut into pit 1430	OxA-10180	-26.0	9250±60	-	cal BC 8690 – 8280	Lawson 2001
Daer Reservoir 2	birch charcoal from a pit in forager knapping site	AA-30355	-25.1	8055±75	-	cal BC 7310 – 6690	Ward 1998
Daer Reservoir 2	Pomoideae charcoal from a pit in forager flint knapper site	AA-30354	-26.7	9075±80	-	cal BC 8520 – 7970	Ward 1998
Druimvargie	bone artefact from midden in rock shelter NMSX.HL 416	OxA-4608	-22.1	8340±80	-	cal BC 7580 – 7080	Bonsall *et al.* 1995 Hedges *et al.* 1998
East Barns	hazelnut shell from post hole sealed within the hut	AA-54961	-24.0	8830±70	-	cal BC 8240 – 7650	Gooder in press
East Barns	hazelnut shell from post hole sealed within the hut	AA-54962	-24.3	8835±65	-	cal BC 8240 – 7650	Gooder in press
East Barns	hazelnut shell from post hole sealed within the hut	AA-54960	-23.0	8985±70	-	cal BC 8290 – 7960	Gooder in press
Fife Ness	hazelnut shell from fill of pit F 84	AA-25202	-26.4	8275±65	-	cal BC 7530 – 7080	Wickham-Jones and Dalland 1998
Fife Ness	hazelnut shell from fill of pit F 84	AA-25203	-24.5	8340±60	-	cal BC 7550 – 7180	Wickham-Jones and

Table 15.1. Radiocarbon determinations from comparable dated sites in the British Isles (c. cal BC 8300–7000 [c. 9200–8000 BP]). (Continued over the next three pages).

Site	Material and context	Laboratory Number	$\delta^{13}C$ (‰)	Radiocarbon Age (BP)	Weighted mean (BP)	Calibrated date range (95% confidence)	Reference
							Dalland 1998
Fife Ness	hazelnut shell from fill of pit F 70	AA-25204	-23.5	8505±75	-	cal BC 7650 – 7370	Wickham-Jones and Dalland 1998
Fife Ness	hazelnut shell from fill of pit F 70	AA-25205	-24.9	8405±60	-	cal BC 7580 – 7200	Wickham-Jones and Dalland 1998
Fife Ness	hazelnut shell from fill of pit F 63	AA-25206	-23.6	8355±60	-	cal BC 7580 – 7180	Wickham-Jones and Dalland 1998
Fife Ness	hazelnut shell from fill of pit F 63	AA-25207	-24.2	8420±65	-	cal BC 7590 – 7210	Wickham-Jones and Dalland 1998
Fife Ness	hazelnut shell from fill of pit F 61	AA-25208	-23.6	8510±70	-	cal BC 7610 – 7380	Wickham-Jones and Dalland 1998
Fife Ness	hazelnut shell from fill of pit F 61	AA-25209	-26.8	8475±75	-	cal BC 7600 – 7350	Wickham-Jones and Dalland 1998
Fife Ness	hazelnut shell from occupation layer F46	AA-25210	-21.8	8410±60	-	cal BC 7580 – 7210	Wickham-Jones and Dalland 1998
Fife Ness	hazelnut shell from occupation layer F46	AA-25211	-25.7	8460±85	-	cal BC 7610 – 7320	Wickham-Jones and Dalland 1998
Fife Ness	hazelnut shell from the lower fill of pit F41	AA-25212	-22.9	8545±65	-	cal BC 7680 – 7480	Wickham-Jones and Dalland 1998
Fife Ness	hazelnut shell from the lower fill of pit F41	AA-25213	-25.2	8495±65	-	cal BC 7610 – 7380	Wickham-Jones and Dalland 1998
Fife Ness	hazelnut shell from the upper fill of pit F41	AA-25214	-23.2	8510±65	-	cal BC 7610 – 7380	Wickham-Jones and Dalland 1998
Fife Ness	hazelnut shell from the upper fill of pit F41	AA-25215	-24.7	8490±60	-	cal BC 7600 – 7380	Wickham-Jones and Dalland 1998
Filpoke Beacon	bulk hazelnut shells from burning spread with associated flints	Q-1474	-25.0 (assumed)	8760±140	-	cal BC 8270 – 7540	Jacobi 1976: 71
Fordhouse barrow	hazelnut shell from pit 21	OxA-10059	-23.2	8255±55	-	cal BC 7520 – 7080	Proudfoot 2001: 122
Fordhouse barrow	hazelnut shell from pit 21	OxA-8225	-23.1	8100±45	-	cal BC 7300 – 6860	Proudfoot 1999
Fordhouse barrow	hazelnut shell from layer 330	OxA-10058	-25.1	7920±50	-	cal BC 7050 – 6640	Proudfoot 2001: 122
Fordhouse barrow	hazelnut shell from pit 20	OxA-10057	-23.9	7890±50	-	cal BC 7040 – 6590	Proudfoot 2001 122
Greenham Dairy Farm	red deer bone with a stratified habitation layer in a cut-off palaeochannel fill	Q-973	-25.0 (assumed)	8779±110	-	cal BC 8240 – 7580	Switsur and West 1973: 542 Sheridan *et al.* 1967
Kettlebury Site 103	hazelnut shell from box H10.7	OxA-378	-25.0 (assumed)	8270±120	-	cal BC 7580 – 7050	Gillespie *et al.* 1985 Reynier 2002: 226
Kettlebury Site 103	hazelnut shell from box 18.9	OxA-379	-25.0 (assumed)	7940±120	-	cal BC 7290 – 6470	Gillespie *et al.* 1985 Reynier 2002: 226
Kettlebury Site 103	hazelnut shell from box 46A at 20cm depth	OxA-6395	-25.0 (assumed)	7990±90	-	cal BC 7290 – 6640	Reynier 2002: 226
Kettlebury Site 103	hazelnut shell from box 16B at 27cm depth	OxA-6396	-25.0 (assumed)	7890±80	-	cal BC 7060 – 6500	Reynier 2002: 226
Kinloch	hazelnut shell from hollow BA S2	GU-2150	-25.7	8310±150	-	cal BC 7600 – 7040	Wickham-Jones 1990
Kinloch	hazelnut shell from lower fill of pit AJ2	GU-2040	-25.1	8560±75	-	cal BC 7750 – 7480	Wickham-Jones 1990
Kinloch	hazelnut shell from pit AD5	GU-1873	-24.9	8590±95	8575±85	cal BC 7940 – 7480	Wickham-Jones 1990

Site	Material and context	Laboratory Number	$\delta^{13}C$ (‰)	Radiocarbon Age (BP)	Weighted mean (BP)	Calibrated date range (95% confidence)	Reference
Kinloch	replicate of GU-1873	GU-1874	-23.8	8515±190	T'=0.1; v=1; T'(5%)=3.8 cal BC 7780 – 7480	cal BC 8200 – 7070	Wickham-Jones 1990
Kinloch	hazelnut shell from fill of pit BA1	GU-2146	-25.0	8080±50	-	cal BC 7300 – 6830	Wickham-Jones 1990
Kinloch	hazelnut shell from fill of pit complex BA4/5	GU-2039	-25.3	7925±65	T'=18.9; v=1; T'(5%)=3.8	cal BC 7060 – 6610	Wickham-Jones 1990
Kinloch	replicate of GU-2039	GU-2149	-25.3	7570±50		cal BC 6470 – 6260	Wickham-Jones 1990
Kinloch	hazelnut shell from fill of hollow BA 10	GU-2147	-25.1	7880±70	-	cal BC 7050 – 6500	Wickham-Jones 1990
Kinloch	hazelnut shell from fill of pit BA3	GU-2145	-25.0	7850±50	-	cal BC 7030 – 6530	Wickham-Jones 1990
Longmoor	hazelnut shell	OxA-377	-25.0 (assumed)	8760±110	-	cal BC 8240 – 7580	Gillespie *et al.* 1985 Reynier 2002: 226
Longmoor	hazelnut shell	OxA-376	-25.0 (assumed)	8930±100	-	cal BC 8290 – 7740	Gillespie *et al.* 1985 Reynier 2002: 226
Lough Boora		UB-6400	-	8350±70	-	cal BC 7580 – 7180	
Lough Boora	bulk charcoal	UB-2200	-	8350±70	-	cal BC 7580 – 7180	Woodman 1978a: 323-5
Lough Boora	bulk charcoal	UB-2267	-	8450±70	-	cal BC 7600 – 7330	Woodman 1978a: 323-5
Lough Boora	bulk charcoal	UB-2199	-	8475±75	-	cal BC 7600 – 7350	Woodman 1978a: 323-5
Lussa 1	charcoal and *Corylus* shell from base of small ring of stones	SRR-160	-28.2	8194±350	-	cal BC 8200 – 6380	Mercer 1980; Harkness and Wilson 1974: 249-50
Lussa 1	mixed charcoal and *Corylus* shell from two small stone rings	SRR-159	-30.5	7963±200	-	cal BC 7520 – 6420	Mercer 1980; Harkness and Wilson 1974: 249-50
Marsh Benham	bulk hazelnut	OxA-5195	-23.7	8905±80	-	cal BC 8270 – 7740	Hedges *et al.* 1996: 191-2
Mount Sandel Lower	eroded (?) bulk charcoal from cutting A, layer 2	UB-591	-	7720±525	-	cal BC 7940 – 5560	Woodman 1985
Mount Sandel Lower	eroded (?) bulk charcoal from cutting C, layer 2	UB-532	-	8490±210	8412±201 T'=2.2; v=1; T'(5%)=3.8 cal BC 7960 – 7040	cal BC 8200 – 7050	Woodman 1985
Mount Sandel Lower	bulk charcoal from cutting C, layer 1	UB-592	-	7360±695		cal BC 7760 – 4800	Woodman 1985
Mount Sandel Upper	charcoal and hazelnuts from F56/4	UB-2358	-	8795±135	-	cal BC 8270 – 7570	Woodman 1985
Mount Sandel Upper	charcoal from F109	UB-2359	-	7885±120	-	cal BC 7080 – 6460	Woodman 1985
Mount Sandel Upper	from F100/2, higher up than UB-912	GrN-10470	-	8380±50	T'=7.8; v=1; T'(5%)=3.8	cal BC 7580 – 7200	Woodman 1985
Mount Sandel Upper	hazelnuts and charcoal from F100/2	UB-912	-	8725±115		cal BC 8230 – 7540	Woodman 1985
Mount Sandel Upper	charcoal and hazelnuts from F56/1	UB-2360	-	8670±100	T'=6.7; v=2; T'(5%)=6.0	cal BC 8160 – 7540	Woodman 1985
Mount Sandel Upper	charcoal from F56/1	UB-951	-	8790±185		cal BC 8410 – 7480	Woodman 1985
Mount Sandel Upper	from F56/1	GrN-10471	-	8430±60		cal BC 7590 – 7330	Woodman 1985
Mount Sandel Upper	hazelnuts and charcoal from F27	UB-2008	-	8440±65	-	cal BC 7590 – 7330	Woodman 1985
Mount Sandel Upper	charcoal from F74	UB-2361	-	8545±165	-	cal BC 8200 – 7180	Woodman 1985
Mount Sandel Upper	hazelnuts and charcoal from F31/0	UB-913	-	8555±70	-	cal BC 7730 – 7480	Woodman 1985
Mount Sandel Upper	hazelnuts + charcoal from F31	UB-2007	-	8795±135	-	cal BC 8270 – 7570	Woodman 1985
Mount Sandel Upper	charcoal from occupation layer L-M-N/35	UB-2356	-	8765±135	-	cal BC 8270 – 7540	Woodman 1985
Mount Sandel Upper	charcoal from occupation layer N/31,	UB-2357	-	8955±185	-	cal BC 8610 – 7590	Woodman 1985

Site	Material and context	Laboratory Number	$\delta^{13}C$ (‰)	Radiocarbon Age (BP)	Weighted mean (BP)	Calibrated date range (95% confidence)	Reference
	P/31-32						
Mount Sandel Upper	hazelnuts + charcoal from F56/5	UB-952	-	8960±70	-	cal BC 8290 – 7840	Woodman 1985
Mount Sandel Upper	charcoal from F99	UB-2362	-	8990±80	-	cal BC 8410 – 7940	Woodman 1985
Newferry Site 3 Zone 7	charcoal from J6 Sandbank	UB-637	-	8895±125	-	cal BC 8300 – 7600	Woodman 1977
Oakhanger Site VII	hazelnut	Q-1489	-	9225±170	-	cal BC 9120 – 7970	Switsur and Jacobi 1979: 54
Oakhanger Site VII	wood charcoal	Q-1490	-	8995±160	-	cal BC 8600 – 7600	Switsur and Jacobi 1979: 54
Oakhanger Site VII	wood charcoal	Q-1491	-	9100±160	-	cal BC 8730 – 7820	Switsur and Jacobi 1979: 54
Oakhanger Site VII	charcoal, *Pinus* and *Corylus* shell from Level 2	Q-1494	-	8885±160	-	cal BC 8450 – 7580	Switsur and Jacobi 1979: 54
Oakhanger Site VII	charcoal, probably *Pinus* from Level 2	Q-1492	-	8975±160	-	cal BC 8550 – 7600	Switsur and Jacobi 1979: 54
Oakhanger Site VII	charcoal, probably *Pinus* from Level 2	Q-1490	-	8995±160	-	cal BC 8600 – 7600	Switsur and Jacobi 1979: 54
Ogof-yr-Ychen	human bone	OxA-7741	-15.9	8415±65	-	cal BC 7590 – 7200	David 2004, DATELIST
Ogof-yr-Ychen	human bone	OxA-7690	-15.0	8280±55	-	cal BC 7520 – 7080	DATELIST
Ogof-yr-Ychen	human bone	OxA-7691	-14.4	8210±55	-	cal BC 7450 – 7060	DATELIST
Potter's Cave	human bone	OxA-7688	-17.0	8580±60	-	cal BC 7740 – 7530	DATELIST
Potter's Cave	human bone	OxA-7687	-16.1	7880±55	-	cal BC 7040 – 6590	DATELIST
Prestatyn	hazelnut shell from the archaeological horizon	OxA-2268	-23.5	8700±100	-	cal BC 8200 – 7540	DATELIST
Prestatyn	hazelnut shell from the archaeological horizon	OxA-2269	-23.6	8730±90	-	cal BC 8210 – 7580	DATELIST
Rhuddlan	hazelnut shells	BM-691	-	8739±86	-	cal BC 8210 – 7580	Burleigh *et al.* 1976: 27-8
Rhuddlan	hazelnut shells	BM-822	-	8528±73	-	cal BC 7680 – 7380	Burleigh *et al.* 1976: 27-8
Sand	bevel-ended bone artefact in Spit 8	OxA-10152	-22.1	8470±90	-	cal BC 7600 – 7320	Ashmore 2004: 102
Staosnaig	hazelnut shell from small pit in Area A	AA-21627	-25.1	8110±60	-	cal BC 7320 – 6830	Mithen 2000: 373
Stump Cross	bulk charcoal	Q-141	-	8450±310	-	cal BC 8270 – 6640	Godwin and Willis 1959: 69
Tolpits Lane	bulk charcoal	Q-1147	-	8260±120	-	cal BC 7580 – 7040	Switsur and Jacobi 1979: 57
Trwyn Du	hazelnut shell from F13	Q-1385	-	8640±150	-	cal BC 8210 – 7370	White 1978: 16-39
Trwyn Du	hazelnut shell from F13	HAR-1194	-	8590±90	-	cal BC 7940 – 7480	White 1978: 16-39
Warcock Hill III	charcoal, oak and birch from Pit 5	Q-789	-	8606±110	-	cal BC 7970 – 7480	Radley *et al.* 1974; Switsur and West 1975: 44-5
Wetton Mill Minor	bone fragments in proximity to Mesolithic flint artefacts	Q-1127	-21.0 (assumed)	8847±210	-	cal BC 8540 – 7520	Switsur and West 1975: 45-6

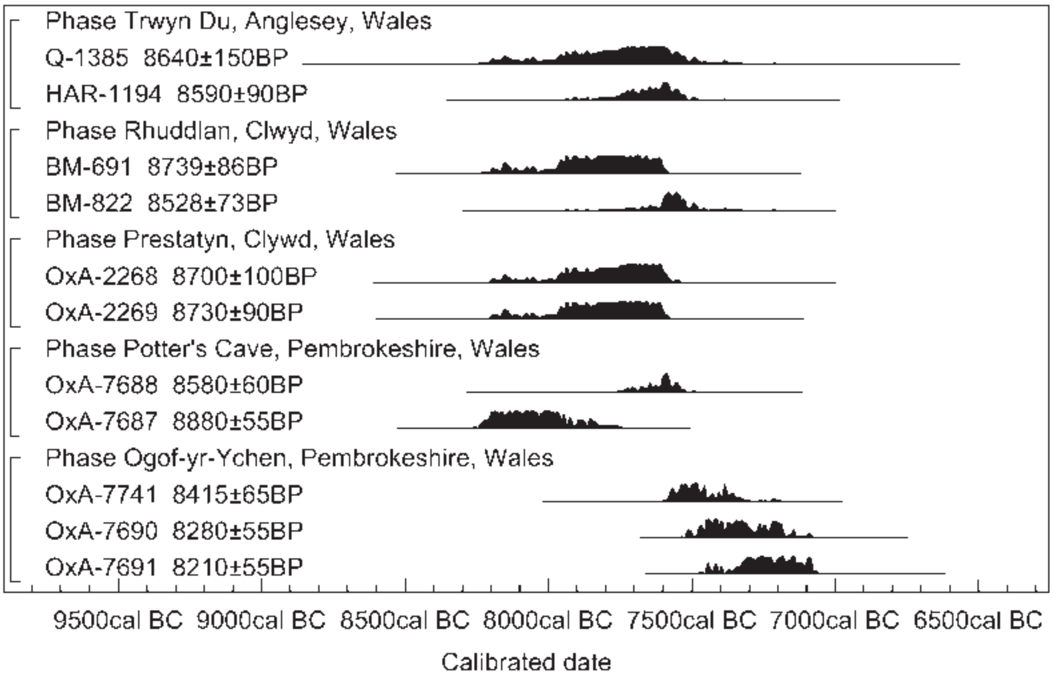


Figure 15.3. Calibrated radiocarbon dates from English archaeological sites potentially contemporaneous with Howick.

direct comparison between sites. More in-depth discussion of newly discovered settlement sites can be found in the edited volume by Waddington and Pedersen (2007). A few archaeological sites with 8th millennium cal BC radiocarbon dates have been excluded from this table where the association between the sample and the archaeology is uncertain (e.g. Hengistbury Head, Kew Bridge, Redkirk Point and Thatcham Site II). The locations of the sites in Table 15.1 are shown in Figure 15.2.

