

Archaeological and palynological studies at the Mesolithic pitchstone and flint site of Auchareoch, Isle of Arran

The late Thomas L Affleck*, Kevin Edwards† and Ann Clarke‡

SUMMARY

The results of an archaeological and environmental (mainly palynological) investigation of a site of Mesolithic age are presented. The inland kame terrace site of Auchareoch on the Isle of Arran has produced some preserved features with over 4400 flint and pitchstone finds, and carbonized hazel-nut shells. The extent and character of the occupation area are assessed and shown to be extensive (300–400 m²). The environmental data demonstrate the limitations imposed by soil pollen and charcoal studies, but suggest that the area has experienced possible hunter-gathering and agricultural impacts, prior to soil deterioration and peat growth. An attempt is made to place the site in the wider context of the Mesolithic of northern Britain.

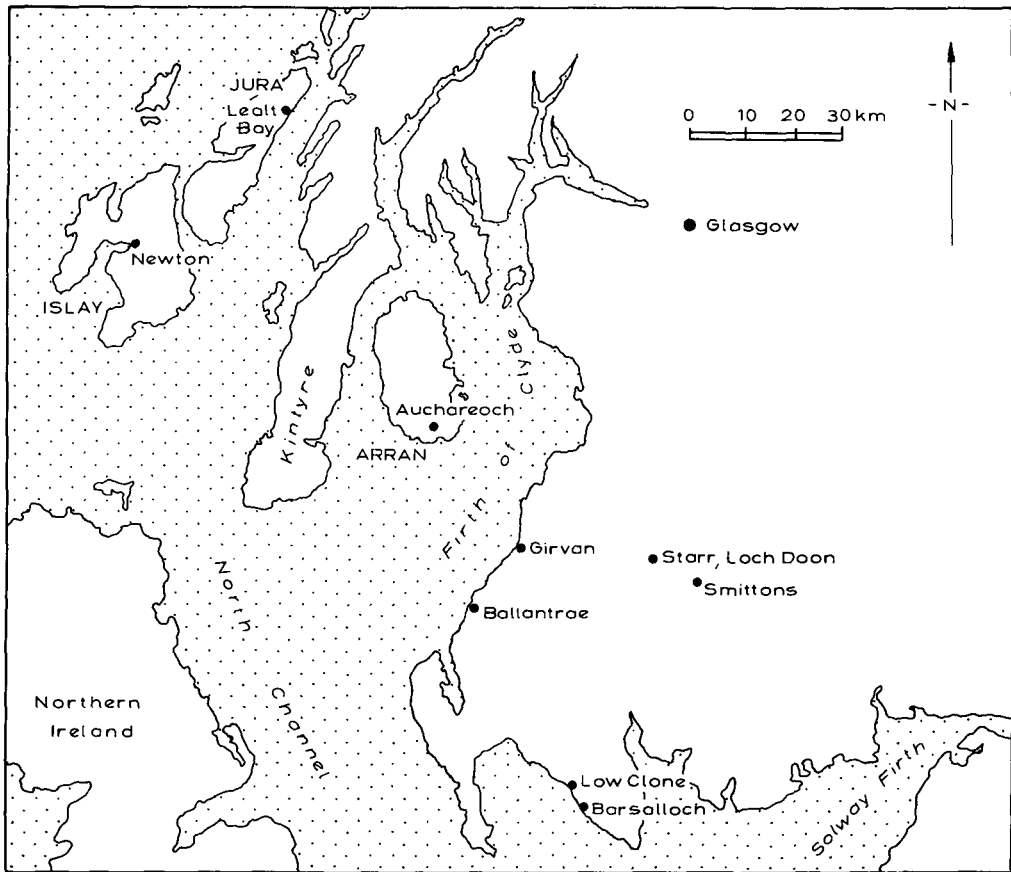
INTRODUCTION

Research shows that the south-west of Scotland was the location for widespread Mesolithic occupation (illus 1). Apart from the long known coastal location of possible settlement (Morrison 1980a; 1982) there was also an extensive inland presence of hunter-gatherer communities (Edwards *et al* 1983). The relatively large size of the Isle of Arran (c 32×17 km) might be expected to have yielded signs of a Mesolithic presence. Apart from the early references of Lacaille (1954) to unspecified localities producing artefacts, which were compared with the late Larnian of north-east Ireland, nothing had come to light until recently. In 1981 Fairhurst reported finds of microliths at Knockenkelly and Auchareoch. In addition, pollen and charcoal evidence of environmental disturbance in the period conventionally ascribed to the Mesolithic has been reported from Machrie Moor in the south-west of Arran (Robinson 1981; 1983; McIntosh 1986). A survey by Allen and Edwards (forthcoming) gives details of locations on Arran (including the Machrie Moor area) which have produced lithics of pitchstone and flint. In these contexts Arran is of great interest because of its known pitchstone sources used in the manufacture of Mesolithic and later artefacts and distributed up to 300 km from Arran sources (Mann 1918; Ritchie 1968; Williams Thorpe & Thorpe 1984).

* Tom Affleck died on 11 March 1987 at the age of 61. This paper is published in memory of one of Scotland's most enthusiastic archaeologists and a much-missed friend.

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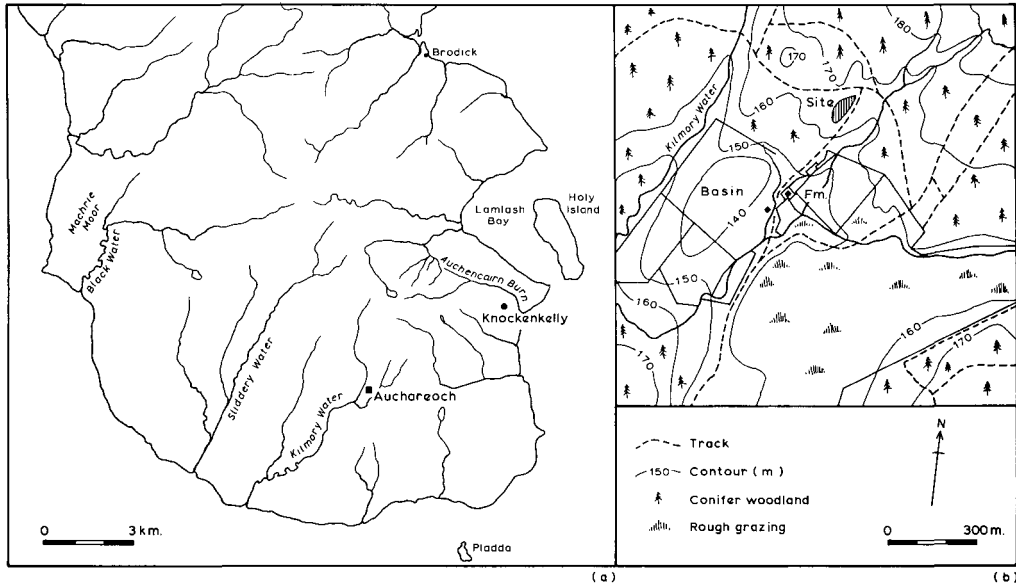


ILLUS 1 Map of south-west Scotland showing the principal locations mentioned in the text

The site of Auchareoch was brought to our attention by Mr Chris Allen. Its importance lies in the fact that not only has it produced several thousands of both flint and pitchstone pieces, but also that it has enabled us to carry out an archaeological and environmental investigation of a pitchstone site. The site lies in an abandoned sand and gravel quarry within forestry plantation. Quarrying in a kame terrace had uncovered fire spots, burnt stone, carbonized hazel-nut shells and over 4400 lithic finds. The aims of the investigations reported here were to assess the extent and character of the Mesolithic occupation and to place the site in its environmental context. A first attempt is also made to place Auchareoch in the wider context of the Mesolithic of northern Britain.

THE SITE

Auchareoch lies 4 km inland from the coast of southern Arran and 0.2 km north-east of Auchareoch farm (NGR NR 9952 2472) (illus 2a and b). The site is located at 165 m OD and occupies a mound which is part of a dissected kame terrace which has suffered greatly from quarrying activities. The kame terrace lies on the northern edge of a small basin now drained by the Kilmory Water and represents an ice-marginal deposit (Gemmell 1972). There was probably an overflow channel to the south of the basin and other kames in the areas are now beneath coniferous forest. Two



ILLUS 2 (a) Map of southern Arran; (b) map showing the situation of the Auchareoch site

quarries have been opened into the site mound, one to its north and one to its south. These were originally opened and worked by the Forestry Commission and local people continued to extract sand from them. Although the northern and southern quarries as well as the disturbed area in-between have produced Mesolithic materials, this paper will focus upon the northern area. Illustration 3 displays a plan of the north quarry and part of the south quarry together with a transect across the former. Much of the archaeological attention has been devoted to the platform area but the exposure along the western side of the quarry has also been investigated with a view to assessing the extent of lithic distributions and the environmental history of the site.

