Stone Tools from a Washing-Limit Deposit of the Highest Post-Glacial Transgression, Lealt Bay, Isle of Jura

by John Mercer

SUMMARY

This paper describes archaeological investigations along the NE. coast of the Isle of Jura, Argyll. To provide a background, work has been done on the Post-Glacial vegetation and coast-line. Pollen analysis has been used to confirm that plant life has been broadly similar to that of mainland Argyll. The extent of the highest Post-Glacial marine transgression has been investigated in two places; in the most sheltered part of Lealt Bay – the excavated site – its material has been traced to about 51 ft. above local O.D., on evidence elsewhere in W. Scotland presumably about the washing limit. Pollen analysis of the old land surface underlying the ancient marine deposit *c.* 47 ft. has shown that the transgression probably reached that point early in the Atlantic period; at the same height a fine-drawn post-transgression diagram has been produced and, although zone indicators have proved disappointingly few, the diagram does show that the maximum stand was of short duration and certainly over during the Atlantic period (tentatively, about the middle). At Lealt Bay an excavation carried out on the old marine deposit *c.* 47 ft. has yielded some 50,000 stone artifacts. The very varied material is thought to cover a long period: rolled specimens, and probably the general vertical distribution, show that a proportion is of pre-land-recovery age; there are differences in patination between tool-forms, and a few individual specimens bear evidence of two phases of use separated by an appreciable time-gap. Numerically dominant, the site's 1,283 microliths include most British forms; almost a third are varieties of the small backed blade, a half are small crescents, triangles and quadrilaterals (the latter including some unusual classes), the rest are tanged, hollow-trimmed and miscellaneous rare types. The main non-microlithic groups are: hafted blades, many being poorly-made end-scrapers; steep scrapers, some on cores and including nosed specimens, and thumb-nail scrapers; many gravers, of various forms; squat, feebly-tanged leaf-shaped flakes; a transverse series ranging from the true *petit tranchet* to crudely-made heavy triangles. Very lightly patinated scale-flaked leaf-shaped points show the site had occupants who were at least as late as Neolithic in culture. No structures, polished axes, pottery or barbed-and-tanged arrowheads were found. Further work at the site and in the area aims to clarify the inter-relationship and sequence of the implement types. An artifact-associated charcoal concentration has also been recovered. It is hoped that geologists working elsewhere in Scotland will soon provide a close dating for the end of the transgression's maximum stand along Lealt Bay's land-recovery isobase; at present all that can be said is that human activity had certainly begun at Lealt Bay *before* the maximum stand's end, the latter event taking place during the Atlantic period, perhaps about the middle, *c.* 4250 B.C. It is thought that Lealt Bay was a well-known landing place and camp for hunters from the mainland.

ACKNOWLEDGMENTS

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PART I: INTRODUCTION AND BACKGROUND

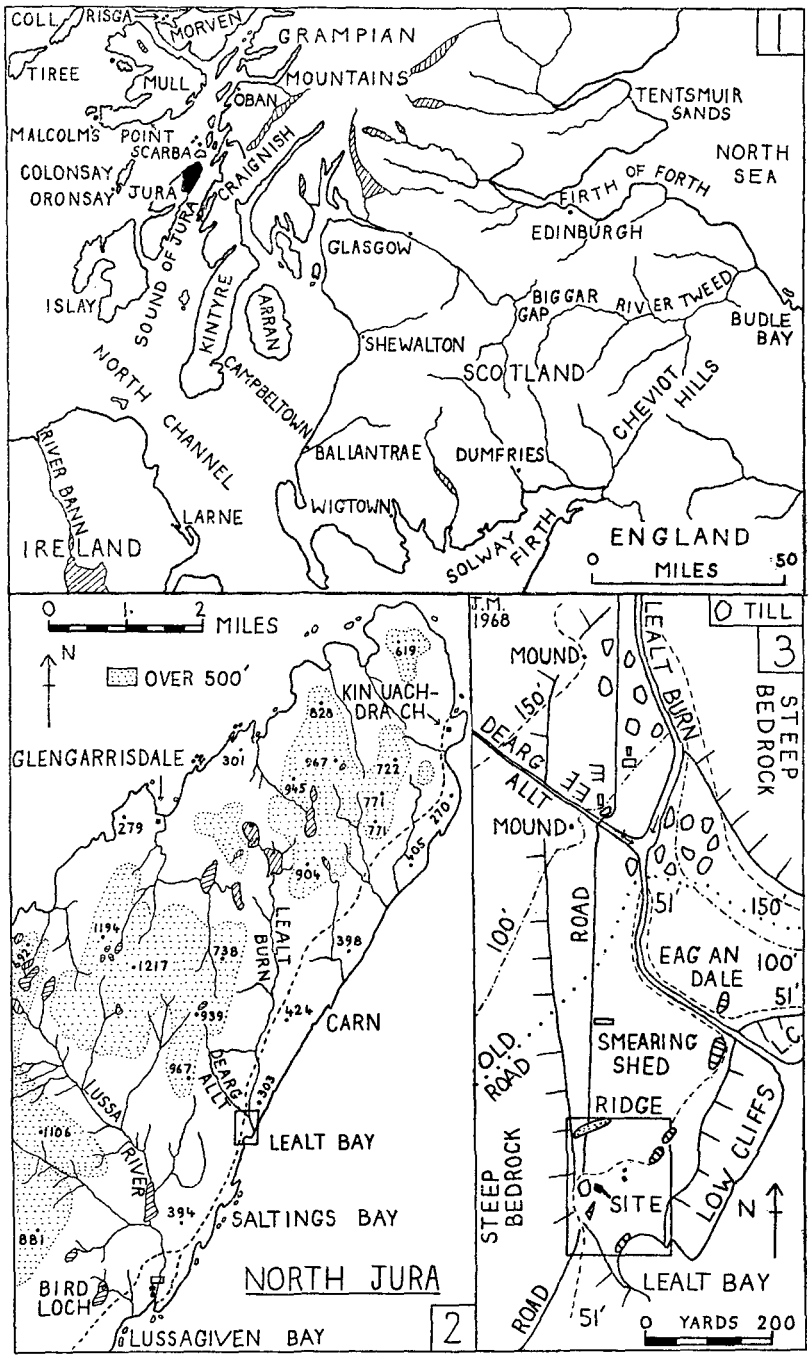
This is the first in a series of reports which the writer is preparing on prehistoric human activity in N. Jura. Part I, after some general notes on the island and its past, records the fresh information on the vegetational and coastline setting to the life of the early people; Part II describes the results of the first excavation.

General

Situated off Scotland's W. coast (fig. 1), Jura is one of the Inner Hebrides. Less than 3 miles of sea separates its NE. corner from the mainland region of Craignish, whilst, each within a mile, to the N. lies the Isle of Scarba, to the S. the Isle of Islay. Westwards, 8 miles away, the indistinct Isles of Colonsay and Oronsay break up the horizon, and behind them stretches the open Atlantic. The mainland shoreline opposite Jura develops southwards into the Kintyre peninsula, and this reaches out to within 13 miles of Ireland, itself visible from Jura on a clear day.

Jura is one of the largest of the Inner Hebrides, about 160 sq. miles in area, with a maximum length of 27 miles and a maximum width of about 7 miles. Cutting into the island from the W., Loch Tarbert all but divides it in two; a rise in sea-level of a little over 50 ft. would be sufficient to cause an actual division. Notably broken only by this pass, mountains run the length of the island: the S. end's Paps, each around 2,500 ft., are the highest; N. the land drops with the island's width until, in the area under study (fig. 2), the range averages a mere 1,000 ft., with passes at half that height, and no more than 5 miles separates the E. coast from the west.

The island's bedrock is almost entirely grey Pre-Cambrian quartzite, a monotony not at all relieved by the narrow zones of slate and phyllites along the E. shoreline; in the N. some colour is added by outcrops of epidiorite and porphyrite. The pleistocene ice, further rounding and levelling Jura's no doubt already weathered topography, moved predominantly from E. to W., scattering transported material about the island. The seaward margins of the glacial deposits which now choke the lower reaches of the valleys have been shaped to some extent by various more recent and comparatively high sea-levels.



FIGS. 1–3. Location maps

It has been known since the last century that stone implements and other relics of human activity occur within the deposits left around the coastline of Scotland by the highest Post-Glacial transgression,[1] and, as will be shown, Jura is no exception to this. Otherwise, all that is known about the island's pre-Christian past, other than by inference, is due to chance finds such as Bronze Age graves. Holding a Food Vessel and a crescentic jet necklace, one cist was recently revealed at the S. end of the island by a Forestry Commission ditching-machine[2]; another, unearthed a few years ago during ploughing at Kinuachdrach at the N. end, was believed to be a smuggler's cache, and the farmer cleared away the slabs, the grave's location becoming obliterated. The island also holds a few standing stones.

History has little to say about Jura of direct archaeological value. Adamnan, looking back on St Columba's day, notes that there were then thirty houses.[3] Martin Martin, describing his seventeenth-century tour of the Hebrides, mentions, as a current tool, the limpet hammer[4]; during an excavation in progress in N. Jura, that of Carn Cave, the present writer has certainly found 'limpet hammers' (of 'Obanian' type); these were in fact alongside iron tools, though well below a hardhead of Mary and Francis and a plack of James VI.

One supposes that, in general, Jura has shared in the fairly well-known events of the region. Certainly it has done so recently, the population, over the 1,200 mark in the early nineteenth century,[5] being at present not much in excess of 200. The settlements, nowadays increasingly infrequent as one goes N., are all along the E. shoreline, situated, perhaps as from the first, upon the only land that is reasonably flat and drained, the unconsolidated glacial and marine deposits. The W. coast, a line of storm-battered overhanging quartzite cliffs fringed by a narrow strip of rock-strewn shore, gives way occasionally to a broad valley with its small ruined settlement, for example Glengarrisdale. Nowadays at least, crossing to the west is spoken of as 'going over to the back', the island facing, in effect, eastwards.

Of the animals which the first people found on Jura nothing is yet known directly. At present there are several thousand deer; Martin reported some 300, and the island's name, dating at least from the Norse period, derives from a word for 'deer'.[6] In addition to horses, cows and sheep, Martin mentions goats, and at the time of writing there are certainly many goats living in a wild state in the safety of the W. coast. Boar-catching 'moats' are recorded[7]; the occupants of Carn Cave, mentioned earlier, had indeed consumed many pigs, but it has not yet been decided whether these were living in a wild state or not. The cave-dwellers had also caught otters and seals. Pennant, writing about 1772, notes stoats and wild cats on Jura,[8] but the New Statistical Account, mildly sceptical over the presence in the past of any such mammals, was emphatic that there was no trace of them by 1843; Carn Cave, however, did yield what is probably a fox bone, an animal never apparently recorded on the island.

This meagre information on Jura's past is supplemented by a survey made in 1931 of the island's monuments.[9] A fresh survey has recently been begun at the S. end by Miss M. Campbell and Miss M. Sandeman, and the results of a preliminary reconnaissance have been published.[10]

A Standard Pollen Diagram for N. Jura

Prior to Dr Durno's visit to Jura to obtain the peat samples for pollen analysis, local advice was sought on the location of a really deep peat deposit. This was expected to yield a full Post-

[1] Gray, A., *PSAS*, XXVIII (1893–4), 263–74.
[2] Henshall, A., *PSAS*, XCVIII (1964–6), 317–8.
[3] Grieve, S., *The Book of Colonsay and Oronsay*, Edinburgh (1923).
[4] Martin, M., *A Description of the Western Islands of Scotland*, London (1703).
[5] *New Statistical Account*, Edinburgh (1845), VII, 539.
[6] Budge, D., *Jura, an island of Argyll*, John Smith, Glasgow (1960), 9.
[7] ibid., 37.
[8] Pennant, T., *A Voyage to the Hebrides*, London (1776).
[9] Rideout, E. H., *PSAS*, LXVI (1931–2), 146–51.
[10] *Discovery and Excavation, Scotland, 1966*, 7 ff.

Glacial vegetation sequence against which would be compared the diagrams connected with the main investigations; it would also fill a gap in the regional network of pollen diagrams. Opinion was unanimous in suggesting the moor above Lussagiven, around Loch Càthar nan Èun, or Bird Loch, at about 200 ft. O.D. Although there were no peat exposures there of more than 5 ft., a point about 50 yds. SE. of the S. end of the loch was selected, well within its basin. Using a Hiller

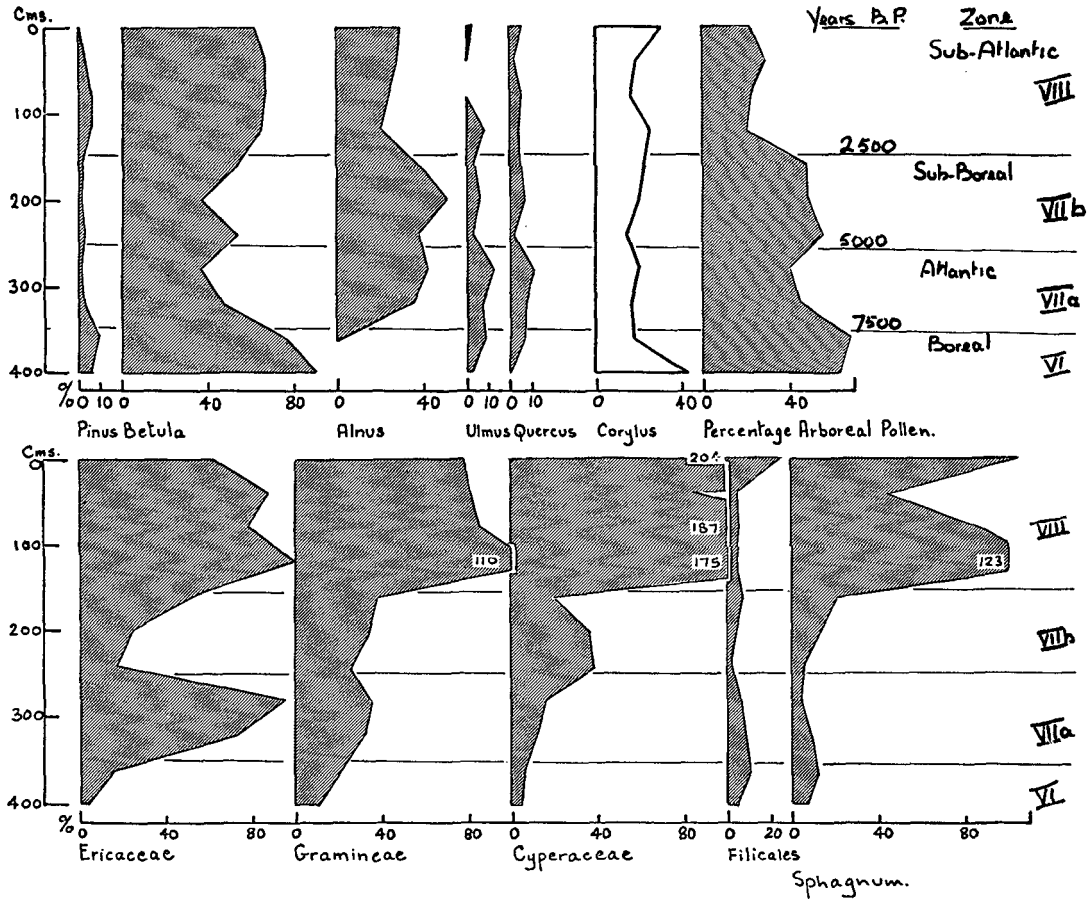


FIG. 4. Bird Loch pollen diagram

sampler, Dr Durno and Mr P. C. Jowsey of the Peat Survey for Scotland in fact only reached bedrock at some 19 ft. The lowest third was a lacustrine deposit, diatomaceous earth, which yielded no pollen.

Fig. 4 represents the pollen diagram for the upper two-thirds of the sampled Bird Loch peat. Dr Durno wrote that each sample was counted until a tree-pollen total (excluding Corylus) of 150 grains was reached; each species, tree or non-tree, has then been represented on the diagram by the percentage relationship of its pollen count to a standard of 150 grains. Dr Durno commented: 'Botanically the diagram agrees very well with others from mainland Argyll which are similarly characterised by a low content of pine pollen and a relatively high proportion of oak and elm. Birch is clearly the dominant tree with alder attaining high values after the transition from the

Boreal to the Atlantic period. The most striking feature of the non-arboreal section of the diagram is the great rise of the grasses, sedges and heather groups in the Sub-Atlantic period.' From the sampling point beside Bird Loch, the only visible trees are now three stunted specimens on a small island in the loch itself. Jura's present trees are almost entirely confined to the shoreline and valley mouths, up to about 100 ft. O.D. A comparison with the old 6-in. map shows the tree line to have clearly receded during the last century or so. The coastal zone under study is now, however, Jura's most wooded area, a long narrow strip primarily composed of poorly-developed birches with roughly equal, lesser quantities of oak, alder, rowan and hazel, and some ash and holly. Elm, though present in the diagram, now seems absent, and the few scattered pines are probably planted. There are mature plantations of spruce and pine in the Lussa Valley and at Saltings Bay, of young larches, firs and pines from the latter inlet as far N. as Lealt Bay, and of mature and decaying birches and alders at Carn. Various types of peat cover the rest of the landscape, the surface vegetation ranging from bracken and a little heather in the drier parts to rushes and mosses in the wetter. Pasturage in general is poor and only a small proportion of the island is cultivable.

It is clear from the pollen diagram that Jura's present lack of trees is a near-ultimate stage in a long process; the rate of deforestation has, however, increased markedly since the opening of the Sub-Atlantic period. No doubt the usually-proposed combination of climate, human activity and grazing animals has been responsible, as it is today: at present deliberate burning together with over-grazing by sheep and deer, the latter no longer regulated by the unrestricted right to hunt, is acting in combination with a cool rainy climate. It is significant that not only do young trees, mainly birches, spring up on the island's moor each summer, to be eaten down in the winter, but, as has been seen, there are mature trees even in the Bird Loch area – refuged on an island.

Washing Limit of the Highest Post-Glacial Transgression of NE. Jura

(1) *Dating by transgression association.* Very few stone industries have been *unequivocally* recovered from *within* the deposits of the highest Post-Glacial transgression of W. Scotland. To the N. of Jura there are two 'Obanian' sites: the lower occupation (but including stone and bone implements?) at MacArthur's Cave, near Oban,[1] and presumably – since Coles has recently said that some of the flints are rolled[2] – a proportion of the collection from the island of Risga, off Ardnamurchan.[3] To the S. of Jura there are the Campbeltown industries – Dalaruan-Millknowe,[4] Albyn Distillery (lower seam),[5] Calton[6] – and the rolled specimens from Ballantrae,[7] all classed as of 'Larnian' affinity. The Isle of Jura lies at the centre of this Obanian-Larnian area but Part II of this paper reports the excavation of a deposit which, though also covering the transgression's maximum, contained stone implements which were numerically overwhelmingly microlithic.

It is clear from various recent papers[8] that the opening and closing dates of the highest Post-Glacial transgression's period of maximum stand varied considerably from place to place, primarily with distance from the ice-centre. The archaeological consequences of this are of course that an *in situ* industry within a transgression-maximum deposit around, say, Oban, may well be of quite dissimilar age to a similarly-placed industry in the area of Dumfries. Once other investigators have accurately positioned the land-recovery isobases, and the opening and closing dates for the transgression's maximum stand along each one are known, it should be possible to see the coastal

[1] Anderson, J., *PSAS*, XXIX (1894–5), 211–30.

[2] Coles, J. M., *Dumfriesshire and Galloway Nat. Hist. & Ant. Soc.*, XLI (1962–3), 67–98; the flints are not, however, described.

[3] Lacaille, A. D., *The Stone Age in Scotland*, O.U.P. (1954), 229–39 (based on Sir G. MacDonald's unfinished typescript).

[4] Gray, A., loc. cit.

[5] McCallien, W. J., and Lacaille, A. D., *PSAS*, LXXV (1940–1), 55–92.

[6] Webb, Rev. J., *Campbeltown Courier*, 6th July 1946.

[7] Lacaille, A. D., *PSAS*, LXXIX (1944–5), 81–106.

[8] Nichols, H., *Trans. Roy. Soc. of Edinburgh*, Vol. 67, No. 6 (1967), 145–87. With full bibliography.

sites in perspective. Few absolute spot-dates with which to date the isobases are so far available, but near Dumfries, for example, where the transgression is thought to have reached only 20-30 ft. O.D., a C-14 age for the end of the maximum stand gave 6645 ± 120 B.P.,[1] in fact Early Atlantic. Donner, referring to the transgression in general,[2] wrote that: 'The 25-foot beach was formed during the Atlantic period, Zone VIIa, and possibly already in part during the Boreal period, Zone VI, as indicated by the radio-carbon measurements which give a date of 8000–5000 B.P. for the 25-foot beach.' Between them these two examples are enough to suggest that, according to area, a difference of as much as 1,500 years may be possible between two final deposits of the highest Post-Glacial transgression.