Figures 15.3–15.6 show the calibrated dates for those sites where few measurements are available, and where there is insufficient information for chronological modelling. It must be made clear that these dates are of mixed quality. Nine of the samples are of unidentified charcoal, and so may have an 'old wood' offset of up to several centuries. Two measurements were obtained from material bulked from more than one context (SRR-160 and Q-1127) and so may represent average ages of material of varying calendar date. A further nine measurements were obtained from bulked fragments of charred plant material from single contexts. These latter results may provide a fair indication of the actual date of these sites, if all the dated material was of the same age, freshly deposited, and from short-lived species (e.g. hazelnuts burnt in a hearth). Seventeen measurements are available from single-entity samples, which should accurately date activity at the sites concerned. A range of sites is represented in Figs. 15.3–15.6, including pits, occupation horizons, burnt deposits, rock shelters, a midden, caves and the Lussa Wood settlement. It is likely that the human skeletons dated from Caldey Island may be rather later than shown here (Fig. 15.5; Ogof-yr-Ychen and Potter's Cave). The stable isotope values from these individuals indicate a high proportion of marine protein in their diets, which would introduce a marine offset in the interpretation of these radiocarbon measurements (Schulting and Richards 2002, table 1). It is currently difficult to quantify this effect reliably, however (Bayliss *et al.* 2004).

Slightly more extensive dating has been obtained from three other hut sites, of similar age and structural form to Howick. Three determinations are currently available from hazelnut shell fragments from a post hole within the recently excavated hut at East Barns, near Dunbar, Lothian, Scotland (Gooder in press). These fall around 8000 cal BC (Fig. 15.7). At Broom Hill, Hampshire (O'Malley and Jacobi 1978), three bulk samples of unidentified charcoal from the structure (pit 3) provide statistically consistent measurements. These samples are earlier than those from the overlying deposits (Q-1460 and Q-1191). This information is incorporated in the chronological model shown in Figure 15.8. The radiocarbon results are consistent with the recorded archaeological sequence, suggesting that there may not be a significant old wood effect. The model suggests that the hut at Broom Hill was used in *cal BC 7610–7300 (93% probability, pit 3 (structure)*; Fig. 15.8). Fifteen bulk samples have been dated from the Mount Sandel settlement (Mount Sandel Upper), Co Londonderry, Northern Ireland (Woodman 1985) although additional dates have since been acquired and will be published in due course (Woodman pers com.). All of

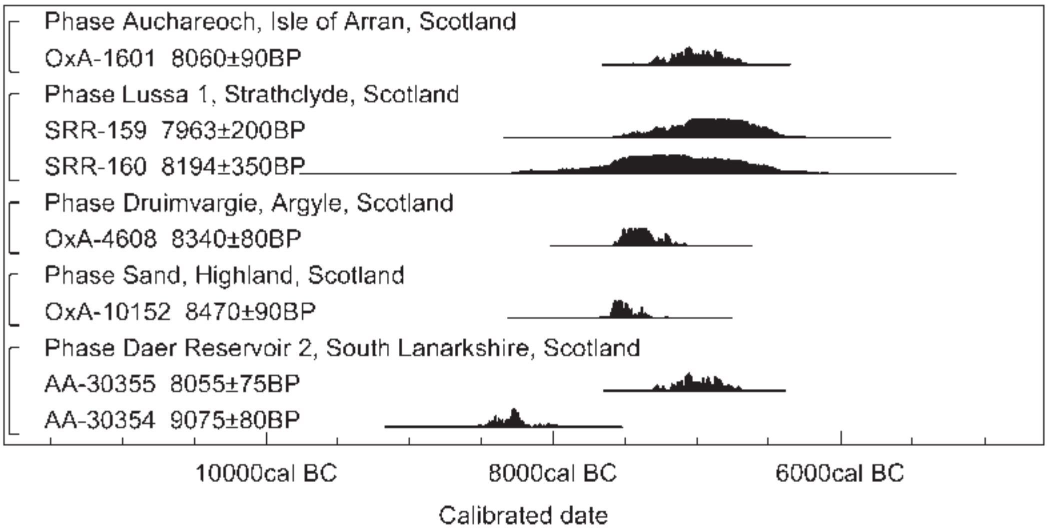


Figure 15.4. Calibrated radiocarbon dates from Scottish archaeological sites potentially contemporaneous with Howick.

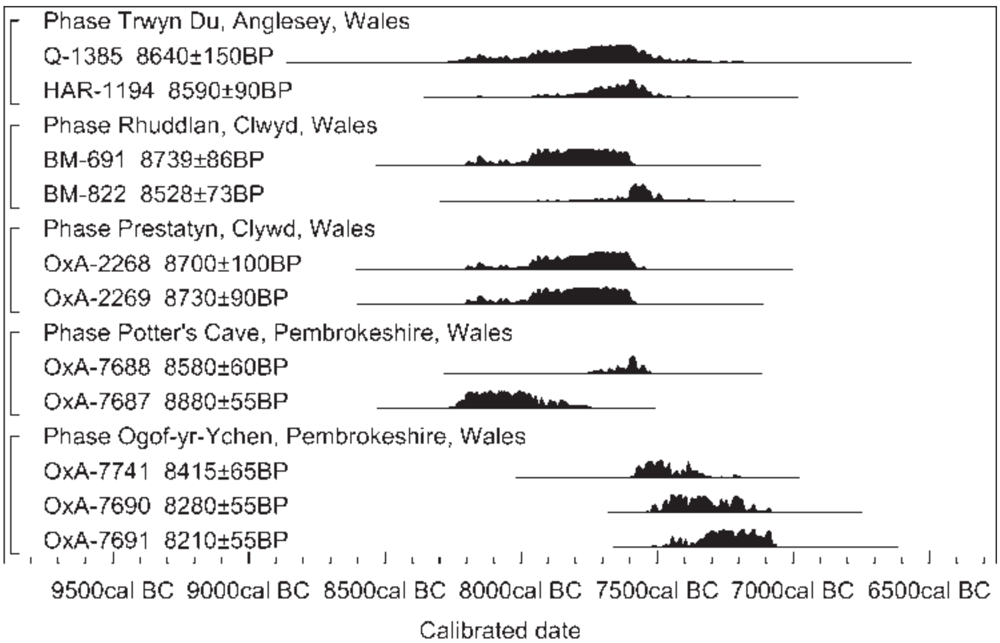


Figure 15.5. Calibrated radiocarbon dates from Welsh archaeological sites potentially contemporaneous with Howick.

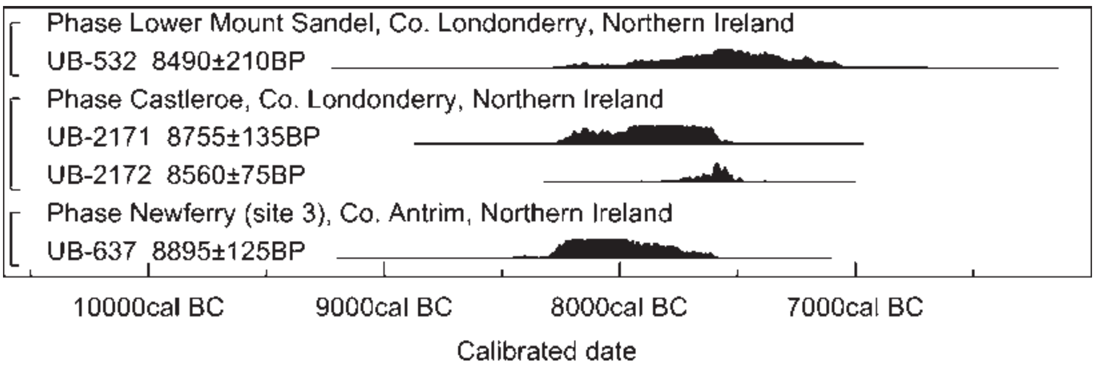


Figure 15.6. Calibrated radiocarbon dates from Irish archaeological sites potentially contemporaneous with Howick.

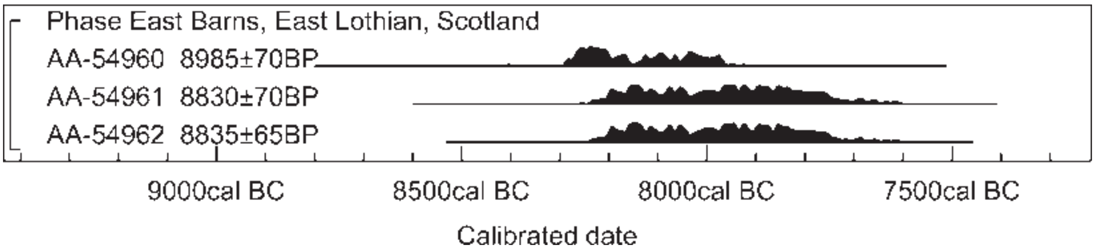


Figure 15.7. Calibrated radiocarbon dates from the hut at East Barns, East Lothian, Scotland (see Gooder in press).

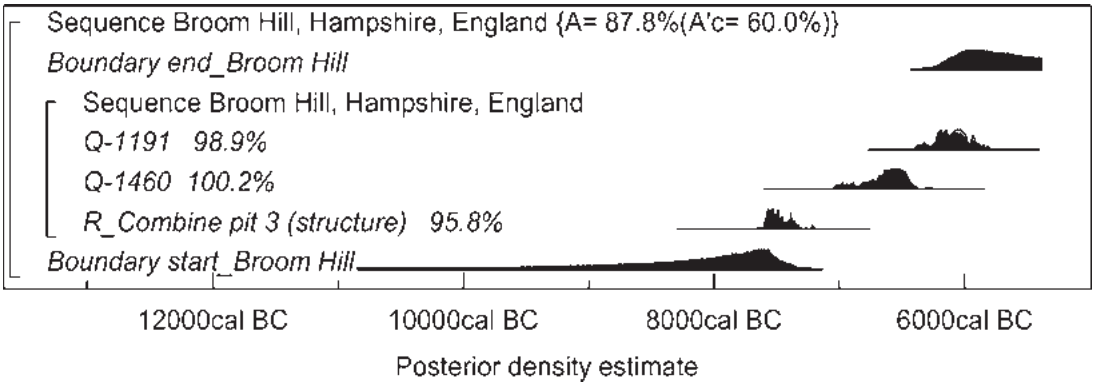


Figure 15.8. Probability distributions of dates from Broom Hill, Hampshire. The format is identical to that of Figure 6.1. The large square brackets down the left hand side along with the OxCal keywords define the overall model exactly.

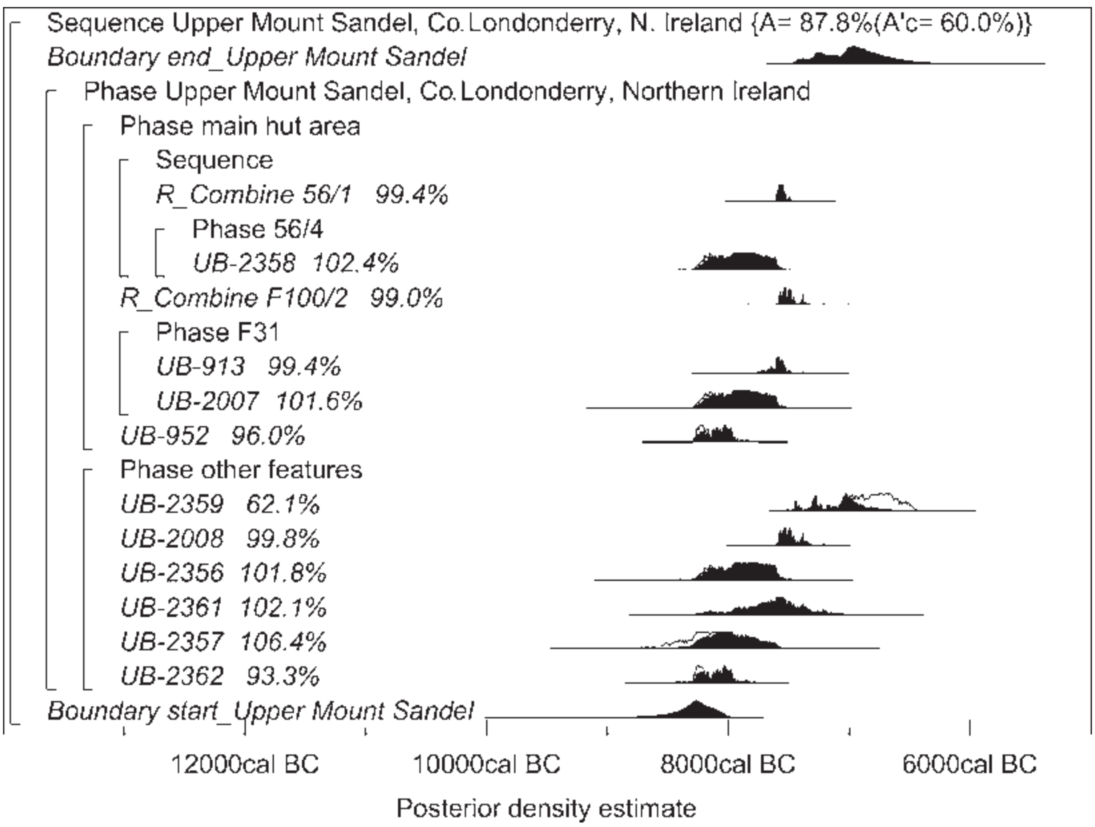


Figure 15.9. Probability distributions of dates from the Mount Sandel settlement (Mount Sandel Upper), Co Londonderry, Northern Ireland. The format is identical to that of Figure 1. The large square brackets down the left hand side along with the OxCal keywords define the overall model exactly.

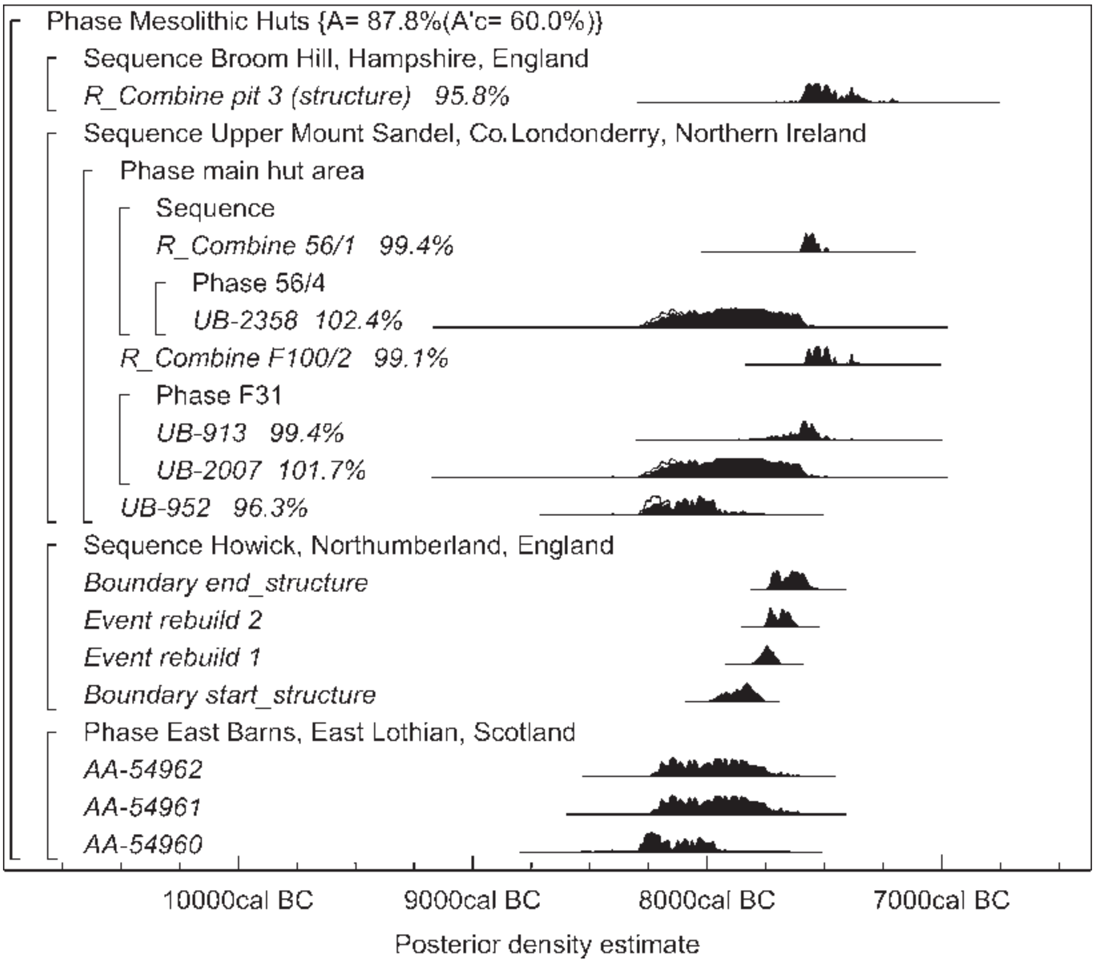


Figure 15.10. Probability distributions for the dates of occupation of Mesolithic huts analogous to Howick from the British Isles. These distributions have been obtained from the chronological models shown in Figures 6.2, 15.4, 15.5 and 15.6.

these contained unidentified charcoal which might suffer from the old-wood effect, although in the only case where there is a stratigraphic relationship between samples (in the main hut), this is consistent with the radiocarbon results (*UB-2358 and 56/1*; Fig. 15.9). In both cases where there are replicate measurements from the same deposit, however, these are statistically inconsistent, suggesting that these samples may have contained material of varying calendar age or that there was some problem in laboratory processing (as suggested by Woodman [2004]). Because of this problem, the best estimate for the use of the main hut area is probably provided by the later samples, falling around 7500 cal BC (see Phase main hut area; Fig. 15.9). The dated samples from other features on the site outwith the main hut area may be contemporary with this structure, or may be somewhat earlier (see Phase other features; Fig. 15.9). Because of the possibility of old-wood offsets, this remains unknown.

Figure 15.10 shows the dates of occupation of huts analogous to the Howick site. It can be seen that all four structures fall in a cluster in the first half of the eighth millennium cal BC (c. 8000–7500 cal BC). The structure at East Barns is probably the earliest of the four huts, followed by the Howick hut, and slightly later by those at Mount Sandel and Broom Hill. We have seen that the Howick hut was in use for several generations (Fig. 6.4). The existing radiocarbon measurements from the other huts do not allow similar estimates to be made for these structures. They may have been in use for a similar period, as the stratigraphy at East Barns and Mount Sandel could suggest. It should be noted that the scatter on the measurements from these sites apparent in Figure 15.10 is an artefact of the limited dating evidence available, and does not suggest a period of prolonged use for these structures.