THE DISTRIBUTION OF LITHIC FINDS

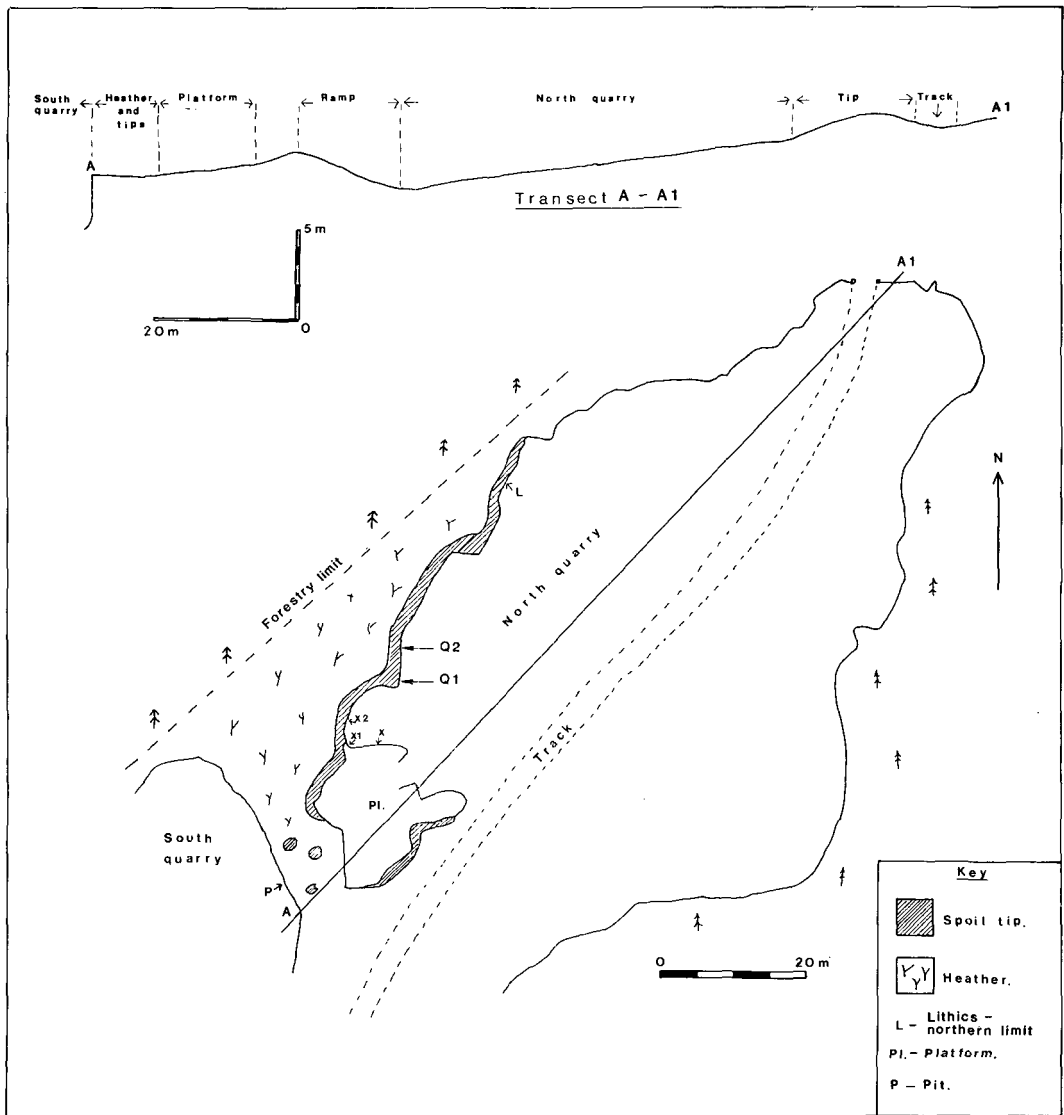
GENERAL

An examination of the area revealed most lithics to be concentrated on the bulldozed platform area between the two quarries. Their numbers appeared to decrease northwards away from the platform along the western face of the north quarry with the limit of finds some 42 m from the platform. Some lithics were also found in the northern face of the southern quarry but not in the east or west faces of the southern quarry or in the eastern face of the northern quarry; however, Mr Allen (pers comm) has found several pieces in those locations. Since the area of greatest lithic density appeared to be the platform area where fire pits containing carbonized hazel-nut shells were also apparent, it was decided to focus initial attention there.

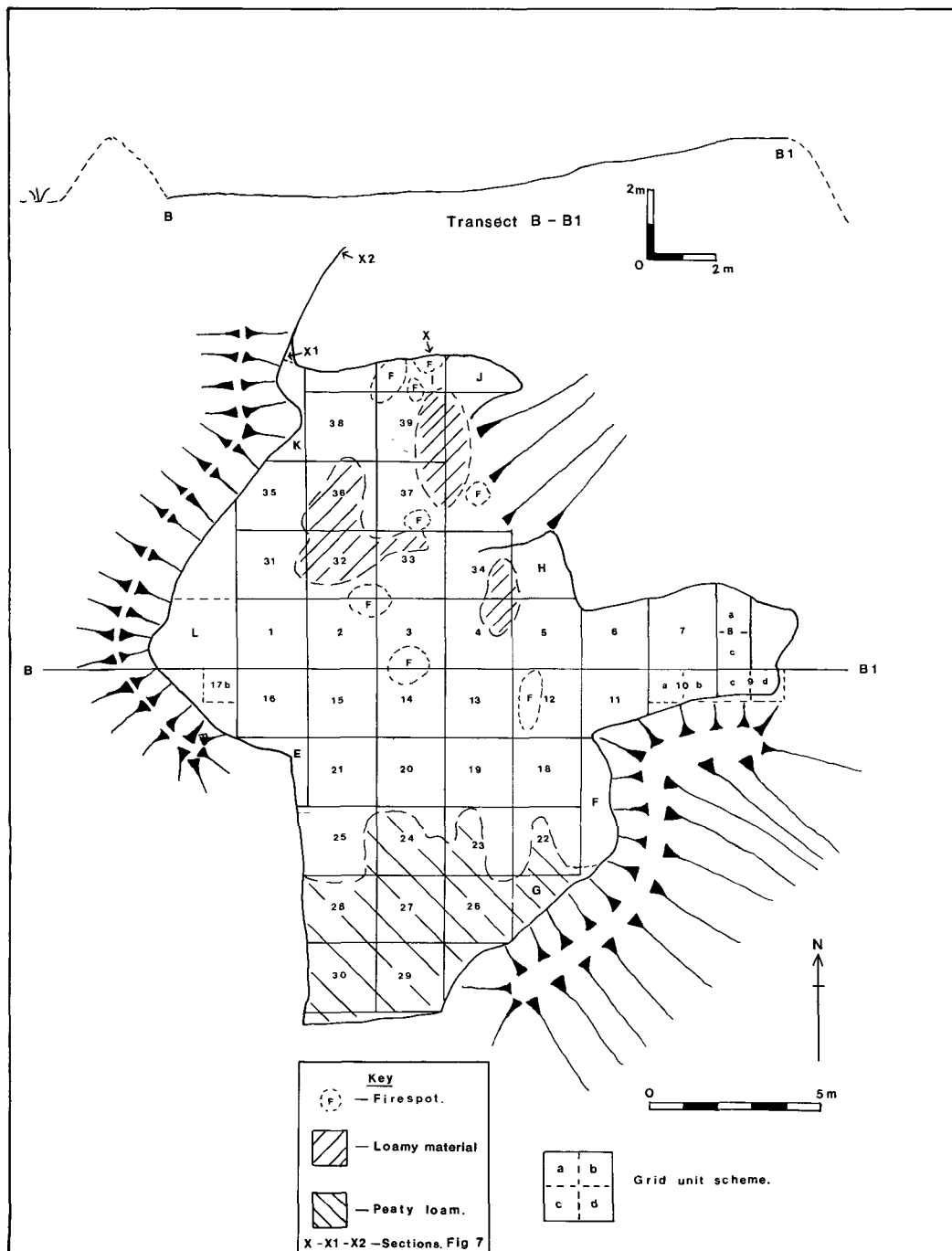
SURVEY AND CONTROLLED LITHIC COLLECTION ON THE STRIPPED PLATFORM AREA

The area stripped of topsoil by the quarrying operations forms a somewhat irregularly-shaped platform at the south-western end of the north quarry (illus 3 and 4). The spoil from the stripping operations was dumped at the eastern and western edges of the platform. The platform is some 44 m²