This not only proposes a need sooner or later for a reappraisal of those sites vaguely grouped in the past as 'transgression-time', it also precludes surprise at the finding of some variety in the cultural facies included in Scotland's transgression deposits.

(2) *The significance of the washing limit.* However, not only has the above local variation in the transgression's dates not been taken into consideration in the past, but many archaeologists have worked on the assumption that the transgression's maximum reach or 'washing limit' was about the back of 'the 25-ft. beach'; this assumption, as is discussed below, is without justification and, excluding any zone of pure coincidence, in error. In fact, as Synge and Stephens have recently remarked in a paper[3] containing many archaeologically valuable measurements of this limit elsewhere (e.g. 48 ft. O.D. at Linne na Craige, near Oban), the washing limit has usually been ignored even by geologists. And this although, ever since McCallien[4] at least, there has been a growing body of opinion that the encroaching Boreal-Atlantic sea merely took over a pre-existing or pre-Recent platform – for, in that case, it would obviously be dangerous to assume that the later sea's maximum reach coincided exactly with the already-present platform. This suggests, then, that when examining a regional coastal site, accurate establishment of the immediate washing limit is a first consideration – appraisal of the site's relationship to the transgression is made hazardous otherwise. And, in fact, evidence described next suggests that on NE. Jura the washing limit lies high above 'the 25-ft. beach'.

(3) *Locating and measuring two NE. Jura washing limits.* Bench marks workably close to the sea are very few on the NE. Jura coast, and since the most central, that in Lealt Glen's Stone Park, could not be located, all measurements have been related to that upon the SE. corner of the highest house at Lussagiven, 100 yds. from the sea; somewhat obliterated, this is the mark which appears on the 1878 (rev. 1897) 6-in. O.S. map, 45·6 ft. 'above the assumed Mean Level of the Sea at Port Ellen' (Isle of Islay) – this is the 'O.D.' used throughout this report.

Using an Austin 'Aqua-lev' water-level and two poles, 8 major bays over the 5 miles between Lussagiven and Carn were measured from O.D. up to about 60 ft. (throughout this paper measurements are to the top of the sub-peat layer – where necessary by the use of probes – unless otherwise stated). Fig. 6 shows a generalised profile through the unconsolidated material making up the W. side of the Lealt Glen, and including the excavated site. The surface-sculpturing between points 1 (O.D.) and 4 can be seen at all the bays measured; the most important variant is that, to a greater or lesser degree, the unconsolidated material between points 3 and 4 is usually replaced by bedrock, for example as a mere outcrop near the bottom (Saltings Bay), a smooth steep slope (the extreme SW. end at Lealt Bay) or a low cliff (Carn).

The back of the pre-Recent platform ('25-ft. beach') may be considered to roughly underlie point 3, but, examining the composition of the Lealt Bay unconsolidated material, it was thought

[1] Godwin, H., & Willis, E. H., *Amer. J. Sci.*, Radiocarbon Suppl. 4 (1962), 57–70.

[2] Donner, J. J., *Suomal. Tiedeakat. Toim.*, A.III, 68 (1963).

[3] Synge, F. M., & Stephens, N., *Trans. Inst. Brit. Geog.*, 39 (1966), 101–45. Another useful bibliography.

[4] McCallien, W. J., *PSAS*, LXXI (1936–7), 174–206.

that a deposit (fig. 7, trench D, deposit 3) which could be traced in various sections to point 5 (*c.* 51 ft. O.D.) – where it became confused with the deposits above and below and was lost – might well be attributable to the highest Post-Glacial transgression, on other workers' evidence presumably about its washing limit. This deposit was in fact that which held the stone industry to be described in Part II, then under consideration for excavation, and it is best described in Part II. Independent proof of the origin of the deposit was sought elsewhere along the coast. A deep, strip-shaped cross-going peat bog (N.G.R. NR 645873), 50–55 ft. O.D., in the Lussa Valley (2 miles S. of Lealt Bay), was examined in detail: there is only space to say that the topography and subsoil of the surrounding land both suggested the bog could well mark the transgression's washing limit, a conclusion with which a pollen analysis result of late Sub-Boreal age for the onset of the peat did not interfere. Further confirmation came during the excavation itself, when deposit 3, underlain by a land surface dated by pollen analysis to just after the Boreal-Atlantic transition, was found to include rolled flint artifacts.

Far, then, from coinciding with the back of the pre-Recent platform, *c.* 35 ft. O.D., the transgression is thought to have reached at least 51 ft. O.D. at Lealt Bay, in its calmest zone. It may be of use to add that the height at which the limit will now be found must vary, not only with the local readjustment which has followed the melting of the ice, but with the degree of exposure of each site to the transgression-time storm seas. The hurricane-sea of 14th January 1968 (though without time to build up) had a Lealt Bay washing limit of a mere 8 ft. O.D. but of twice that at a more exposed beach nearby; McCann considered that, on the unprotected W. coast of Jura, an earlier and higher transgression than that of Boreal-Atlantic times affected areas 20 ft. above its day-to-day or notch-cutting stand,[1] and this figure certainly does not sound too high. It is quite probable therefore that at many places on Lealt Bay's isobase the transgression not only far exceeded the '25-ft. beach', it even went higher than 51 ft. O.D.; digging may usually be the only way to locate its superficially inconspicuous washing limits.

(4) *The Late-Glacial transgression of Lealt Glen.* The present height at Lealt Bay of the washing limit of the Boreal-Atlantic transgression had been fixed reasonably satisfactorily, but it was noted that the excavation's main section (fig. 7, trench D) did not appear to include any deposit attributable to the Late-Glacial high sea. To avoid misinterpretation, an examination of the valley above the site was therefore made: there is only space to say that mounds of probable glacial origin (149–94 ft. O.D.) and till forming the banks of Lealt Burn down to 52 ft. O.D., combined with the site's apparent outwash-gravel foundation (traced down to 35 ft. 5 in. O.D.), suggested that, as in valleys in Mull and Arran,[2] a glacier rather than a high sea last occupied that part of the Lealt Glen which lies above the site zone. There was thus no reason to doubt that deposit 3, the main cultural horizon, was the washing-limit deposit of the highest Post-Glacial transgression.

PART II: THE EXCAVATIONS

Location and description of the excavated site (Pl. 1; figs. 3, 5)

Known locally as Lealt Bay, the inlet at the southern limit of the mouth of the Lealt Glen is mapped by the O.S. as Camas a' Bhuailte (N.G.R. NR 662902). About 100 yds. in each direction, the bay is protected by high promontories to N. and S., the former rising to about 45 ft. O.D., the latter perhaps twice as high. The S. and W. sides of the bay are wooded; to the N. lies moor-

[1] McCann, S. B., *Trans. Inst. Brit. Geog.*, 35 (1964), 1–16.

[2] Lacaille, A. D., *The Stone Age in Scotland*, O.U.P. (1954), 43. Referred to henceforth as 'Lacaille'.

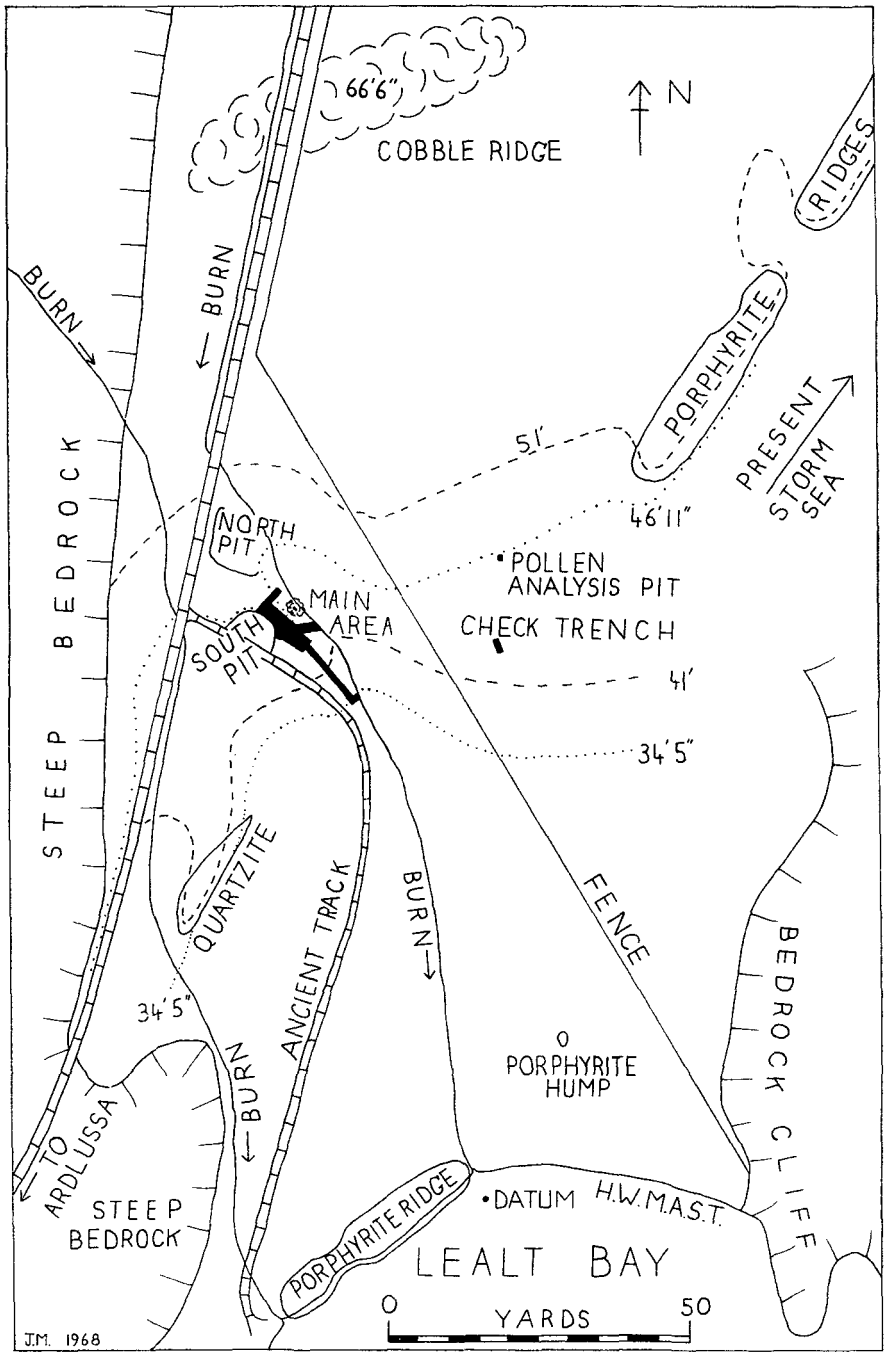


FIG. 5. Map of Lealt Bay

land. The two areas excavated (totalling 460 sq. ft.) are part of the NW. stretch of a crescentic terrace, 150 yds. long, which lies about 90 yds. behind the present shoreline.

The Main Area of Excavation

Fig. 6 shows a trench plan of the Main Area. The centre of trench D is 95 yds. from the shoreline datum; the top of its deposit 3 was 47 ft. 5 in. above it. To the NE. of the Main Area a small steep-sided burn cuts through the terrace; to the N. and S., dug for road ballast within living memory, lie shallow pits; the road passes 13 yds. to the west. Just S. of the S. Pit there is an overgrown cart track which can be followed to the shore; this was last used many years ago when wool was shipped off from 'the Bay of the Shieling'. In spite of all these marginal disturbances, it is not considered that the excavated area had been affected.

The live vegetation of the Main Area consisted of a single mature alder on the edge of the burn, many dozen self-seeded birch saplings, dense very active bracken giving way to stunted heather around the seawards margin, and rough grass. There were no nettles and no significant amount of cultivation weeds. In some places the tops of cobbles could be felt underfoot.

Throughout the following description, reference may usefully be made to figs. 6 and 7 and Table 1.

Deposit 4. The upper part of the peat was removed in small blocks; these were broken up and examined. Pl. 2b shows the S. or S. Pit margin of the W. part of trench A, viewed from trench D, once the upper peat had been cleared off. The original surface of this strip, with that of trench D, was the ridge or crown of the Main Area, and the highest point of the excavation above O.D.; nor did thicker peat cover any part of the Main Area. The plate shows the continuation of the peat ridge, untouched, at the far end of the cleared strip.

Cobbles having been revealed, attention was next turned to them. They were found to be supported by a tightly-interlaced web of bracken roots; these had probably lifted the cobbles. No trace was recognised at any point of a construction, the cobbles always lying without any apparent significance. The upper cobbles were removed, thus baring to the full the accumulation of live and dead bracken roots. These archaeologically detestable growths had to be cut through one by one. The roots, the well-drained peat and many small cobbles made up the base of deposit 4. Several dozen humanly-struck pieces of stone, mainly flint, were found in the bottom half of deposit 4 in the course of the whole excavation. One flint was firmly embedded in the fork of a bracken root. Artifacts in this deposit were individual and no distribution pattern could be recognised.

Deposit 3. The sections cleared in the wall of the S. Pit prior to the excavation had made it clear that deposit 3 was to be the main archaeological horizon. Packed hard throughout, its cobbles, gravel and sand had the appearance of those to be seen on a sheltered beach; sieving showed up a silt element. In colour the deposit was grey with a very faint tinge of pink; there was no trace of humus or iron. The deposit was without any sign of sub-division. Its excavation had two primary aims:

(*a*) to ascertain the relationship of the artifacts to their matrix (in origin the washing-limit deposit of the highest Post-Glacial transgression) and

(*b*) to recover the artifacts in divisions fine enough to allow subsequent study to try to show whether or not there had been distinct periods of knapping at the site.

The boundary between the deposit 4 peat and deposit 3 was very clear. In the few places where the larger cobbles and bracken roots were absent, the peat had come away cleanly at its base; there the top inch of deposit 3 was merely darker than the rest. Where there had been

bracken roots in deposit 4, many of the lowest had dipped into and spread horizontally through the top inch or so of deposit 3; very occasionally one was found to have penetrated deposit 3 rather more vertically, reaching a maximum of about 3 in. into it.

First of all a 4-in. layer of deposit 3 was removed, 4 in. being considered the trampling limit – the depth below which, as a general rule for a large area of such a hard-packed cobble-protected deposit, human trampling was unlikely to have sent artifacts. Nor did it seem likely that bracken roots would have interred any artifacts below this depth. Below 4 in., 2-in. layers were used. Maximum artifact recovery was effected by riddling the whole of the cleared material in water, using a $\frac{1}{8}$-in.-mesh sieve; the nearby burn was first prepared for this extremely slow operation.

The maximum thickness of deposit 3 was in trench D: an average of 10 in., with pockets an inch or two deeper dovetailing with the deposit below. In *all* directions from trench D the deposit was found to taper away, until it was only an inch thick at the ends of trenches B, E and G. This tapering over such a small area, which much reduced the value of the fine-drawn vertical divisions, was partially counteracted by laying out the trenches to correspond with areas of roughly similar thickness of deposit. The extent to which deposit 3 was excavated is shown by Table 1.

Trench N, with the lower end of K and the burn section N(BS), revealed a different stratification, and this complex will be dealt with shortly.

Deposit 3 held at least 50,000 pieces of humanly-struck stone over the Main Area (92%) and the Check Trench (8%) together (estimates, based on weight).

Reverting to the Main Area alone, analysis of *horizontal* distribution showed the artifacts to be concentrated on the crown – within trench A (as enclosed by the unbroken line in fig. 6 *lower*). They were comparatively few in B, E, F, G and the 4 ft. at the upper end of K, disappeared almost entirely down the rest of K, to reappear in some quantity at its lower end and in trench N (mainly in deposit 3B, see below).

Where deposit 3 was over about 4 in. thick, a *vertical* distribution of the artifacts in accordance with the index in fig. 7 (trench D) was satisfactorily established. In trench D, for example, the top or 0–4 in. layer of deposit 3 produced about 2,500 artifacts; the 4–6 in. layer several hundred; the 6–8 in. layer only 63; in the bottom inch or two there were no artifacts. Where the thickness of deposit 3 fell below about 4 in., all that can be said is that artifacts occurred throughout it. As another example, in trench Y – where deposit 3 had already tapered to half – the artifacts did reach to the bottom. In assessing the relationship of the artifacts to the deposit, it should be remembered that a layer of cobbles, cleared as deposit 4, protected the artifacts' matrix, extremely hard-packed gravel, sand and finer material. The writer's conclusion is that only marine action – the mixing of maximum-stand time gravels and tools, with a regressing time tool element added on top – can account for the vertical distribution of the artifacts, and, therefore, that a proportion, including the rolled specimens, dates from the pre-land-recovery period.

Deposit 2. Humus-rich, blackish greasy loam at the top grading evenly through less organic, ginger-coloured crumbly soil into deposit 1. Many faceted cobbles and coarse gravel. Though this deposit no doubt contained eluviated humus, the evidence next put forward showed it to be the pre-transgression land-surface.

Pollen analysis was carried out on a vertical series of four samples taken from the top of deposit 2, at 2-in. intervals (these samples thus ran from 22 to 16 in. below the original surface of trench D). Although deposit 2 is recorded as extending 10 in. down (fig. 7) only about the upper half had been thought to be subaerial build-up (the lower part probably being illuvial matter, decomposed roots etc.), and so it was acceptable that only the top two samples yielded pollen.