A model for the chronology of occupation at the small Mesolithic camp at Fife Ness, Fife, Scotland is shown in Figure 15.11. The results form a very tight group, consistent with a limited period of occupation. They are also consistent with the only stratigraphic information included in the model – that the lower fill of pit F41 is earlier than the upper fill. This model suggests that the site was occupied between *7600–7520*

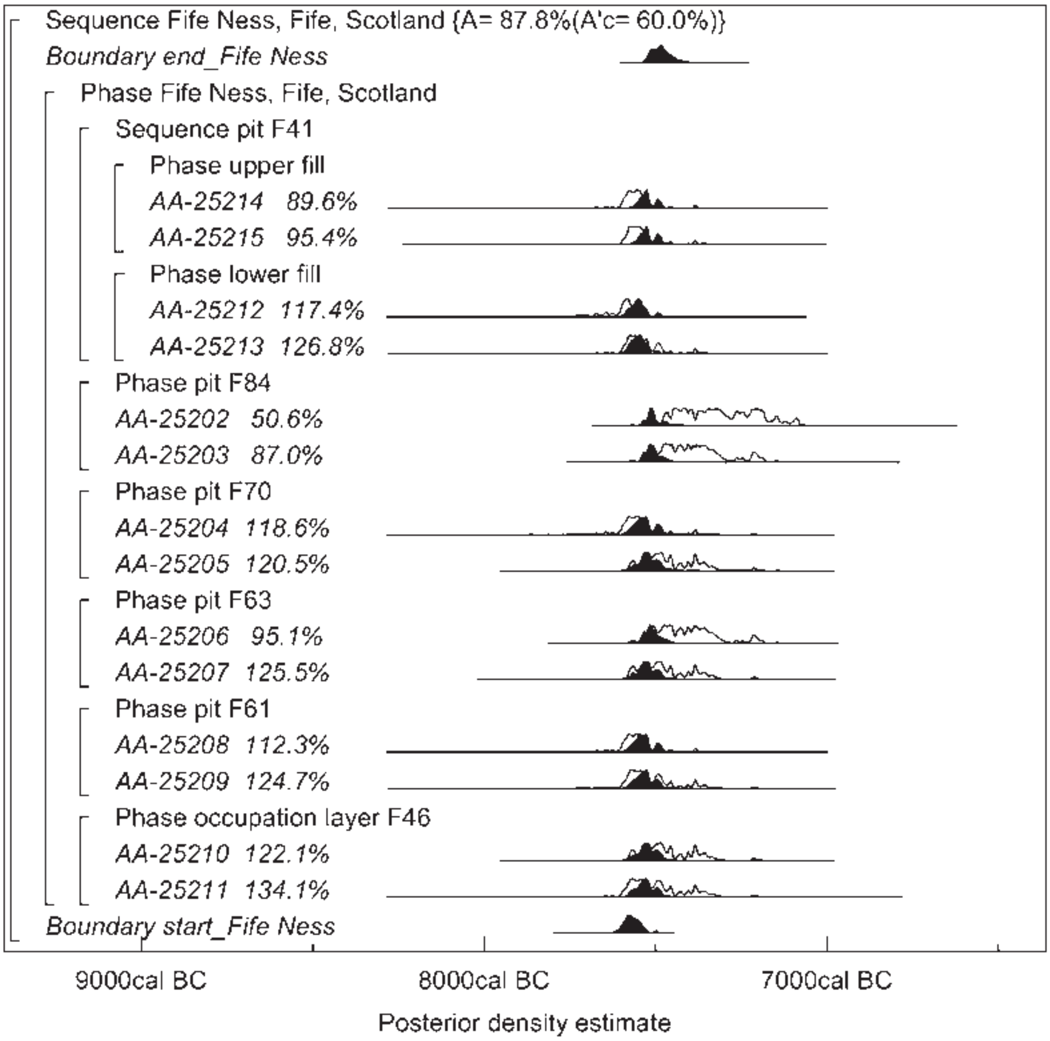


Figure 15.11. Probability distributions of dates from the Mesolithic camp at Fife Ness, Fife, Scotland. The format is identical to that of Figure 6.1. The large square brackets down the left hand side along with the OxCal keywords define the overall model exactly.

cal BC (93% probability) and *7540–7400 cal BC (95% probability)*. The pit group at Cramond, Edinburgh, Scotland also seems to have been used for a limited period of time in the third quarter of the 9th millennium cal BC (Fig. 15.12). Again, the radiocarbon measurements are consistent with the stratigraphic information incorporated in the model that pit 1430 was earlier than pit 1432. These dates provide the earliest evidence so far for the use of a typologically 'Later Mesolithic' tool kit in the British Isles (Saville 2004, 206–7).

The chronology of the occupation site at Kinloch, Rhum, Scotland is shown in Figure 15.13. As suggested by Wickham-Jones (1990, 135), it is possible that the activity in areas AD and AJ is earlier than the occupation in area BA. The radiocarbon results from areas AD and AJ are statistically consistent, and so may represent a single episode of occupation. The radiocarbon measurements from area BA, however, are not consistent, and so must represent a prolonged phase of activity. It is not clear whether these two phases were separated by a period of abandonment or whether they form part of a chronological continuum of activity across the site. A model that incorporates this latter interpretation shows good agreement (Fig. 15.13, $A_{overall}$=87.8%; Bronk Ramsey 1995), and so this is also a plausible explanation. In either case, activity on the site spanned rather more than 1000 years, from c. 7800 cal BC–c. 6500 cal BC.

The limited dating currently available for the Mesolithic pits below the Fordhouse Barrow, Angus, Scotland is shown in Figure 15.14. These results do not form a consistent group, suggesting this activity took place over some period in the centuries around 7000 cal BC.

Figure 15.15 shows the dating of the occupation site at Lough Boora, Co. Offaly, Ireland. Despite being bulk samples of unidentified charcoal from unknown contexts, these results are remarkably consistent, suggesting the site was occupied for a limited period c. 7500 cal BC.

The site at Oakhanger VII, Hampshire, England

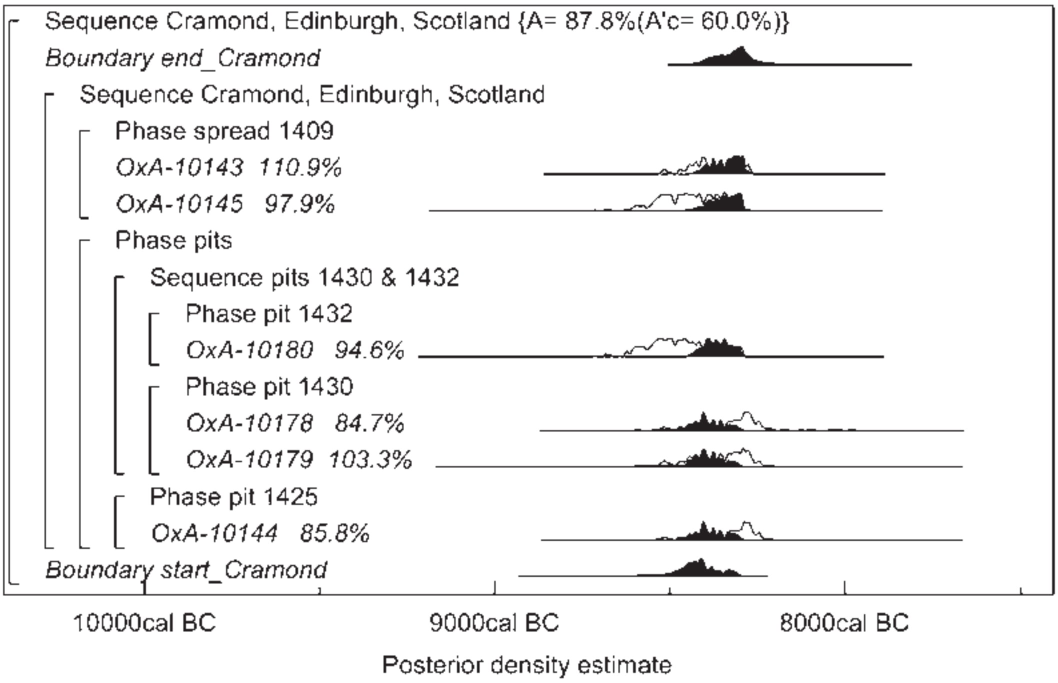


Figure 15.12. Probability distributions of dates from the pit group at Cramond, Edinburgh, Scotland. The format is identical to that of Figure 6.1. The large square brackets down the left hand side along with the OxCal keywords define the overall model exactly.

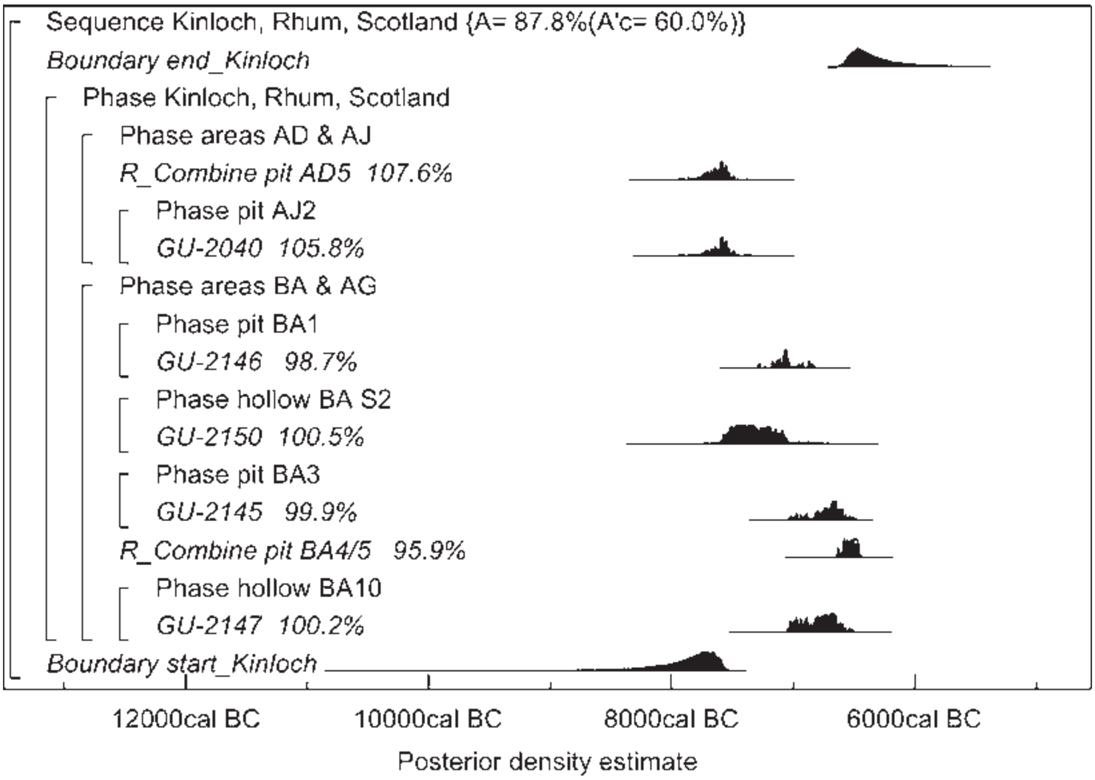


Figure 15.13. Probability distributions of dates from Kinloch, Rhum, Scotland. The format is identical to that of Figure 6.1. The large square brackets down the left hand side along with the OxCal keywords define the overall model exactly.

also appears to have been occupied for a relatively short period of time, as it has produced six consistent radiocarbon measurements (Fig. 15.16; Jacobi 1981). Two of the samples were of unidentified charcoal, although the consistency of these measurements with those from known short-life material (e.g. Q-1489) suggests that wood-age offsets may not be a significant problem. However, the samples were of bulked material from the phase 2 horizon and so may represent material of a range of actual ages. Never-

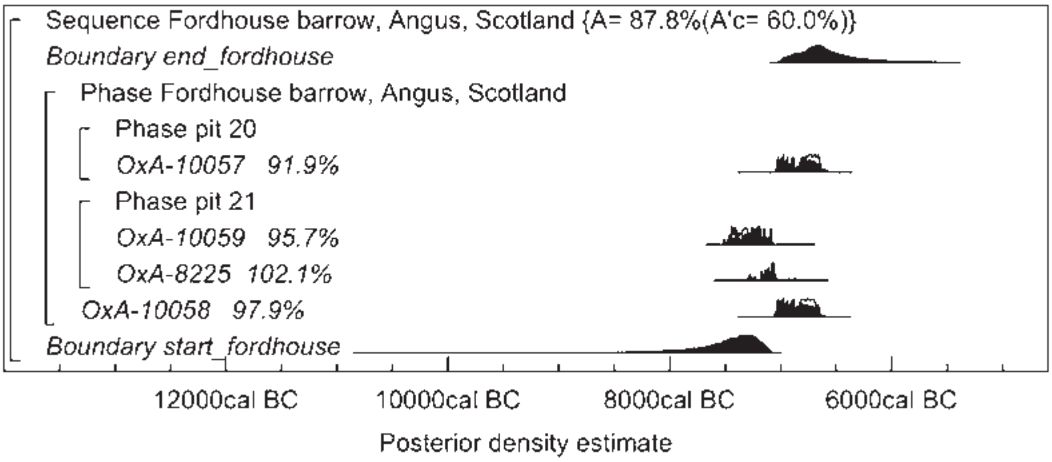


Figure 15.14. Probability distributions of dates from Fordhouse Barrow, Angus, Scotland. The format is identical to that of Figure 6.1. The large square brackets down the left hand side along with the OxCal keywords define the overall model exactly.

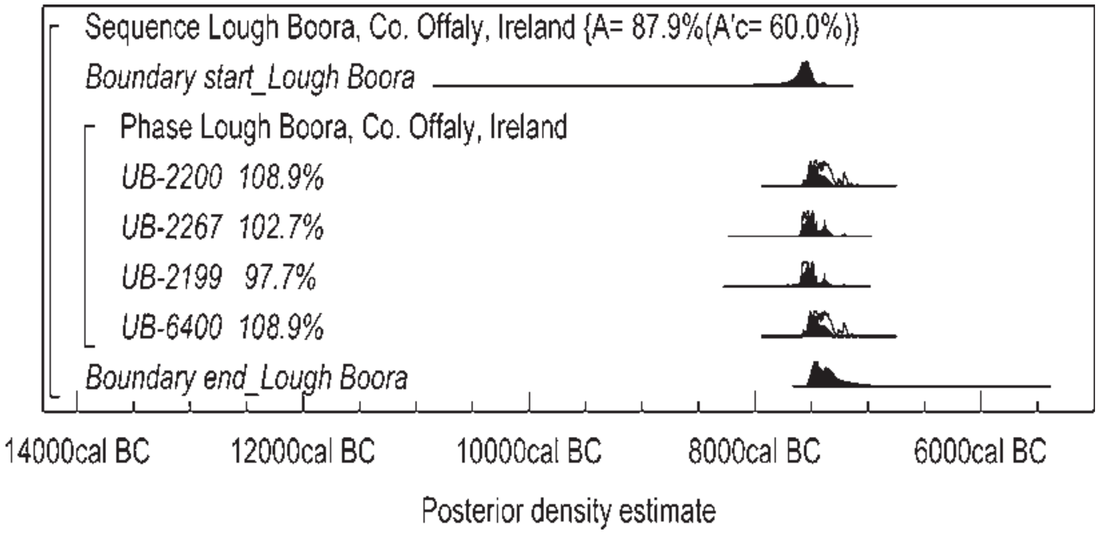


Figure 15.15. Probability distributions of dates from Lough Boora, Co. Offaly, Ireland. The format is identical to that of Figure 6.1. The large square brackets down the left hand side along with the OxCal keywords define the overall model exactly.

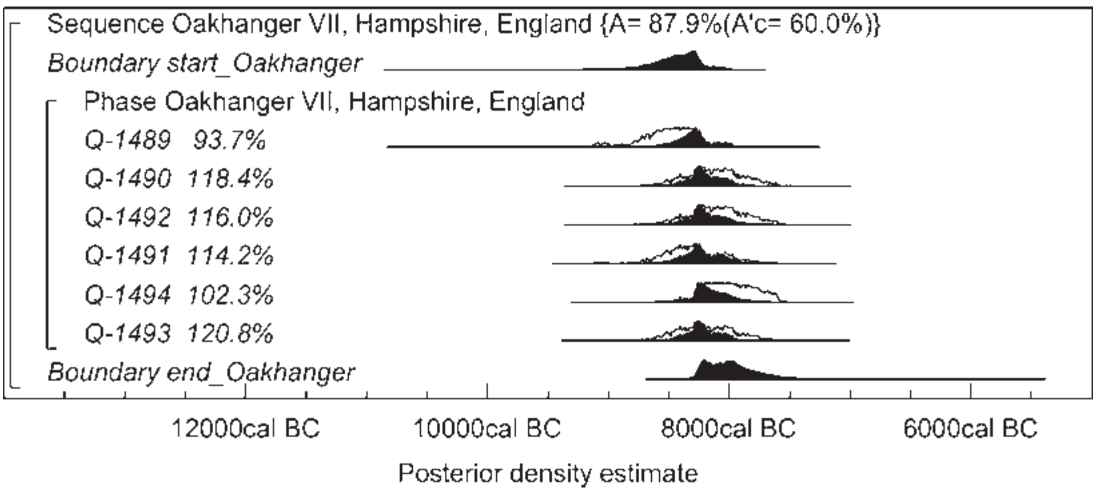


Figure 15.16. Probability distributions of dates from Oakhanger VII, Hampshire, England. The format is identical to that of Figure 6.1. The large square brackets down the left hand side along with the OxCal keywords define the overall model exactly.

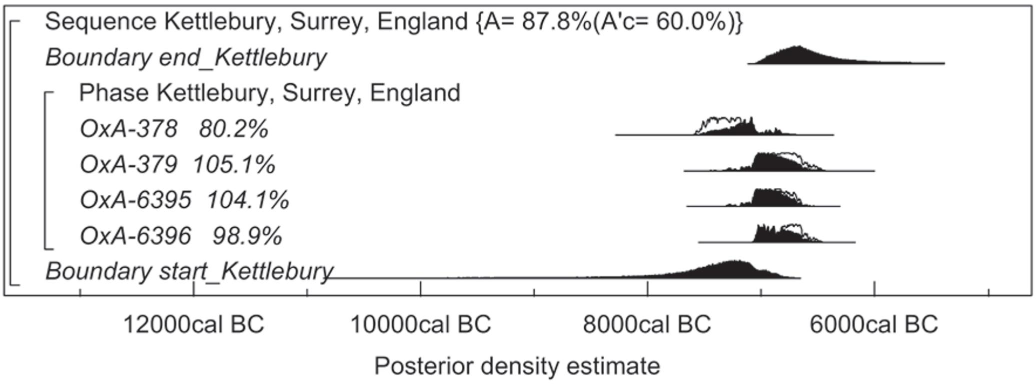


Figure 15.17. Probability distributions of dates from Kettlebury, Surrey, England. The format is identical to that of Figure 6.1. The large square brackets down the left hand side along with the OxCal keywords define the overall model exactly.