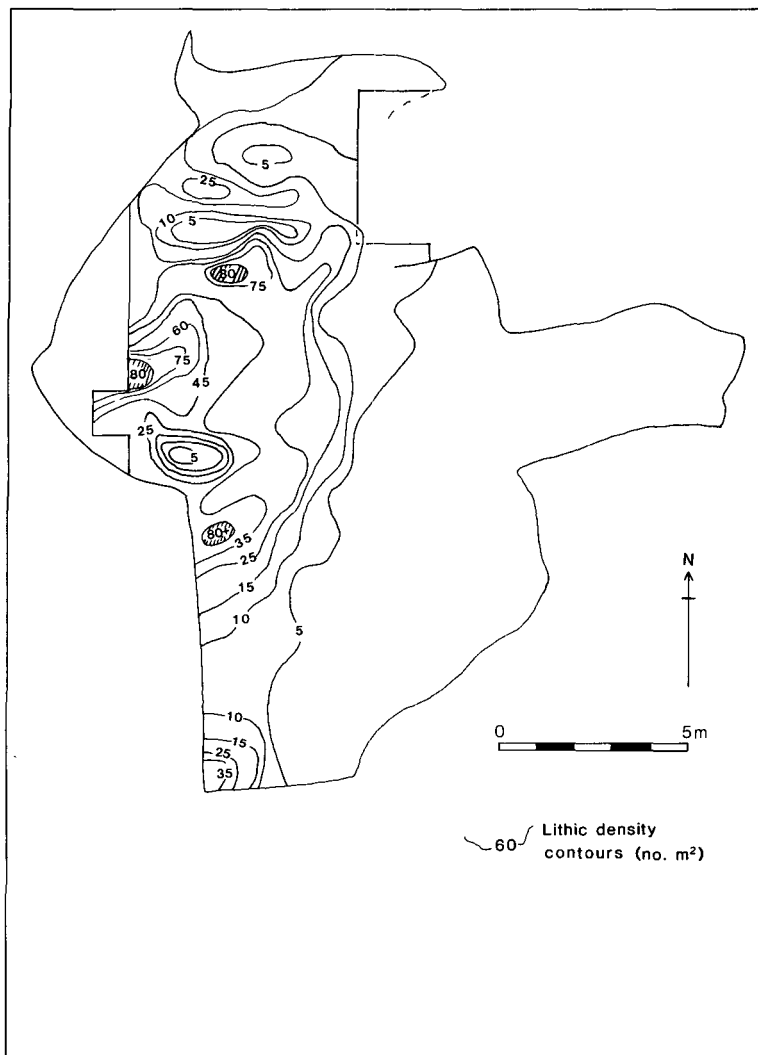
in area with greatest dimensions of 9.0 m along both north-south and east-west axes. The transects A-A1 (illus 3) and B-B1 (illus 4) show the platform to slope downwards in a southerly and westerly direction. Most of the surface is a sandy soil with some gravel, but smaller areas with either a more loam-like or peaty appearance were also recorded (illus 4, grid squares 22-30, 32, 38, 39). For surface collection the area was gridded in 4 m² units, with each numbered unit further sub-divided into four 1 m² lettered quadrants. Irregular areas on the perimeter of the gridded area were designated by the letters E-K. The soil material overlying the present surface of the platform was skimmed very lightly but further detailed excavation was not undertaken. Lithic material was collected and bagged separately for each grid unit - 161 samples in all. Further samples from the surface of adjacent spoil tips were also collected.



ILLUS 3 Plan of the Auchareoch site



ILLUS 4 Plan of the platform area



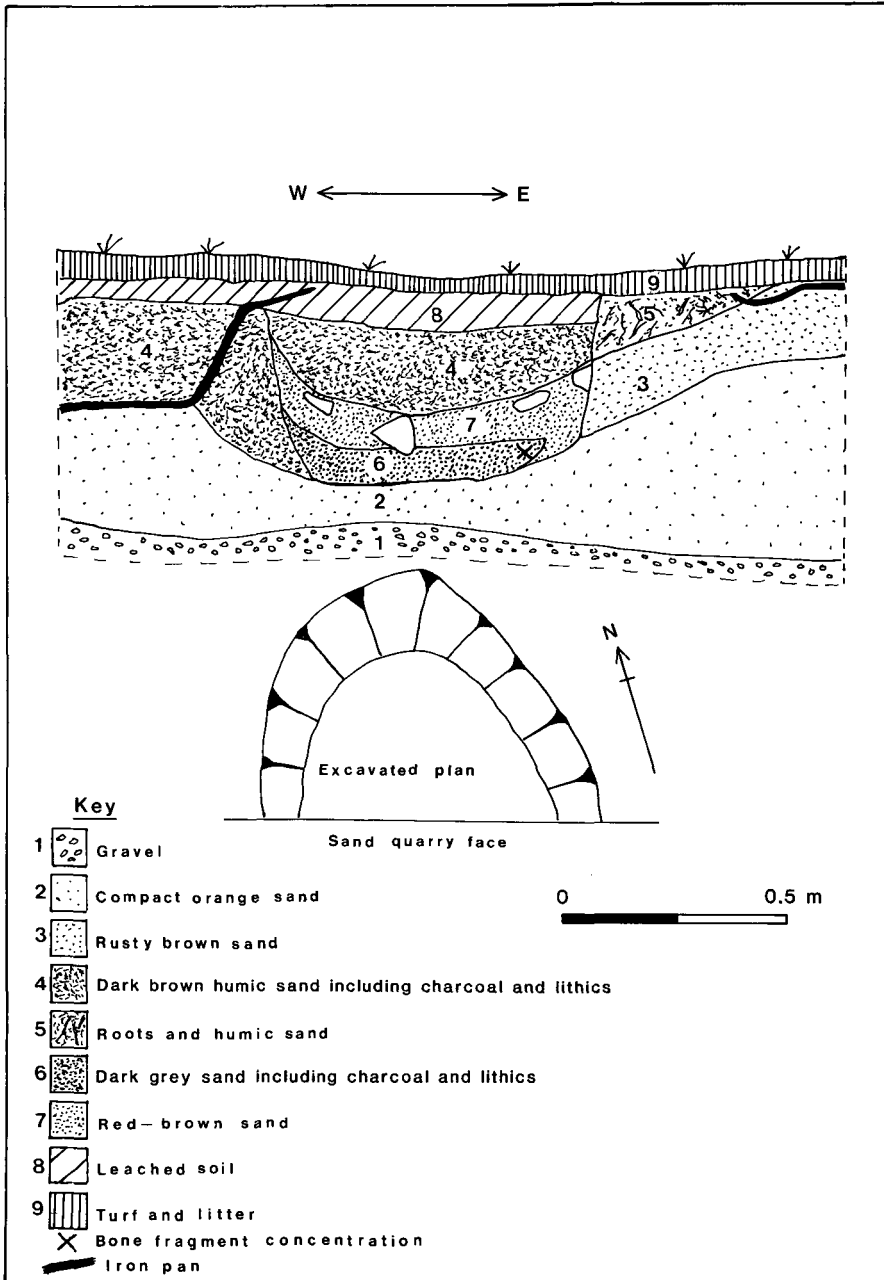
ILLUS 5 Lithic density contour map of the platform area

From the number of lithics per square metre on the platform, a plan has been constructed showing lithic density contours (illus 5). This shows three quite distinct locales of concentration over 80 lithics per m^2 . These are all situated towards the western edge of the platform where the general lithic density is in excess of 30 per m^2 .