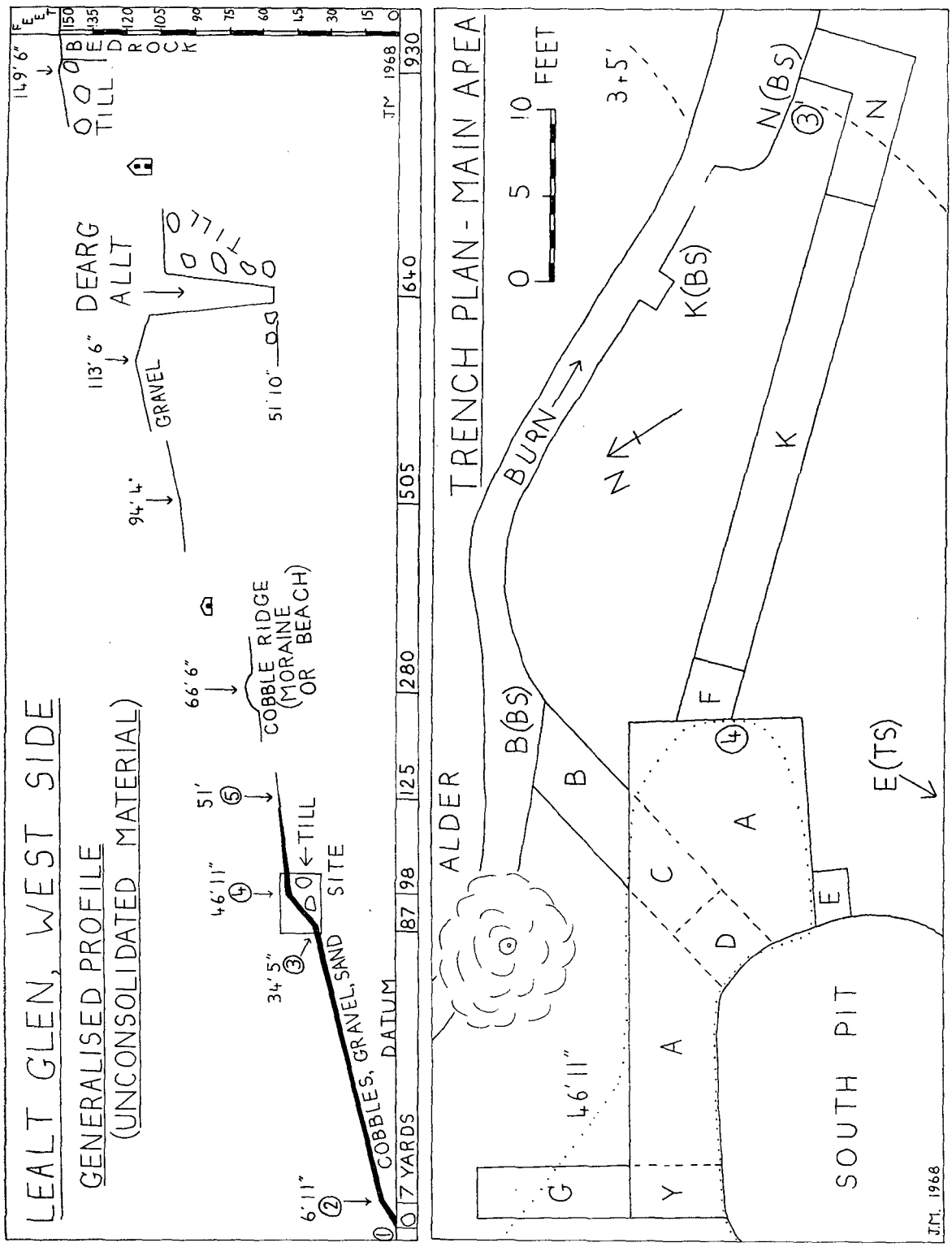


FIG. 6. Generalised Profile, Lealt Glen, and Site Plan, Lealt Bay

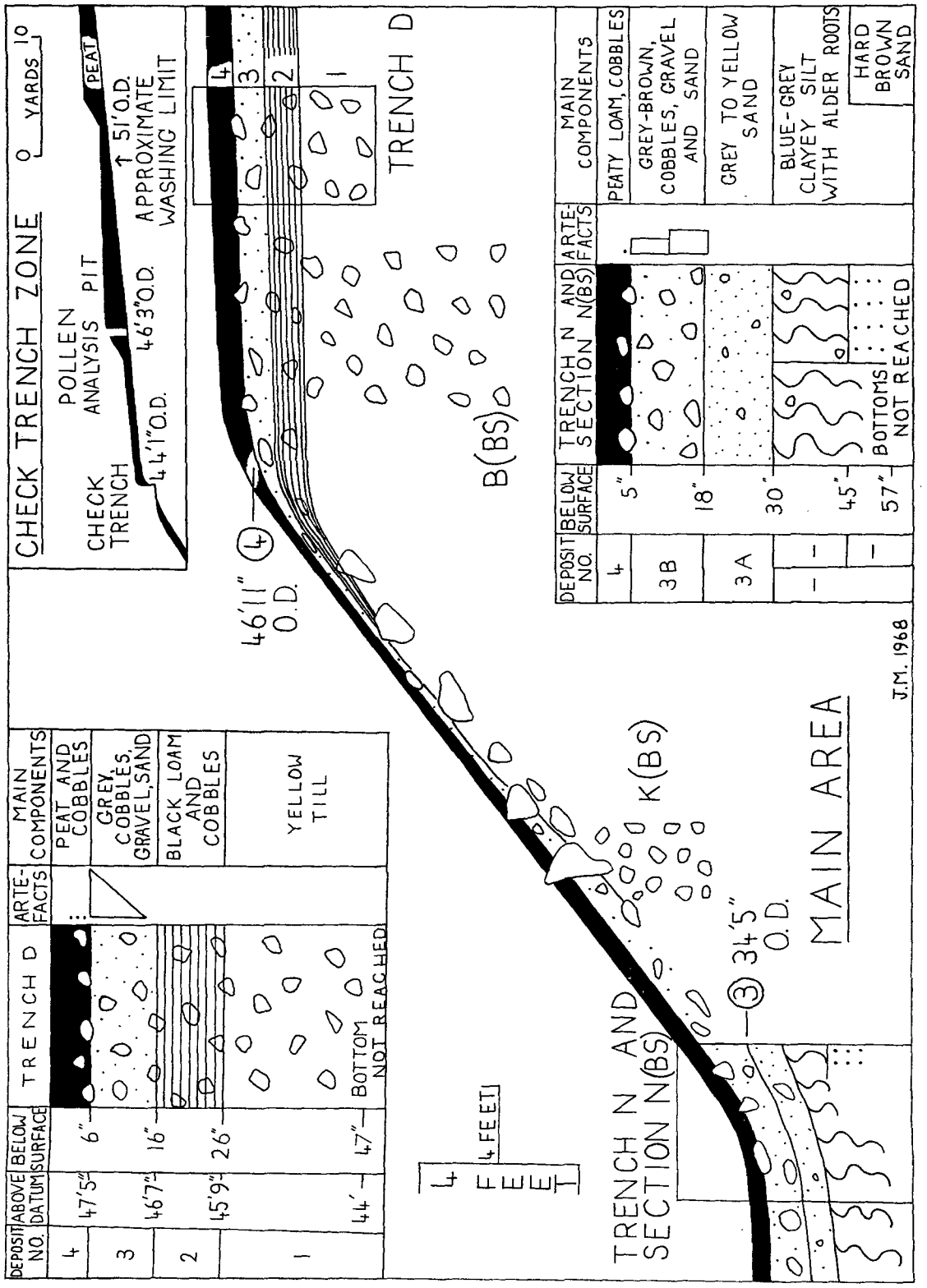


FIG. 7. Sections, Lealt Bay

Based on straightforward individual percentages of total pollen, excluding Corylus, fig. 8 (the lower part of the diagram) shows the results of these counts. Woodland was then markedly dominant in the vicinity (80% against the present 10% shown by the upper, post-transgression part of the diagram, to be discussed shortly). Dr Durno was of the opinion that the hazel and birch all-time peaks were probably those to be seen just before the Boreal-Atlantic transition in the Bird Loch diagram (fig. 4); however, the considerable alder pollen was most likely to date from after the transition, the slow build-up of the containing deposit being responsible for the mixing. He therefore felt that the top of the layer might be placed just after the Boreal-Atlantic transition.

Nichols, in his paper[1] on Aros Moss (near Campbeltown) and Racks Moss (near Dumfries), wrote: 'Zone VI . . . this Alnus increase at Racks Moss may be a local feature, perhaps related to the rise of sea-level, as the late Zone VI peak in alder counts at Aros Moss appears to be. The fact that sub-clay peat from nearby Redkirk Point has been dated 8135±150 B.P. (Q–637) possibly supports my contention that at Racks Moss the marine inundation spanned the Boreal-Atlantic transition' (p. 155), and, over his Aros Moss diagram (pp. 164–5) 'Near the close of Zone VI, Alnus climbs sharply, with a high peak (23 per cent at 425 cm) which precedes the main curve of Alnus development . . .' and also 'Zone VIIa. – Alnus percentages rise quickly'. Now, though there were no roots at all in any Main Area deposit *upon* the terrace, the burn section N(BS) was found to hold what were apparently pre-transgression roots; also, the lower 3 ft. of the 4 ft. of post-transgression peat in the zone of the Pollen Analysis Pit (see below) was densely packed with roots. Some three dozen samples submitted to Dr Metcalfe at Kew proved to be entirely alder. Adding this to Nichols' evidence leads one to wonder whether the rising transgressing-time water-table would not often have led to valley mouths being taken over by alders, thereby making the alder-dominance point of a coastal site's pollen diagram an unreliable indicator of the opening of the Atlantic period. If further evidence were to substantiate this, the top of Lealt Bay's pre-transgression deposit would thereby be moved back into the Late Boreal, the high alder count merely showing the imminent arrival of the encroaching sea. Another sample taken at 16 in. closely confirmed the proportions shown in the diagram, with the addition of 4% pine, clearly much the highest reading for this tree at Lealt Bay; a possible comparison is to the Late Boreal pine maximum at Bird Loch and elsewhere.

In summary, Dr Durno dated the top of deposit 2 to just after the Boreal-Atlantic transition. This provides, first, a maximum antiquity for the beginning of the maximum stand of the highest Post-Glacial transgression of Lealt Bay, and, second, a maximum antiquity for all the artifacts except those which were rolled (and which may therefore well have come from elsewhere in the bay).

No artifacts were found in deposit 2 (see also Table 1).

Deposit 1. Angular cobbles, gravel, sand, yellow clay, hard-packed; considered glacial outwash ('till' in text figures), perhaps Valley Glaciation, 8300–7800 B.C.[2] Bottom not reached. No artifacts (see also Table 1).

Trench N. The lower end of trench K, the whole of trench N and the extensive burn section N(BS) revealed a series of deposits (fig. 7) which are of considerable interest as part of events in Late-Quaternary Jura. They amplify the archaeological information to be derived from the rest of the trenches and sections.

The short trench N includes the back angle of the pre-Recent platform (the highest point of

[1] Nichols, H., op. cit.

[2] Lacaille, p. 58.

deposit 3A is 34 ft. 5 in. O.D.), being at the foot of the slope leading up to the crescentic terrace. Bog myrtle grew thickly on the original surface of the lower, more horizontal part of the trench, heather on the slope.

Deposit 4 had its base amongst small cobbles (as upon the terrace). Those at the lowest point of the trench were well-rounded lenticulates and near-spheroids; at the higher end they were more angular.

Deposit 3, as had been already seen from the N(BS) section in the burn, was found to separate gradually, in the downhill direction, into two eventually distinct deposits, 3B upon 3A. Below the cobbles, deposit 3B consisted of a rather mushy ill-drained mixture of material ranging from coarse gravel to fine sand; there was considerable orange-staining. It was considered to have been finally sea-worked early in the regression. The top half of deposit 3B held some 650 artifacts, the bottom half about 1,000. Distribution appeared haphazard; no gradual downward decrease could be discerned, unlike that indicated in fig. 7 for the upper region's artifacts. Of 36 pieces of well-patinated green pitchstone found during the excavation, 34 came from upon the terrace, one from trench N, one from the Pollen Analysis Pit. Deposit 3B graded rapidly down into 3A, fine sand; this was yellow towards the burn, grey away from it. Clearly rather earlier than 3B, deposit 3A has its present parallel around the lower margin of the inter-tidal zone of the active bay. The top 3 in. was sieved but, as it only yielded 23 small flint chips, this deposit was not further examined.

After clearing, section N(BS) revealed two more deposits below 3A, neither with artifacts. The upper, considered the top of the remaining pre-transgression land (perhaps in origin an offshore deposit of the Late-Glacial transgression, subsequently overlain by glacial outwash) was a coherent pale blueish-grey clayey-silt, holding the mentioned alder roots (which, still firmly in growing position, appeared truncated above). Below the upper end of the clayey-silt there was a near-consolidated fine sand, brown but reddening if dried out (perhaps a Late-Glacial transgression deposit too). Regrettably, and because of the small forces available, contact has not yet been established between these deposits and the site's foundation, glacial outwash.

The Check Trench (Pl. 2a; figs. 5, 7)

Because of the finding of the few dozen artifacts here and there throughout the very shallow deposit 4 of the Main Area, further information on the importance of this distribution was sought from a completely separate trench. By probing with steel rods, part of the terrace 35 yds. away E. was found to have a much thicker peat cover than the Main Area. A landscape position similar to that of trench F, the top of the slope, was chosen for the trench; this was to ensure good drainage, the whole of the terrace E. of the burn being waterlogged. Vegetation here was rough grass with sphagnum moss.

The top of the peat at the upper end of the Check Trench was 45 ft. 4 in. O.D. Fifteen inches thick there, the peat (deposit 4) decreased gradually downhill to 9 in. at the lower limit of the trench. Measured in terms of the surface of deposit 3, below the peat, the length of the trench was 6 ft., the width 3 ft., and the angle of slope about the usual 25° below the horizontal. There were in fact no artifacts in this trench's version of deposit 4. The only intrusions were a number of firm fragments of charcoal; occurring about 2 in. above the base of the peat, these remain to the present without association.

Below the peat, as in the Main Area, cobbles and coarse gravel were revealed; at the back of the trench these stood at 44 ft. 1 in. O.D. The matrix, a pale grey mixture of fine sand and silt, occurred in pure pockets, 3–5 in. deep, amongst the cobbles and coarse gravel. A total of 3,848 stone artifacts was found in the pockets and amongst and below the well-embedded stones. These

artifacts represented 8% of the total recovered, whilst the area of the Check Trench was 4% of that excavated. Scattered throughout the pockets, black in the pale grey matrix, were small pieces of very soft charcoal. At the NE. corner the pockets became markedly darker, due to a strong content of very fine charcoal particles. Pl. 2a shows the upper limit of the pockets; the triangle outlines a section through those with the concentration of fine charcoal particles. C-14 assay would here give a minimum antiquity for the site and for the end of the transgression's maximum stand. But, since the site is thought to have had a long life and the Check Trench included a discarded rough-out for a scale-flaked leaf-shaped point, the charcoal is most logically from a late occupation; nor could the dating be applied with certainty to any of the site's many tool-forms.

Once the above artifact-and-charcoal-holding pockets had been cleared, it was found that the matrix of the cobbles and gravel below was a reddish-brown mud containing some fibrous vegetable matter. The two lowest steps seen in Pl. 2a are in fact this deposit. Once exposed it rapidly mixed with the water draining down the floor of the shaft from the marshy area above. Neither artifacts nor charcoal was found in this deposit, of which 2 in. in depth was removed and sieved in water.

The purity of the fine silty-sand suggests hillwash, obviously post-transgression, but this of course cannot be used to date the Check Trench's artifacts (and a few were in fact heavily rolled); the even diffusion of fine charcoal particles throughout the pockets also suggests hillwash. The underlying brown muddy deposit is probably peaty seepage.

The Pollen Analysis Pit (figs. 5, 7)

Pollen analysis of peat *overlying* the site was necessary, but the shallow covering of the Main Area was unlikely to produce a valuable result. In order to find a suitable sampling place – one that would push back the *terminus ante quem* as far as possible, if only for a part of the site – the peat immediately behind the Check Trench was probed to find its deepest point.

A sharp rise (fig. 7, 'Check Trench Zone') of the *peat* surface occurs about 10–15 yds. back from the front of the terrace. This abrupt change of slope, upon being levelled, was found to have no direct relation to the profile of the underlying deposit (levelled with the aid of probes), which rose more or less evenly; as the figure shows, the peat soon thinned back to its previous thickness. However, this sharp ridge in the peat is no doubt connected with the transgression, perhaps a combination of factors such as temporarily heightened water-table and, subsequently, permanently blocked drainage.

A pit was dug in the ridge 13 yds. inland from the Check Trench, the probing having shown that there the surface of the deposit underlying the peat was 46 ft. 3 in. O.D., a height corresponding to the top of deposit 3 on the trenches A–K boundary of the Main Area. From about a foot down the peat contained many alder roots. At 3 ft. down, cobbles began in the peat. Alder roots of arm-thickness penetrated the mixture, gripping the cobbles and much faceted by the contact. Between 3 ft. 7 in. and 3 ft. 10 in., a total of 71 nondescript artifacts was found, together with abundant fine charcoal; these relics lay amongst roots, cobbles and coarse gravel in a matrix of brown mud which held finer gravel and sand, much of it unrolled. From 3 ft. 10 in. to 4 ft. 2 in. there were only the alder roots and stone material, and digging was not pursued further. A series of 23 samples at 2-in. intervals was taken from 3 ft. 10 in. upwards.

The upper part of fig. 8 is the resulting diagram; the lowest sample (brown mud) held no pollen, so counting began at 44 in. Whilst the peat analysed in the upper part of the diagram (i.e. deposit 4) did not physically overlie the soil represented by the lower part (deposit 2), the O.D. height of the base of the former (46 ft. 3 in.) was about that of the top of the latter (46 ft. 7 in.). It will be appreciated that, because of the obvious variation around the bay in the

build-up of the peat, and probably in the date of its onset, some of the implications of any single diagram would be only certainly applicable to the sampling point. The diagram to be described has as wide an application as could be contrived.

Dr Durno was convinced that 'the upper part starts in the Atlantic period' but he did not indicate the Atlantic-Sub-Boreal transition. The present writer, noting that at 32 in. an oak minimum coincides with the first appearance of plantain, a probable cultivation indication (oak and plantain in fact alternate) and with an abrupt rise and fall in grasses and fall and rise in

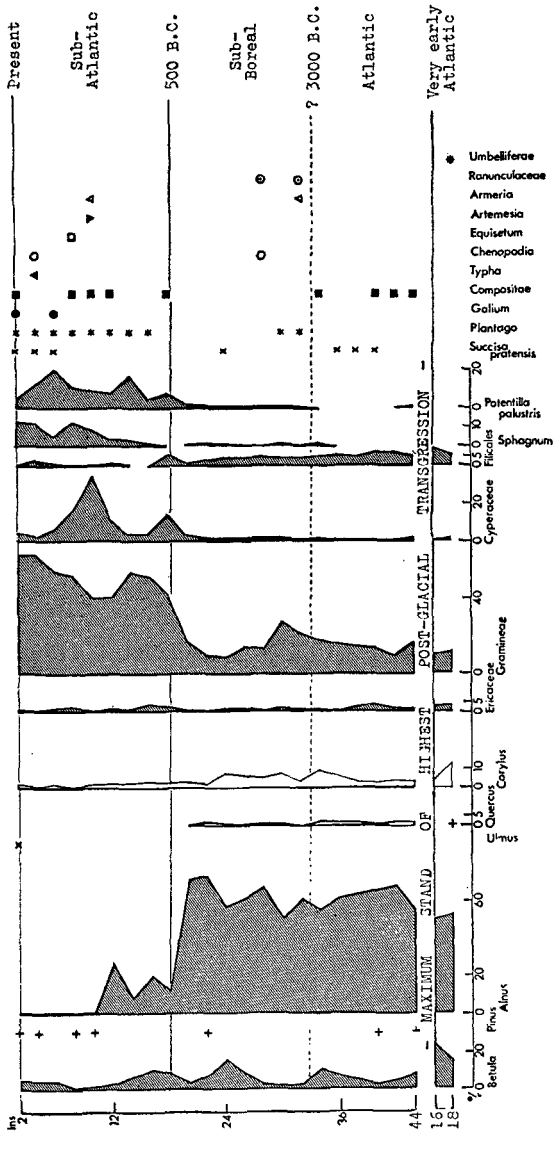


FIG. 8. Lealt Bay pollen diagram based on percentage of total pollen (*upper*, Deposit 4 of Pollen Analysis Pit, base 46 ft. 3 in. O.D.; *lower*, Deposit 2 of Main Area, top 46 ft. 7 in. O.D.)

birches, suggests that, as elsewhere, these events may have occurred around the Atlantic-Sub-Boreal transition (note the abrupt oak-elm fall in the less detailed Bird Loch diagram). Of the chronological gap between the lowest (44 in.) sample and the top of the pre-transgression layer (dated to just after the Boreal-Atlantic transition), Dr Durno wrote that 'the evidence provided by the comparatively minor fluctuations in the proportions of pollen content does not suggest a very long interval of time'. He felt there were no other indications as to when in the Atlantic period the upper peat had begun to form.

A possible construction, then, is that a minimum antiquity of about mid-Atlantic can be ascribed to:

(*a*) the end of the transgression's maximum stand at Lealt Bay

and thus to (*b*) the opening of human activity at the site. Concretely, this refers to the 71 waste pieces in the Pollen Analysis Pit itself and to all the rolled artifacts; it also applies to that unknown proportion of the rest which has already been proposed as of pre-land-recovery age (i.e. probably of maximum stand time, and not visibly rolled).

C-14 dating of a sample from the base of the deep peat would provide a more finely-drawn *terminus ante quem*.

TABLE 1

TRENCH AND SECTION SUMMARY

		Deposit				
		4	*3*	*2*	*1*	
A	Trench (excluding C, D and Y)	7–2 in.	4 in.	Not reached		
South Pit	Sections			Accord with D		
B	Trench	4–1 in.	3–1 in.	2–1 in.	Top bared (browning towards burn)	
B(BS)	Burn section				60 in. as bared in B trench (more gravel than clay)	
C	Trench	6–4 in.	10–6 in.	Top bared		
D	Trench	7–5 in.	12–8 in.	12–8 in.	21 in. (yellow). Bottom not reached	
E	Trench	2 in.	1 in.	Top bared		
E(TS)	Track section	Accords with K trench (for the same height)				
F	Trench	3–2 in.	3 in.	Top bared		
G	Trench	5–1 in.	4–1 in.	Top bared		
North Pit	Section			Accords with G		
K	Trench	3–2 in.	3–2 in.	1 in.	Top bared (brownish-yellow) down to *c.* 36 ft. O.D.	
K(BS)	Burn section				36 in. as B(BS), to 35 ft. 5 in. O.D.	
Y	Trench	6–5 in.	6–4 in.	Top bared		
				Deposit		
		4	*3B*	*3A*	*Clayey-silt-with-roots*	*Sub-consolidated sand*
N	Trench	5–3 in.	15–10 in.	3 in.	Not reached	
N(BS)	Burn section	5–3 in.	15–10 in.	12–10 in.	(1) 15 in. (2) 48 in. (probed)	(1) 12 in. +
				Deposit		
		4	*3* (*Silty-sand*)	*3* (*Peaty seepage*)		
Check Trench		15–9 in.	5–3 in.	2 in. (bottom not reached)		

CATALOGUE OF THE FINDS

Summary Description

(1) A very worn rostral plate of the Cirripede Balanus, most probably *B. balanoides* (L.), the acorn barnacle; the plate showed signs of predation by a boring mollusc. It was found in trench N. centrally within deposit 3B, at a height of about 34 ft. O.D. Of the littoral group of fauna, the present average upper limit of the acorn barnacle at Lealt Bay is about 9 in. O.D.

(2) Quartzite artifacts.

(3) Flint and other stone artifacts.

(4) Charcoal. In addition to that already described in the Check Trench, a single minute piece, very solid, was found in the top 4 in. of deposit 3, trench A. So little charcoal in the Main Area is perhaps due to washing down by the sea.