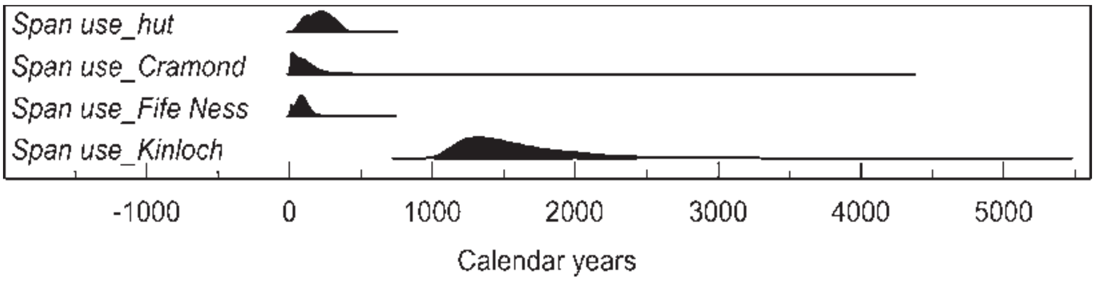


Figure 15.18. Probability distributions showing the length of time during which the occupation sites at Howick, Cramond, Fife Ness, and Kinloch were in use. The distributions derive from the models shown in Figures 6.2–6.3, Figure 15.11, 15.12 and Figure 15.13.

theless, the consistency of the results suggests that the site is likely to fall c. 8000 cal BC.

Figure 15.17 shows that the site at Kettlebury, Surrey, England is also likely to have been occupied for a relatively short period, c. 7000 cal BC. The four results are statistically consistent, and all are single-entity samples of short-life material.

Only four sites from all those discussed above have a sufficient number of radiocarbon determinations, of sufficient contextual quality, to enable a realistic quantitative assessment of the duration of activity at the site to be made (at Mount Sandel, it is unclear whether there is an extended period of activity, or whether the earlier dates suffer from old-wood offsets). These estimates are shown in Figure 15.18. It can be seen that three of these sites were in use for a relatively short period of time, for a few centuries at most. Kinloch is different, as activity at this site seems to have occurred over more than a millennium. The evidence is sketchy, but the sites at Kettlebury, Oakhanger VII and Lough Boora also seem to have been occupied for relatively short periods of time, whereas the activity beneath the Fordhouse barrow may have been of longer duration.

Figure 15.19 shows summaries of the dating available from sites associated with broad-blade, non-geometric lithic assemblages. At least two of these sites (Lussa 1, Strathclyde, Scotland and Kettlebury, Surrey, England) may have been occupied after 7000 cal BC.

Figures 15.20a and 15.20b show summaries of the dating available for sites associated with narrow-blade or micro-triangle blade assemblages. The site at Cramond was probably in use a few centuries before 8000 cal BC, and those at East Barns and Howick shortly after this date, but by c. 7500–7000 cal BC, narrow-blade sites had spread further south and west, with examples from County Durham (e.g. Filpoke Beacon), Southern England (e.g. Broom Hill, Hampshire), Wales (e.g. Prestatyn, Clywd), western Scotland (e.g. Kinloch), and Ireland (e.g. Mount Sandel Upper, Lough Boora).

There appears to be a period of overlap when both broad blade and narrow blade lithic assemblages were in use during the 8th millennium cal BC, and possibly for as long as two millennia from *c*. 8500–*c*. 6500 cal BC.

Lithic Technology and the Adoption of Narrow-Blade Traditions

The dates from the early North-East British sites referred to above (Figs. 15.20a and b) are also by far the earliest dates for narrow-blade stone tool industries in Britain (as all the east coast sites mentioned have an associated narrow-blade assemblage). Therefore, not only does it seem just possible that the

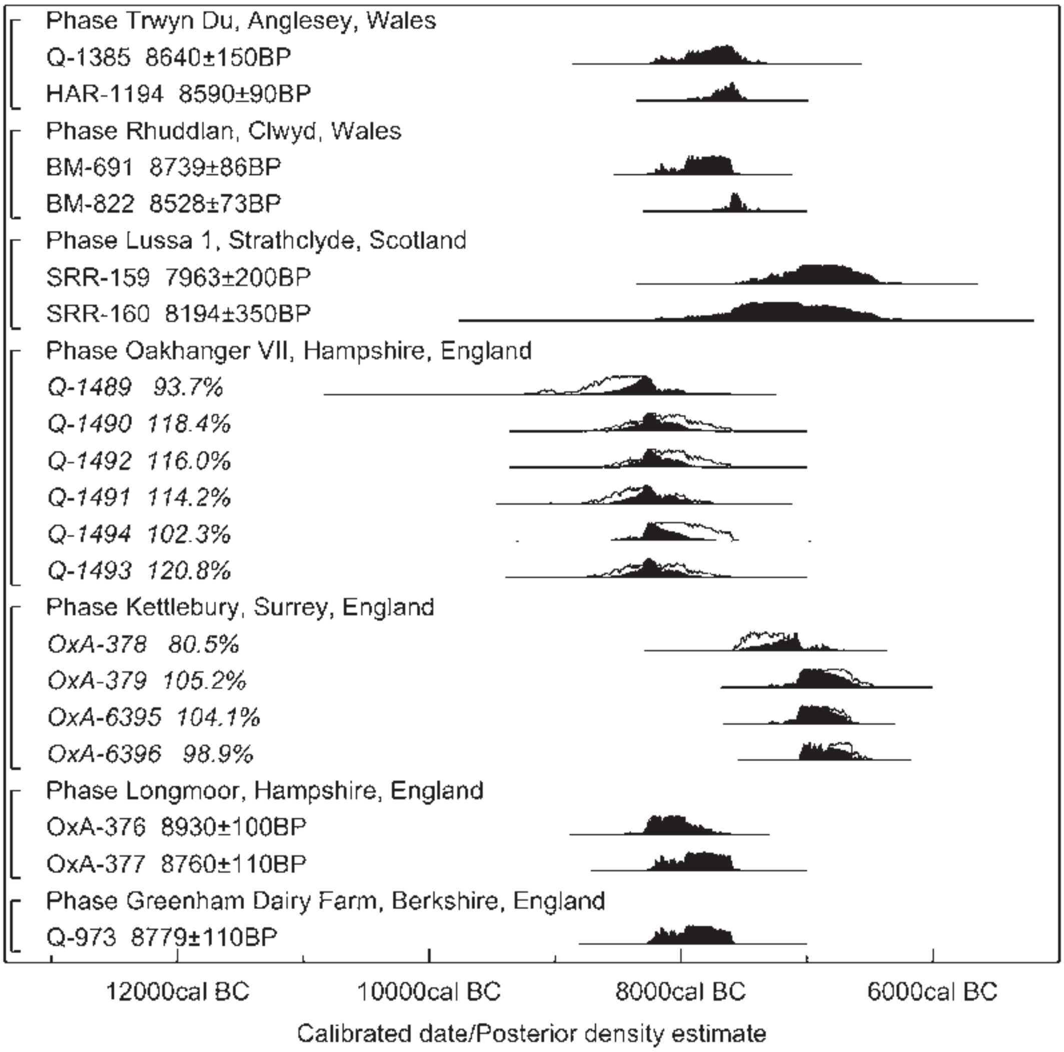


Figure 15.19. Probability distributions of dates from sites associated with broad-blade, non-geometric lithic assemblages. The distributions derive from the models shown in Figures 15.3–15.5, 15.16 and 15.17.

human colonisation/infilling of the north may have been initiated along the North-East coast but the narrow-blade techno-complex may have also spread from this area to the rest of the British Isles. In short, the narrow-blade industries that come to dominate the later Mesolithic tool kits of the British Isles appear, on the basis of the dating currently available, to have spread into Britain first by way of the North Sea Basin seaways rather than across the land bridge into central and southern Britain, as has been suggested before (e.g. Jacobi 1976).

When these early North-East British dates are compared with those from elsewhere around the North Sea Basin there is evidence for widespread adoption of a narrow-blade technology at this time (e.g. see Jacobi 1976). For example in western Sweden Nordqvist (2000, 164) identifies triangle microliths as first appearing in the Late Hensbacka period and occurring through the Early Sandarna period and partly into the Late Sandarna period. The earliest of these Swedish periods correlate with the time span represented by the British dated sites at Cramond, East Barns and Howick while those of the later periods correlate with the dates from Fife Ness, Kinloch, Filpoke Beacon, Broomhead Moor site V, Warcock Hill III, Broom Hill, Mount Sandel and Lough Boora (see Dating Chapter). Elsewhere early-mid 8th millennium cal BC dated assemblages containing narrow-blade triangle microliths have been documented around the North Sea Basin region such as at Aardhorst-Vessem III, Rotsterhaule, Warns and Milheeze II in the Netherlands (see Jacobi 1976), in Belgium at Verrebroek Dok (Crombé 1988), as well as at Maglemose sites in Denmark such as Barmose I (Blankholm 1990), Stallerupholm (Jacobi 1976) and in Germany sites such as Duvensee Site 13 (Bokelmann 1985). Although not all elements of these assemblages are shared across this area, such as the lack of core-axes from northern British sites, the general adoption of a narrow-blade industry that utilised scalene triangle forms together with backed blades (sometimes referred to as rods, though this is misleading as

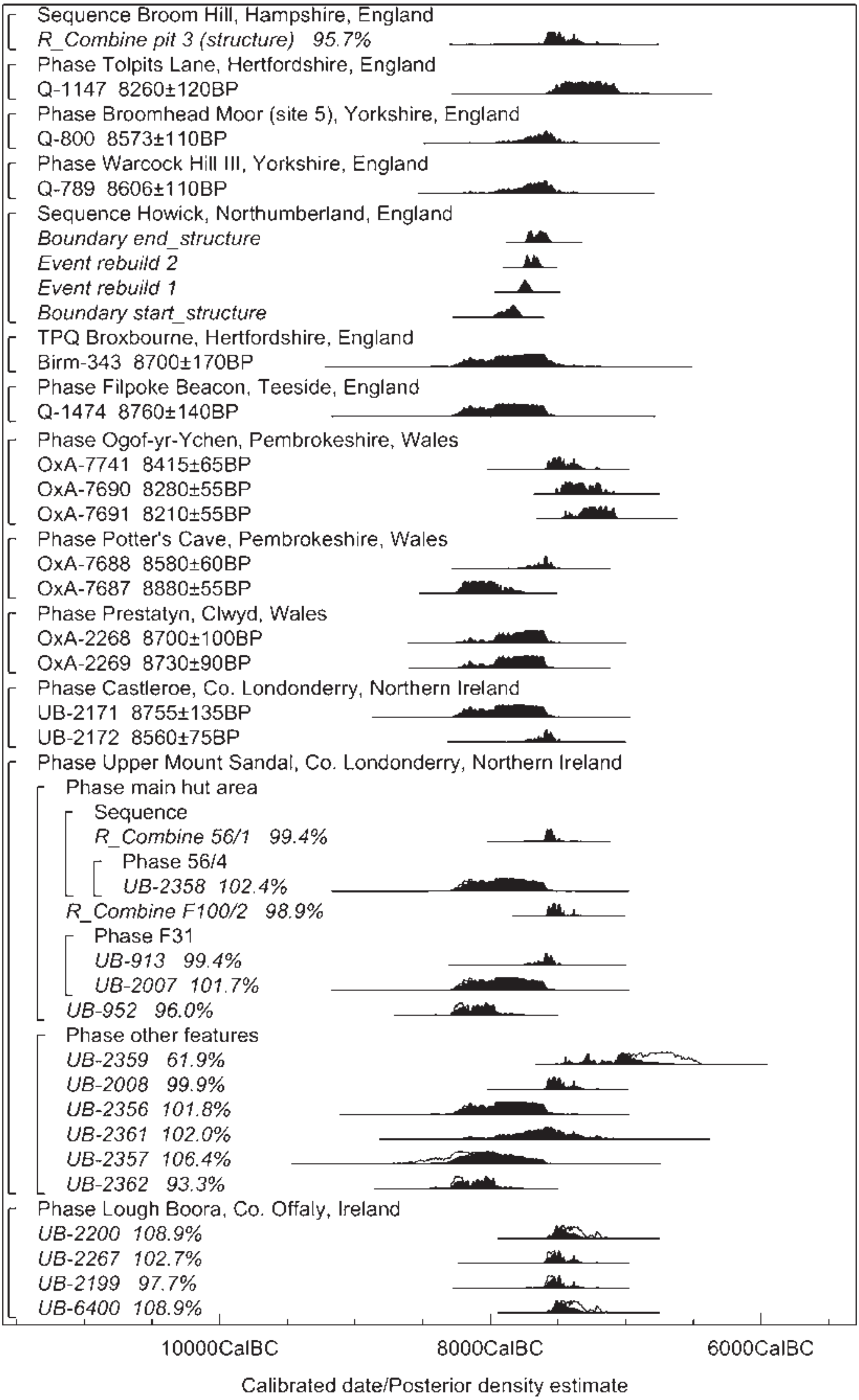


Figure 15.20a. Probability distributions of dates from sites in England, Wales, and Ireland associated with narrow-blade lithic assemblages. The distributions derive from the models shown in Figures 6.2, 15.3, 15.5, 15.6, 15.8, 15.9 and 15.15.

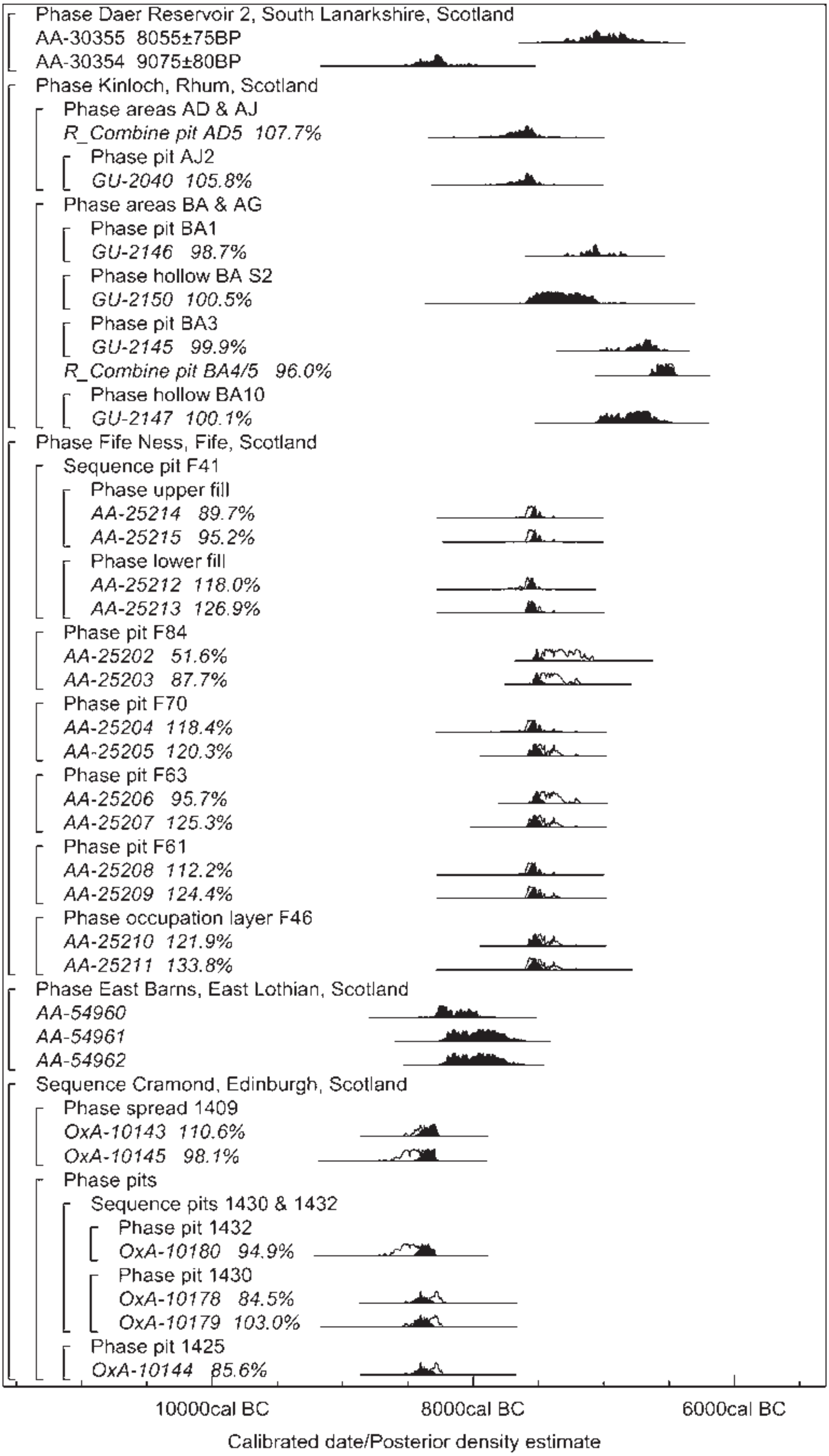


Figure 15.20b. Probability distributions of dates from sites in Scotland associated with narrow-blade lithic assemblages. The distributions derive from the models shown in Figures 15.4, 15.7, and 15.11–15.13.

they are of different form to the smaller and more geometric 'rods' that belong to the latest phases of the Mesolithic in Britain (e.g. the dated Pennine sites excavated by Spikins [2002] and Chatterton [2007]), indicates that communication networks were in place that connected groups around the North Sea margin in such a way as to allow for commonalities in their choice of stone tool equipment. Whether or not this reflects social and/or cultural affinities across a large network of North-West European groups is another question altogether (see also papers in Waddington and Pedersen 2007), but at the level of technological choices it does constitute what may be termed a shared techno-complex. However, these commonalities do not appear to have lasted beyond the breaching of the land bridge c. 7000 cal BC (see Shennan *et al.* 2000, 309) because, as Jacobi has previously pointed out, it is soon after this that artefact forms common to North-West Europe but entirely absent from Britain, such as trapezoid microliths and pressure-flaked points, emerge (Jacobi 1976). From this time on the material culture of the British Isles follows a rather insular trajectory until the advent of the Neolithic some 3000 years later.