THE SOUTH QUARRY PIT

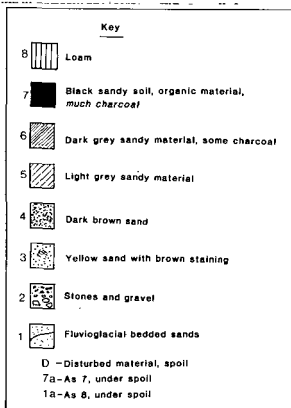
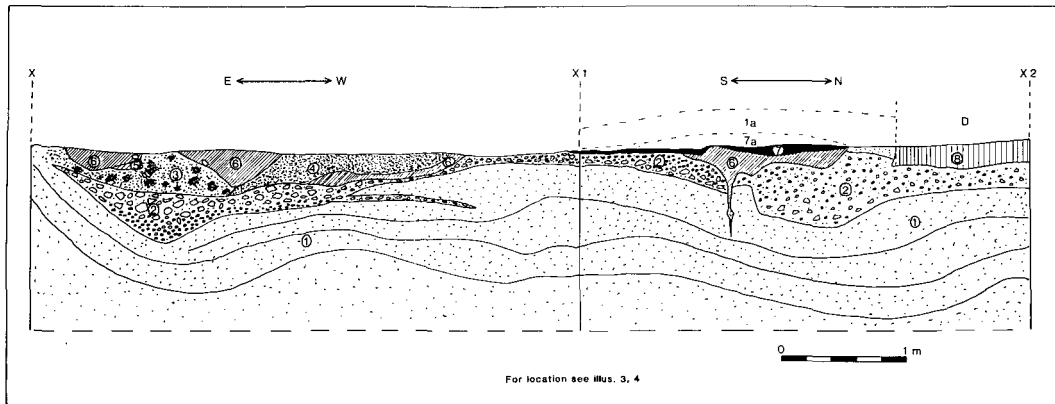
A pit at the northern end of the south quarry (illus 3) has been excavated by Mr Peter Strong who has put both his plans and material at our disposal. Illustration 6 presents a section drawing of the pit derived from Strong's site sketch.

The primary fill of Strong's pit (illus 6, layer 6) contained fused material of charcoal, sand and bone suggesting fire at a relatively high temperature. The red-brown sand of layer 7 could indicate a



ILLUS 6 Section drawing of the south quarry pit (after field sketch provided by Mr Peter Strong)

natural and partial infilling of the pit which was then succeeded by further fire activity (layer 4). The boulders in layer 7 were not fire-marked and there is no indication that they were 'pot boilers'. Many lithics were found in both of the charcoal-rich layers 4 and 6, and it was noted that the proportions of pitchstone here were much lower than those found on the platform surface. The bone and charcoal



ILLUS 7 Section drawing of the north quarry fire spots area

materials do not appear to be further identifiable. The composition of this pit is somewhat different from the features found at the platform edge of the north quarry (see Fire spots section below).

ADDITIONAL INFORMATION

Mr Chris Allen kindly loaned us his collection of lithics gathered over a period of years from the site, mainly in the platform area. This material is of great interest since it constitutes a primary collection which includes large-size lithics. Material subsequently collected from the site has been the less evident smaller material and thus the two data sets, together with those collected by Mr Strong, should show a relatively complete picture of the lithics assemblage from Auchareoch. A selection of lithic material is shown in illus 9.

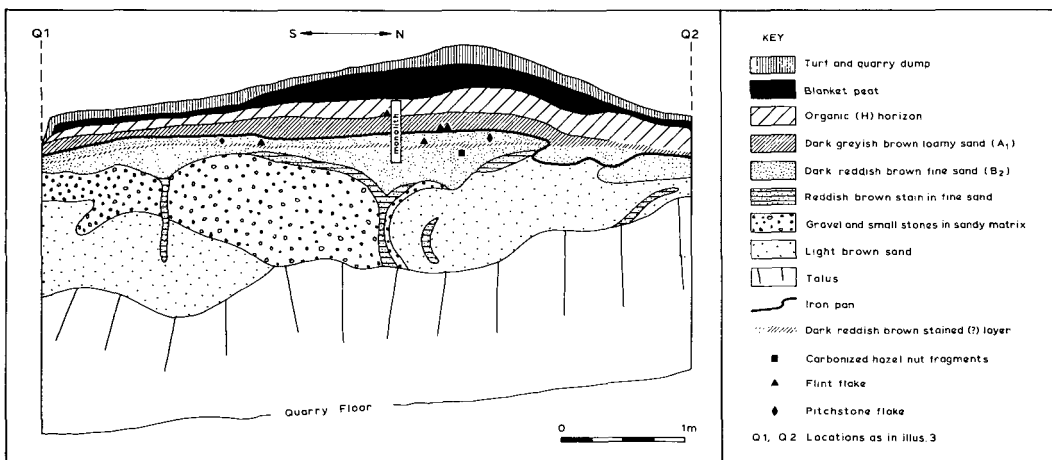
FIRE SPOTS

The stripped platform has produced evidence of apparent fire spots (illus 4) notably in grid squares 37-39, the north-east corner of 2, 3-4 and 12. The sandy soil was reddened and had a high content of finely comminuted charcoal and carbonized material. Carbonized hazel-nut (*Corylus avellana*) fragments were present and a relatively high proportion of the recovered flint material showed evidence of fire-crazing.

Two of the fire spots north of grid square 39 have been cut by the south face of the north quarry and the resulting exposed sections are shown in illus 7 (section X-XI). The material underlying the fire spots appears to be undulating fluvioglacial sand beds and there are also layers of stones and gravels. The fire-spot material here is predominantly a dark grey mineral soil containing lithics and small pieces of charcoal including hazel-nut fragments. A fire spot in the west face of the north quarry (section XI-X2, illus 7) has a black, charcoal-rich, organic and sandy layer overlying dark grey mineral material similar to the grey material in the platform-edge fire spots. It is possible that quarrying operations have led to a slight truncation of the latter.

ENVIRONMENTAL STUDIES

The stratigraphy of the western face of the north quarry reveals the morphogenetic complexity of the site. Since this particular quarry face was not encumbered with too much talus and because lithic finds were visible along its length, the opportunity was taken to plan its principal features and part of the southern section is shown in illus 8 (equivalent to the area between points Q1 and Q2 in illus 3). The whole section is some 46 m in length. The visible *in situ* basal materials consist of light-coloured sand containing stones and boulders. Let into this, especially in the centre and southern end, are beds of angular debris which contain cryoturbation features in some places. A soil has developed within these fluvioglacial and periglacial materials and an iron pan divides the lower brown mineral soil from an upper bleached podzolic horizon. The soil profile contains stones throughout and the whole is overlain by a blanket peat which attains a thickness of 30 cm at the northern end of the quarry. Surface vegetation and/or disturbed tip overlay the site. The lithic materials from the quarry face are found beneath the peat and within the soil horizons on either side of the iron pan.



ILLUS 8 Stratigraphy of part of the west face of the north quarry

The exact stratigraphic relationship between the platform area and the visible soil profiles in the west face of the quarry are difficult to determine given the sloping nature of the terrace and the fact that the site stratigraphy is obscured in many places by dumped material. As far as we were able to ascertain, the platform surface is approximately level with the base of the H horizon of the podzol visible in the west quarry face (see below).

TABLE 1
Description of the monolith profile

Depth (cm)	Horizon	Characteristics
0-12.5	H	Black (10 YR 2/1) organic layer with abundant quartz grains and occasional stones (up to 1 cm); many fine roots; boundary sharp.
12.5-27.0	A ₁	Very dark greyish brown (10 YR 3/2) loamy sand; frequent weathered sandstone stones (up to 2 cm); some very fine rootlets; boundary sharp but undulating.
At 27.0	B ₁	Dark reddish brown (5 YR 2.5/2) thin undulating iron pan.
27.0-50.0	B ₂	Dark reddish brown (5 YR 3/3 to 5 YR 3/4 nearer base) fine sand, incorporating a dark reddish brown (stained?) layer (5 YR 3/2) at 36-39 cm; small stones (0-1.5 cm) throughout; no rootlets.

POLLEN ANALYSIS

A soil monolith 50 cm in length was collected from the western face of the north quarry (illus 8 and table 1). This was investigated mainly by pollen analysis in an attempt to reconstruct aspects of the environmental history of the site. Of special interest was the fact that the layers investigated were those found to contain lithic material. The results of these analyses are discussed later.

POST-SURVEY INVESTIGATIONS

THE LITHIC ASSEMBLAGE

In total 4417 lithics were collected from the site. Table 2 summarizes these by type, number and collection strategy. The only securely stratified elements are those from the north quarry-face fire spots and those found during excavation of the pit. The platform lithics may represent material which has arrived at its present position, in part, by downward movement through overlying soil (see Discussion below).

Of particular interest in a comparison of collection strategies are those collections from the platform. The gridded collection almost triples the amount of material from the platform mainly through recognition of the smaller size component. Thus many of the flakes here comprise tiny debris and the microlithic element is tripled. This suggests that close controlled collecting can add valuable information towards the formation of any assemblage.

RAW MATERIALS

The assemblage comprises 90% flint and 9.4% pitchstone. Quartz and agate are present in minute quantities and there are four flakes of a soft shiny substance, possibly mudstone.

The cortex present on 12% of the flint indicates the use of rolled flint pebbles. These were probably collected from beaches local to the site where flint can be found today.