(5) 13 small pieces of carbonised hazel-nut shell, all in trench N, deposit 3B.

(6) Half an extremely corroded bullet-like ball of lead, originally ½-in. diameter. Trench N, deposit 3B.

The Quartzite Implements (fig. 9)

Twenty stones were considered to bear signs of human attention. These graded, at their most uncertain, into others as likely to have been damaged or smoothed naturally. The 20 preserved are probably all quartzite, now mostly in a comparatively soft, friable state, some of them of the consistency of sandstone. All were found in the 4-in. top layer of deposit 3, trench A. The most interesting were:

(*a*) Three which bore grooves and pits holding a grey-white paste. Experiment showed that the rubbing together of two wetted pieces of quartzite produced an apparently similar paste; as a filling in a depression this would probably have some persistence. The same result was not obtained by rubbing antler.[1] No. 1 (1 in. thick, 13 oz.), to which most paste adhered, was found paste-face downwards. This face had been worn obliquely, or bevelled, along all four edges, the corners being rounded off. A groove, crossing its face diagonally, was particularly pasty, this paste bearing four or five smooth dents. The illustration shows how only small areas of the original cortex remained intact; there were three small similarly-shaped pock-marks close together on one patch. The back bore no sign of use. No. 4 (1 in. thick, 10 oz.) had a pronounced pasty groove in its smoother face. Its underside, very rough and fresh-looking, had adhesions of paste such as would occur if it were held in a paste-covered hand or rested upon a paste-daubed surface. Possibly the groove was used in the preparation of arrow-shafts; discussing prehistoric archery, Clark described grooved rubbers ranging from the Late-Glacial Ahrensburgian of the continent to the Bronze Age in Britain, also noting that known prehistoric arrow-shafts fall between 0·7 and 1 cm in maximum diameter.[2] No. 3 (1 in. thick, 11 oz.) had a centrally-placed battered shiny patch on one side, a pronounced, almost centrally-placed, circular pit, 1 in. in diameter, on the other; traces of paste.

(*b*) Three flattish stones each bore signs of battering at the centre of one main face. In plan, these were circular (4½ oz.), oval (6½ oz.), triangular, No. 2 (5½ oz.).

(*c*) Five elongated specimens of near semi-circular or 'D' section. On three, the chord face was much smoother than the arc; these weighed 1½ oz., ½ oz. (broken) and ½ oz. The latter (No. 5) was a tanged specimen, its chord, the smoothest face amongst the three specimens, increasingly worn away tipwards.

[1] Clark, J. G. D., *The Mesolithic Settlement of Northern Europe*, C.U.P. (1936), 107.

[2] Clark, J. G. D., *PPS*, XXIX (1963), 50 ff.

(*d*) Four small flat pebbles, roundish (1–2 in. diameter), each with one or both sides showing signs of smoothing. The smoother face of the smallest (¼ oz.) had a greasy, black, slightly lustrous surface.

(*e*) One brown-stained stone (3½ by 2½ in., ½ in. thick but one face had split off) had traces of a reddish substance engrained in its remaining original face.

Flint and Other Stone Artifacts (figs. 9–15)

The material. In total, the excavation yielded 51 lb. 3 oz. of struck stone, excluding quartzite. Of this, 12 lb. 1 oz. was milky quartz. Veins of it are common throughout the island's bedrock quartzite, and it can be found as rounded pebbles on all beaches. Only beach pebbles could be identified with certainty amongst the Lealt Bay artifacts. Two grades of milky quartz could be distinguished, a clean, glossy, fairly tractable variety with a marked bulb of percussion, and a brittle fissured sort which tends to shatter in its entirety rather than yield flakes. There were also a few ounces of broken-up colourless quartz crystals, perhaps inferior to the better milky quartz in performance. The writer has located a source of 1-in. crystals, half a mile S. of the site, whilst the local people's 'Glittering Rock' at Carn owes its name to a covering of variously-sized pink or white specimens.

The remaining 39 lb. or so consisted of stone not apparently present on Jura in bedrock state. There was an ounce or two of green pitchstone (see Appendix I) and half a water-worn pebble of siliceous vein material. The rest was entirely flint (this includes chert).

The basic colour of a pound of the flint lay between pink and dark red. That of the rest was, in the main, either a medium-tone yellow-brown or a pale to medium grey. Blackish-brown flint was absent.

Faces resulting from prehistoric human workmanship were in the majority heavily patinated from chalky to dirty white; the patina was commonly brown-specked. Irregular brown-staining, no doubt illuvial material from above, was frequently remarked, being particularly noticeable on the larger artifacts; such specimens occurred at all depths. Probably not more than 5% of the flint was lightly patinated.

Original cortex, now at least a greyish or a brownish white, often bore a web of fine cracks. The cortex-outline of most of the larger fragments, together with a few partially reconstructed nuclei (No. 276), suggested that small, very rolled pebbles were the main material; 17 such pebbles were found amongst the struck material, the largest weighing 2 oz., the six smallest together weighing 1 oz. The origin of the flint is discussed in Appendix II.

Several dozen artifacts, with heavy white patina, bore signs of very severe rolling. They were found at all points of the Main Area and in the Check Trench, and at all depths. Many other white-patinated artifacts had salient points which were rounded in outline, rough-surfaced and brown. In spite of the quantity of flint found at the site, frequent examination of the burn bed, to as far away as the sea, added only a single artifact; this was uniformly stained dark brown, and glossy. The topography is strongly against the burn having been responsible for the rolled nature of the artifacts found at the top of the terrace and in the Check Trench.

Artifacts found haphazardly throughout trench N were very heavily patinated, almost all being also stained a pale orange; a number were markedly rolled; their surfaces were most glossy, even with something of the shallow translucence of bone china. Whilst the burn may have taken some of them down there, nothing suggests that it was not the sea which finally laid down the containing deposits. Unrolled specimens from near the top of deposit 3B could of course be equally well of post-transgression age, as could those near the top of deposit 3 over the whole of the excavated area.

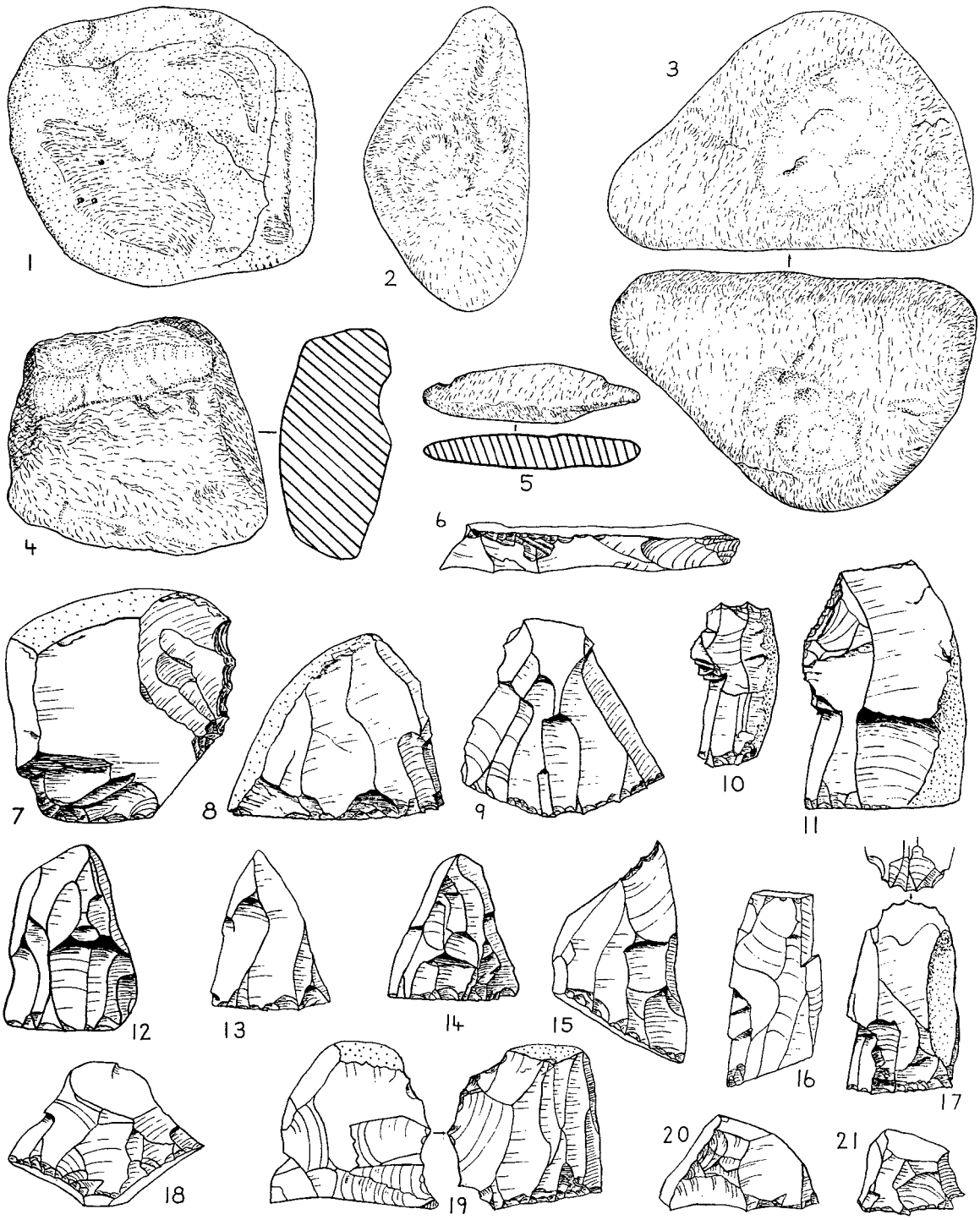


FIG. 9. Quartzite implements, Nos. 1–5 ($\frac{1}{2}$), and cores (No. 16 is $\frac{2}{3}$, others $\frac{1}{3}$)

The Typology

Cores (31, probably scrapers)		129
Not trimmed but damaged as by use		1,279
Microliths		1,283
Micro-burins		250
Blades with haft-trimming (other than end-scrapers)		53
Scrapers (including 31 core-scrapers)		346
Gravers and graver-like tools		47
Non-microlithic tanged points		61
Other non-microlithic points		23
Leaf-shaped flakes (not tanged) trimmed and/or used		81
Heavy triangles, quadrilaterals and pentagons		60
Perforators		81
Bifacially-flaked choppers and (?) axe-maker's waste flake		5
Toothed flakes		13
Scale-flaked specimens		33
Arched, tip-heavy flakes trimmed and/or used		44
Miscellaneous forms		4
Trimmed but not classified		392
	Total	4,184

Cores (31 probably scrapers)

	Total	*No. of Platforms* 1	3	2	*Angle 80°–100°*	*Scrapers*
1. No trace of cortex – Nos. 9, 12–15, 18, 20, 21	36	17	2	17	7	12
2. Cortex tip (*including one of transparent quartz) – No. 19	9	5*	1	3	3	4
3. Flaked only part of the way round (*including one of pitchstone, No. 16) – Nos. 7, 8, 10, 11, 16, 17	84	65*	2*	17	4	15
Totals	129	87	5	37	14	31

(*a*) Total weight was 3 lb. 10 oz., average just under ½ oz. Individuals graded from a maximum of 2 oz. – No. 7 in (*f*) following – downwards, the 12 smallest weighing 2 oz. in total (amongst these was No. 21, and also a specimen with three platforms). Milky quartz not included.

(*b*) No. 18 has two platforms at an obtuse angle; No. 10 almost parallel to each other; Nos. 15, 19 are right-angled varieties. No. 16, pitchstone, has been scarred from three directions (third not illustrated).

(*c*) Core-silhouette varied from squat (Nos. 8, 9) to elongated (Nos. 10, 17, 11, the last the longest).

(*d*) Core-rejuvenation waste included discs, segments and elongated flakes. The latter were the most common; a few were flaked from the direction of the narrow end of the core at varying angles, but most were struck off in the plane of the platform, tangentially; No. 6 was part of a limited spread of unusually large, uninhibitedly-struck, buff-coloured waste. Flakes which, struck from the platform in the normal working manner, have removed cortex-free core-tips, will be considered under 'arched, tip-heavy flakes' (p. 36).

(*e*) A few cores very rolled, No. 12 very heavily so; its unbroken patination is a dense chalky white. The exquisitely-flaked Nos. 13 (pink), 14 (grey), similar to the first specimen, were sharp-edged and lightly patinated.

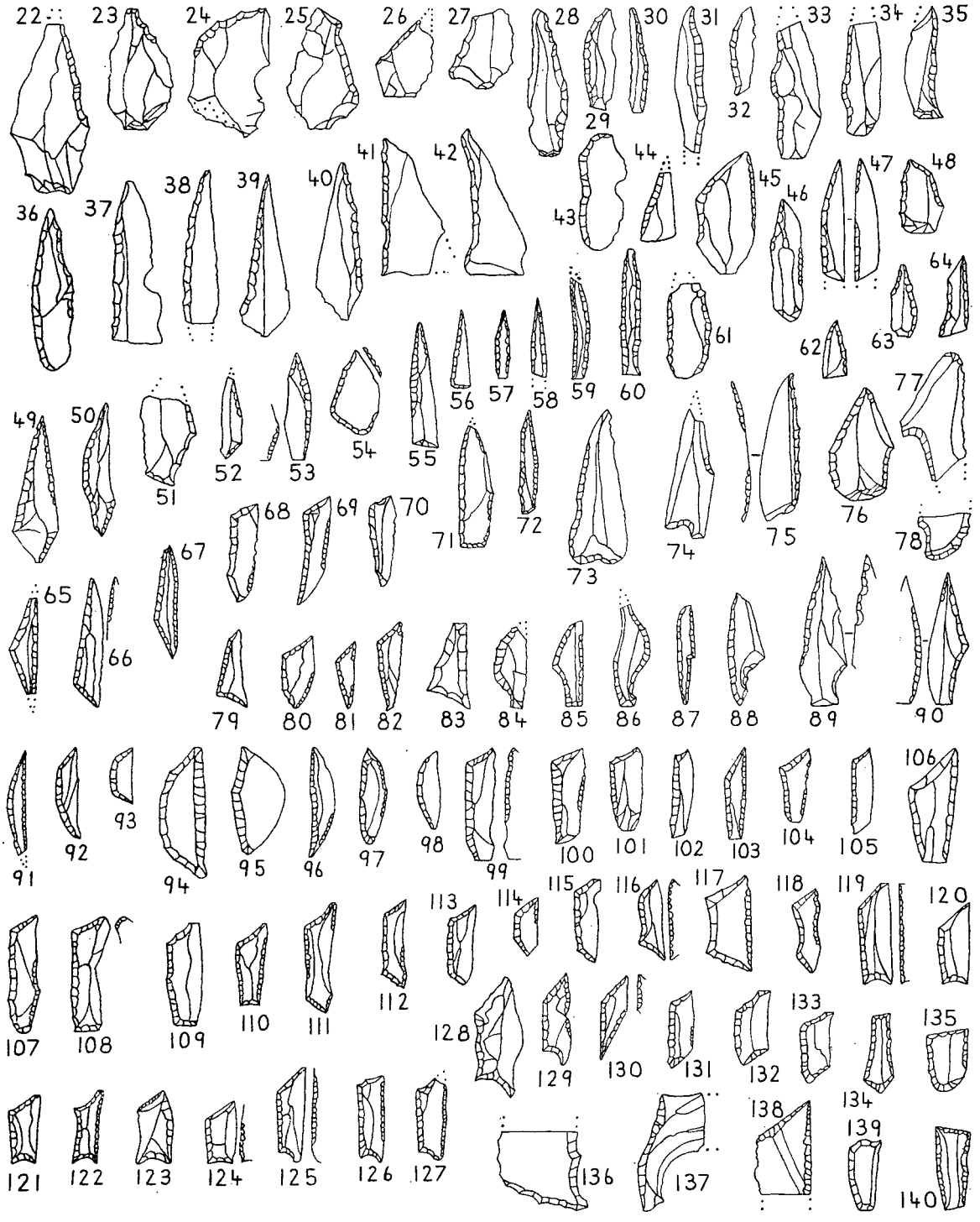


FIG. 10. Microliths (Nos. 83, 106, 117 $\frac{2}{1}$, others $\frac{1}{1}$)

C

(*f*) No. 7 has two differing sets of flake facets – one heavily rolled (with accompanying natural platform), the other quite unrolled (struck from a second platform, also natural, at right angles to the first).

(*g*) Those probably used as scrapers have been distinguished on various combinations of minute edge-flaking, dulling and general suitability (Nos. 17, 20).

TABLE 2

	Description	*Heavy patina*	*Quantity*	*Bulb*	*Prob. frag.*	*Illustration nos. and notes*
Pointed objects, base not separately trimmed						
1Ai	Partially trimmed one side, 1–$\frac{3}{8}$ in. (except No. 22)	3	5	4	4	Nos. 22–5. No. 24 not bulbar
ii	Partially trimmed one side, under $\frac{3}{8}$ in.	3	6	5		Nos. 26–7, both bulbar
B	Fully trimmed one side					
ia	Trimmed side convex, 1–$\frac{3}{8}$ in.	19	22	2	83	Nos. 28–31, 38. No. 28 bulbar. Frags. B class generally
ib	Trimmed side convex, under $\frac{3}{8}$ in.	8	8	4		No. 32
iia	Trimmed side straight or concave, 1–$\frac{3}{8}$ in.	32	35	7		Nos. 33–4 bulbar, humped. No. 35 bulbar, rolled. Nos. 37, 39–42. No. 43 bulbar, trimmed round tip
iib	Trimmed side straight, under $\frac{3}{8}$ in.	4	5	1		No. 44
C	Partially trimmed each side, 1–$\frac{3}{8}$ in.	4	4	2		On No. 45 untrimmed break facet makes tip. No. 46 bulbar, rolled
Dia	Fully trimmed one side, partially the other, 1–$\frac{3}{8}$ in.	8	9	1	5	Nos. 36, 47
ib	Fully trimmed one side, partially the other, under $\frac{3}{8}$ in.	12	17	3		No. 48 bulbar. Nos. 62–4
E	Fully trimmed each side, maximum width over a quarter of length	2	3	0	10	No. 61
2	Fully trimmed each side, maximum width under a quarter of length	4	6	0	32	Nos. 57–60. Compare No. 72. Seven frags. with inverse trimming one side
Pointed objects, base separately trimmed						
3Ai	Base tapered by trimming from below	6	8	1	5	Nos. 49–52. Varied (No. 52 sole 'irreg. elongated trapeze')
ii	Base tapered by trimming from above (each about $\frac{7}{10}$ in.)	8	8	0	1	No. 53. All very similar
Bi	Base trimmed convexly	0	1	1	2	No. 54. Frags. quite rounded (one made on earlier material)
ii	Base trimmed straight or nearly so	5	5	0	3	Nos. 55–6, 71–2. Frags. (inc. 3Bi) could be 6Bi, ii
Ci	Base trimmed concavely, symmetrically	0	1	1		No. 73, patination light, hollow feeble, bulbar
ii	Base trimmed concavely, asymmetrically	0	2	1		No. 74. No. 75, incipient tang prob. broken off. Pat. light
D	Miscellaneous tanged forms	9	15	3	5	Nos. 76–8, 84–90. Nos. 76, 84 bulbar. No. 77, bulb at upper end, may be micro-burin

Not Trimmed but Damaged as by use

Blades (see *infra*, p. 28) – No. 142	95	7%
Other (114 milky quartz)	1,184	93%
Total	1,279	100%

The edges of No. 142 are so worn away that one cannot tell whether it was originally trimmed or not; it has had some further use at a much later date.