The earliest dates now available for narrow-blade sites, all from North and North-East Britain (Cramond, East Barns and Howick), are earlier than some of the broad-blade sites in western and southern Britain (e.g. Lussa 1; Kettlebury; Trwyn Du and Rhuddlan Site M; Figs 15.19, 15.20a and b). The same narrow-blade sites are contemporary with, or in the case of Cramond earlier than, other broad-blade sites in southern and western Britain such as Oakhanger VII, Longmoor, Greenham Dairy Farm, The Nab Head Site 1; Daylight Rock (Caldey Island) and Rhuddlan Site E (Figs. 15.19, 15.20a and b). This unexpected evidence for the early adoption of narrow-blade industries in North-East Britain calls into question the longstanding view that broad-blade and narrow-blade industries could be explained primarily as a chronological division (Jacobi 1976; Switsur and Jacobi 1979), subsequently linked to a change in hunting strategies associated with an improving climate and new types of fauna (Myers 1987). Rather, as noted by the recalibrating and modelling of the available radiocarbon dates (Figs. 15.3–15.20b), there is a period of overlap between broad-blade and narrow-blade sites during the late 9th and 8th millennia cal BC, and possibly for as long as two millennia (c. 8500–c. 6500 cal BC). These new data require a different explanation, as the chronological argument is no longer adequate. It remains true that after c. 7000 cal BC, narrow-blade industries dominate all British Mesolithic assemblages, with broad-blade traditions having been largely abandoned by this time, and it is also true that there are broad-blade sites with earlier dates than the earliest of the narrow-blade sites, such as Star Carr, Thatcham and Marsh Benham. There is undoubtedly a chronological dimension to this question, but the division is blurred by a long period of overlap and a geographical distinction between the location of the chronologically overlapping sites. Taking this into account it is suggested here that the broad-blade industries could be associated with the Early Mesolithic groups who occupied Britain. Settlement appears to have been most dense in southern regions and northwards to the Tees, north of which settlement at this time seems to be much less dense and perhaps episodic, with only a handful of broad-blade sites known, and virtually no associated dates. On present evidence, the narrow-blade sites first appear in North East Britain c. 8400 cal BC on the western shore of the North Sea Basin (e.g. Cramond) and by c. 8000 cal BC and shortly after appear to be widespread along this coastline (e.g. East Barns, Howick), and even reaching North Wales, perhaps via the northern seaways, as implied by the dated site at Prestatyn (see also David and Walker 2004). By c. 7600, narrow-blade sites had spread north (e.g. Fife Ness), west (e.g. Kinloch) and south (e.g. Filpoke Beacon) from the early North-East British sites, and certainly by c. 7500 cal BC had reached Ireland (e.g. Mount Sandel) and southern England (e.g. Broom Hill). Therefore it can be suggested that the narrow-blade techno-complex perhaps arrived in Britain by way of human movements around and across the North Sea Basin at a time of rapid sea level rise and inundation of the North Sea Plain. The adoption of this flaking tradition could then have spread from North-East Britain to the rest of what shortly became the British Isles. Spread of the technology appears to have been rapid and, at least in the initial phases, resulted from movement along the seaways of the northern British littoral. Over an overlapping period of perhaps 1500 years or so, the use of broad-blade forms seems to have been abandoned in favour of the narrow-blade technology. It is also noteworthy that it is narrow-blade industries that are associated with all the probable 'permanent' hut sites, which in itself suggests a link between a particular type of settlement system and the early adoption of narrow-blade technology. Whether the initial adoption of narrow-blade forms in North-East Britain represents the arrival of displaced newcomers or the adoption by pre-existing coastal groups of what was becoming a widespread way of working flint around the North Sea Basin at this time remains open to question, but contact amongst North Sea groups is clearly evident. The broad blade/narrow blade debate is a fascinating question and sure to run for some time, but as our understanding of the dating sequence and settlement patterns in different regions of the British Isles improves it is hoped greater clarity will emerge.

Conclusion

The Howick results have opened up a new perspective on Mesolithic settlement in northern England, and one which has much wider implications. This monograph has provided the results from the fieldwork together with a discussion of the key topics arising from this study. We hope that it will encourage further comparative investigation and integration of recent research in the British Isles, Scandinavia, Germany, the Low Countries and France in relation to broader issues such as the colonisation of northern Europe and the nature of Early Holocene settlement. With growing interest in hunter-gatherer marine archaeology, the Howick results reinforce the importance of understanding the North Sea Basin, the English Channel and the Irish Sea/St George's Channel not just as seaways but as distinct geographic arenas around which human groups organised themselves and interacted.

Bibliography

Aaris-Sørensen, K. 1984. Om en uroksetyr fra Prejlerup – og dens sammenstød med Maglemosekulturen. *Nationalmuseets Arbejdsmark* 1984: 165–173.

Affleck, T.L., Edwards, K. and Clarke, A. 1988. Archaeological and palynological studies at the Mesolithic pitchstone and flint site of Auchareoch, Isle of Arran. *Proceedings of the Society of Antiquaries of Scotland* 118: 37–59.

Albert, R.M., Bar-Yosef, O., Meignan, L. and Weiner, S. 2003. Quantitative Phytolith Study of Hearths from the Natufian and Middle Palaeolithic Levels of Hyonim Cave (Galilee, Israel). *Journal of Archaeological Science* 30: 461–80.

Aldhouse-Green, S. and Pettitt, P. 1998. Paviland Cave: contextualizing the 'Red Lady'. *Antiquity* 72 (No. 278): 756–772.

Allen, M.J. 1991. Analysing the landscape: a geographical approach to archaeological problems. In Schofield, A.J. (ed.) *Interpreting Artefact Scatters. Contributions to Ploughzone Archaeology*. Oxford, Oxbow Monograph 5: 39–57.

Andersen, S.H. 1995. Coastal adaptation and marine exploitation in Late Mesolithic Denmark – with special emphasis on the Limfjord region. In Fischer, A. (ed.) *Man and Sea in the Mesolithic. Coastal Settlement above and below present sea level.* Oxford, Oxbow Monograph 53.

Andersen, S.H. 2000. 'Køkkenmøddinger' (shell middens) in Denmark: a survey. *Proceedings of the Prehistoric Society* 66: 361–84.

Andersen, S.H. and Johansen, E. 1986. Ertebølle revisited. *Journal of Danish Archaeology* 5: 31–61.

Andrefsky, W. 1998. *Lithics: Macroscopic Approaches to Analysis*. Cambridge, Cambridge University Press.

Andrews, M.V., Gilbertson, D., Kent, M. and Mellars, P. 1985. Biometric studies of the morphological variation in the intertidal gastropod *Nucella lapillus* (L.): environmental and palaeoeconomic significance. *Journal of Biogeography* 12: 71–87.

Archaeological Practice. 1996. *Middle Warren fieldwalking assessment: phases 1 and 2*. Report by The Archaeological Practice, University of Newcastle upon Tyne (unpublished).

Ashmore, P. 1999. Radiocarbon dating: avoiding errors by avoiding mixed samples. *Antiquity* 73: 124–30.

Ashmore, P. 2004. A datelist (to October 2002) for early foragers in Scotland. In Saville, A. (ed.) *Mesolithic Scotland and its Neighbours*. Edinburgh, Society of Antiquaries of Scotland: 95–157.

ASUD (Archaeological Services University of Durham). 1998. *Turning the Tide Archaeological Assessment.* University of Durham (unpublished report).

ASUD (Archaeological Services University of Durham). 2000. *The Breamish valley Archaeology Project. Annual Report 2000*. ASUD report 756. University of Durham.

Baales, M. 2001. From lithics to spatial and social organization: interpreting the lithic distribution and raw material composition at the final Palaeolithic site of Kettig (Central Rhineland, Germany). *Journal of Archaeological Science* 28 (2): 127–142.

Bahn, P., Pettitt, P. and Ripoll, S. 2003. Discovery of Palaeolithic cave art in Britain. *Antiquity* 77: 227–31.

Bailey, G.N. and Craighead, A. 2003. Late Pleistocene and early Holocene coastal palaeoeconomies: a reconsideration of the molluscan evidence from Northern Spain. *Geoarchaeology: an International Journal* 18 (2): 175–204.

Balicki, A. 1965. *The Netsilik Eskimo*. New York, Natural History Press.

Ball, D. F. 1964. Loss-on-ignition as an estimate of organic matter and organic carbon in non-calcareous soils. *Journal of Soil Science* 15: 84–92.

Bamforth, D.B. 1987. Investigating microwear polishes with blind tests: the institute results in context. *Journal of Archaeological Science* 15: 11–23.

Bang Andersen, S. 1996. The Colonization of Southwest Norway: An Ecological Approach. In L. Larsson *The Earliest Settlement of Scandinavia and Its Relationship With Neighbouring Areas*. Stockholm, Almqvist and Wiksell International: 219–234.

Barlow, C. and Mithen, S. 2000. The experimental use of elongated pebble tools. In Mithen, S. (ed.) *Hunter-Gatherer Landscape Archaeology. The Southern Hebrides Mesolithic Project 1988–98*. Cambridge, McDonald Institute Monographs Vol 2: 513–521.

Bartley, D.D. 1966. Pollen analysis of some lake deposits near Bamburgh in Northumberland. *New Phytologist* 65: 141–165.

Barton, H., Torrence, R. and Fullager, R. 1998. Clues to stone tool function re-examined. *Journal of Archaeological Science* 25: 1231–1238.

Bateson, E. 1895. *A History of Northumberland Vol II*. Newcastle upon Tyne, Northumberland County History Committee, Austin Reid and Company.

Bayliss, A., Shepherd Popescu, E., Beavan-Athfield, N., Bronk Ramsey, C., Cook, G.T. and Locker, A. 2004. The potential significance of dietary offsets for the interpretation of radiocarbon dates: an archaeologically significant example from medieval Norwich. *Journal of Archaeological Science* 31: 563–75.

Beckensall, S. 1976. The excavation of a rock shelter at Corby's Crags, Edlingham. *Archaeologia Aeliana* 5th Ser. 4: 11–16.

Beckensall, S. 2001. *Prehistoric Rock Art in Northumberland*. Stroud, Tempus.

Bell, M.G. 1997. Environmental Archaeology in the coastal zone. In Fulford, M., Champion, T. and Long, A. (eds) *England's Coastal Heritage*. London, English Heritage: 56–73.

Berridge, P. and Roberts, A. 1986. The Mesolithic period in Cornwall. *Cornish Archaeology* 25: 7–34.

Bettinger, R.L., Malhi, R. and McCarthy, H. 1997. Central place models of acorn and mussel processing. *Journal of Archaeological Science* 24: 887–99.

Biggins, J.A., Biggins, J., Coxon, B. and Watson, M. 1997. Geophysical Survey of the Prehistoric Settlement at Gardener's Houses Farm, Dinnington. *Durham Archaeological Journal* 13: 43–53.

Biggins, J.A. and Taylor, D.J.A. 2004. A geophysical survey at Housesteads Roman fort, April 2003. *Archaeologia Aeliana* 5th Ser. 33: 1–9.

Biggins, J.A., Waddington, C. and Johnson B. 2002. *Survey of the Iron Age/Romano-British defended settlement at Howick Haven*, University of Newcastle (unpublished report submitted to Northumberland County Council).

Binford, L.R. 1978a. Dimensional analysis of behavior and site structure: learning from an Eskimo hunting stand. *American Antiquity* 43 (3): 330–361.

Binford, L.R. 1978b. *Nunamiut ethnoarchaeology*. New York, Academic Press.

Bird, D.W. and Bliege Bird, R.L. 1997. Contemporary shellfish gathering strategies among the Meriam of the Torres Strait Islands, Australia: testing predictions of a central place foraging model. *Journal of Archaeological Science* 24: 39–63.

Bjerck, H. B. 1995. The North Sea Continent and the Pioneer Settlement of Norway. In A. Fischer (ed.) *Man and Sea in the Mesolithic: Coastal Settlement Above and Below Present Sea Level*. Proceedings of the International Symposium, Kalundborg, Denmark 1993. Oxford, Oxbow Publishers: 131–144.

Blankholm, H.P. 1985. Maglemosekulturens hyttegrundrids. En undersøgelser af bebyggelse og adfærdsmønstre i tidlig mesolitisk tid. *Aarbøger for nordisk Oldkyndighed og Historie* 1984: 61–77.

Blankholm, H.P. 1987. Maglemosian hutfloors: an analysis of the dwelling unit, social unit and intra-site behavioural patterns in Early Mesolithic Southern Scandinavia. In Rowley-Conwy, P., Zvelebil, M. and Blankholm, H.P. (eds) *Mesolithic Northwest Europe: Recent Trends*. Sheffield, Department of Archaeology and Prehistory, University of Sheffield: 109–120.

Blankholm, H.P. 1990. Stylistic Analysis of Maglemosian Microlithic Armatures in Southern Scandinavia: An Essay. In P.M. Vermeersch and P. Van Peer (ed.) *Contributions to the Mesolithic in Europe: Papers Presented at the Fourth International Symposium 'The Mesolithic in Europe', Leuven 1990*. Leuven, Leuven University Press: 239–257.

Blankholm, H.P. 1993a. *On the Track of a Prehistoric Economy: Maglemosian Subsistence in Early Postglacial South Scandinavia*. Århus, Aarhus University Press.

Blankholm, H.P. 1993b. Barmose I revisited. *Mesolithic Miscellany* 14 (1 and 2): 12–14.

Boismier, W.A. 1997. *Modelling the Effects of Tillage Processes on Artefact Distributions in the Ploughzone. A simulation study of tillage-induced pattern formation*. Oxford, British Archaeological Reports, British Series 259.

Bokelmann, K. 1985. A Rest Under the Trees: An Ephemeral Mesolithic Camp in the Duvensee Peatbog. *Mesolithic Miscellany* 6: 7 - 10.

Bonsall, C. 1984. Low Hauxley, Northumberland: Mesolithic/Bronze Age coastal site. *Proceedings of the Prehistoric Society* 50: 398.

Bonsall, C. 1996. The 'Obanian' problem. Coastal adaptations in the Mesolithic of western Scotland. In Pollard, T. and Morrison, A. (eds) *The Early Prehistory of Scotland*. Edinburgh, Edinburgh University Press: 183–197.

Bonsall, C., Tolan-Smith, C. and Saville, A. 1995. Direct dating of Mesolithic antler and bone artefacts from Great Britain: new results for bevelled tools and red deer antler mattocks. *Mesolithic Miscellany* 16 (1): 2–10.

Boomer, I., Waddington, C., Stevenson, A.C. and Hamilton, D. (2007.) Holocene coastal change and geoarchaeology at Howick, Northumberland. *The Holocene*, 17.1: 89–104.

Borek, M.J.E. 1975. *Pollen analysis and vegetational history of the Akeld Basin*. Unpublished MSc thesis, University of Durham.

Bosanquet, R.C. 1934. Stone Axe found near Longhoughton. *Proceedings of the Society of Antiquaries of Newcastle* 4th Ser. 6 (5): 202–203.

Bradley, R. 1987. Flint Technology and the Character of Neolithic Settlement. Lithic Analysis and Later British Prehistory. Some problems and approaches. In Brown, A.G. and Edmonds, M.R. (eds) *Lithic analysis in later British prehistory*, Oxford, British Archaeological Reports British Series 162: 181–185.

Bradley, R. 2001. The birth of architecture. *Proceedings of the British Academy* 110: 69–92.

Brain, C.K. 1981. *The Hunters or the Hunted? An introduction to African cave taphonomy*. Chicago, Chicago University Press.

Brinch Petersen, E. 1989. Vænget Nord: Excavation, Documentation and Interpretation of a Mesolithic Site at Vedbæk, Denmark. In Bonsall, C. (ed.) *The Mesolithic in Europe: Papers Presented at the Third International Symposium, Edinburgh 1985*. Edinburgh, John Donald Publishers: 325–330.

Bronk Ramsey, C. 1995. Radiocarbon calibration and analysis of stratigraphy. *Radiocarbon* 36: 425–430.

Bronk Ramsey, C. 1998. Probability and dating. *Radiocarbon* 40: 461–74.

Bronk Ramsey, C. 2001. Development of the radiocarbon calibration program. *Radiocarbon* 43: 355–363.

Bronk Ramsey, C. and Hedges, R.E.M. 1997. Hybrid ion sources: radiocarbon measurements from microgram to milligram. *Nuclear Instruments and Methods in Physics Research B* 123: 539–545.

Bronk Ramsey, C., Higham, T. and Leach, P. 2004. Towards high precision AMS: progress and limitations. *Radiocarbon* 46: 17–24.

Brown, A. 1997. Clearances and clearings: Deforestation in Mesolithic/Neolithic Britain. *Oxford Journal of Archaeology* 16: 133–146.

Buck, C.E., Cavanagh, W.G. and Litton, C.D. 1996. *Bayesian Approach to Interpreting Archaeological Data*. Chichester, J. Wiley and Son.

Buck, C.E., Christen, J.A., Kenworthy, J.B. and Litton, C.D. 1994. Estimating the duration of archaeological activity using ^{14}C determinations. *Oxford Journal of Archaeology* 13: 229–40.

Buck, C.E., Kenworthy, J.B., Litton, C.D. and Smith, A.F.M.

1991. Combining archaeological and radiocarbon information: a Bayesian approach to calibration. *Antiquity* 65: 808–21.

Buck, C.E., Litton, C.D. and Scott, E.M. 1994. Making the most of radiocarbon dating: some statistical considerations. *Antiquity* 68: 252–63.

Buck, C.E., Litton, C.D. and Smith, A.F.M. 1992. Calibration of radiocarbon results pertaining to related archaeological events. *Journal of Archaeological Science* 19: 497–512.

Buckley, F. 1922. Early Tardenoisian remains at Bamburgh. *Proceedings of the Society of Antiquaries of Newcastle upon Tyne* 3 (10): 319–23.

Buckley, F. 1925. The microlithic industries of Northumberland. *Archaeologia Aeliana* 4th Ser. 1: 42–47.

Burgess, C.B. 1972. Goatscrag, A Bronze Age rock shelter cemetery in North Northumberland. *Archaeologia Aeliana* 4th Ser. 50: 15–69.

Burleigh, R., Hewson, A. and Meeks, N. 1976. British Museum Natural Radiocarbon Measurements VIII. *Radiocarbon* 18: 16–42.

Carruthers, R.G., Burnett, G.A. and Anderson, W. 1932. The geology of the Cheviot Hills. *Memoir of the Geological Survey of England and Wales, Sheets 3 and 5*. London, His Majesty's Stationery Office: 174.

Carlsson, T., Kaliff, A. and Larsson, M. 1999. Man and the landscape: aspects of mental and physical settlement organization. In Boaz, J. (ed.) *The Mesolithic of Central Scandinavia*. Oslo: University of Oldsakssamling: 47–72.

Cassidy, J., Raab, J.M. and Kononenko, A.N. 2004. Boats, bones and bifaces: The early Holocene mariners of Eel Point, San Cklemente Island, California. *American Antiquity* 69 (1): 109–130.

Chatterton, R. 2007. South Haw: an upland Mesolithic Site in its local and regional context. In Waddington, C. and Pedersen, K. (eds) *Mesolithic Studies in the North Sea Basin and Beyond. Proceedings of a conference held in Newcastle in 2003*. Oxford, Oxbow: 69–80.

Clapperton, C.M., Durno, S.E. and Squires, R.H. 1971. Evidence for the Flandrian history of the Wooler Water, Northumberland, provided by pollen analysis. *Scottish Geographical Magazine* 57: 14–20.

Clark, J.G.D. 1946. Seal-hunting in the Stone Age of northwestern Europe: a study in economic prehistory. *Proceedings of the Prehistoric Society* 12: 12–48.

Clark, J.G.D. 1971. *Excavations at Star Carr. An Early Mesolithic Site at Seamer Near Scarborough, Yorkshire*. Cambridge, Cambridge University Press.