Pitchstone is available in the kame deposits in the form of rounded pebbles. As 15% of the pitchstone exhibits an abraded cortex it is likely that fluvioglacial material was exploited. Those pieces classified as chunks (see table 2) include mainly the gravel element of pitchstone: tiny rounded pebbles (6-20 mm diameter), whole or broken, which would be too small for artefact production. Pitchstone samples from the site include many petrological forms, both euhedrally porphyritic and aphyric (Williams Thorpe & Thorpe 1984), and varying in degree of glassiness and colour. This degree of variation would strengthen the idea of mixed fluvioglacial sources for the pitchstone rather than a single outcrop source.

TABLE 2
Auchareoch Lithics: type and collection strategy
(I=inner, S=secondary, P=primary)

Type	Chris Allen coll	P Strong platform	Grid coll platform	Pit	North quarry	Total
FLINT						
Flakes I	683 (213)	144 (49)	1725 (462)	230 (80)	227 (64)	3009 (868)
S	140 (17)	25 (4)	133 (30)	31 (2)	43 (12)	372 (65)
P	18 (5)	3	13 (5)	–	5 (2)	39 (12)
Blades I	107 (16)	16 (2)	38 (4)	43 (4)	28 (7)	232 (33)
S	21	–	2	12	–	35
Chunks	33 (24)	–	35 (19)	4 (1)	10 (4)	82 (48)
Cores	14 (4)	–	3	7	1	25 (4)
Pebbles	2	–	1	–	–	3
Scalene triangles	22 (2)	–	36 (3)	6 (1)	11 (1)	76 (7)
Backed fragments	12 (2)	(2)	28 (3)	4 (1)	6 (1)	52 (9)
Backed blades	–	–	–	–	–	–
Crescent	–	–	3	2	–	5
Triangle	–	–	1	–	–	1
Microburin	1	–	9 (1)	3	1	14 (1)
Notched blades	2	–	–	–	–	2
Retouched Core trimmer	4 4	– –	1 –	4 (1)	1 1	10 6 (1)
TOTAL	1070 (283)	190 (57)	2038 (528)	350 (90)	335 (91)	3983 (1049)
PITCHSTONE						
Flakes I	119	6	159	4	13	301
S	18	1	15	2	3	39
P	8	–	8	–	–	16
Blades I	22	2	3	5	1	33
S	5	–	–	1	2	8
Cores	9	–	1	1	1	12
Scalene triangles	–	–	3	–	–	3
Backed fragments	1	–	3	–	–	4
Retouched	–	–	–	2	–	2
TOTAL	182	9	192	15	20	418
Chunks	45	–	101	1	3	150
QUARTZ	2	2	6	–	–	10
AGATE	1	–	–	–	1	2
MUDSTONE	2	–	–	2	–	4
					TOTAL LITHICS	4417

Over a quarter of the flint assemblage was burnt (figures in parentheses, table 2). Burning was not recorded for the pitchstone as no evidence was available for the effect of heat upon this raw material.

PRIMARY TECHNOLOGY

Primary knapping on both flint and pitchstone involved the use of weathered nodules fashioned into platform cores from which blades and flakes were removed. Seventy per cent of the cores are single platform whilst the rest have double platforms but these are not necessarily opposed. All of the cores are of a small size which may reflect the intensive use of the material before discard. Flake scars

present on the cores indicate that about 45% were used in the production of blades some of which were microblades c 3 mm wide (illus 9, 22, 30–31). Twenty-four per cent produced blades and flakes (illus 9, 22, 30–32) and the rest were either all flakes or split pebbles (illus 9, 33, 34).

Flakes and flake debris comprised 87% of the flint and 85% of the pitchstone. Many of the flakes were of a regular shape indicating the fine quality of the raw material.

A significant proportion of the assemblage is blades: 6.7% of the flint and 9.8% of the pitchstone. Sizes range from 1 cm to 5 cm long and from 3 mm to 2 cm wide (illus 9, 18, 19).

SECONDARY TECHNOLOGY

Narrow blade microlithic forms are the dominant retouched item and compose 4.2% of the flint and 1.6% of the pitchstone. Of the total 45% are scalene triangles (illus 9, 5–7), 30% backed fragments, 11% backed blades (illus 9, 1–4) with the rest comprising crescents (illus 9, 8, 9) a triangle, microburins (illus 9, 10–17) and notched blades (illus 9, 20, 21) (see table 2).

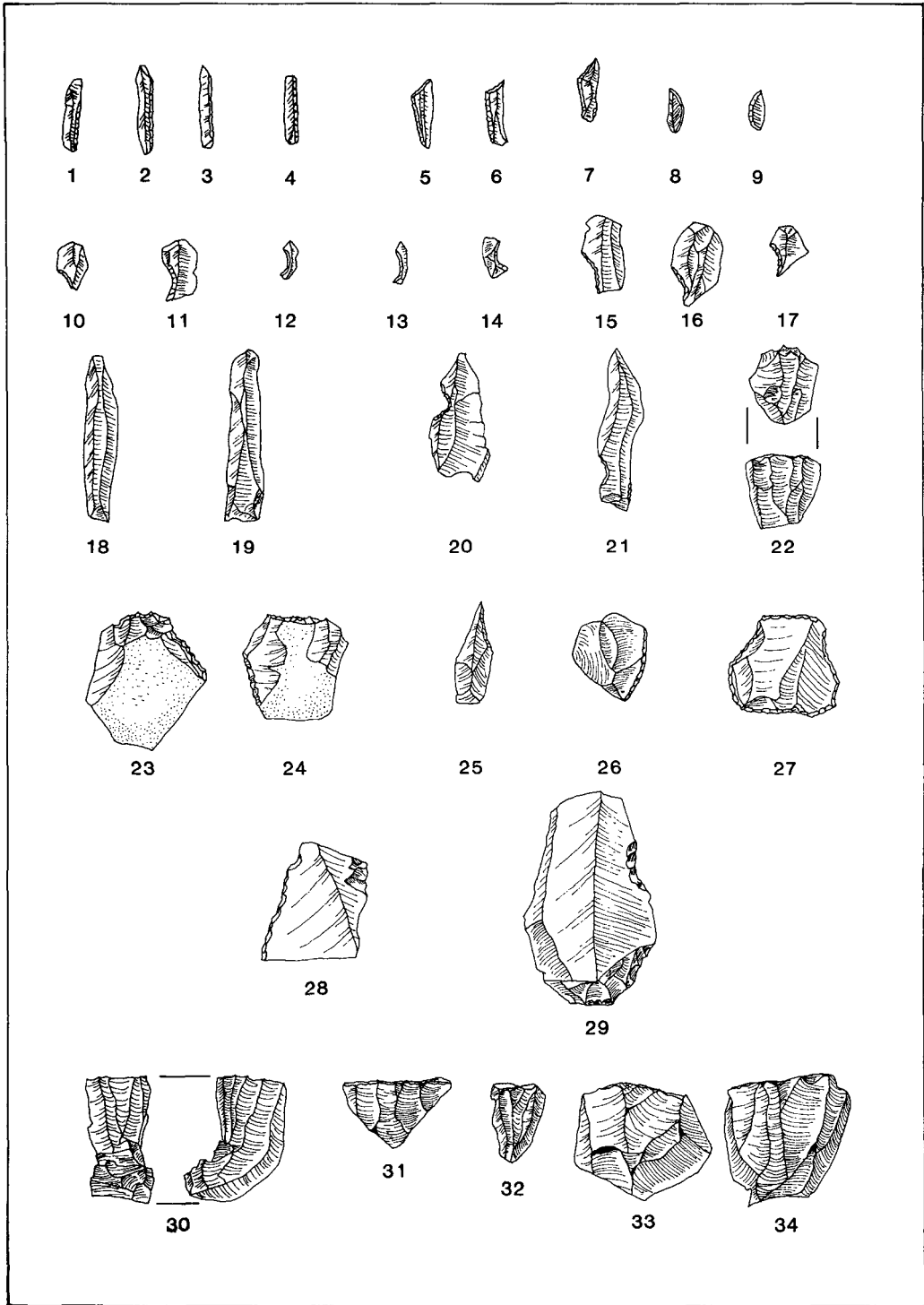
Microliths can be produced by retouching microblades or by the microburin technique in which a notch is formed on the side of the blade to facilitate snapping across the width thereby removing the thick bulbar end. The evidence of microburins and microblades from the site would suggest that both techniques were being used. The microburin technique may in fact be directly related to the production of scalene triangles (Woodman 1978).