DESCRIPTION OF MICROLITHS

	Description	*Heavy patina*	*Quantity*	*Bulb*	*Prob. frag.*	*Illustration nos. and notes*
Triangles and crescents						
4A	Isosceles	2	2	0		No. 65
B	Scalene	25	32	1	16	Nos. 66–70, 79–83. Frags. are pointed ends narrowing rapidly towards base
5A	Crescent, median spine towards arc	23	38	0	17	Nos. 91–3
B	Crescent, median spine towards chord	4	5	4	1	Nos. 94–7. No. 95 barely patinated
C	Crescent, improvised and indeterminate	4	8	1		No. 98 made across tip of hinged flake
Quadrilaterals						
6A	Sub-trapezoid, sub-trapezium, base not trimmed	36	54	9	119	Nos. 99–106. No. 103, complete, is not a broken triangle. Frags. (upper ends) group 6 generally
B	Trapezoid, trapezium, base trimmed					
i	Base trimmed convexly	1	1	0		No. 107. See 3Bii
ii	Base trimmed straight	11	16	0		Nos. 108–10
iii	Base trimmed obliquely					
a	Back straight	4	6	1		Nos. 111–5. *See Note 1 below.* Compare No. 52
b	Back concave	3	3	0	1	Nos. 116–8
iv	Base trimmed concavely					
a	Symmetrically	4	6	0	3	Nos. 119–24. No. 122 has hollow-trimmed 'upper' end. Frags. (basal) could be 3Ci
b	Asymmetrically/obliquely	5	5	1		Nos. 125–9
C	Rhomboid	3	4	0	1	Nos. 130 (developed tail) to 133
Pentagons						
7	Irregular, symmetrical, abruptly pointed	0	1	1		No. 134
Totals		252	341	54	308	

Summary

Class	1A	1B	1C	1D	1E	2	3Ai	3Aii	3B	3C	3D
Total	11	70	4	26	3	6	8	8	6	3	15
%	3·2	20·3	1·2	7·8	0·9	1·8	2·3	2·3	1·8	0·9	4·4

Class	4	5	6A	6Bi, ii	6Biii	6Biv	6C	7	Total	Bulb
Total	34	51	54	17	9	11	4	1	341	54
%	10	14·9	15·8	5	2·7	3·2	1·2	0·3	100	15·8

Microliths

Classified (complete except where indicated)		341
Fragmentary but with some identity		308
Fragmentary, not classified		628
Miscellaneous		6
	Total	1,283

Conclusions can safely be drawn only from the first group. The second group will be seen to add no more than the suggestion that the easily-broken rods, class 2, are under-represented proportionally in the first group. Each of the members of the third group could have come from any of a number of classes in the first group. Some oddities were placed in the final group (see note 2, below).

Many specimens retain the entire bulb. Some have had the bulb partially chipped away, others have no doubt had it chipped away entirely. When the basic material consisted of small and not easily obtained pebbles, it is possible that the bulb of a flake too short for division by the micro-burin technique had either to be tolerated or removed by direct chipping. However, the notch-and-break method can be recognised on many specimens. Yet others are too small or too worn or patinated for the technique employed to be recognised. The column 'Bulb' indicates the occurrence of such specimens as were *clearly* not made by the micro-burin technique.

(1) Broad specimens of 6Biiia shape will be found under 'Heavy triangles, quadrilaterals and pentagons' (see *infra*, p. 32).

(2) Miscellaneous items: Nos. 135, 136, 139, 140 (? broken lower end) are heavily patinated, Nos. 137, 138 (pink) lightly so.

(3) No. 141 (broken), pink with light patina, is perhaps a typical microlithic blade, without secondary attention.

(4) Small, lightly patinated bulbar points with trimming (often inverse) which was not considered steep enough to be treated as microlithic are considered in a separate section on p. 30. Other than in trimming these rather broad points resemble a few specimens in microlithic class 1.

Micro-burins. With the bulbar end of the original flake downwards, these may be described as follows:

	Heavy patina	*Total*	%
(1) Notch on the right, butt end (Nos. 297, 302)	112	141	56
(2) Notch on the right, tip end (No. 299)	9	10	4
(3) Notch on the left, butt end (No. 298)	23	26	10
(4) Notch on the left, tip end (No. 300)	18	24	10
(5) Indeterminate (Nos. 303–4)	38	49	20
Totals	200	250	100

Four were between 1 and $\frac{4}{5}$ in. (No. 302), the rest smaller. Included are a few small-blade fragments notched for division but broken straight across just above the notch, no doubt unintentionally. Many of the specimens bore miscellaneous trimming in addition to their chipped half-notch, suggesting that they were made from discarded implements. Group 5 holds a finely-worked lightly-patinated double-ended specimen (No. 303). Also included in group 5 is No. 304, never divided, perhaps because, being a core-trimming, it was eventually decided that it was likely to be unworkable; its notches, formed by a single chip each, are distinct from that on the right side of No. 165, which has had wear.

As a generality, heavy patina on only 80% tallies with that on those microlithic groups likely to have been made in the main by the micro-burin technique (see also 'bulb' column): the

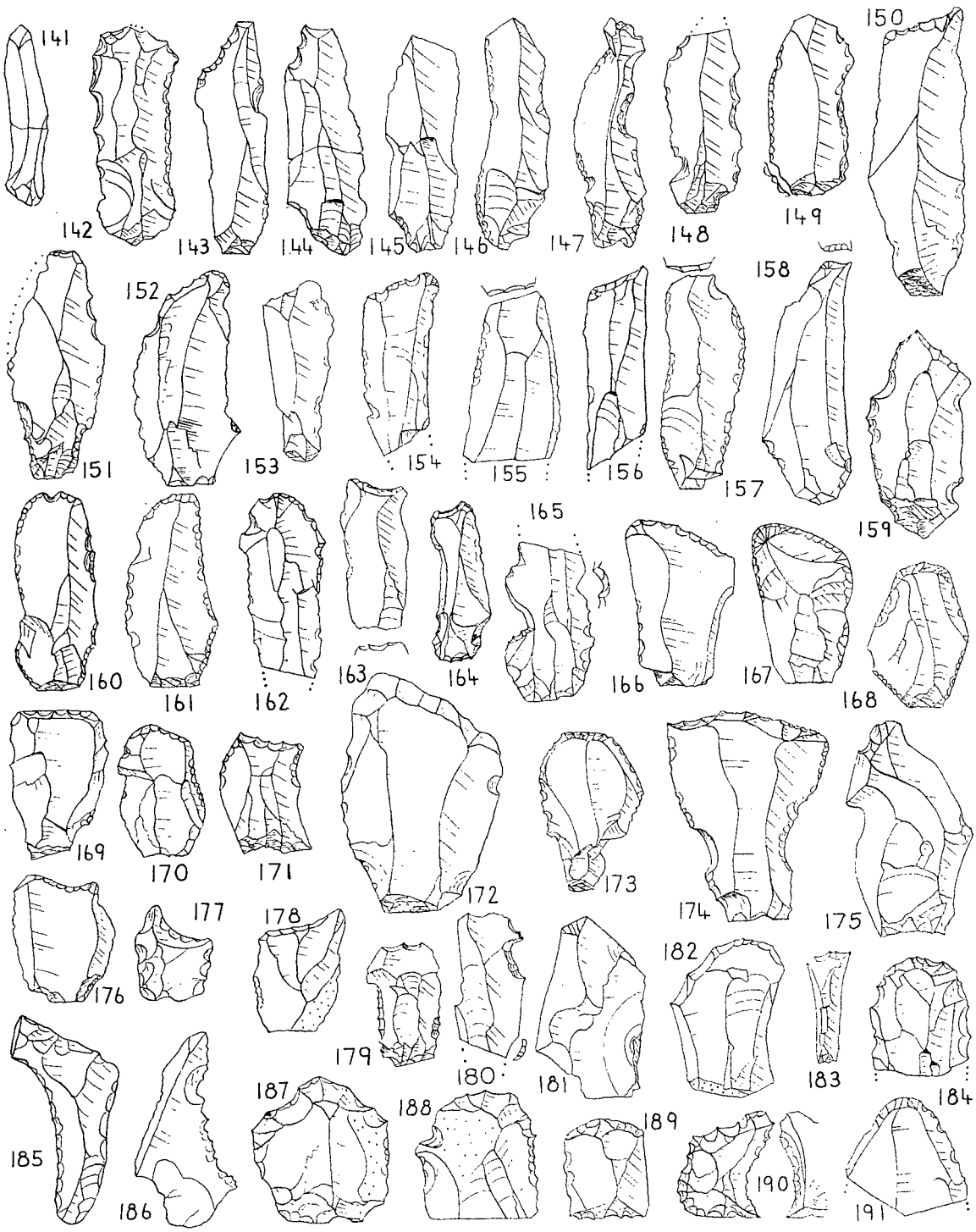


FIG. 11. Hafted blades, scrapers on ends of blades and flakes, other scrapers (all $\frac{1}{1}$)

triangles, crescents and some quadrilateral classes (not, for example, 6Bivb, heavily patinated). It may be then that such work, if not necessarily limited to the later part of the site's life, was certainly active at the end.

Blades. A blade was defined as twice or over twice as long as it was wide; cortex-free; flattish; with sides ranging between parallel and tapering to one end or the other. Excluded were broken fragments under 2:1, rejuvenation waste and objects included under 'microliths'.

Over 1⅛ in. long		*Total*	*%*
5	(1) Without use or trimming	76	28
20	(2) With use only (see p. 25)	95	35
29	(3) Haft trimming (other than end-scrapers)	53	19
	(4) Scrapers (see p. 29), most with haft trimming		
17	End of blade 30 (Nos. 150–64, 183)		
2	Side of blade 5 (Nos. 165, 180)	35	13
0	(5) Gravers (see p. 29)	2	1
5	(6) Trimmed but not classified (see p. 37)	10	4
78	Totals	271	100

(*a*) 1⅛ in. is about the combined length of the average micro-burin and average divided microlith.

(*b*) The secondary working on class 3 (Nos. 143–9) takes the form of about ⅓ in. of feeble non-microlithic edge-trimming at one end or both, on one or both edges. Very few specimens have ever had a point, and the only obvious use of the trimming, which sometimes produces an elongated trapeze (No. 144, compare with outline of *steeply*-trimmed Pavilandspecimens[1]), seems to be to aid hafting. The heavily-used No. 144, found broken, bears the trimming at each end, and was therefore perhaps hafted first at one end, then at the other; the two sets of trimming appear on the same edge and, perhaps correspondingly, it is only the opposite side which has been used, along its full length; one would expect the second trimming to be usually on the same edge as the first, since the first trimming had already made its edge useless for cutting, by blunting what would become the leading part. However, in the case of No. 148, which probably bears much-worn trimming on diagonally-opposed corners, it seems reasonable to suppose that the edge bearing the first trimming was considered preferable to that lacking the large chip, and so there was a change of working edges; each edge is in fact well worn on this specimen. When only one side at one end is trimmed, then sometimes the corresponding part of the opposite edge (at the same end) is not damaged – as one might expect, since that part would have been within the haft too (Nos. 143, 146). It can be seen that either end may be prepared to take the haft; on No. 143, which has never been more pointed, only the tip-end has been trimmed (a narrow tip-end is more quickly hafted than a blunt butt-end). Naturally, the initial shape of the blade would decide the exact trimming needed to yield the best tool. Superficially, the usually asymmetrical trimming suggests a marked angle between blade and haft.

(*c*) Almost without exception, all the blades were well patinated. The edges of most were sharp, but one or two (No. 165) showed signs of rolling. No. 142, heavily worn and patinated, has been re-used; the later scars are barely patinated.

(*d*) In summary, it can be said that, though there were comparatively few blades (0·5%), the analysis shows that the production of a third at least was not haphazard: 88 specimens were subjected to intensive use as cutters and scrapers, most being clearly mounted in hafts. About half of them were 1⅛–1⅝ in. long.

[1] Garrod, D. A. E., *The Upper Palaeolithic Age in Britain*, O.U.P. (1926), fig. 8, No. 11.

Scrapers (including 31 core-scrapers)

		Convex	*Straight*	*Concave*	*Total*	%
(1A)	End of blade (Nos. 150–64, 183)	9	17	4	30	9
(B)	End of flake (Nos. 166–77)	23	18	4	45	13
(C)	Broken end of blade or flake (Nos. 184, 191)	11	9	0	20	6
	Sub-totals	43	44	8	95	28
(2A)	Side of blade (Nos. 165, 180)	0	0	5	5	1
(B)	Side of flake (No. 179)	0	0	14	14	4
(3)	Other					
(A)	Over 1 in. (Nos. 181–2, 185–6, 192–5, 197–201, 203)	72	15	20	107	31
(B)	Under 1 in. (Nos. 178, 187–90, 196, 202)	63	6	19	88	25
4)	Cores used as scrapers (Nos. 17, 20, see p. 22)	30	1	0	31	9
5)	Arched, tip-heavy flakes (No. 272, see p. 36)	0	4	2	6	2
	Totals	208	70	68	346	100

(*a*) Groups 1 and 2 have been limited strictly to 'pure' specimens – blades as defined *supra*, p. 28, and cortex-free, well-shaped flakes used entire. The working edges on these scrapers, which are highly patinated (one or two with later damage, e.g. No. 151), are flattishly trimmed, frequently unemphatically and untidily. Of 1A there are 21 over 1 in. long, of 1B ten, 2A four, 2B two. The chalky patina of flake No. 179 has been broken into by the neatly-trimmed concavity, yet another example of re-use after an appreciable time gap. Two specimens (Nos. 163–4) in 1A (concave) have straight-scraper opposite ends.

(*b*) 3A (convex) includes: 3 specimens made of core-rejuvenation platform discs and one of a platform edge segment; a patinated and rolled core-trimming which has been later broken up and one of the fresh steep faces flaked into a scraper; 3 highly patinated nosed scrapers (Nos. 196, 200, the latter becoming perforator-like but nose buttressed). 3A (straight) includes a side-scraper (No. 203). Many classes include compound specimens (notably 3B convex, as illustrated).

(*c*) 36 specimens were made of milky quartz, 25 of them from group 3A (convex) – No. 194. Generally, amongst the trimmed fragments of milky quartz the scraper was by far the most commonly recognised form.

(*d*) *Illustrated.* 1A, end of blade, convex (Nos. 151–2, 160–2, 183), straight (150, 153–9), double-ended, concave and straight (163–4); 1B, end of flake, convex (166–8, 174–5), straight (169–73), concave (176); 1C, broken end, convex (184, 191); 2A, side-notched blade (165, 180), 2B, side-notched flake (179, compare with 174, its notches presumed for hafting); 3A, convex (181–2, 192–6, 198–200), straight (197, 201, 203), concave (185–6); 3B, convex or thumbnail (187-90), straight (202), concave (178).

(*e*) No. 185 is heavily rolled and patinated, No. 186 is unrolled and unpatinated. No. 177 (in 1B concave, but doubtful) is heavily rolled, Nos, 165, 199 rather less so.

(*f*) It is thought that most of the heavily-used group 1A have been trimmed for hafting – see 'blades' section, p. 28 – as have been a few of group 1B (e.g. Nos. 169, 176). On such specimens of 1A, side use is common, but each has also some trace of scraper-like preparation at the tip.

Gravers and graver-like tools (Pl. 3)

(1) Centre. No. 207, patination very heavy indeed; very worn, perhaps rolled 1

(2) Whole width, shapeless decorticated lumps. No. 209, trimmed opposite end, heavy patina. Two small, narrow specimens, battered at each end, are perhaps chisels or wedges 3

(3) Corner:

(A) Heavy squat core trimmings. Patination medium No. 215, heavy No. 216 (very worn) 5

(B) Heavy elongated lumps, patination medium. No. 208 is double-ended 4

(C) Medium-sized elongated flakes. Patination heavy on five (No. 213 with finely trimmed side-scraper-like back is possibly an example of graver-blow used to shape butt for hafting,[1] and in fact a side-scraper – as No. 203 – and not a graver; No. 214 with faceted blow-platform), light on two (No. 217, also with faceted blow-platform) 7

(D) Miscellaneous small flakes, patination medium to heavy, two with faceted blow-platforms (No. 204) 9

(E) Small heavily-patinated flat flakes with straight-trimmed transverse edge. The working corner seems to have been *chipped* to the required shape on these specimens (No. 206, somewhat like a micro-burin but with fully-faceted transverse edge; No. 205, seen from bulbar side, used at each corner). Had these tools not had beak-like salient corners they would have been classified as scrapers (conversely see Nos. 171, 277, also trimmed on either side of leading edge but not beaked). Semenov (p. 100) felt that such small delicate tools, including the *bec à encoche* graver (? No. 180), might have been used for artistic engravings 10

(F) Straight-trimmed transverse edge with a nose at one corner, well patinated. Only two of these have actually been struck (No. 210 trimmed around base and partly up side). On the other four, the salient shows use, for example Nos. 211 (nose glossy) and 212; the latter's nose is particularly chisel-like. The protuberance may have served initially as the working edge, and then, once blunted, have given purchase to a sharpening blow (more than would ordinary faceting). A graver with a markedly nosed corner (as opposed to merely a concave transverse edge) to its faceted transverse edge was found at Langwith (3 miles SW. of Creswell Crags).[2] See also Nos. 158, 188 6

(G) Small flat flakes with microlithically-trimmed back, patination heavy (No. 218). These do not show signs of use and are doubtful 2

Total 47

Non-microlithic pointed flakes

(1) Tanged	31	
Tang-end fragments	30	61
(2) Miscellaneous heavy points		
Elongated lumps	2	
Butt notched or faceted	2	
Nuclear	1	5

(3) Small, lightly-patinated bulbar points with sub-microlithic mainly-inverse trimming: Nos. 236, 238 (see Note 4 of 'microliths', also p. 26) 18

(4) Leaf-shaped flakes (not tanged) trimmed and/or used 81

Total 165

On most of class 1 the tanging consisted of a mere tapering-in of the bulbar end; these specimens, mostly squat, many heavy, their butts comparatively massive, were all densely patinated (Nos. 219–21, 223, 226–9, 232). A more stalked tang appeared on the lighter flakes (Nos. 233, 239, 231, the latter of translucent quartz and its tang formed to some degree with the aid of natural fracture planes). Perhaps the difference in tanging merely reflects the greater tractability of the thinner material but it was noted that patination was very varied amongst the

[1] Semenov, S. A., *Prehistoric Technology*, Cory, Adams & Mackay (1964), fig. 17, Nos. 1–4.

[2] Mullins, E. H., *J. Derbyshire Archaeol. Natur. Hist. Soc.* (1913).

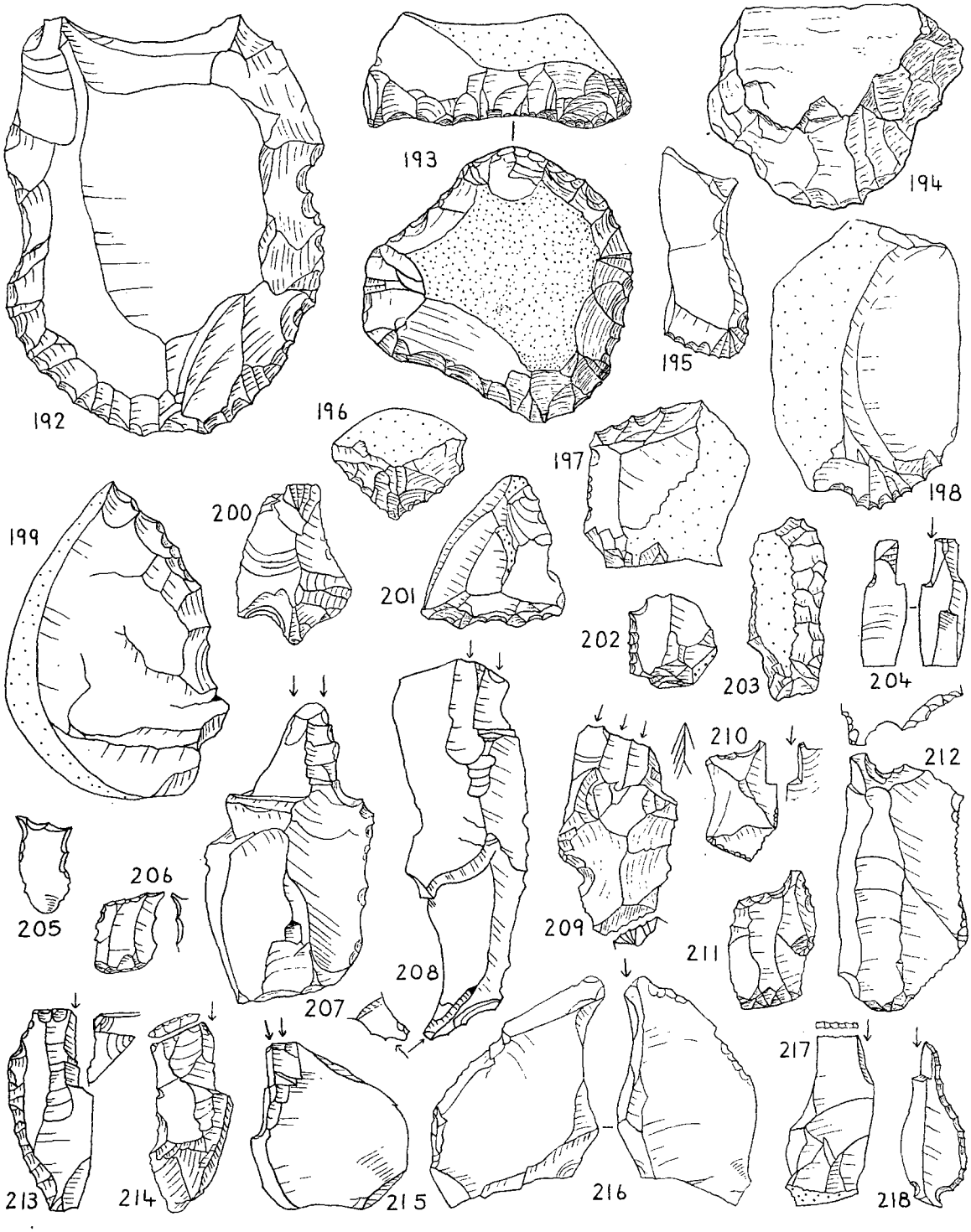


FIG. 12. Miscellaneous scrapers and gravers (½)

more stalked variety. No. 239 is lightly patinated; it has been trimmed on one side from above, on the other from below; No. 233, on the other hand, is very heavily patinated. The barely-patinated specimens are made of a good quality dark grey-brown flint. One or two of the heavier, well-patinated specimens have slightly glossy, worn ridges, probably evidence of some rolling. Though tanged, all the members of this group do not look equally suitable for arrowheads. Mitchell has suggested that the Irish 'Larnian' points, to which the members of class 1 have a strong similarity, were used for gutting fish.[1] An asymmetrical tip, such as characterises many of the Lealt Bay specimens, might even help the operation.