Clark, J. G. D. 1972. *Excavations at Star Carr: a case study in bioarchaeology*. Reading, Mass., Addison-Wesley Modular Publications, Module 10.

Clark, J.G.D. and Rankine, W. F. 1939. Excavations at Farnham, Surrey (1937-38): The Horsham Culture and the question of Mesolithic dwellings. *Proceedings of the Prehistoric Society* 5: 61–118.

Clarke, A. Forthcoming. *The coarse stone assemblage from Sand, Skye.*

Clarke, A. 1990. Coarse stone tools. In Wickham-Jones, C.R. (ed.) *Rhum: Mesolithic and Later Sites at Kinloch, excavations 1984–86.* Society of Antiquaries of Scotland Monograph Series 7.

Clarke, D. 1976. *Mesolithic Europe: The Economic Basis*. London, Gerald Duckworth Limited.

Clutton-Brock, J. 1987. *A Natural History of Domesticated Mammals*. London, British Museum (Natural History).

Coles, J.M. 1971. The early settlement of Scotland: excavations at Morton, Fife. *Proceedings of the Prehistoric Society* 37: 284–366.

Coles, J.M. 1983. Morton revisited. In O'Connor, A. and Clarke, D.V. (eds) *From the Stone-Age to the Forty-Five*. Edinburgh, John Donald**:** 9–18.

Coles, B. J. 1998. Doggerland: A Speculative Survey. *Proceedings of the Prehistoric Society* 64: 45–81.

Connock K.D., Finlayson, B. and Mills, A.C.M. 1992. The excavation of a shell midden site at Carding Mill Bay, near Oban, Scotland. *Glasgow Archaeological Journal* 17: 25–38.

Corbet, G.B. and Harris, S. 1991. *The Handbook of British Mammals*, 3rd edition. Oxford, Blackwell.

Cormack, W.F. and Coles, J.M. 1968. Mesolithic site at Low Clone, Wigtonshire. *Transactions of the Dumfriesshire and Galloway Natural History and Antiquities Society* 45: 44–72.

Crombé, P. 1998. *The Mesolithic in Northwestern Belgium: Recent Excavations and Surveys*. Oxford: British Archaeological Reports International Series 716.

David, A. 1995. *Geophysical survey in archaeological field evaluation. Ancient Monuments Laboratory*. London, English Heritage.

David, A. and E. Walker 2004. Wales during the Mesolithic period. Mesolithic Scotland and its Neighbours. In Saville, A. (ed.) *The Early Holocene Prehistory of Scotland, its British and Irish Context and Some Northern European Perspectives*. Edinburgh, Society of Antiquaries of Scotland: 299–337.

David, B. 1990. How was this bone burnt? In Solomon, S., Davidson, I. and Watson, D. (eds) *Problem Solving in Taphonomy: Archaeological Studies from Europe, Africa and Oceania*. Queensland, Australia. Tempus, Anthropology Museum, the University of Queensland: Archaeology and Material Culture Studies in Anthropology Vol. 2: 65–79.

Davies, G. and Turner, J. 1979. Pollen diagrams from Northumberland. *New Phytologist* 82: 783–804.

Davies, J. 1983. The Mesolithic Sites of Northumberland. *Northern Archaeology* 4(ii): 18–24.

Davies, J. 2004. Lithics and small finds from the Bolam and Shaftoe region of southern Northumberland. *Northern Archaeology* 20: 1–132.

Degerbøl, M. 1961. On a find of a Preboreal domestic dog (*Canis familiaris* L.) from Star Carr, Yorkshire, with remarks on other Mesolithic dogs. *Proceedings of the Prehistoric Society* 27: 35–55.

Deith, M.R. 1983. Molluscan calendars: the use of growth-line analysis to establish seasonality of shellfish collection at the Mesolithic site of Morton, Fife. *Journal of Archaeological Science* 10: 423–40.

Donahue, D.J., Beck, J.W., Biddulph, D., Burr, G.S., Courtney, C., Damon, P.E., Patheway, A.L., Hewitt, L., Jull, A.J.T., Lange, T., Lifton, N., Maddock, R., McHargue, L.R., O'Malley, J.M. and Toolin, L.J. 1997. The status of the NSF-Arizona AMS laboratory. *Nuclear Instruments and Methods in Physics Research B*. 123: 51 –56.

Drucker, P. 1955. *Indians of the Northwest Coast*. American Museum of Natural History, Anthropological Handbook 10.

Dumont, J.V. 1985. A preliminary report on the Mount Sandel microwear study. In Woodman, P.C. (ed.) *Excavations at*

Mount Sandel 1973–77. Belfast: Dept. for the Environment for Northern Ireland. HMSO. (Northern Ireland Archaeological Monographs No 2): 61–70.

Dyer, B. 1902 *Results of investigations on the Rothamsted soils*. USDA Official Experimental Station bulletin 106).

Eliade, M. 1959. *The Sacred and Profane: The Nature of Religion*. (translated from the French by Willard R. Trask). New York, Harcourt Brace Jovanovich.

Eliade, M. 1964. *Shamanism: Archaic Techniques of Ecstasy*. (Bollingen Series LXXVI). Princeton, Princeton University Press.

Farrimond, P. and Flanaghan, R.L. 1996. Lipid stratigraphy of a Flandrian peat bed (Northumberland, UK): A comparison with the pollen record. *The Holocene* 6: 69–74.

Fearnley-Whittingstall, H. 2001. *The River Cottage Cookbook*. London, Harper Collins.

Fischer, A. (ed.) 1995. *Man and Sea in the Mesolithic: Coastal Settlement Above and Below Present Sea Level. Proceedings of the International Symposium, Kalundborg, Denmark 1993*. Oxbow Monograph 53. Oxford, Oxbow Books.

Fischer, A., Vemming Hansen, P. and Rasmussen, P. 1984. Macro and micro wear traces on lithic projectile points: experimental results and prehistoric examples. *Journal of Danish Archaeology* 5: 7–13.

Finlayson, B. 1989. *A Pragmatic Approach to the Functional Analysis of Chipped Stone Tools*. Edinburgh: Edinburgh University. Unpublished PhD Thesis.

Finlayson, B. 1990. The function of microliths, evidence from Smittons and Starr SW Scotland. *Mesolithic Miscellany* 11 (1): 2–6.

Finlayson, B. 1995. Complexity in the Mesolithic of the Western Seaboard. In Fischer, A. (ed.) *Man and Sea in the Mesolithic.* Oxford, Oxbow: 261–264.

Finlayson B. and Mithen, S. 2000. The Morphology and Microwear of Microliths from Bolsay farm and Gleann Mor: a Comparative Study. In Mithen, S. (ed.) *Hunter-gatherer landscape archaeology: The Southern Hebrides Mesolithic Project 1988–98. Volume 2.* Cambridge, McDonald Institute Monographs: 589–593.

Foley, R. 1981. A model of regional archaeological structure. *Proceedings of the Prehistoric Society* 47: 1–17.

Friis Hansen, J. 1990. Mesolithic cutting arrows: functional analysis of arrows used in the hunting of large game. *Antiquity* 64 (4): 494–504.

Fullager, R. 1993. Flakes stone tools and plant food production: a preliminary report on obsidian tools from Talasea, West New Britain, PNG. In Anderson, P.C., Beyries, S., Otte, M. and Plisson H. (eds) *Traces et Fonction: les gestes retrouvés* 1. Liege, ERAUL 50: 331–337.

Fullager, R. (ed.) 1998. *A Closer Look. Recent Australian Studies of Stone Tools*. Sydney: Sydney University Archaeological Methods Series 6.

Gelfand, A.E. and Smith, A.F.M. 1990. Sampling approaches to calculating marginal densities. *Journal of the American Statistical Association* 85: 398–409.

Gendel, P.A. 1984. *Mesolithic Social Territories in Northwestern Europe*. Oxford, British Archaeological Reports International Series 218.

Gibbons, M. and Gibbons, M. 2004. Dyeing in the Mesolithic. *Archaeology Ireland* 17: (4,66): 28–3.

Gilks, W.R., Richardson, S. and Spiegelhalther, D.J. 1996. *Markov Chain Monte Carlo in practice*. London, Chapman and Hall.

Gillespie, R., Gowlett, J.A.J., Hall, E.T., Hedges, R.E.M. and Perry, C. 1985. Radiocarbon dates from the Oxford AMS system: Archaeometry datelist 2. *Archaeometry* 27: 237–246.

Godwin, H. and Willis, E.H. 1959. Cambridge University Natural Radiocarbon Measurements I. *Radiocarbon* 1: 63–75.

Gooder, J. 2007. Excavation of a Mesolithic house at East Barns, East Lothian, Scotland: an interim report. In Waddington, C. and Pedersen, K.L.R. (eds) *Mesolithic Studies in the North Sea Basin and Beyond. Proceedings of a Conference Held at Newcastle in 2003.* Oxford, Oxbow: 49–59

Gould, R.A. 1980. *Living Archaeology, New Studies in Archaeology*. Cambridge, Cambridge University Press.

Gowlett, J.A.J., Hedges, R.E.M., Law, I.A. and Perry, C. 1986. Radiocarbon dates from the Oxford AMS system: Archaeometry datelist 4. *Archaeometry* 28: 206–221.

Grace, R. 1989. *Interpreting the Function of Stone Tools. The quantification and computerization of microwear analysis.* Oxford, BAR International Series 474.

Grace, R., Graham, I.D.G. and Newcomer, M.H. 1985. The quantification of microwear polishes. *World Archaeology* 17 (1): 112–120.

Grace, R., Ataman, K., Fabregas, R. and Haggren, C.M.B. 1988. A Multivariate approach to the functional analysis of stone tools. In Beyries, S (ed.) *Industries Lithiques CNRS*. Oxford, British Archaeological Reports International Series 411 (1): 217–230.

Green, F. 1996. Mesolithic or later houses at Bowman's Farm, Romsey Extra, Hampshire, England? In T. Darvill and J. Thomas (eds.) *Neolithic Houses in Northwest Europe and Beyond*. Oxford: Oxbow Monograph 57: 113–122.

Griffitts, J. and Bonsall, C. 2002. Experimental determination of the function of antler and bone 'bevel-ended tools' from prehistoric shell middens in Western Scotland. In Choyke, A.M. and Bartosiewicz, L. (eds) *Crafting Bone: Skeletal Technologies through Time and Space.* BAR International Series 937: 207–220.

Grigson, C. and Mellars, P.A. 1987. The mammalian remains from the middens. In Mellars, P.A. *Excavations on Oronsay: Prehistoric Human Ecology on a Small Island*. Edinburgh, Edinburgh University Press: 243–89.

Grimm, E.C. 1991. *Tilia and TiliaGraph*. Illinois, University of Illinois.

Grøn, O. 1983. Social behaviour and settlement structure: preliminary results of a distribution analysis on sites of the Maglemose Culture. *Journal of Danish Archaeology* 2: 32–42.

Grøn, O. 1987. Reconstruction of the social structure of the Maglemose Culture of Southern Scandinavia and Northern Germany. *Mesolithic Miscellany* 8(1): 18–19.

Grøn, O. 1988. Seasonal Variation in Maglemosian Group Size and Structure. *Current Anthropology* 28 (4): 303–317.

Grøn, O. 1989. General spatial behaviour in small dwellings: a preliminary study in ethnoarchaeology and social psychology. In Bonsall, C. (ed.) *The Mesolithic in Europe: Papers Presented at the Third International Symposium, Edinburgh 1985*. Edinburgh, John Donald Publishers Limited: 99–105.

Grøn, O. 1990. A large Maglemosian winter house? *Mesolithic Miscellany* 11(1): 7–13.

Grøn, O. 1992. Some comments on the interpretation of Barmose I. *Mesolithic Miscellany* 13(2): 12.

Grøn, O. 1994. Barmosen I – continued. *Mesolithic Miscellany* 15(1): 22–24.

Grøn, O. 1995. The Maglemose Culture: The Reconstruction of the Social Organization of a Mesolithic Culture in Northern Europe. Oxford, Tempus Reparatum.

Grøn, O. 1999. A Revision of the model for dwelling organization in the Southern Scandinavian Mesolithic. In Thévenin, A. and Bintz, P. (eds.) *L'Europe des derniers chasseurs. Épipaléolithique et mésolithique. Peuplement et paléoenvironnement de l'Épipaléolithique et du Mésolithique. Actes du 5e colloque international UISPP, commission XII, Grenoble, 18–23 septembre 1995*. (Documents préhistorique 11). Paris, Éditions du Comité des travaux historiques et scientifiques: 321–326.

Grøn, O. and Sørensen, S.A. 1993. Møllegabet II – a submerged Mesolithic site and a 'boat burial' from Ærø. *Journal of Danish Archaeology* 10: 38–50.

Grøn, O. and Sørensen, S.A. 1995. Aggemose: an inland site from the Early Kongemose Culture on Langeland. *Journal of Danish Archaeology* 11: 7–18.

Hampton O.W. 1999. *Culture of Stone. Sacred and Profane Uses of Stone among the Dani.* Texas AandM University Press.

Hardy, K. 1993 *Preceramic Lithics in Central Mexico: An examination of the Tehuacan and Oaxaca chronological sequences.* London: University College London. Unpublished PhD Thesis.

Hardy, K. 2004. Microwear Analysis of a Sample of Flaked Stone Tools from Camas Daraich. In Wickham-Jones, C.R. and K. Hardy. *Camas Daraich: a Mesolithic site at the Point of Sleat, Skye.* (SAIR). Edinburgh.

Hardy, K. Forthcoming a. Use-wear analysis of a sample of flaked stone tools from Sands of Forvie. In Warren, G.M. *Fieldwork at the Sands of Forvie, Aberdeenshire*.

Hardy K. Forthcoming b. Worked bone. In Hardy, K. and Wickham-Jones, C.R. (eds.) Mesolithic and later sites around the Inner Sound, Scotland: the work of the Scotland's First Settlers project 1998–2004. Edinburgh. To be published in SAIR (Scottish Archaeological Internet Reports).

Hardy, K. and Sillitoe, P. 2003. Material Perspectives: Stone Tool Use and Material Culture in Papua New Guinea. *Internet Archaeology* 14. http://intarch.ac.uk/journal/issue14/hardy_index.html

Hardy, K. and Wickham-Jones, C.R. 2003. Scotland's First Settlers: the Mesolithic seascape of the Inner Sound, Skye and its contribution to the early prehistory of Scotland. *Antiquity* 76: 825–833.

Hardy K. and Wickham-Jones C. Forthcoming. Mesolithic and later sites around the Inner Sound, Scotland: the work of the Scotland's First Settlers project 1998–2004. To be published in SAIR. Edinburgh.

Hardy, K., Miket, R. and Saville, A. Forthcoming. *An Corran, Staffin, Skye: a rockshelter with Mesolithic and later occupation.*

Hayden, B. 1979. *Palaeolithic Reflections: Lithic technology of the Western Desert Aborigines.* New Jersey: Humanities Press Inc. (for the Australian Institute of Aboriginal Studies. Canberra, Australia).

Harkness, D.D. and Wilson, H.W. 1974. Scottish Universities Research and Reactor Centre Radiocarbon Measurements II. *Radiocarbon* 16: 238–251.

Haselgrove, C.C. and Healey, F. 1992. The prehistory of the Tyne-Tees lowlands: some recent finds. *Durham Archaeological Journal* 8: 1–24.

Hather, J.G. 1998. Identification of macroscopic charcoal assemblages. In Mellars, P. and Dark, P. (eds) *Star Carr in Context: New Archaeological and Palaeoecological Investigations at the Early Mesolithic site of Star Carr, North Yorkshire*. Cambridge, MacDonald Institute: 183–196.

Hayden, B. 1979. *Palaeolithic Reflections: Lithic technology of the Western Desert Aborigines.* New Jersey, Humanities Press Inc. (for the Australian Institute of Aboriginal Studies. Canberra, Australia).

Hayden, B. 1990. The right rub: hide working in high ranking households. In Graslund, B. (ed.) *The Interpretative Possibilities of Microwear Studies.* Uppsala, *Aun* 14: 89–102.

Healy, F., Heaton, M. and Lobb, S.J. 1992. Excavations of a Mesolithic site at Thatcham, Berkshire. *Proceedings of the Prehistoric Society* 58: 41–76.

Hedges, R.E.M., Bronk, C.R. and Housley, R.A. 1989. The Oxford Accelerator Mass Spectrometry facility: technical developments in routine dating. *Archaeometry* 31: 99–113.

Hedges, R.E.M., Housley, R.A., Law, I.A., and Bronk, C.R. 1989. Radiocarbon dates from the Oxford AMS system: Archaeometry datelist 9. *Archaeometry* 31: 207–34.

Hedges, R.E.M., Housley, R.A., Law, I.A., Perry, C. and Gowlett, J.A.J. 1987. Radiocarbon dates from the Oxford AMS system, Archaeometry datelist 6. *Archaeometry* 29: 289–306.

Hedges, R.E.M., Housley, R.A., Pettitt, P.B., Bronk Ramsey, C. and van Klinken, G.J. 1996. Radiocarbon dates from the Oxford AMS system, Archaeometry datelist 21. *Archaeometry* 38: 181–207.

Hedges, R.E.M., Pettitt, P.B., Bronk Ramsey, C. and van Klinken, G.J. 1998. Radiocarbon dates from the Oxford AMS system: Archaeometry datelist. *Archaeometry* 26: 437–455.

Hesjedal, A., Damm, C., Olsen, B. and Storli, I. 1996. *Arkeologi pä Slettnes. Dokumentasjon av 11.000 års bosetning*. Tromsø, Tromsø Museums Skrifter XXVI.

Hodson, A. 1971. *Concepts in Statistical Mechanics*. New York, Gordon and Breach Science Publishers.

Houtsma, P., Kramer, E., Newell, R.R. and Smit, R.L. 1996. *The Late Palaeolithic Habitation of Haule V: From Excavation Report to the Reconstruction of Federmesser Settlement Patterns and Land-Use*. Assen, van Gorcum.

Huntley, J.P. and Stallibrass, S.M. 1995. *Plant and Vertebrate Remains from Archaeological Sites in Northern England: Data Reviews and Future Directions.* Durham, Architectural and Archaeological Society of Durham and Northumberland.

Innes, J.B. and Frank, R.M. 1988. Palynological evidence for late Flandrian coastal changes at Druridge Bay, Northumberland. *Scottish Geographical Magazine* 104: 14–23.

Isbister, A. 2000. Burnished haematite and pigment production. In Ritchie, A. (ed.) *Neolithic Orkney in its European Context*. Cambridge, McDonald Institute Monographs: 191–195.

Jacobi, R.M. 1976. Britain inside and outside Mesolithic Europe. *Proceedings of the Prehistoric Society* 42: 67–84.

Jacobi, R.M. 1980. The Early Holocene settlements of Wales. In Taylor J.A. (ed.) *Culture and Environment in Prehistoric Wales*. Oxford, British Archaeological Reports British Series 76: 131–206.