OTHER RETOUCED PIECES

There are 12 pieces which exhibit other forms of retouch. These are described in the catalogue below. Of the six pieces which exhibit microlithic retouch, five are made on regular inner flakes and one on a blade. This retouch forms a finely blunted edge but it is not known if this would be the working edge or to protect fingers or to facilitate hafting. In contrast, five other pieces are scrapers made on thick flakes or blades with steep retouch around the end and/or sides. Number 11 is a particularly fine example of an end scraper made on a blade (illus 9, 29). A notch on its side may indicate hafting. Another fine piece is no 10, made on pitchstone, which is a very regular scraper (illus 9, 27). The only other tool type is no 12, an awl, which has been retouched to form an isolated point at an angle to the vertical. All the retouched pieces are standard items in a microlithic assemblage. The awl is of a type recognized from the Mesolithic site at Kinloch, Rhum.

RETOUCED CATALOGUE

- | | | |
|----|--|---------------------|
| 1 | Regular inner flake of flint, broken. Microlithic retouch along distal end (illus 9, 26). | <i>Platform</i> |
| 2 | Regular inner flake of burnt flint, broken. Microlithic retouch along distal end. | <i>Platform</i> |
| 3 | Regular inner flake of flint, broken. Steep microlithic retouch along left edge (illus 9, 28). | <i>Pitfill</i> |
| 4 | Regular inner flake of flint. Steep microlithic retouch along part of left side. | <i>Pitfill</i> |
| 5 | Regular inner flake of pitchstone. Small amount of fine retouch on right side enhancing steep edge angle. | <i>Pitfill</i> |
| 6 | Fine inner blade of flint. Microlithic retouch obliquely across distal end (illus 9, 25).
Obliquely truncated blade. | <i>North Quarry</i> |
| 7 | Thick secondary flake of flint. Retouch around distal end and left side.
End and side scraper. | <i>Platform</i> |
| 8 | Thick secondary flake of flint. Steep retouch on right side (illus 9, 23). Side scraper. | <i>Pitfill</i> |
| 9 | Thick secondary flake of flint. Steep retouch on proximal end (illus 9, 24). End scraper. | <i>Pitfill</i> |
| 10 | Regular inner flake of pitchstone. Steep regular retouch around sides and distal end (illus 9, 27).
Scraper. | <i>Pitfill</i> |
| 11 | Thick inner blade of flint. Steep retouch around distal end and notch formed on left side (illus 9, 29).
End scraper. | <i>Platform</i> |
| 12 | Regular inner flake of flint. Fine microlithic retouch on distal end has formed an isolated point.
Awl. | <i>Platform</i> |



ILLUS 9 Selected lithic material (scale 2:3)

THE USE OF FLINT AND PITCHSTONE

Both flint and pitchstone appear to have been utilized in the same manner. Flint was dominant as a raw material in terms of gross numbers. However, the similar percentage of blades from each assemblage would suggest that, when available, pitchstone was as desirable as flint. Indeed, the small amount of pitchstone and its occurrence in pebble form from fluvioglacial deposits would suggest that either large numbers of reasonably sized pebbles were not easily available or that pitchstone was not actively sought for use.

The function of the assemblage

The presence of all stages in the primary and secondary reduction processes indicate that knapping was carried out on site. One important aspect of this was the production of blades and microliths. This preponderance of microliths among the retouched pieces would place the assemblage within the type A microlith dominated sites of Mellars (Mellars 1976). These sites are also characterized by a pronounced bias in favour of a particular microlithic form. At Auchareoch the scalene triangles dominate.

The marked industrial specialization apparent in Type A assemblages is taken to 'reflect a strong bias in favour of primary subsistence activities (presumably hunting) against the usual range of maintenance or domestic activities (eg skin preparation, bone working etc)' (Mellars 1976, 388).

POLLEN AND OTHER ANALYSES

MONOLITH DESCRIPTION

The position of the monolith (illus 8), was chosen in order to embrace the principal soil horizons and those levels containing stratified lithics. The 0 cm datum for the profile (table 1) represents the top of the H horizon (nomenclature is that used by the soil survey of Scotland – see Ragg & Clayden 1973 for English and American comparisons). The monolith was overlain by disturbed blanket peat and quarry dump material, and *Calluna vulgaris* (heather) was growing on the surface 20 cm above the top of the sample profile. The profile is distinguished particularly by its sharp horizationation. Although the soils of the area are generally classified as peaty gleys of the Arran Association (Bown *et al* 1982) no mottling was observed in the quarry-face exposures and the soil seems more akin to a peaty podzol.

ANALYTICAL METHODS AND DATA PRESENTATION

Monolith sub-samples were prepared for pollen analysis by standard preparation techniques of NaOH maceration, acetolysis, digestion in HF, and embedding in silicone oil (Faegri & Iversen 1975). To assist in the analysis, samples were prepared by dry weight and to each was added a known quantity of exotic marker grains, in this case *Lycopodium clavatum* spores (Stockmarr 1971). Pollen counts ranged from 200 to 325 total land pollen grains. In the lower levels of the monolith particularly, there was insufficient pollen to make a count reasonable, and types found during scanning of a number of slides are represented in the diagram with a small dot. In addition to pollen, spores and fragments of microscopic charcoal $>152 \mu\text{m}^2$ in size were also counted. Charcoal is represented in the pollen diagram as fragments of charcoal per gram of material. The pollen diagrams are presented in illus 10a and 10b together with data on loss-on-ignition and soil pH.

The pollen zones I, II and III are combined palynological and pedological zones which serve to facilitate discussion. The boundary between zones I and II is placed at the level of the iron pan (B₁) and the boundary between zones II and III is placed at the boundary between the A₁ and H horizons

of the profile. Zone I is largely bereft of pollen other than in two spectra – the lowermost at about 37 cm and produced from the dark reddish brown band within the B₂ horizon and the other at the top of zone I immediately below the iron pan. These two spectra are very different in terms of microfossil percentages. The lower has a predominance of *Alnus glutinosa* (alder), Coryloid, (hazel and/or bog myrtle), Gramineae (grasses) and *Calluna vulgaris* (heather) pollen and *Polypodium* (polypody) spores, while the upper horizon is dominated by Gramineae and *Calluna* pollen. There are traces of cereal-type pollen elsewhere in the zone and charcoal values increase in concentration through the zone down to the level of the pollen spectrum at 37 cm. Zone II is dominated by Coryloid and Gramineae pollen throughout with *Calluna* values rising towards the top of the zone. In addition *Alnus*, Cyperaceae (sedges) and *Plantago lanceolata* (ribwort plantain) pollen and *Polypodium*, Filicales (undifferentiated ferns) and *Pteridium aquilinum* (bracken) spores are also well in evidence. In zone III there is a preponderance of *Calluna vulgaris* pollen and pollen of the Gramineae family. Pollen and charcoal concentrations (illus 10b) are at their highest values for the profile as also are the values for loss-on-ignition.

ENVIRONMENTAL RECONSTRUCTION

(a) Some problems

It seems highly likely that the pollen and spore data from Auchareoch have been subject to the problematic processes which surround the palynological record obtained from mineral soils. The pattern of decreasing pollen concentrations down-profile is normal in podzol profiles (Dumbleby 1985) and may be caused by the downward movement of pollen and/or the destruction of older pollen (Havinga 1974; 1984). The proportions of indeterminable and damaged pollen and spores are very high in zones I and II which may further provide an indication of the destruction and disappearance of palynomorphs (rather than simply of their damageability) given the superior representation for the resistant *Polypodium* spores and the easily recognized pollen of *Alnus* and Coryloid. There may even be some homogeneity of the pollen spectra in zone II (especially the lower half) which could denote possible mixing by soil fauna at a time when soil acidity was lower. Such factors must be constantly borne in mind when attempting to understand environmental records based on soil pollen analysis. In the following reconstruction, the palynological data are discussed together with the related pedogenesis of the profile.

(b) Reconstruction

There are no indications of a lateglacial or early postglacial pollen flora at the kame terrace site (cf Cocks Heads, North York Moors – Dumbleby 1961). If soil-forming processes had given rise initially to a brown podzolic or even a brown earth soil beneath a woodland cover, then clear evidence for this has now disappeared. It could be proposed that the pollen in the lone lowermost spectrum (37 cm) is representative of a former mixed woodland, grassland and heathland vegetational cover. The high incidence of spores, (especially *Polypodium* and Filicales), while denoting the presence of ferns, could also indicate that the spectrum in question is characterized by the survival of such resistant palynomorphs rather than providing a realistic picture of early conditions in the vicinity of the site. The palynomorphs at the 37 cm level may conceivably have arrived in position via root-channel movement, though this level does not have an increased value for loss-on-ignition. The slightly higher pH values in zone I may retain a signal of lower soil acidity prior to later leaching (note the lower pH values for zones II and III, although the range of values is not large). It is possible that a combination of low organic content and higher pH in zone I is partly responsible for the poor preservation and lack of countable pollen in the zone.