No. 219 is a unique specimen. Its basal end shows signs of tapering-in, and probably of thinning. The tip is probably broken. Patination is very heavy. The large chips out of the right edge have broken through an earlier patina to the interior flint, and have since been only lightly patinated. In its size, grade of flint (? Antrim) and patina, this point resembles scraper No. 192, also a unique specimen.

Class 2 are all heavily patinated. No. 234, improvised on an elongated lump, would have made an effective arrowhead. No. 222 has a deliberately-notched butt and crude tanging, No. 224 has been trimmed right around the butt. No. 225, bearing crude bifacial flaking, appears to be the butt end of a heavy point.

Most of class 4 seem more likely to have been knives than weapon heads. No. 230, with massive butt-end and blunt, hinged-off tip, has use, perhaps upon trimming, fully along each side. Even the more average-size and fully-trimmed No. 235, though pointed, is shouldered, and thus seems unsuitable for an arrowhead (it is remarkably similar to a Rough Island Early Larnian specimen[2]). Only a few, such as the heavily patinated No. 237 (not clearly tanged), which has neat but not very steep trimming, would have had any penetrating capacity.

Heavy triangles, quadrilaterals and pentagons. The 60 specimens, made on core-trimmings, splayed hinge-flakes and flake fragments, present a wide range of technique and patination. Trimming goes from steep battering through fine neat work to rough chipping. Since few are made across sections of flakes – and many of those that were so made were either basically ill-shaped or have been damaged – most leading edges have had to be trimmed straight. Most are probably transverse arrowheads, but a few may be scrapers (e.g. Nos. 242, 248).

The more or less microlithic specimens, geometrically a continuation of microlithic category 6Biiia, seemed most informatively treated here. The great difference in the choice of primary material, in the trimming and in the size suggests there is no direct local relationship between the 6Biiia specimens and those about to be described.

(1) Triangles, on flake fragments. Nos. 240–1, both heavily patinated 7

(2) Flake-end, with fourth (bulbar) side. Nos. 242, 249–50, all heavily patinated 16

(3) Miscellaneous markedly tanged specimens. No. 244 has minute facets on the upper side of the tang. Nos. 246–8 are well patinated, No. 245 and the others lightly so. No. 246 is a hinge flake, complete 15

(4) Trapeziums ('trapezes', *petits tranchets*), the transverse edge the edge of the flake (fragment):

(*a*) Splayed. No. 243 is a unique specimen, heavily patinated, very thick in section, with its long edge neatly trimmed. No. 253, medium patina (nearest to the specimens in microlith class 6Biiia). Nos. 251–2, 254, 257 are typical of the haphazard aspect of the rest 15

[1] Mitchell, G. F., *J. Roy. Soc. Antiq. Ireland*, LXXIX (1949), 170–81.

[2] Movius, H. L., *The Irish Stone Age*, C.U.P. (1942), fig. 22, No. 3.

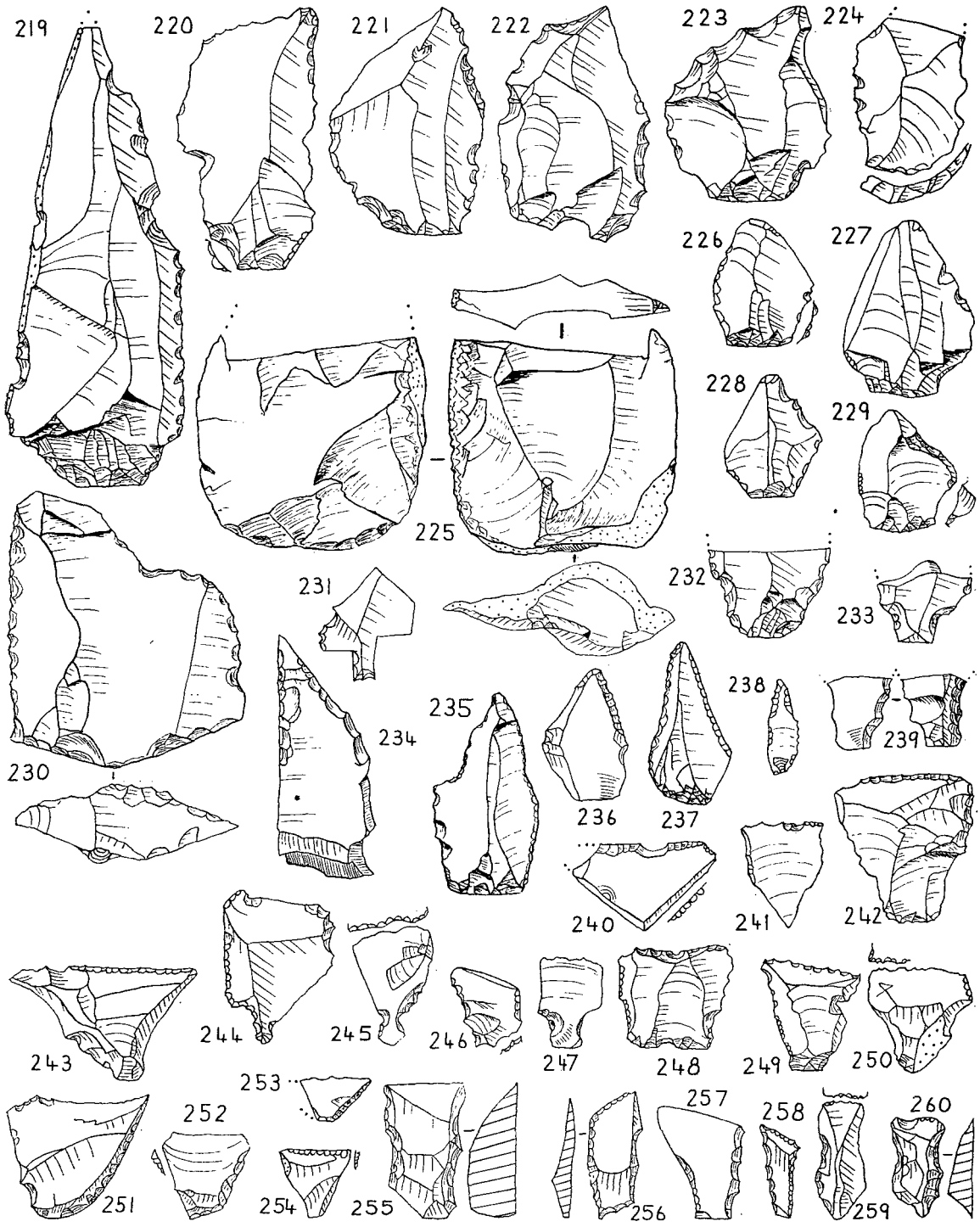


FIG. 13. Tanged points and others, transverse arrowheads ($\frac{1}{1}$)

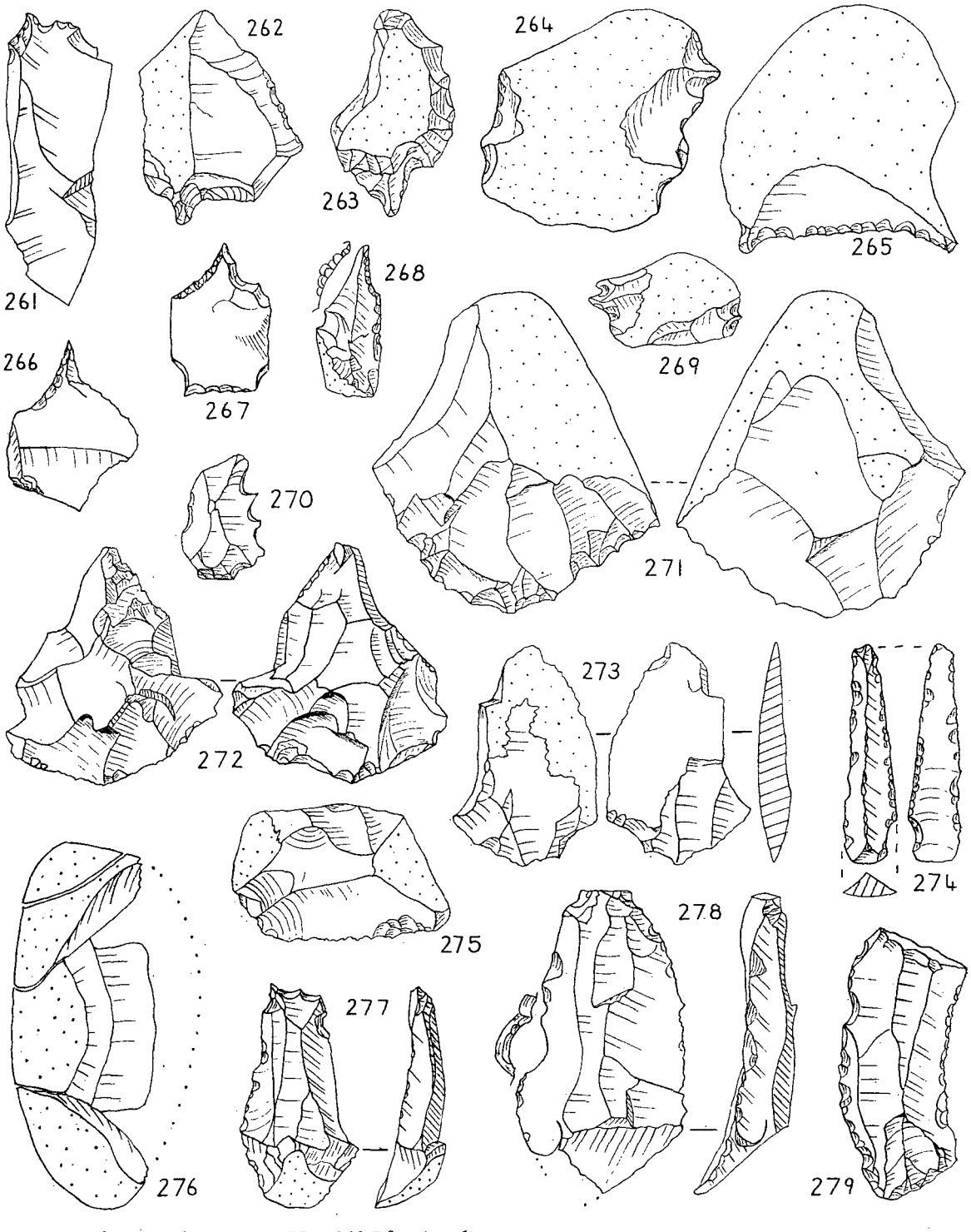


FIG. 14. Perforators, choppers etc. (Nos. 266–7 $\frac{2}{1}$, others $\frac{1}{1}$)

(*b*) Narrow. Nos. 255–6, 258, all heavily patinated	5
(5) Pentagons, very lightly patinated. No. 259 with inverse retouch along the leading edge, No. 260. Doubtful.	2
Total	60

For comparison with other industries (see Table 3, Note 6, p. 39) it can be said that several well-known transverse types occurred on Jura. But crudely-made varieties were the most common. Patination suggests the 60 specimens cover a wide time-range.

Perforators (Nos. 261–9). The 81 were very varied in shape and patina. A third were made on core-trimmings, the rest on miscellaneous flake fragments. Nos. 264–5, 267, 269 are double. The steep, very heavily patinated No. 263 was probably also a scraper and once a core; the nose is not buttressed, in comparison to No. 200.

There were at least two examples of double patination. No. 262 was originally a well-struck flat core-trimming flake with edge use. It now has an extremely heavy white patina with purplish blotching along the ridges; broken across the middle, and revealing a thin sandwiched layer of high-grade glossy brown flint, the break face has been carefully trimmed into a spur. The second example, No. 267, a double specimen, is made of green pitchstone: the left side of the upper point bears steep glossy-green trimming, the other side has flatter trimming which, like the rest of the flake, including the lower point, is heavily patinated the typical mud colour. However, this specimen may be a misleading example of double patina – it is hard to accept that one man, needing a perforator, found and touched-up a perforator long discarded by a predecessor! No. 266, of unpatinated translucent pink flint, is somewhat similar in shape to the pitchstone specimen.

Bifacially-flaked choppers and (?) axe-maker's waste flake. No. 271, a true pebble-tool, has a ong ancestry. No. 272 has had the cortex removed entirely; it too could be hafted. No. 273, made on a thin primary flake and broken, is quite different to the other two. No. 275 could be an axe-maker's waste flake, with some use of the lower edge. A few core fragments and heavy core-trimmings, each with a strong, sharp but damaged edge may have been pressed into service as choppers too (in 'Damaged by use', p. 24). A few specimens with markedly-concave edge (worn rather than smashed) seemed best placed under scrapers (class 3A); they were not 'fish-tailed'.

Toothed flakes. No. 270, a small flat flake, is complete. Most of the 13 specimens are broken, a few are only small pieces. Some may merely be objects broken during a first stage of trimming, and not fraying-tools at all.

Scale-flaked specimens

Leaf-shaped points	
Complete or almost so (Nos. 280–3)	4
Probably discarded during manufacture	8
Broken-off pointed ends (Nos. 284–7)	4
Edge-trimmed flake (No. 290)	1
Miscellaneous fragments (No. 293)	10
Waste scales (longest, No. 292, is $\frac{7}{16}$ in.)	3
Also with edge-trimming of sub-microlithic type (cf. p. 30) (Nos. 288–9, 291)	3
Total	33

Most of the specimens present a lustrous grey lightly patinated surface, and have some degree of translucence. However, what are probably the basal end of a leaf-shaped point (No. 293) and its waste scale are made of very dark green pitchstone, of the harder, lightly-patinated grade (see Appendix I).

Only the fragment No. 291 (perhaps a basal end), scaled on one side only, bears the site's more usual chalky patina; it has inverse, somewhat microlithic retouch along parts of its edge. Two small complete points (Nos. 288–9) seem to be near-microlithically trimmed fragments of scaled flakes; their colour-cum-patination, uniform, is the same as that of the majority of the scale-flaked specimens. It should be noted that the shapes of the last two specimens are not peculiarly microlithic. Also, one of the rough-outs has a touch of neat edge-trimming. Possibly the scale-flakers made the small points too, possibly they were made by the workers who produced class 3 of the non-microlithic pointed flakes (see *supra*, p. 30).

Arched, tip-heavy flakes. These ('Larne picks', 'core-rejuvenation flakes') are probably inevitable in industries using very rounded nodules, especially small ones, as their raw material. The majority are well-patinated, but there is considerable variation in size and proportions. In accordance with this is the variety shown by the analysis below. Some two-thirds (50) of those found (72) had received secondary attention. About half of these (24) had the bulbar end *abruptly* narrowed by trimming or at least use. Possibly these were used as were the hafted blades and end-of-blade scrapers, the heavy end providing a ready-made haft (No. 278); in this connection it is of interest that two specimens, their *bulbar* ends transversely trimmed, seem most likely to be

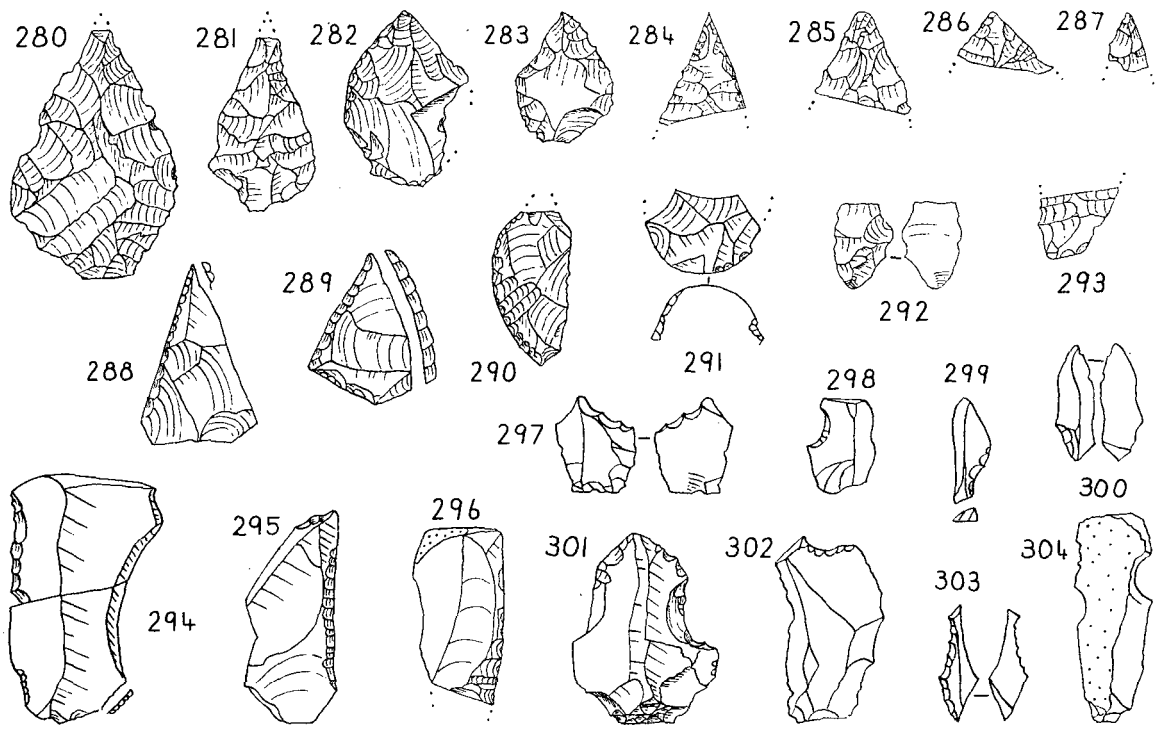


FIG. 15. Scale-flaked work, micro-burins and others (Nos. 288–9 $\frac{2}{1}$, others $\frac{1}{1}$)

end-scrapers (No. 277). Two very large inverse chips out of the side of No. 278 are more lightly patinated than the rest of the flake, which is otherwise markedly similar in exterior colouring to the hafted blades and blade-end scrapers; its broken heavy end is naturally flawed and the damage there may not be significant.

	Total	*With cortex tip*	*Without cortex tip*	*Heavy end transverse use*
Bulbar end narrowed by trimming	14	11	3	4*
Bulbar end narrowed by use	10	6	4	3
Sub-totals	24	17	7	7
Bulbar end trimmed transversely	2	2	0	0
Concave scrapers, used only	2	1	1	0
General side use	22	16	6	3*
Neither trimming nor use	22	18	4	0
Totals	72	54	18	10

(1) Asterisked entries each include a specimen *trimmed* across the heavy end. On many the heavy ends appear smashed, but, as cortex often separates irregularly from the core, this has had to be ignored.

(2) End-of-flake scrapers totalled 4 (2 bulbar, 2 heavy end), and these are included with the 2 concave specimens, under scrapers (p. 29), leaving a total of 44 'trimmed and/or used' in this group.

Miscellaneous forms. No. 279, a heavy two-platform flake with use and perhaps trimming on the convex edge and use on the concave edge; in a most advanced state of patination, its marked curvature makes it stand out. No. 274, a heavily patinated triangular-sectioned rod from trench N, deposit 3B, is so heavily rolled that it is difficult to distinguish trimming from use; it might be a knapping tool. No. 294 was found in two pieces, both with heavy patina but one white and the other yellow; it seems to show an opening trimming stage arrested by the flake breaking in two. No. 295, heavily patinated, has been neatly trimmed.

Here also one can mention that two shapeless fragments of flint have traces of a black tar-like substance on them.

Trimmed but not classified

Blades (see p. 28)	10
Other (35 milky quartz) – Nos. 296, 301	382
Total	392

SUMMARY OF DATING INDICATIONS AT THE SITE

Pending results from further work under way in N. Jura, there are the following *site* indications of relative age:

(1) All the scale-flaked artifacts were in the very top of the archaeological horizon, the only unambiguous depth/typology evidence.