Jacobi, R.M. 1981. The last hunters in Hampshire. In Shennan, S.J. and Schadla-Hall, R.T. (eds) *The archaeology of Hampshire from the Palaeolithic to the Industrial Revolution*.

Hampshire Field Club and Archaeol. Soc. Monograph 1: 10–25.

Jacobi, R.M. 1987. The lateglacial archaeology of Gough's Cave at Cheddar. In Collcutt, S.N. (ed.) *Recent studies in the Palaeolithic of Britain and its nearest neighbours*. Sheffield, J R Collis.

Jahren, A.H., Toth, N., Schick K., Clark J.D. and Amundson R.G. 1997. Determining stone tool use: chemical and morphological analyses of residues on experimentally manufactured stone tools. *Journal of Archaeological Science* 24: 245–250.

Jenkinson, D. 1988. Soil Organic matter and its Dynamics. In Wild, A. (ed.) *Russell's Soil Conditons and Plant growth*. London, Longmans: 565–607.

Jobey, G. and Newman, T.G. 1975. A Collared Urn cremation on Howick Heugh, Northumberland. *Archaeologia Aeliana* 5th Ser. 3: 1–16.

Johansen, L. and Stapert, D. 1998. Dense flint scatters: knapping or dumping? In *Aktuelle Forschungen zum Mesolithikum*. (Urgeschichtliche Materialhefte 12). Tübingen, Mo Vince Verlag: 29–41.

Johnson, G.A.L. 1995. Robson's Geology of North-East England. *Transactions of the Natural History Society of Northumbria* 56: 5.

Jordan, P. 2001. Ideology, Material Culture and Khanty Ritual Landscapes in Western Siberia. In Fewster, K.J. and Zvelebil, M. (eds) *Ethnoarchaeology and Hunter-gatherers: Pictures at an Exhibition. Oxford,* British Archaeological Reports International Series 955: 25–42.

Jordan, P. 2003. *Material Culture and Sacred Landscape: The Anthropology of the Siberian Khanty*. California, AltaMira Press.

Juel Jensen, H. 1986. Unretouched blades in the Late Mesolithic of South Scandinavia. *Oxford Journal of Archaeology* 5 (1): 19–33.

Juel Jensen, H. 1994. *Flint tools and plant working*. Aarhus, Aarhus University Press.

Kaliff, A., Carlsson, T., Molin, F. and Sundberg, K. 1997. *Mörby. Östergötlands äldsta boplats*. Riksantikvarieämbetet, Rapport UV Linköping 1997:38, Linköping.

Karsten, P. and Knarrström, B. 2001a. Tågerup – fifteen hundred years of Mesolithic occupation in Western Scania, Sweden: a preliminary view. *Journal of European Archaeology* 4(2): 165–174.

Karsten, P. and Knarrström, B. (eds) 2001b. *Tågerup – specialstudier*. *(Skånska spår – arkeologi längs Västkustbanan)*. Lund, Riksantikvarieämbetet, UV Syd.

Keeley, L.H. 1980. *Experimental Determination of Stone Tool Uses: a Microwear Analysis.* Chicago, University of Chicago Press.

Keeley, L.H. and Newcomer, M.H. 1977. Microwear analysis of experimental flint tools: a test case. *Journal of Archaeological Science* 4: 29–62.

Keeney, G. S. 1939. A pagan Anglian cemetery at Howick. *Archaeologia Aeliana* 4th Ser. 16: 120–128.

Keesing, R.M. 1982. *Kwaio Religion: The Living and the Dead in a Solomon Island Society*. New York, Columbia University Press.

Klitgaard-Kristensen, D., Sejrup, H.P., Haflidason, H., Johnsen, S. and Spurk, M. 1998. A regional 8200 cal. yr BP cooling event in northwest Europe, induced by final stages of the Laurentide ice-sheet deglaciation? *Journal of Quaternary Science* 13 (2): 165–169.

Knight, J., Orford, J.D., Wilson, P., Wintle, A.G. and Braley, S. 1998. Facies, age and controls on recent coastal sand dune evolution in North Norfolk, eastern England. *Journal of Coastal Research* 26: 154–161.

Knutsson, K. 1988a. *Making and using stone tools, the Analysis of Lithic Assemblages from Middle Mesolithic Sites with Flint in Västerbotten, Northern Sweden*. Uppsala University, *AUN* 11.

Knutsson, K. 1988b. *Patterns of tool use, scanning electron microscopy of experimental quartz tools*. Uppsala University, *AUN* 11.

Knuttsson, K. 1990. A new lithic scene. The archaeological context of used tools. In Graslund, B. (ed.) *The Interpretative Possibilities of Microwear Studies*, *Aun*, 14, 15–30 (Proceedings of the International conference on lithic use-wear analysis, 15th–17th February 1989. Uppsala, Sweden).

Lacaille, A.D. 1954. *The Stone Age in Scotland.* Oxford, Oxford University Press.

Lage, W. 2004. Zur interpretation der lehmstraten in den feuerstellen des Duvenseer Moores – lehmplatten als Gar- und Röstvorrichtungen Wahrend des Mesolithikums in Schleswig-Holstein. *Archäologisches Korrespondenzblatt* 34 (3): 293–302.

Larsson, L. 1989. Late Mesolithic settlement and cemeteries at Skateholm, southern Sweden. In Bonsall, C. (ed.) *The Mesolithic in Europe: Papers Presented at the Third International Symposium, Edinburgh 1985*. Edinburgh, John Donald Ltd: 367–378.

Larsson, M. 1996. *Högby. Mesolitiska och sennneolitiska boplaster vid Högby i Östergötland. Bosättningsmönster och materiell kultur*. Riksantikvarieämbetet. Rapport UV Linköping, 1996:35, Linköping.

Lass Jensen, O. 2001. Kongemose og Ertebøllekultur ved den fossile Nivåfjord. In Lass Jensen, O., Sørensen, S.A. and Møller Hansen, K. (eds) *Danmarks jægerstenalder – status og perspektiver. Beretning fra symposiet "Status og perspektiver inden for dansk mesolitikum" afholdt i Vordingborg, september 1998*. Hørsholm, Hørsholm Egns Museum: 115–129.

Lawson, J. 2001. A list of archaeological radiocarbon dates (Cramond, Edinburgh). In Turner, R. (ed.) *Discovery and Excavation in Scotland* new ser 2: 124.

Lee, R., and Devore, I. 1978. *Kalahari Hunter-Gatherers: Studies of the !Kung San and Their Neighbors*. Harvard University Press.

Lyman, R.L. 1994. *Vertebrate Taphonomy*. Cambridge, Cambridge University Press.

MacKenzie, M.A. 1991. *Androgynous Objects: String bags and gender in central New Guinea.* London, Harwood Academic Publishers.

MacLaughlan, H. 1867. Notes not included in the Memoirs already published on Roman Roads in Northumberland. Newcastle Upon Tyne, Privately Printed.

Malm, T. 1995. Excavating submerged stone age sites in Denmark – the Tybrind Vig example. In Fischer, A. (ed.) *Man and Sea in the Mesolithic. Coastal Settlement above and below present sea level.* Oxford, Oxbow Monograph 53.

Mason, S.L.R. 1996. *Hazelnut (Corylus spp.) as a past food resource*? UCL, Institute of Archaeology, Bioarchaeology Discussion Group, Wednesday 28th February 1996.

Mason, S.L.R. 2000. Fire and Mesolithic subsistence – managing oaks for acorns in northwest Europe? *Palaeogeography, Palaeoclimatology, Palaeoecology* 164: 139–150.

McCarthy, A., Finlay, N. and McClean, O. 1999. Marine molluscan remains. In Woodman, P.C., Anderson, E. and Finlay, N. *Excavations at Ferriter's Cove, 1983–95: Last Foragers, First Farmers in the Dingle Peninsula*. Bray, Wordwell: 93–102.

McCutcheon, P.T. 1992. Burned archaeological bone. In Stein, J.K. (ed.) *Deciphering a Shell Midden*. New York, Academic Press: 347–70.

Meehan, B. 1982. *Shell Bed to Shell Midden*. Canberra: Australian Institute of Aboriginal Studies.

Mellars, P. (ed.) 1987. *Excavations on Oronsay: Prehistoric Human Ecology on a Small Island*. Edinburgh, Edinburgh University Press.

Mellars, P. 1998. Postscript: major issues in the interpretation of Star Carr. In Mellars, P. and Dark, P. (eds) *Star Carr in Context: New Archaeological and Palaeoecological Investigations at the Early Mesolithic site of Star Carr, North Yorkshire*. Cambridge, MacDonald Institute: 215–241.

Mercer, J. 1980. Laussa 1: the late-glacial and early post-glacial occupation of Jura. *Proceedings of the Society of Antiquaries of Scotland* 110: 1–32.

Milner, N., Craig, O.E, Bailey, G.N., Pedersen, K. and Andersen, S.H. 2004. Something fishy in the Neolithic? A re-evaluation of stable isotope analysis of Mesolithic and Neolithic coastal populations. *Antiquity* 78: 9–22.

Mithen, S.J. (ed.) 2000. *Hunter-Gatherer Landscape Archaeology: The Southern Hebridean Mesolithic Project, 1988–1998*. Cambridge, McDonald Institute for Archaeological Research.

Mithen, S.J. and Score, D. 2000. Experimental roasting of hazelnuts. In Mithen, S.J. (ed.) *Hunter-Gatherer Landscape Archaeology: The Southern Hebrides Mesolithic Project 1988–1998*. Cambridge, MacDonald Institute: 507–512.

Mithen, S.J., Finley, F., Carruthers, W., Carter, S. and Ashmore, P. 2001. Plant use in the Mesolithic: Evidence from Staosnaig, Isle of Colonsay, Scotland. *Journal of Archaeological Science* 28: 223–234.

Mook, W.G. 1986. Business meeting: Recommendations/Resolutions adopted by the Twelfth International Radiocarbon Conference. *Radiocarbon* 28: 799.

Moore, P.D., Webb, J.A. and Collinson, M.E. 1989. *Pollen Analysis*. Oxford, Blackwell.

Moores, A.M. 1999. *Holocene Environmental Change, human activity and archaeological landscapes in the North Tyne Basin*. Unpublished PhD thesis, University of Newcastle upon Tyne.

Moss, M.L. 1993. Shellfish, gender, and status on the Northwest coast: reconciling archaeological, ethnographic, and ethnohistorical records of the Tlingit. *American Anthropologist* 95 (3): 631–652.

Mulholland, H. 1970. The microlithic industries of the Tweed valley. *Transactions of the Dumfriesshire and Galloway Natural History and Antiquarian Society* 47 (3rd Ser.): 81–110.

Mullan, G.J. and Wilson, L.J. 2004. A possible Mesolithic engraving in Aveline's Hole, Burrington Combe, north Somerset. *Proceedings of the University of Bristol Speaeological Society* 23 (2): 75–85.

Murdock, G.P. 1967. *Ethnographic Atlas*. Pittsburgh, University of Pittsburgh Press.

Myers, A. M. 1987. All shot to pieces? Inter-assemblage variability, lithic analysis and Mesolithic assemblage 'types'; some preliminary observations. In Brown, A. G.and Edmonds, M. R. (eds) *Lithic Analysis and Later British Prehistory. Some problems and approaches*. Oxford, British Archaeological Reports British Series 162: 137–153.

NERC. 1971. *British Regional Geology; Northern England (forth edition).* HMSO.

Newcomer, M.H., Grace, R. and Unger-Hamilton, R. 1986. Investigating microwear polishes with blind tests. *Journal of Archaeological Science* 13: 203–217.

Newell, R.R. 1981. Mesolithic dwelling structures: fact and fantasy. In Gramsch, B. (ed.) *Mesolithikum in Europe. 2. Internationales Symposium Potsdam, 3. bis 8. April 1978 Bericht*. (Veröffentlichungen des Museums für Ur- und Frühgeschichte Potsdam Band 14/15). Berlin, VEB Deutscher Verlag der Wissenschaften: 235–284.

Nordqvist, B. 2000. *Coastal Adaptation in the Mesolithic: A Study of Coastal Sites With Organic Remains from the Boreal and Atlantic Periods in Western Sweden*. Göteborg, Department of Archaeology and Ancient History, Göteborgs University.

O'Malley, M. and Jacobi, R.M. 1978. The excavation of a Mesolithic occupation site at Broom Hill, Braishfield, Hampshire, 1971–1973. *Rescue Archaeology in Hampshire* 4: 16–38.

Orford, J.D., Wilson, P., Wintle, A.G., Knight, J. and Braley, S. 2000. Holocene coastal dune initiation in Northumberland and Norfolk, eastern UK: climate and sea-level changes as possible forcing agents for dune initiation. In Shennan, I. and Andrews, J. (eds) *Holocene Land-Ocean Interaction and Environmental Change around the North Sea*. London, Geological Society of London Special Publications 166: 197–217.

Oshibkina, S.V. 1985. The material culture of the Veretye-type sites in the region to the east of Lake Onega. In Bonsall, C. (ed.) *The Mesolithic in Europe. Papers presented at the Third International Symposium*. Edinburgh, Edinburgh University Press.

Owen, L. 2000. Lithic functional analysis as a means of studying gender and material culture in prehistory. In Donald, M. and Hurcombe, L. (eds) *Gender and Material Culture in Archaeological Perspective*. London, MacMillan Press.

Palmer, S. 1999. *Culverwell Mesolithic Habitation Site, Isle of Portland, Dorset, Excavation Report and Research Studies*. Oxford, British Archaeological Reports British Series 287.

Payne, S. and Munson, P.J. 1985. Ruby and how many squirrels? The destruction of bones by dogs. In. Fieller, N.R.J., Gilbertson, D.D. and Ralph, N.G.A (eds) *Palaeobiological Investigations: Research Design, Methods and Data Analysis*. Oxford, British Archaeological Reports International Series 266: 31–40.

Payton, R.W. and Palmer, R.C. 1990. *Soils of the Alnwick and Rothbury district (Sheet 81)*. Silsoe, Soil Survey and Land Research Centre.

Petersson, M. 1951. Mikrolithen als Pfeilspitzen. Ein Fund aus dem Lilla Loshult-Moor ksp. Loshult, Skåne. *Kungliga Humanistiska Vetenskapssamfundets i Lund Årsberättelse IV(1950–1951)*: 123–137.

Price, T.D. 1978. The spatial analysis of lithic artifact distribution and association on prehistoric occupation floors. In Davis, D.D. (ed.) *Lithics and Subsistence: The Analysis of Stone Tool Use in Prehistoric Economies*. (Vanderbilt University Publications in Anthropology No. 20). Nashville, Vanderbilt University: 1–33.

Proudfoot, E, 1999. Fordhouse barrow, Dun. *Discovery and excavation in Scotland 1999*, 111.

Proudfoot, E 2001. Fordhouse barrow, Angus. *Discovery and excavation in Scotland* (new series) 2, 122.

Radley, J, Tallis, J H, and Switsur, V R, 1974 The excavation of three "narrow blade" Mesolithic sites in the southern Pennines, England. *Proceedings of the Prehistoric Society* 40, 1–19.

Raistrick, A. 1933. The distribution of Mesolithic sites in the north of England. *Yorkshire Archaeological Journal* 31: 141–156.

Raistrick, A. 1934. Mesolithic sites of the north-east coast of England. *Proceedings of the Prehistoric Society of East Anglia* 7: 188–198.

Raistrick, A., Coupland, F. and Coupland, G. 1935. A Mesolithic site on the south-east Durham coast. *Transactions of the Northern Naturalists Union* 1 (4): 207–216.

Raistrick, A. and Westoll, T.S. 1933. A prehistoric site on the south Durham coast. *Vasculum* 19: 139–144.

Ragg, J.M. 1960. *The soils of the country round Kelso and Lauder*. Edinburgh: HMSO.

Reynier, M.J. 2002 Kettlebury 103: a Mesolithic "Horsham" type stone assemblage from Hankley Common. Elstead, *Surrey Archaeological Collections*, 89, 211–231.

Reynier, M.J. 2005. *Early Mesolithic Britain. Origins, Development and Directions*. Oxford, British Archaeological Reports British Series 393.

Ripoll, S., F. Muñoz, F., Bahn, P., and Pettitt. P. 2004. Palaeolithic cave engravings at Creswell Crags, England. *Proceedings of the Prehistoric Society* 70: 93–105.

Robinson, J. and Biggins, J.A. 1999. *Cushat Wood, Howick, Northumberland; Survey of an Iron Age Settlement*. Commissioned by Tyne and Wear Museums for the Howick Estate, Unpublished Report.

Robins, R.P. and Stock, E.C. 1990. The burning question: a study of molluscan remains from a midden on Moreton Island. In Solomon, S., Davidson, I. and Watson, D. (eds) *Problem Solving in Taphonomy: Archaeological Studies from Europe, Africa and Oceania*. Queensland, Australia. Tempus, Anthropology Museum, the University of Queensland: Archaeology and Material Culture Studies in Anthropology Vol. 2: 80–100.

Robson, D.A. 1966. A guide to the geology of Northumberland and the Borders. *Transactions of the Natural History Society of Northumberland, Durham and Newcastle upon Tyne* XVI, No 1.

Rowell, T.K. and Turner, J. 1985. Litho-, Humic and Pollen stratigraphy at Quick Moss, Northumberland. *Journal of Ecology* 73: 11–25.

Rowley-Conwy, P. 1981. Mesolithic Danish bacon: permanent and temporary sites in the Danish Mesolithic. In Sheridan, A. and Bailey, G. (eds) *Economic Archaeology: Towards an Integration of Ecological and Social Approaches*. Oxford, British Archaeological Reports International Series 96: 51–55.

Rowley-Conwy, P. 1995. Wild or domestic? On the evidence for the earliest domestic cattle and pigs in South Scandinavia and Iberia. *International Journal of Osteoarchaeology* 5: 115–126.

Russell, N.J., Bonsall, C. and Sutherland, D.G. 1995. The exploitation of marine molluscs in the Mesolithic of western Scotland: evidence from Ulva Cave, Inner Hebrides. In Fischer, A. (ed.) *Man and Sea in the Mesolithic: Coastal Settlement above and below Present Sea Level*. Oxford, Oxbow: 273–288.

Sackett, J.R. 1990. Style and ethnicity in archaeology: the case for isochretism. In Conkey, M.W. and Hastorf, C.A. *The Uses of Style in Archaeology*. Cambridge, Cambridge University Press: 32–43.

Sanchez, A., Canabate, M.L. and Lizcano, R. 1996. Phosphorus analysis at archaeological sites: An optimisation of the method and interpretation of the results. *Archaeometry* 38(1): 151–164.

Saville, A. 1980. On the measurement of struck flakes and flake tools. *Lithics*, 1: 16–20.

Saville, A. 1997. Palaeolithic handaxes in Scotland. *Proceedings of the Society of Antiquaries of Scotland* 127: 1–16.