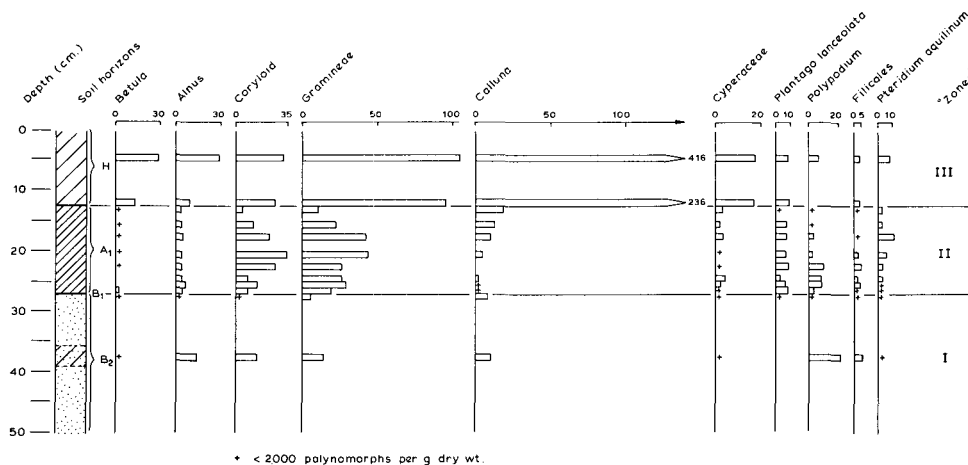
The high levels of *Calluna* pollen in the two full spectra of zone I are of great interest and the

topic is worthy of further comment. The heather pollen may denote an early phase and perhaps a spatially limited area of soil acidity and/or heath formation. Acidification could be a result of natural podzolization processes given the sandy parent materials of the kame terrace and the wet climate of Arran. *Calluna* heath might also develop from burning activities in connection with game-driving or agriculture (Simmons *et al* 1981). The levels of microscopic charcoal are certainly high throughout zone I and this may support the use of fire. The finds of cereal-type pollen grains may be additional support but it is difficult to understand the reason for their absence from the two full spectra. The finds of Mesolithic-type materials in the overlying deposits might also be thought to compromise the designation of cereal-type finds as actual cereal pollen rather than to non-cereal grasses. The hunter-gatherer/agricultural transition was not always a sharp one (see discussion in Edwards & Hiron 1984; Edwards & Ralston 1984, and below) but it is also possible that the cereal-type pollen (and by implication, any or all of the microfossils in the zone) has been transported down-profile.

As is always the case with pollen studies, especially those based on a single profile, the pollen source areas are not always clear. Hence, it is quite possible that during the time when the pollen in zone I was being deposited, the site itself was then (and perhaps thereafter) undergoing podzolization and had an acid-tolerant vegetation cover. At the same time, areas beyond the immediate confines of the site, possibly with superior soil fertility, may have been under cultivation and gave rise to the finds of cereal-type pollen.

Later conditions may well be shown in the zone II spectra. These suggest a predominance of hazel and grassland with open land taxa such as *Plantago* spp, Ranunculaceae, *Succisa* and Compositae liguliflorae. The presence of more than 2% cereal-type pollen in the lower levels of zone II, together with pollen typical of disturbed ground such as Caryophyllaceae, Cruciferae and *Artemisia* indicate that cereal cultivation in addition to probable pastoral activity may have been taking place on or near the site. Indeed, there is even the possibility that soil improvement has taken place as a result of prehistoric land management (cf Maltby & Caseldine 1984). However, the iron pan, rising *Calluna* values and the overlying humic horizons equally and perhaps more strongly indicate that there was a local pedological change at the site, perhaps resulting from anthropogenic activities. It is possible that a change in local conditions as a result of human or environmental pressures led to an increase in soil acidity. This would provide more acidic humic material which could travel through the profile giving rise to the eluviated A₁ horizon of the profile as seen today, and leading to the formation of an iron pan as a result of iron deposition at a lower point in the profile. Such processes would result in an acidic surface soil which would favour colonization by *Calluna* and other heaths. This is possibly indicated by the increasing values for *Calluna* through zone II. The percentage reduction in Gramineae and Coryloid values is supported by the absolute (concentration) values (illus 11) and suggests that heath vegetation was expanding at the expense of other types. The recurrence of high *Calluna* representation following the zone I records may indicate the existence of a polycyclic profile (Proudfoot 1958; Maltby & Caseldine 1984; Whittington 1984).

The pollen and spore taxa in zone III are suggestive of a predominant heathland cover in the vicinity of the site. The high concentrations of such woodland taxa as *Betula*, *Alnus* and Coryloid are almost certainly a function of the lithological change to organic material rather than a real increase in woodland area around the site. There is also a high charcoal concentration which is also likely to be a response to the greatly increased organic matrix of zone III rather than a certain increase in burning activity. Heather can be favoured by burning but there are no other clear indications of fire. The charcoal could denote attempts to maintain an open productive vegetation cover by cultivators or pastoralists. All of the charcoal could equally well be due to a combination of domestic burning (heating and cooking) and natural conflagrations. The plurality of possible explanations is a recognized limitation of charcoal data (cf Edwards, in press).



ILLUS 11 Pollen and spore concentration diagram (palynomorphs per g dry weight $\times 10^3$)

Since the profile gives way to peat then it can be seen that acidic soil conditions persisted to the present day.

DISCUSSION

In his consideration of the palynology of archaeological sites, Dimbleby (1985, 121) also applies himself to the vertical distribution of stones and artefacts. He suggests that archaeologists have shown little curiosity about the fact that flints are often buried below the likely contemporary ground surface. He does not favour an explanation based on the trampling of such artefacts into the soil, but rather provides strong evidence of earthworm activity and the burial of lithics within the soil profile prior to the onset of soil acidity which would be inimical to earthworms. Dimbleby (1985, 102) also notes that a whole occupation floor at the Neolithic site of Rackham, Sussex, may have been thus moved down-profile. The downward movement of pollen through the soil body at Auchareoch has already been intimated (and see below) and it seems likely that such an explanation could best explain the variable position of flint and pitchstone lithics in the west quarry face (illus 8). It seems unlikely that quarrying operations have buried the lithics within the face given the fact that many of them were observed when the faces had been trowelled clean to aid the planning of the stratigraphy. With regard to the stripped platform area from which lithics were recovered during the controlled survey, it is possible that they were not found exactly where they fell during tool manufacture. The fact that the platform surface featured some fire spots which may have been only slightly truncated may indicate, however, that the lithics reached their present level without too much vertical dislocation.

Analysis of the lithics has revealed that pitchstone (including waste) accounts for 9.4% of the material. Pitchstone also occurred as 116 small natural pebbles, recognized as *in situ* fluvioglacial material. The small dimensions of most of the pitchstone lithics and the frequently weathered surface areas on many of them suggests that the local kame terrace was the immediate source of the raw pitchstone. The flint material is most probably derived from beach pebbles transported to the site. The typology of the collected assemblage is comparable with other sites assigned to the Mesolithic period.

The microlithic element of the Auchareoch assemblages shows morphological similarities to

Type A assemblages from sites on the high (300 m OD) North Yorks Moors and Pennines, with triangular and sub-triangular, rod, lunate, and trapezoidal forms. As at the Arran site, many of these northern English assemblages demonstrate a distinct bias in favour of one particular form. At Dunford Bridge B (Radley *et al* 1974) and Rocher Moss I (Radley, quoted *in* Mellars 1976), both in west Yorkshire, and Farnedale Moor, north Yorkshire (Radley 1969), rods are the predominant form, while at White Hill North (Radley, quoted *in* Mellars 1976), also on the North Yorks Moors, the dominant forms are small trapezoids (Mellars 1976). Although surface lithic collections of Mesolithic provenance are recorded from the Ayrshire coastal areas of Ballantrae (Edgar 1940; Lacaille 1945, 1954), Girvan (Morrison 1980b), and Shewalton (Lacaille 1930, 1954), at present few specific parallels can be seen with the Arran material. Similarly, no positive evidence can be seen for close typological relationships between the Arran material and that of the Campbeltown sites (Gray 1894; McCallien & Lacaille 1941).