(2) The following are the most interesting of the consistently-patinated groups (but see Appendix III). *Heavily patinated:* microlithic classes 1B, 3Aii, 3Bii, 6Biiib, 6Bivb (p. 26); blades with haft trimming (p. 28); end-of-blade and nosed scrapers (p. 29); graver No. 207 (p. 29); feebly-tanged squat leaf-shaped flakes (p. 30). *Lightly patinated:* a proportion of the microlithic classes 4, 5 and 6 and of the micro-burins (p. 26); small, sub-microlithic, often inversely trimmed leaf-shaped points (p. 30); scale-flaked leaf-shaped points (p. 35). *Double patination:*

perforators (p. 35) made from discarded material. *Re-used without appreciable time gap:* scale-flaked specimens (p. 35).

(3) Rolled were specimens from: cores (p. 22), one of microlithic (small blade) aspect (No. 12); microliths (p. 26) classes 1Biia (No. 35), 1C (No. 46); scrapers, various (see p. 29).

(4) Pollen analysis:

(*a*) The deposit 2 count yielded a *terminus post quem* for all artifacts except the rolled specimens (presumably from an earlier zone elsewhere in the bay): not earlier than Early Atlantic.

(*b*) The deposit 4 count provided a working *terminus ante quem* for all the rolled artifacts and a proportion (indeterminable) of the rest: already present at Lealt Bay by mid-Atlantic times.

SOME COMPARISONS

Conclusions. Including the rolled and/or heavily patinated implements just listed, a fair proportion of the Lealt Bay collection is close in aspect to the uppermost industries of Britain's more southerly 'Upper Palaeolithic' cave-dwellers[1] (some of whom seem likely to have in fact been Post-Glacial); nevertheless, and although there is no evidence for a changed way of life, the Lealt Bay people come at present under the heading 'Mesolithic' (as Coulonges is untiringly pointing out,[2] this change of name, the boundary not definable because non-existent, adds nothing but a confusing note: 'A Sauveterre, ce jour-là, Breuil et moi condamnions le Mésolithique'). At the opposite extreme, the implements with light or double patina include technology of at least as late a cultural stage as Neolithic. Otherwise, whilst site evidence suggests the collection represents a long period, it does not allow precise division into phases. However, further N. Jura material, now accumulating, seems likely to provide information in this aspect. Comparison with British and continental Post-Glacial industrial groups, made below, does not encourage one to affix a specific label to the Lealt Bay industry. All that seems clear is that most of its elements have been found somewhere in the British Isles and, where dated, fell into the Late Boreal to Late Atlantic time-span. Lealt Bay's major (non-Neolithic) element is for the moment best summarised as at least as old as mid-Atlantic in arrival date, of the ultimate stage in steeply-blunted tools and thus of the final Palaeolithic in technological evolution, and of southern origin.

The microlithic aspect. The Lealt Bay microlithic groups 1B and 3A, together with such specimens as the well-patinated tanged or 'shouldered' Nos. 89, 90, are small versions of tools found at British 'Upper Palaeolithic' sites, for example at Creswell Crags,[3] where the industries were given a Late-Glacial age by Armstrong; more recent work at Mother Grundy's Parlour has produced C–14 dates which are reported[4] to show 'the survival of a variant of the Creswellian with increased microlithic element till 6000–7000 B.C.' but the artifacts in question do not seem to have been published yet. There is also overlap with another industry for which Armstrong proposed a Late-Glacial age, that at Sheffield's Hill, Scunthorpe.[5]

Table 3 ('P' means 'present', the British 'Sauveterrian-affinity' industries have not been summarised numerically) compares the Lealt Bay microlithic aspect with some notable British and continental microlithic industries of long-accepted Post-Glacial age (and, following Clark's treatment,[6] Sheffield's Hill has been included in 'Central and East'). The second column is an indication of the forms recognised in a small display in the St Germain-en-Laye museum of lightly-

[1] Garrod, D. A. E., op. cit.

[2] Coulonges, L., *Bull. Soc. Préh. France*, LVI (1959), No. 9–10, 590–2, and letter to the writer.

[3] Garrod, D. A. E., op. cit.

[4] Foster, I. Ll., and Daniel, G., *Prehistoric and Early Wales*, Routledge (1965), 34n.

[5] Armstrong, A. L., *Mem. & Proc. Manchester Lit. & Phil. Soc.*, 82–3 (1937–9), 115, fig. 14.

[6] Clark, J. G. D., *PPS*, XXI (1955), 3–20.

TABLE 3

Lealt Bay Class	%	*Le Martinet*	*Tard*	*Horsham (SE.)* Class	%	*Peacock's Farm* Class	%	*South of Solway–Tweed* SW.	C.&E.	Welsh coast	Pennines	I. of Man	NE.	*Tentsmuir Sands*	*Deeside*	*Shewalton*
1A, C	4	P	EM	A	36	1AB	34	P	P	P	P	P	P	P	Bulbar	Bulbar
1B, D, E	29	P	EM	B	3	2A	20	P	P	P	P	P	P	P	P	P
2	2	P	L?	in B	?	2B	0	P	P		P	P	P		P	P
3Ai	2	?	ML	C1, D4	8	3Ai	5	P	P	P	P	P				
3Aii	2			E	8	3Aii, D	5		P			P				
3B	2	P	L	C2	1	3B, 3Ci/ii	3	P	P			P			P	
3C	1	P	ML	F	23	3Ei/ii	0	P	P	P[1]	P	P				
3D	4	?		G	3	—	0		P		P				P[2]	
4	10	P	ML	D1	12	4	15	P	P	P	P	P	P	P	P	P
5	15	P	M	D2	2	5	2	P	P	P	P	P	P		P	P
6A	16	P		D5	2	in 6A	7	P	P	P[1]	P		P		P	P
6Bi/ii	5			D6b	1	6B	7	P	P		P		P			
6Biii	3		L	—	0	in 6A	2		P							
6Biv	3		L	—	0	—	0									
Note 6	P	P	ML	P	P	6C–F	P	P[3]	P		P	P		P[4]	P	P
6C	1	P	EM	D7	1	6G	0		P		P					
7	1			—	0	—	0									

[1] Wainwright, G. J., *PPS*, XXIX (1963), 99 ff.
[2] Lacaille, p. 182, fig. 70, No. 21.
[3] Higgs, E. S. *PPS*, XXV (1959), 209, ff.
[4] Lacaille, p. 280, fig. 123, No. 2.

patinated microliths from one of the 'Sauveterrian' type-sites, Le Martinet at Sauveterre-la-Lémance, Lot-et-Garonne, France; other forms have been drawn from those in the illustration reproduced by Clark[1] from Coulonges' original report on Le Martinet.[2] The Tardenoisian column is based on Lacaille[3] (Early, Middle, Late Belgian). Then follow Clark's summary figures for the SE. England 'Horsham' group (as it stood in 1933), based on 1,128 microliths (2,608 found, together with unpolished axes).[4] Next, the Late Boreal (5650 B.C. ± 150) Peacock's Farm industry, the most important 'Sauveterrian-affinity' site, in Cambridgeshire; these percentages should be treated with caution, since they are based upon only 66 specimens (77 found).[5] The rest of the columns indicate the occurrence of the various forms throughout Clark's 'Sauveterrian-affinity' industries[5] (Peacock's Farm is included in 'C. & E.'); these indications are based upon Clark with the addition of a few more (e.g. tanged points in fact occur in the Marsden-region Pennine industries[6]) and of the forms found at the Shewalton site in Ayrshire.[7]

All percentages have been given in round figures. It would of course be quite unrealistic to treat such typological statistics as more than a rough guide: they reveal mere presence on the one hand and marked preference on the other (the latter only three or four classes in each column below). Neither should much reliance be placed on the absence of forms at some of the numerically smaller sites.

The following points emerge:

(1) The most common microlithic implement of Jura's early people was the backed bladelet, a small blade fully-blunted at least down one side, the blunting sometimes convex, sometimes straight, the tip usually but not always brought to a point. Known throughout Great Britain, this tool was much used at Peacock's Farm (though there it was not the most common form); but in the Horsham group, further south, it is barely represented.

(2) The implement which does characterise the Peacock's Farm and Horsham group industries is the obliquely-blunted point, an asymmetrical point made by oblique partial blunting of one side, at the tip end. Men with this technique did not reach Lealt Bay in significant numbers, and a really typically southern specimen has not been found (No. 45 is the nearest). This is in agreement with the form's representation N. of about the Solway-Tweed line – present knowledge[8] suggests that there it is rare, and often bulbar when it does occur.

(3) A few makers of tools with one edge or another trimmed concavely reached Jura. The main peculiarity of the Horsham is its hollow-based points, but these have previously been recorded as far N. as the Isle of Man.[9]

(4) Makers of various types of microlithic tanged point also landed on Jura. Again one finds these at the Horsham sites. They have also been illustrated from the Pennines and from Deeside. Including the broken tang ends, there would be about half as many specimens found at Lealt Bay as at the eight Horsham sites in total.

(5) Makers of small 'geometric' triangles, crescents and quadrilaterals were present long enough at Lealt Bay to leave their tools in quantity – these accounted for just over half of the Jura total, in the proportion of five to three fully-backed blades. Geometric forms occur all over Britain at least as far N. as Deeside. At Peacock's Farm they accounted for about a third, also at about 5:3 backed blades. At Horsham, with the exception of triangles, there were very few small geometric forms, under a fifth. All the various well-known British types are present on Jura. So

[1] Clark, J. G. D., loc. cit.
[2] Coulonges, L., *Archives Inst. Paléont. Humaine*, Mém. 14 (1935).
[3] Lacaille, fig. 38.
[4] Clark, J. G. D., *Arch. J.*, XC (1933), 52–77.
[5] Clark, J. G. D., *PPS*, XXI (1955), 3–20.
[6] Buckley, F. A., privately printed (1921). In Lacaille, p. 106.
[7] Lacaille, p. 286, fig. 127.
[8] e.g. Lacaille, p. 182, 279.
[9] Clark, J. G. D., *PPS*, I (1935), 70–92.

too is the Peacock's Farm hollow-'backed' trapezium,[1] and such a rare form as the hollow-'based' trapezoid-cum-trapezium; they are both part of a group of minute 'trapeze'-like forms.

(6) The heavy triangles, quadrilaterals and pentagons, though geometrically similar to those noted in the last sentence, do not however form a continuum with them, the different approach, trimming and much larger size producing a series of implements of quite distinct aspect. As Table 3 (Note 6) shows, there are parallels (few numerically, and very varied) all over Britain. Late British specimens (contemporary with Neolithic and later culture – for example, those from the Caithness chambered cairns) have been summarised by Clark,[2] who has also discussed the continental blade and trapeze industries (in age 'broadly equivalent to the Atlantic').[3] 'True' *petits tranchets* such as No. 255 are the characteristic form of the Danish Ertebølle people, of the Atlantic period[4]; as is well known, the comparatively low sea-level of the Boreal phase had turned a great part of the North Sea area into dry land and, in Early Atlantic times, in spite of the returning water, the stretch from Scandinavia to central Britain was still easily traversed (the route had already been used by people of the Ertebølle's parent culture, the Maglemosian). The Lealt Bay material lacked dating evidence (other than that it was not earlier than Early Atlantic); however, one does note that the most morphologically-primitive specimens (Nos. 255–6) are the most heavily patinated.

(7) A rare, perhaps new, geometric form is a small, lightly patinated, carefully-made pentagon (No. 134). This specimen may be useful as a link with other sites. So too may the hollow-backed trapezium, noted under '5' above (Nos. 116–8). Another rare form is represented by the hump-backed Nos. 33–4: its ancestor may perhaps be seen at the Hengistbury Head Late Upper Palaeolithic site,[5] in the shape of a degenerating shouldered point (e.g. fig. 4, No. 13) and its parallel at Lominot (Site 3) in the Marsden region of the Pennines (fig. 5, No. 10).[6]

(8) Nothing prevented the Post-Glacial Palaeolithic ('Mesolithic') people of France and Belgium from joining those of Britain, and, as Table 3 suggests, the Lealt Bay microlithic element could represent the types remaining after a fusion of Sauveterrian, Tardenoisian and earliest Post-Glacial British workmanship.

(9) Moving finally to Ireland, the microliths described by Batty[7] from the lower Bann Valley closely parallel Lealt Bay's classes 1B–D and 2, the backed bladelets and rods. It should further be noted that the Irish 'Larnian' industries[8] include a few microliths, some at least of Lealt Bay's class 1B, backed bladelets.

The earlier non-microlithic aspect. Only the feebly-tanged leaf-shaped flakes lack obvious possible origins southwards, Late Glacial and later. Livens' conclusion[9] over Scotland's tanged points (few and varied), that they were probably of 'Upper Palaeolithic' origin, can be applied to Lealt Bay's base-tapered leaf-shaped points, though there is little evidence to link Scottish forms directly to any of those of S. Britain (e.g. the Gower peninsula 'Font Robert derivatives'[10]) or the continent. As for convex trimming of the butt, the only parallel noted is far from Lealt Bay in time, in the Base Zone at Creswell Crags.[10]

Considering now Jura's region (where all industries are Post-Glacial in age), one notes that a part of the non-microlithic element at Lealt Bay bears a strong similarity to the well-excavated NE. Ireland Larnian industries[11] (which, as has been said, include a very small proportion of

[1] Clark, J. G. D., *PPS*, XXI (1955), 8. Fig. 2, No. 39.
[2] Clark, J. G. D., *Arch. J.*, XCI (1934).
[3] Clark, J. G. D., *PPS*, XXIV (1958), 24 ff.
[4] Clark, J. G. D., *The Mesolithic Settlement of Northern Europe*, C.U.P. (1936), 142–4.
[5] Mace, A., *PPS*, XXV (1959), 233 ff.
[6] Buckley, F., in J. G. D. Clark's *The Mesolithic Age in Britain*, C.U.P. (1932).
[7] Batty, J., *U.J.A.* (1938)
[8] Movius, H. L., op. cit.
[9] Livens, R. G., *PSAS*, LXXXIX (1955–6), 438 ff.
[10] Garrod, D. A. E., op. cit.
[11] Movius, H. L., op. cit.

microliths, some at least of Lealt Bay's main single class, 1B). With the exception of the heavy picks (possibly explicable by the scarcity of large raw material) Lealt Bay includes amongst its many forms all the implements of the Larnian (Movius noted that asymmetrical points were typical of the Early Larnian – see Lealt Bay Nos. 220–4). The Irish Larnian, to which Movius ascribed an Upper Palaeolithic ancestry, has been given an opening date of Late Boreal; at this time the highest Post-Glacial transgression of NE. Ireland was still short of its maximum stand.

The later non-microlithic aspect. The fact that one scale-flaked artifact (No. 291) is very heavily patinated and the other 32 specimens are only lightly so may show that the technique lasted a good length of time at Lealt Bay (but see Appendix III). Specimens similar to No. 280 have been found on the nearby Isle of Arran in the Neolithic chambered tombs of Giants' Graves[1] and Sliddery Water,[2] and in this connection it can be recalled that No. 293 may well be made of Arran pitchstone.

Neolithic culture reached Northern Ireland well before 3000 B.C. (e.g. along the Bann River, dated to the Atlantic-Sub-Boreal transition by pollen analysis,[3] to 3330±170 B.C. by C–14 assay[4]). The Bann River industries – which included scale-flaked points similar to those just noted from Lealt Bay – were characterised by the most developed Irish form of the leaf-shaped flake (descended from those of the pre-Bann industries): some of Lealt Bay's base-tapered flakes may have been contemporary with the Bann River culture (rather than with the Irish pre-Bann industries). Similar implements have been found as far south as the Isle of Man.[5] Lealt Bay also yielded a few tangs more stalked than the Bann-affinity specimens; but quite stalked Isle of Man specimens are known, and the paper by Livens, mentioned above, included a few scattered and undated Scottish examples. The lighter patina of the Lealt Bay specimens (No. 239) may show that tanged points were produced throughout most of the site's period of use. At the undated Shewalton site (the finds lay on the surface of a dune at about 50 ft. O.D.), an implement somewhat similar to the tanged quartz point No. 231 was said to be a poor microlithic imitation of a Bronze Age barbed-and-tanged arrowhead, though the illustration[6] does not show any sign of barbing; at Lealt Bay nothing suggests that No. 231 is other than a member of a group of tanged points which covered the site's period of occupation. Bronze Age work has not in fact been identified at Lealt Bay.

Perforators were seemingly in use late on at Lealt Bay: at the Irish Neolithic site of Castelreagh Hills, Co. Down, heavy triangles (somewhat similar to class 1 on p. 32) and perforators were the characteristic implements.[7] With affinity with some of the microlithic points, the lightly patinated small points with sub-microlithic, often inverse trimming (the latter a characteristic of the Irish Late Larnian) may also date from the end of the stone-working period at Lealt Bay.

GENERAL SUMMARY

The ice having melted, trees gradually covered Jura, reaching their maximum extent late in the Boreal period; the woods were characterised by birch but contained substantial quantities of pine, elm, oak and hazel; the climate was comparatively drier than at present. About the opening of the wetter Atlantic phase, alders began to replace the pines. By the middle of the period the alders shared the dominance with the birches, and elm and oak had reached their Post-Glacial peaks. However, in overall size the woods were already diminishing.

Following the pre-Boreal transgression of Jura ('Inside the 35-foot isobase . . . to 16–36 feet

[1] Bryce, T. H., *PSAS*, XXXVII (1902–3), 36–67.
[2] Bryce, T. H., *PSAS*, XXXVI (1901–2), 74–181.
[3] Jessen, K., and Farrington, A., *PRIA*, LXIV (1938), 205–60.
[4] Watts, W. A., *Antiquity*, XXXIV (1960), 111 ff.
[5] Clark, J. G. D., *PPS*, I (1935), 70 ff.
[6] Lacaille, p. 286, fig. 127, No. 26.
[7] Whelan, C. B., *Irish Naturalists' J.*, IV (1933), 201–2.

O.D.')[1] the sea regressed, until, during the first half of the Boreal phase, it stood perhaps as much as 120 ft. below its present level.[2] It then began to encroach again. Present interpretation is that it was not until the Boreal period was over, and the alders dominant at Lealt Bay, that this transgression attained its maximum stand along the NE. Jura coast, a level from which, during the most severe storms, it could reach at least 51 ft. O.D. at Lealt Bay, and at more exposed bays presumably higher.

The transgressing sea engulfed tools of some of the earliest men to reach Jura; one cannot say for how long these had already lain in the bay, nor at what height the sea found them. These tools, heavily rolled, came to rest as part of the washing-limit beach. During the transgression's period of maximum stand more people appeared on the then-active beach; the sea worked their discarded artifacts down into its washing limit deposit too. Sooner or later the sea's level began to fall away from its maximum stand; at Lealt Bay this movement began during the Atlantic period, perhaps by the middle. There is no geological evidence by which to date the close of stone-working at Lealt Bay.

It is suggested that Lealt Bay's role in W. Scotland and Jura was that of well-known landing-place and camp for hunters. The inlet may also have been used by those going to Islay and Colonsay. Lealt Bay is about the nearest point to the mainland and, since a crossing there avoided the risk of being swept into the whirlpool sound at the N. tip, it may well have been the most frequented of the island's landing-places. At the back of the sheltered bay, the quartzite-tipped spit of glacial outwash protected a little inlet-cum-gully, and the hunters would have drawn their boats up into it; occasionally, perhaps, they navigated the quarter-mile, narrow, overhanging Eag an Dale ('hollow in the dale') creek, now extinct of course, and landed in the bed of the Lealt Glen, just below another flint-working site at the meeting of the two burns. From either landing-place they had easy access into the interior of the N. end of the island.

The Lealt Bay camps evidenced by the discarded tools were made in the one height zone, on the level sometimes-transgressed beach-cum-terrace, within easy reach of the burn. Nevertheless, some of these camps are presumed to date from land-recovery times (at least those Neolithically-equipped); this is acceptable, since the back of the terrace is even *nowadays* the best camping ground in many bays, the lower land being simply a spread of unturfed, unsheltered cobbles. There would not have been trees below the terrace for a long time after the transgression, but it is probable that there was tree cover from about the washing limit inland for far longer. The alder roots found in the Pollen Analysis Pit suggest this; and they are supported by the pollen counts, since these show a temporary Sub-Boreal increase in woodland, with alder dominant alone in the middle of the period. Both for the more comfortable ground and for shelter, it is likely that the hunters' camps kept for long to the terrace no matter where the sea was at the time.

The great variation in tool-forms suggests the presence of many people from different parts over a long period. They brought their own raw material, a small amount at least originating in Arran. When their nodules were worked out they turned to local materials and their predecessors' discarded implements. Any shell, bone, antler or wooden tools seem to have left no trace. Nothing about the stone implements suggests the people's material way of life was different from that of the Late-Glacial cave people of S. Britain, but the better climate and extended hunting grounds would have provided a more pleasant background to their existence.

The number of broken pointed tip-ends of microliths found at the site suggests, at first consideration, that even those most like arrowheads were not always used in this way. A few were no doubt broken during the final stage of manufacture and others perhaps came back to the

[1] Nichols, H., Unpub. Ph.D. dissertation, Univ. of Leicester, 1963.