Saville, A. 2004. The material culture of Mesolithic Scotland. In Saville, A. (ed.) *Mesolithic Scotland and its neighbours. The early Holocene prehistory of Scotland, and its British and Irish context and some northern European perspectives*. Edinburgh, Society of Antiquaries of Scotland: 185–220.

Schofield, A. J. 1991 Artefact distributions as activity areas: examples from south-east Hampshire. In Schofield, A.J. (ed.) *Interpreting Artefact Scatters: Contributions to Ploughzone Archaeology*. Oxford, Oxbow Monograph 5: 117–128.

Schulting, R. J. and Richards, M. P. 2000. The use of stable isotopes in studies of subsistence and seasonality in the British Mesolithic. In Young, R. (ed.) *Mesolithic Lifeways. Current Research from Britain and Ireland*. University of Leciester, Leicester Archaeology Monographs No. 7: 55–65.

Schulting, R. and Richards, M.P. 2002. Finding the coasting Mesolithic in southwest Britain: AMS dates and stable isotope results on human remains from Caldey Island, south Wales. *Antiquity* 76: 1011–1025.

Scott, E.M. (ed.) 2003. The Third International Radiocarbon Intercomparison (TIRI) and the Fourth International Radiocarbon Intercomparison (FIRI) 1990–2002: results, analysis, and conclusions. *Radiocarbon* 45: 135–408.

Shennan, S. 1997. *Quantifying Archaeology*. (Second Edition). Iowa City, University of Iowa Press.

Shennan, I., Lambeck, K., Horton, B., Innes, J., Lloyd, J., Mcarthur, J. and Rutherford, M. 2000. Holocene isostacy and relative sea-level changes on the east coast of England. In Shennan, I. and Andrews, J. (eds) *Holocene Land-Ocean Interaction and Environmental Change around the North Sea*. London, Geological Society of London Special Publications 166: 275–298.

Shiel, R. and Hardy, K. 2003. Statistical analysis of use-wear data. In Hardy, K. and Sillitoe, P.

Material Perspectives: Stone Tool Use and Material Culture in Papua New Guinea.

Internet Archaeology 14. http://intarch.ac.uk/journal/issue14/hardy_index.html.

Shiel, R. and Hardy, K. (In prep.) A statistical method for interpreting use-wear analysis data on stone tools.

Shipman, P., Foster, G. and Schoeninger, M. 1984. Burnt bones and teeth: an experimental study of color, morphology, crystal structure and shrinkage. *Journal of Archaeological Science* 11: 307–325.

Shore, J.S., Bartley, D.D. and Harkness, D.D. 1995. Problems encountered with the ^{14}C dating of peat. *Quaternary Science Reviews* 14: 373–383.

Shotton, F.W., and Williams, R.E.G., 1973 Birmingham University Radiocarbon Dates VII, *Radiocarbon* 15, 451–468.

Sillitoe, P. 1988. *Made in Niugini. Technology in the highlands of Papua New Guinea.* London, British Museum Publications.

Sillitoe, P. and Hardy, K. 2003. Living Lithics. Ethnography and Archaeology in Highland Papua New Guinea. *Antiquity* 77: 296, 555–566.

Simmons, I.G. 1996. *The Environmental Impact of Later Mesolithic Cultures*. Edinburgh, Edinburgh University Press.

Simmons, I.G. 2003. The *Moorlands of England and Wales*. Edinburgh, Edinburgh University Press.

Skaarup J. 1995. Hunting the hunters and fishers of the Mesolithic – twenty years of research on the sea floor south of Funen, Denmark. In Fischer, A (ed.) *Man and Sea in the Mesolithic. Coastal Settlement above and below present sea level.* Oxford, Oxbow Monograph 53: 397–401.

Slota, Jr P.J., Jull, A.J.T., Linick, T.W. and Toolin, L.J. 1987. Preparation of small samples for ^{14}C accelerator targets by catalytic reduction of CO. *Radiocarbon* 29: 303–306.

Smith, C. 1992. *Late Stone Age Hunters of the British Isles*. London, Routledge.

Smith, D.E., Shi, S., Cullingford, R.A., Dawson, A.G., Dawson, S., Firth, C.R., Foster, I.D.L., Fretwell, P.T., Haggart, B.A., Holloway, L.K., and Long, D. 2004. The Holocene Storegga Slide tsunami in the United Kingdom. *Quaternary Science Reviews* 23: 2291–2321.

Soffer, O., Adovasio, J.M., Illingsworth, J.S., Amirkhanov, H.A., Preaslov, N.D. and Street, M. 2000. Palaeolithic perishables made permanent. *Antiquity* 74: 812–821.

Sørensen, S. A. 1996. *Kongemosekulturen i Sydskandinavien*. Færgegården: Egnsmuseet Færgegården.

Spikins, P. 2002. Prehistoric Peoples of the Pennines: Reconstructing the Lifestyles of Mesolithic Hunter-Gatherers on Marsden Moor. Leeds, West Yorkshire Archaeology Service on behalf of English Heritage.

Stapert, D. and Krist, J.S. 1990. The Hamburgian Site of Oldeholtvolde (NL): Some Results of the Refitting Analysis. In Cziesla, E. (ed.) *The Big Puzzle: International Symposium on Refitting Stone Artefacts*. Studies in Modern Archaeology 1. Bonn,Holos: 371–404.

Stapert, D., Krist, J.S. and Zandbergen, A.L. 1986. Oldeholtvolde: A Late Hamburgian Site in the Netherlands. In Roe, D.A. (ed.) *Studies in the Upper Palaeolithic of Britain and Northwest Europe*.. Oxford, British Archaeological Reports International Series 296: 187–226.

Stein, J.K. 1992. The analysis of shell middens. In Stein, J.K. (ed.) *Deciphering a Shell Midden*. New York, Academic Press:1–24.

Stenhouse, M.J. and Baxter, M.S. 1983. ^{14}C dating reproducibility: evidence from routine dating of archaeological samples. *PACT* 8: 147–61.

Stone, P. and Planel, P.G. 1999. Introduction. In Stone, P. and Planel, P.G. *The Constructed Past. Experimental Archaeology, Education and the Public*. London, Routledge**:** 1–14.

Stuiver, M. and Kra, R.S. 1986. Editorial comment. *Radiocarbon* 28(2B): ii.

Stuiver, M. and Polach, H.A. 1977. Reporting of ^{14}C data. *Radiocarbon* 19: 355–363.

Stuiver, M. and Reimer, P.J. 1986. A computer program for radiocarbon age calculation. *Radiocarbon* 28: 1022–1030.

Stuiver, M. and Reimer, P.J. 1993. Extended ^{14}C data base and revised CALIB 3.0 ^{14}C age calibration program. *Radiocarbon* 35: 215–230.

Stuiver, M., Reimer, P.J., Bard, E., Beck, J.W., Burr, G.S., Hughen, K.A., Kromer, B., McCormac, F.G., van der Plicht, J. and Spurk, M. 1998. INTCAL98 radiocarbon age calibration, 24,000–0 cal BP. *Radiocarbon* 40: 1041–1084.

Switsur, V.R. and Jacobi, R.M. 1979. A radiocarbon chronology for the early postglacial stone industries of England and Wales. In Berger, R. and Suess, H.E. (eds) *Radiocarbon Dating*. London, University of California Press: 41–68.

Switsur, V. R., and West, R. G., 1973 University of Cambridge Natural Radiocarbon Measurements XII. *Radiocarbon*, 15: 534–44.

Switsur, V R, and West, R G, 1975 University of Cambridge Natural Radiocarbon Measurements XIII. *Radiocarbon*, 17: 35–51.

Teasdale, D. and Hughes, D. 1999. The glacial history of North-East England. In Bridgland, D., Horton, B.P. and Innes, J.B. (eds) *The Quaternary of North-East England*. Quaternary Research Association Field Guide. 10–17.

Tipping, R. 1996. The Neolithic Landscapes of the Cheviot Hills Hinterland: Paleoenvironmental Evidence. *Northern Archaeology* 13/14: 17–33.

Tipping, R. 1998a. Towards an environmental History of the Bowmont valley and the northern Cheviot Hills. *Landscape History* 20: 41–50.

Tipping, R. 1998b. The chronology of late Quaternary fluvial activity in part of the Milfield basin, northeast England. *Earth Surface Processes and Landforms* 23: 845–856.

Tolan-Smith, C. 1997a. The Stone Age landscape: the contribution of fieldwalking. In Tolan-Smith, C. (ed.) *Landscape Archaeology in Tynedale*. Newcastle upon Tyne, Department of Archaeology, University of Newcastle upon Tyne: 79–89.

Tolan-Smith, C. 1997b. Excavations at Brikside Fell Cairn, 1997. *University of Durham and University of Newcastle upon Tyne Archaeological Reports 1997* 21: 11–12.

Unrath, G., Owen, L.R., van Gijn, A., Moss, E.H., Plisson, H. and Vaughan, P. 1986. An evaluation of Use-Wear Studies: a Multi-analyst Approach. *Early Man News* 9/10/11: 117–176.

van der Veen, M. 1982. Carbonised plant remains from Neolithic Thirlings (Northumberland). *Ancient Monuments Laboratory Report* 3831: 4.

van Hoek, M. and Smith, C. 1988. Rock Carvings at Goatscrag Rock Shelters, Northumberland. *Archaeologia Aeliana* 5th Ser 16: 29–35.

Vang Petersen, P. 1982. Jægerfolket på Vedbækbopladserne. *Nationalmuseets Arbejdsmark* 1982: 179–189.

van Wijngaarden-Bakker, L.H. 1985. The faunal remains. In Woodman, P.C. (ed.) *Excavations at Mount Sandel 1973–77*. Belfast, Northern Ireland Archaeological Monographs No. 2, HMSO: 71–76.

Vereschagin, N.K. 1967. Primitive hunters and Pleistocene extinctions in the Soviet Union. In Martin, P.S. and Wright, Jr. H.E. (eds) *Pleistocene Extinctions: the Search for a Cause*. New Haven and London, Yale University Press: 365–398.

Waddington, C. 1996. *Middle Warren. Fieldwalking Assessment Phase II*. Archaeological Practice, University of Newcastle Upon Tyne, unpublished report.

Waddington, C. 1998a. Fieldwalking. In *Turning the Tide Archaeological Assessment*. Archaeological Services University of Durham. Unpublished Report: 18–28.

Waddington, C. 1998b. Cup and ring marks in context. *Cambridge Archaeological Journal* 8 (1): 29–54.

Waddington, C. 1999a. *A Landscape Archaeological Study of the*

Mesolithic-Neolithic in the Milfield Basin, Northumberland. Oxford, British Archaeological Reports British Series 291.

Waddington, C. 1999b. Recent lithic finds from Bowden Doors, Northumberland. *Archaeologia Aeliana* 5th Ser. 27: 173–174.

Waddington, C. 2001a *Fieldwalking Results from Maiden's Hall Archaeological Evaluation*. Unpublished Report for the Archaeological Practice, University of Newcastle upon Tyne.

Waddington, C. 2001b *Milfield Fieldwalking and Test Pit Results*. Department of Archaeology, University of Newcastle upon Tyne. (unpublished).

Waddington, C. 2004. The Maelmin Heritage Trail. Archaeological research and the public. In Frodsham, P. (ed.) *Interpreting the Ambiguous. Archaeology and Interpretation in Early 21st Century Britain*. Oxford, British Archaeological Reports British Series 362**:** 49–57.

Waddington, C., Bailey, G. Boomer, I. and Milner, N.J. 2006. A Bronze Age Cist Cemetery at Howick, Northumberland. *The Archaeological Journal* 162: 65–95.

Waddington, C. and Passmore, D. (in press) Characterization and interpretation of surface artefact scatters: a model of inference. *Geoarchaeology*.

Waddington, C. and Pedersen, K.L.R. (eds) 2007. *Mesolithic Studies in the North Sea Basin and Beyond. Proceedings of a Conference Held at Newcastle in 2003.* Oxford, Oxbow.

Waraas, T. A. 2001. *Vestlandet i tidleg Preboreal tid. Fosna, Ahrensburg eller vestnorsk tidlegmesolitikum?* Unpublished MA dissertation. Bergen, Universitetet i Bergen.

Ward, G.K. and Wilson, S.R. 1978. Procedures for comparing and combining radiocarbon age determinations: a critique. *Archaeometry*. 20: 19–31.

Ward, T., 1998 Daer Reservoir 1 and 2, Crawford. *Discovery and Excavation in Scotland 1998*, 128.

Wayland Barber, E. 1994. *Women's Work: The first 20,000 years. Women, Cloth and Society in Early Times.* New York, W.W. Norton and Co.

Westcott. D. (ed.) 1999. *Primitive technology: A Book of Earth Skills.* Salt Lake City, Gobbs-Smith.

Weyman, J. 1975. Mesolithic occupation at Gallowhill Farm, Corbridge. *Archaeologia Aeliana* 5th Ser. 3: 219–220.

Weyman, J. 1980. A flint chipping site at Low Shilford, Riding Mill, Northumberland. *Archaeologia Aeliana* 5th Ser. 8: 159–161.

Weyman, J. 1984. The Mesolithic in North-East England. In Miket, R. and Burgess, C. (eds) *Between And Beyond The Walls: Essays in Honour of George Jobey*. Edinburgh, John Donald: 38–51.

Whallon, R. 1973. Spatial analysis of occupation floors I: the application of nearest neighbor analysis of variance. *American Antiquity*, 38: 266–278.

Whallon, R. 1974. Spatial analysis of occupation floors II: the application of nearest neighbor analysis. *American Antiquity*, 39: 16–35.

Whallon, R. 1978. The Spatial Analysis of Mesolithic Occupation Floors: A Reappraisal. In Mellars, P. A. (ed.) *Mesolithic Settlement in Northwest Europe*. London, Duckworth: 27–35.

White, C. 1968. *Report on Field Survey, June–August 1968*. Canberra: Australian Institute of Aboriginal studies, Document 68/738 (mimeographed).

White, J.P. 1968. Ston naip bilong tumbuna*:* the living stone age in New Guinea. In Bordes, F. and de Sonneville Bordes, D. (eds) *La préhistoire: problèmes et tendances.* Paris, CNRS: 511–516.

White, J.P. and Thomas, D.H. 1972. What mean these stones? Ethno-taxonomic models and archaeological interpretations in the New Guinea Highlands. In Clarke, D.L. (ed.) *Models in Archaeology.* London, Methuen and Co: 275–308.

White, R. B. 1978 Excavation at Trwyn Du, Anglesey, 1974. *Archaeologia Cambrensis* 127: 16–39.

Wickham-Jones, C.R. 1990. *Rhum: Mesolithic and Later Sites at Kinloch, Excavations 1984–86.* Edinburgh, Society of Antiquaries of Scotland Monograph Series 7.

Wickham-Jones, C. R. 2004. Structural evidence in the Scottish Mesolithic. Mesolithic Scotland and its Neighbours. In Saville, A. (ed.) *The Early Holocene Prehistory of Scotland, its British and Irish Context and Some Northern European Perspectives*. Edinburgh, Society of Antiquaries of Scotland**:** 229–242.

Wickham-Jones, C.R. and Dalland, M. 1998. A small Mesolithic site at Fife Ness, Fife, Scotland. *Internet Archaeology* 5: 1–32. http://intarch.ac.uk/journal/issue5/wickham_toc.html

Wiessner, P. 1983. Style and social information in Kalahari San projectile points. *American Antiquity* 48 (2): 253–76.

Wiessner, P. 1990. Is There a Unity to Style? In Conkey, W.M. and Hastorf, C.A. (eds) *The Uses of Style in Archaeology*. Cambridge, Cambridge University Press: 105–112.

Woodman, P.C. 1978a. *The Mesolithic in Ireland: hunter-gatherers in an insular environment*. Oxford, BAR British Series 58.

Woodman, P.C. 1978b. The chronology and economy of the Irish Mesolithic: some working hypotheses. In Mellars, P.A. (ed.) *The Early Postglacial Settlement of Northern Europe*. London, Duckworth: 333–369.

Woodman, P. C. 1984. Excavations of a Mesolithic Site at Cass-Ny-Hawin, Isle of Man. *Mesolithic Miscellany* 5 (1): 2–4.

Woodman, P.C. 1985. *Excavations at Mount Sandel 1973–1977*. Belfast, Northern Ireland Archaeological Monographs 2 HMSO.

Woodman, P.C. 1987. Excavations at Cass ny Hawin, a Manx Mesolithic site, and the position of the Manx microlithic industries. *Proceedings of the Prehistoric Society* 53: 1–22.

Woodman, P.C. 2004. Some problems and perspectives: reviewing aspects of the Mesolithic period in Ireland. In Saville, A. (ed.) *Mesolithic Scotland and its Neighbours. The Early Holocene Prehistory of Scotland, and its British and Irish Context and Some Northern European Perspectives*. Edinburgh, Society of Antiquaries of Scotland: 285–297.

Woodman, P.C., Anderson, E. and Finlay, N. 1999. *Excavations at Ferriter's Cove, 1983–95: Last Foragers, First Farmers in the Dingle Peninsula*. Bray, Wordwell.

Woodman, P.C., McCarthy, M. and Monahan, N. 1997. The Irish Quaternary Faunas Project, a survey of the ^{14}C evidence. *Quaternary Science Reviews* 16: 129–59.

Wymer, J. 1962. Excavations at the Maglemosian sites at Thatcham, Berkshire, England. *Proceedings of the Prehistoric Society* 28: 329–361.

Yellen, J. E. 1977. Cultural patterning in Faunal Remains: Evidence from the !Kung Bushmen. In Ingersoll, D. and Yellen, J.E. (eds) *Experimental Archaeology.* New York, Columbia University Press: 271–331.

Young, R. 1987. Lithics and Subsistence in North-Eastern England. Aspects of the Prehistoric Archaeology of the

Wear Valley, County Durham from the Mesolithic to the Bronze Age. Oxford, British Archaeological Reports.

Young, R. 2000a. Aspects of the 'coastal Mesolithic' of the north east of England. In Young, R. (ed.) *Mesolithic Lifeways. Current Research from Britain and Ireland*. University of Leicester, Leicester Archaeology Monographs 7: 179–190.

Young, R.E. 2000b. Investigations at Howick. *Archaeology in Northumberland 1999–2000.* Morpeth, Northumberland County Council: 31.

Zagorska, I. and Zagorski, F. 1985. The Bone and Antler Inventory from Zvejnieki II, Latvian SSR. In Bonsall, C. (ed.) *The Mesolithic in Europe. Papers presented at the Third International Symposium.* Edinburgh, Edinburgh University Press..

Zvelebil, M. 1994. Plant use in the Mesolithic and its role in the transition to farming. *Proceedings of the Prehistoric Society* 60: 35–74.

Zvelebil, M., Green, S.W. and Macklin, M.G. 1992. Archaeological landscapes, lithic scatters, and human behaviour. In Rossignol, J. and Wandsnider, L. (eds) *Space, Time and Archaeological Landscapes*. New York, Plenum Press: 193–226.