Two sites on the Wigtownshire Solway coast, Low Clone (Cormack & Coles 1968) and Barsalloch (Cormack 1970), have Type B assemblages (*sensu* Mellars 1976). The assemblage from Low Clone contained no geometric microliths and the few microliths from Barsalloch 'consist of rather unprepossessing little implements similar to those from Low Clone' (Cormack 1970, 74). However, the inland Mesolithic sites of Starr 1, Loch Doon (Affleck 1986), and Smittons 1 and 2 in the upper Ken valley (Affleck, unpublished), have assemblages with significant numbers of geometric microliths similar to those from Auchareoch. Mulholland (1970, 86–7) notes the presence of Arran pitchstone in the Tweed Valley Mesolithic industries and sees this as evidence of contact with south-west Scotland, further postulating that the isolated examples of Arran pitchstone on Tweed sites reached the area from the Ayrshire coast via Loch Doon. Six small pitchstone flakes have been found on the east side of this loch (M Ansell, pers comm). Only a general similarity is apparent in the assemblage from coastal Ayrshire, Tweedside and Auchareoch.

There are, however, significant parallels with other west coast island assemblages. The site of Newton, Islay (Clarke, unpubl) and Kinloch, Rhum (Wickham-Jones & Pollock 1985) have both produced similar narrow blade assemblages. Comparable assemblages have also been recovered in excavations on the Isle of Jura, notably that at Lealt Bay (Mercer 1968). This site has produced an assemblage indicated by Mellars (1976) as Type B1, although the values given for microliths (84.5%) and scrapers (14.3%) are the highest and lowest respectively for Type B1 sites in Mellars's Table 4. To qualify for B1 status, Mellars (1976, 391) suggests microlith and scraper frequencies of 70–80% and 14–22% respectively. Lealt Bay, then, could almost equally be seen as a borderline Type A site. This is further emphasized by the dominance of one particular microlithic form, a Type A characteristic – in this case a scalene morphology with generally left dorsal retouch. This is also the dominant form in the Auchareoch microlith site. Morrison (1980a, 164) noted that the large number of microliths (1283) from Lealt Bay was unique for a Scottish Mesolithic site (more than 1000 microliths have been recovered from Kinloch, Rhum – Wickham-Jones, pers comm). Moreover, 43 pieces of green pitchstone were found at Lealt Bay, shown by analysis to be identical to samples from Brodick (Mercer 1968, 45). It was also pointed out that andesitic pitchstone occurred at Loch Craignish on the mainland adjacent to Jura.

The severe disturbance of the Auchareoch site by forestry road construction and quarrying has clearly eaten into the kame terrace, rendering an estimation of the original occupation area difficult (illus 3). The original kame probably sloped down to the level of the present eastern edge of the north quarry, some 30 m east of the road. Occasional lithics have been found in this area and in the west face of the north quarry 42 m north of the stripped platform. Similarly, away from the platform and northern edge of the south quarry, there are few lithics. Our work clearly suggests that the greatest visible concentration of lithics is on the platform. The lithic densities indicated at the west edge of the

stripped platform (illus 5) and the pit feature exposed in the south quarry face would suggest that the site extends under the heather-covered area (illus 3). Overall, the area of occupation could cover 300–400 m². This is much larger than reported (3.9–44.0 m²) for a Type A site (Mellars 1976), but if this were a site occupied at frequent intervals, then the result would be an aggregation of small time-transgressive camp units.

Mellars suggests that a microlith-dominated Type A assemblage such as that of Auchareoch might indicate a hunting-camp economy. Unfortunately the bone material from Strong's pit is unidentified and may well be unidentifiable. The abundance of hazel-nut shells suggests that they were gathered locally and could indicate autumn occupation or food storage. If animals such as red deer were being hunted in their higher altitude (summer) haunts, then a period of occupation including at least the summer months seems possible. Since the site is only a matter of a few hours walk from the coast, via the Kilmory Water, it is also possible that frequent short periods of occupation, postulated above, was the pattern. This is not to deny the possibility that the site could have been used as an inland base from which coastal environments could be exploited. It has been recognized that Mesolithic sites favour certain soils, topography and local environments (Jardine & Morrison 1976; Mellars & Reinhardt 1978) and the sand and gravel terrace here would provide dry and possibly more open conditions. The Kilmory Water, a suggested access route, and smaller streams nearby would also be a source of salmonids.

The environmental reconstruction is characterized by possibilities rather than certainties. If the lowermost pollen spectrum is representative of both wooded and unwooded habitats, then the dominant taxa of alder, hazel, grass and heather are also well-represented in the Mesolithic (and later) age levels of the pollen diagram from Moorlands on Machrie Moor (McIntosh 1986). However, at this site (11 km to the north-west), as well as in the likely Neolithic and later deposits at the Monamore cairn site (5 km to the north-east – MacKie 1964), pollen of birch was present in high frequencies (McIntosh 1986; Durno 1964). Furthermore, charcoal fragments from the pre-cairn turf-line at Monamore were identified (Brett 1964) as coming from birch, oak and rowan (*Sorbus aucuparia*). The pollen record at Auchareoch is not inconsistent with the presence of such plant types (apart from an absence of rowan), but if the record is taken at face value, then the vegetational picture presented is slightly different with fewer dominant species. The high Coryloid (cf hazel) frequencies are supported by the presence of hazel-nut remains at Auchareoch, and the high microscopic charcoal counts in Zone I might be compared with the similarly high charcoal values in Mesolithic levels from Machrie Moor (Robinson 1983; McIntosh 1986). If the charcoal is anthropogenic in origin (as opposed to natural burning), it could indicate burning associated with game-driving activities – but equally, it could derive from such domestic needs as heating and cooking (Edwards 1985).

The presence of cereal-type pollen in all three zones at Auchareoch, together with herbaceous taxa typical of open land (including ground devoted to arable and pastoral activities), such as *Plantago lanceolata*, *Ranunculaceae*, *Caryophyllaceae*, *Rumex acris* type, Cruciferae and *Artemisia*, indicates the existence of probable farming activities at or close to the site. Although the possibility of pioneer agriculture within the period normally associated with the late Mesolithic has been suggested for the Machrie Moor sites on pollen-analytical grounds (Edwards *et al* 1986), the fact that the Auchareoch pollen assemblages are found largely within a mineral soil matrix and are therefore subject to the limitations imposed by such a deposit must counter any temptation to ascribe such features to Mesolithic peoples. The pollen spectra, in most cases, are probably later than the lithic remains found in the equivalent levels at the site. In this respect, they are similar to Mesolithic sites from southern England where cereal-type pollen is found at or below the levels of flint materials (eg Oakhanger VII – Rankine *et al* 1960; Addington – Dimbleby 1963).

The iron pan in the quarry-face stratigraphy and the consistent presence of heather pollen

suggest that the kame terrace site became wetter perhaps as a result of farming and related soil degradation activities, although conceivably in response to progressive soil and/or climatic changes (Ball 1975; Moore 1975). The continuous charcoal representation in the upper sections of the pollen profile, if anthropogenic in origin, may result from domestic activities or the burning of felled and dried woodland to provide enriching ash for impoverished soils. If the latter suggestion is correct, then it may also be the case that, for the immediate site at least, it was a temporary expedient given the subsequent development of peat over the site.

The investigations reported here have gone some way to revealing the archaeological and environmental richness of the Auchareoch site. A number of imponderables remain, however. The full extent of the occupation area or areas has only been crudely estimated, and indeed may not be susceptible to resolution because of the amount of quarrying and the existence of coniferous woodland. The lack of identifiable bone and plant remains coming within the scope of the present survey limits our horizons for economic reconstruction. It is to be hoped that continued environmental research at the site will overcome these difficulties. Perhaps the principal area for which additional data must be sought lies in that of dating. The materials on the site available to us have been open to post-occupation disturbances for many years. The best hope for dating would appear to be with small-sample dating of charcoal¹, and this possibility is to be pursued within the context of a wider programme of dating for the Mesolithic of the west of Scotland. For the moment, and given the lack of a proposed or accepted framework for the Scottish Mesolithic, we refrain from placing Auchareoch within a more specific temporal category.

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NOTE ADDED IN PROOF

- 1 Radiocarbon dates have now been obtained from the Accelerator Unit of the University of Oxford. They are given here as a matter of report and they will be discussed in a future article on the site:
- | | |
|--|-------------|
| OxA-1599 charred hazel-nut shell, platform fire spot | 7300±90 bp |
| OxA-1600 oak wood charcoal, west quarry face | 7870±90 bp |
| OxA-1601 charred hazel-nut shell, south quarry pit | 8060±90 bp. |