[2] Lacaille, p. 51.

camp in carcasses, whilst some may have been the haft-embedded ends of broken barbs. However, one notices next that, although the worked-out relatively few cores show the scarcity of flint, there are several hundred microliths which are complete or nearly so, most of them certainly usable with or without a little trimming. Not merely were these discarded at the site, they were not re-used. Perhaps the sea rapidly hid the minute tools by working them down into the sandy shingle. But this would not explain why they were discarded at the camp in the first place. Possibly the hunters' arrows, for example, were not taken away at the end of a hunting session, for religious or superstitious reasons; others would then not touch them.

One must assume that hunting was easier on Jura than on the mainland. Possibly some easily gained quarry was particularly plentiful on the island, such as wild pigs. At the end of the Middle Ages, Jura was 'little more than a natural forest for timber, and a hunting-ground where the Lords of the Isles and the Macdonalds of Islay hunted deer and wild boar. There were stewards and foresters in charge of the hunting and the forests, and a native people resident who lived by simple agriculture and fishing. There are still traces to be seen of the moats into which the wild boar were driven. The deer were killed by the use of dogs, and before the coming of gunpowder, the bow and arrow were used by archers of great skill.'[1] With a few obvious changes in detail, this describes even Jura's present, and it may be that the description holds good for the prehistoric period as well.

During their stay the early hunters no doubt lived off more than meat and hazel nuts. But suggestive absences are the 'limpet hammers' and other more distinctive 'Obanian' pebble-tools; nor is there evidence for fishing, although during the transgression's maximum stand there was deep water along the outer side of the spit. But it will have been noted that, as elsewhere in Britain, the Bird Loch pollen diagram shows that about the end of the Atlantic period there was a sharp decline in the elm (dated 3375 ± 120 B.C. and 3160 ± 120 B.C. at Fallahogy near Newferry, N. Ireland[2]) from the trunk of which prehistoric men were probably able to get a food ('slippery elm'). Pine too, also increasing again in the later and less favourable Sub-Atlantic, is low from mid-Atlantic onwards and, as until recently in many northern countries, a bread-like food may have been made from its inner bark. Such parasitism is harmful to the trees, but hunting groups could not really make much impact in this way on the forest, and oak, in any case, declines alongside elm. So possibly early agriculturalists and not hunters were responsible for this sudden decrease in woodland.

The elm in particular likes the land most suitable for cultivation, and so the elm–oak decline could mark the first clearing of Jura's woods for agriculture. One may feel that the Lealt Bay diagram backs this conclusion, with the addition of the first appearance of a reliable cultivation indicator, plantain. The Bird Loch diagram clearly shows how, about the Atlantic/Sub-Boreal transition, the birches, quick to grow and accepting anywhere with adequate light, suddenly increased to a momentary peak, perhaps as the first to return to the cleared but already abandoned areas. At this time too the grasses and heather began the steady climb to their present dominance, taking over all the land on which, for one reason or another, the trees have since been unable to grow.

But there is no sign of an agricultural settlement at Lealt Bay. No stone constructions, and there is no cave visible for several miles in each direction. Moreover, permanent islanders fit in less well with the great quantity of mainland flint and the considerable variety of tool-making techniques and of individual specimens within an implement type. The only certain agricultural-age traces were the Neolithic-type arrowheads; the absence of polished axes, pottery and querns is

[1] Budge, D., op. cit.

[2] Clark, J. G. D., and Godwin, H., *Antiquity*, xxxvi (1962), 10 ff.

strongly against any occupation by a farming people. The Pollen Analysis Pit showed that, of the 3–4 ft. of organic deposit built up at that spot since the transgression, all but the top foot is dense with alder roots: this suggests that the zone immediately inland was neither farmed early on nor particularly suitable for such work. There are traces of comparatively-recent lazy-beds running northwards along the E. side of the nearby porphyrite ridges, but, since the strip is within the washing limit, it is probable that there would not have been enough earth there for tillage until well into land-recovery times. It is not until one is as far inland as the Smearing Shed zone that one finds land likely to have been cultivable around the opening, say, of the Sub-Boreal period. Possibly, then, one should look further up the valley for traces of the earliest farmers.

The unassociated charcoal near the base of the peat in the Check Trench may be used to underline the complete lack of knowledge on Jura's post-transgression prehistory. Further work may show whether there is any truth in the suggestions made in the last paragraphs; perhaps at the same time it will provide some idea of the closing date of the site and of the relation to it of the Bronze Age cists which, until now, were the beginning of Jura's prehistory.

The present paper suggests, then, that Lealt Bay was a much-used landing-place and camping ground for prehistoric hunters from the mainland. As a result, the excavated material can be expected to include specimens of most of the stone tools in use during the first phase of man's activity in W. Scotland.

APPENDIX I

Dark Green Pitchstone

The 43 fragments fell into two groups. The commonest variety had a pale muddy brown exterior when dry, but upon being wetted it became a dull dark green; it was so soft that an edge could easily be scaled with the fingernail, revealing an unchanging dark green glossy interior; there were 36 pieces of this, including two cores (No. 16), and No. 267, a minute awl (the latter with double patination – see 'perforators'). The second variety had an unchanging, matt, dark green exterior, was very hard and contained macroscopic impurities; there were only 7 pieces of this, including what is probably the basal end of a small scale-flaked point (No. 293) and a waste scale.

Specimens were submitted to the Institute of Geological Sciences, Edinburgh. The softer variety was 'probably from a Tertiary pitchstone dyke, very similar to those found on Arran, where they weather to the grey patination to be found on your specimens'. The harder specimens 'may well be from the glassy selvidge of a Tertiary dyke, and are probably more acid than basic in composition'. 'Specific gravity determinations on your specimens gave the figure of 2·34 for them all. I enclose a fragment of pitchstone from Arran, which also has a S.G. of 2·34. It is a piece from a sample collected from the schoolhouse garden in Brodick. The average of 24 samples of flint give S.G. 2·54, ranging from 2·6 to 2·4, so that your specimens are not flint.' The report goes on to note that andesitic pitchstone has been recorded from the head of Loch Craignish (immediately S. of Craignish, see fig. 1).

APPENDIX II

Flint (including chert)

It is probable that the site covers several hundred square yards at least and, based upon the excavation figures, this suggest that discarded flint may amount to some hundreds of pounds, the equivalent of many thousand pebbles. Yet in several years' examination of the area's beaches, river beds and boulder clay exposures, the writer has not found a single flint pebble other than in association with humanly-worked specimens.

It is usually written that the Mesolithic people of W. Scotland sought their flint N. and NW. of Oban – on the Isle of Mull and in Morven and Ardnamurchan.[1] From Jura one can see Malcolm's

[1] Lacaille, p. 216.

Point, on the S. side of Mull, where there is a Tertiary conglomerate of flint and gravel (fig. 1) This is the nearest bedrock source to Lealt Bay.

A trip was made to obtain nodules from the conglomerate. In a dug-out canoe, for example, this could probably be managed on a calm day in a few hours (16 miles). The writer, after a much longer journey by public transport, approached the conglomerate along the shore. Between perhaps 25 and 40 ft. above present high-water mark, the deposit lies near the base of a basalt cape some 900 ft. high. Never comfortably accessible from above, it is possible that at the time of the Boreal–Atlantic transgression maximum the flint was not easily reached along the shore either.

By comparison with the commonest type of basic nodule used at Lealt Bay, Jura, those at Malcolm's Point seemed many times *larger* (several pounds may be average) and, correspondingly perhaps (since all may be in origin from the same pre-Tertiary deposit), seemed *far less rolled.* The smaller specimens at Malcolm's Point were unrolled; they looked to be pieces shattered from the large nodules. Comparison of interior colouring showed no significant agreement between the two collections. The only specimen collected which recalled the Lealt Bay flints was a single very rolled small pebble – on the present tide-line below the conglomerate. Also, the minute size of the whole flint pebbles found at Lealt Bay – the six smallest together only weighed an ounce – makes such a prolific source of large nodules as Malcolm's Point a most improbable origin for the Jura specimens.

The writer is therefore of the opinion that the most common type of Lealt Bay pebble did not come from Malcolm's Point. There has not yet been time to visit Mull's more-distant flint deposits, nor the others mentioned. The Institute of Geological Sciences was unable to suggest a concentrated source of very small, very rolled flint pebbles. The most common Jura specimens seem likely to have been gleaned from a reliable but not prolific source, such as a river bed, loch shore or sea beach, perhaps in Mid Argyll. Suggestions will be welcomed.

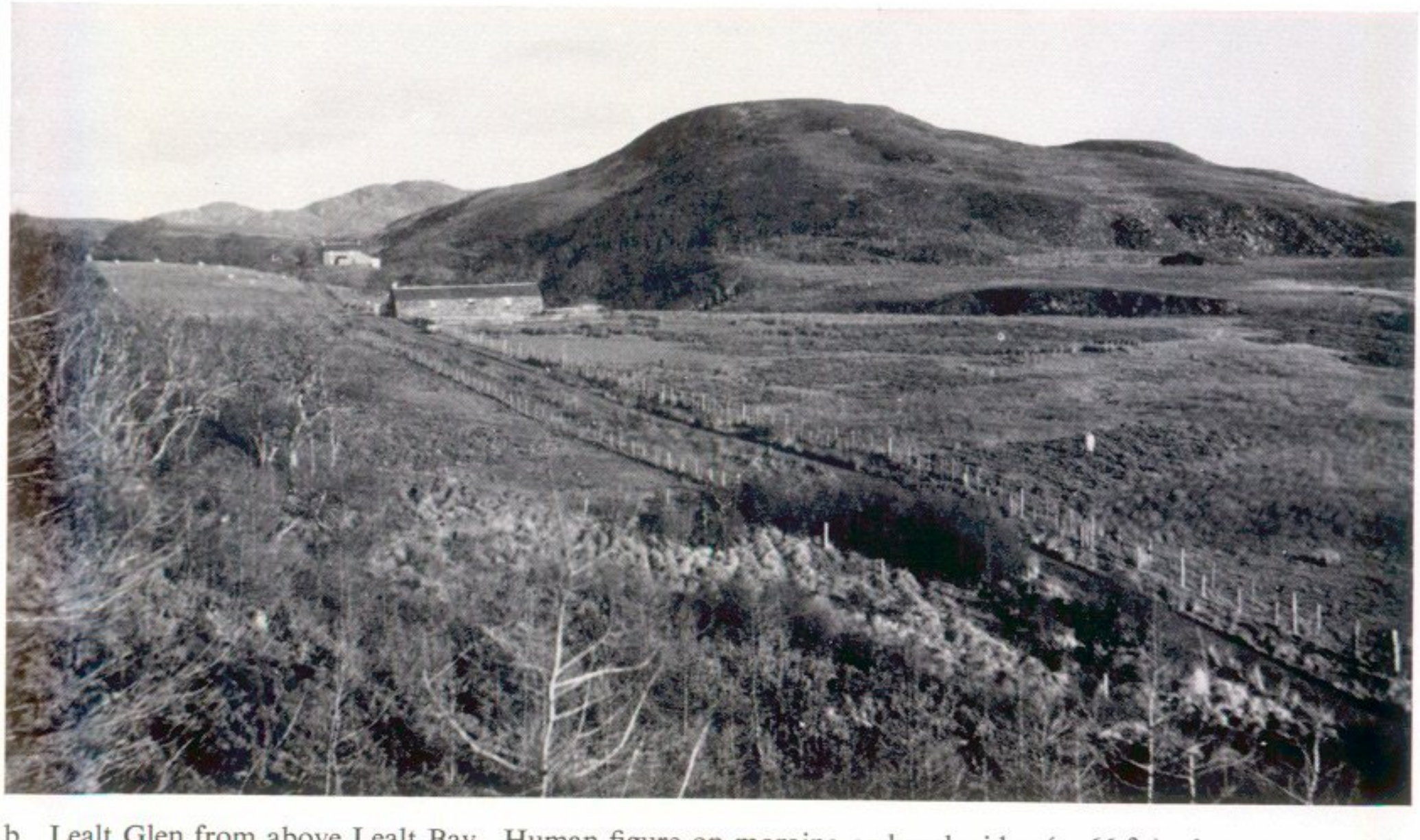
APPENDIX III

Artifact Patination

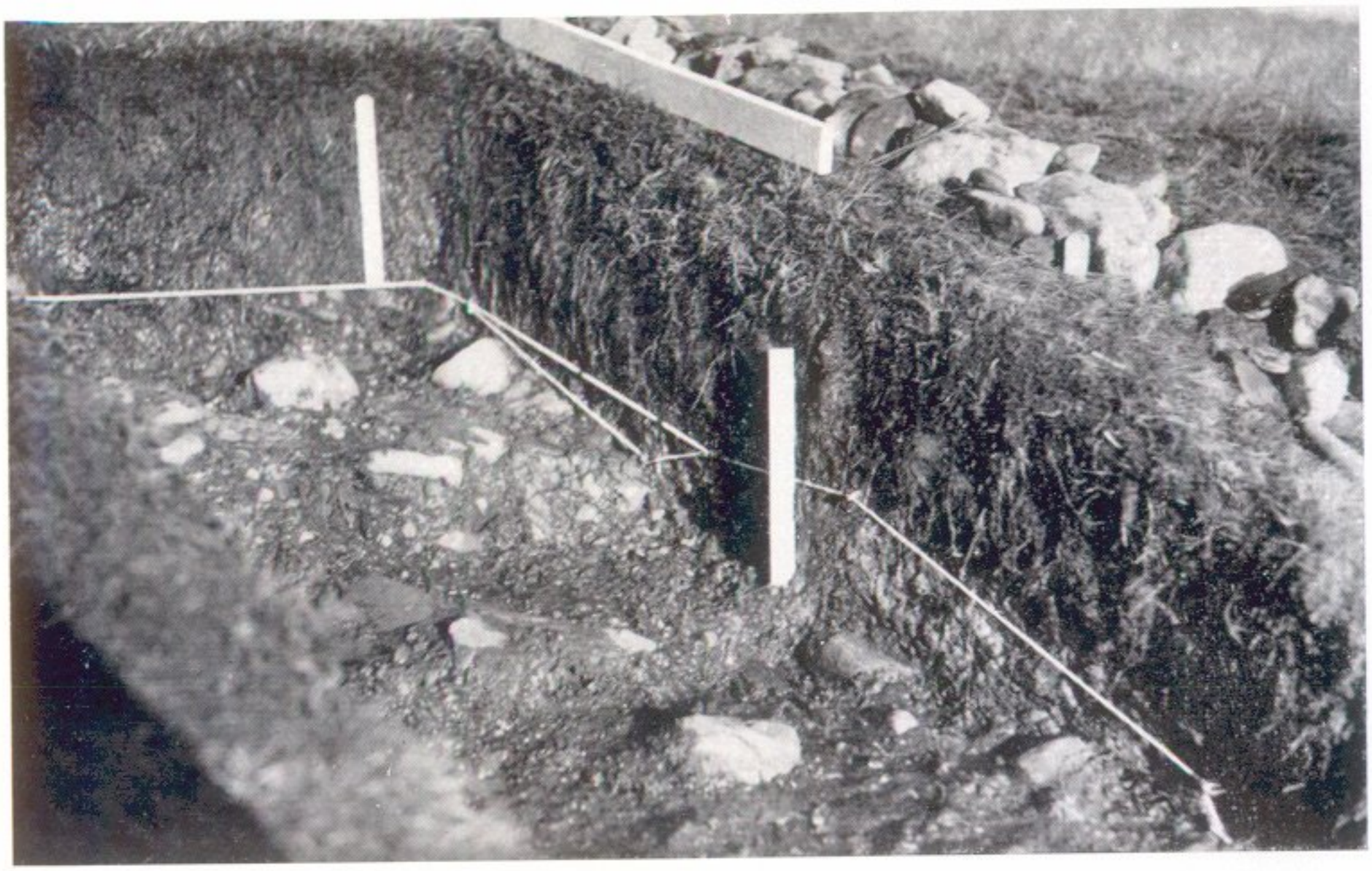
Although this has been indicated throughout, it must be recalled that absolute reliance cannot be placed on such evidence. This is so even though the conclusions are based on quite large numbers and limited to relative age within the site. Schmalz[1] has said that an acid matrix patinates far more slowly than does an alkaline one. It is possible that at Lealt Bay some *early* flints (for example, in the Main Area) lay for a long time exposed to patination by subaerial weathering, whilst others were relatively soon covered by the encroaching peat, a slowly-patinating matrix. Conversely, *late* Main Area specimens could have acquired a weathering patina equivalent or greater than that of, say, the Check Trench specimens (probably early covered by peat). Certainly, where other evidence is available it does not conflict with the patination conclusions (for example, the evidence of rolling; or of the lightly-patinated scale-flaked arrowheads, which one can expect to be late on well-attested typological grounds). But the possibility that the patination is an unsound guide is not forgotten.

[1] Schmalz, R. F., *PPS*, xxvi (1960), 44 ff.

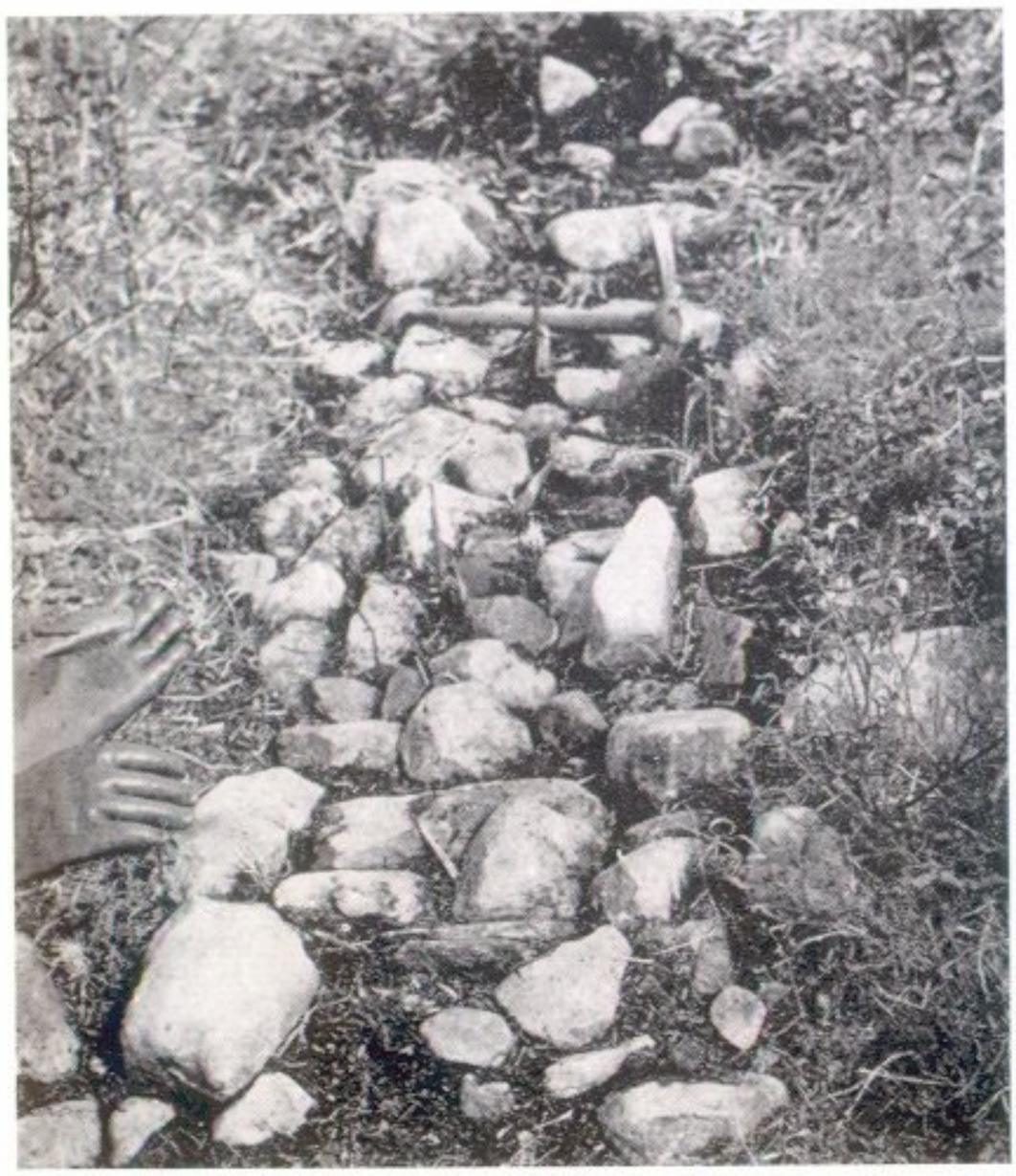
a Lealt Bay from the south-east. Site is on each side of upper end of fence



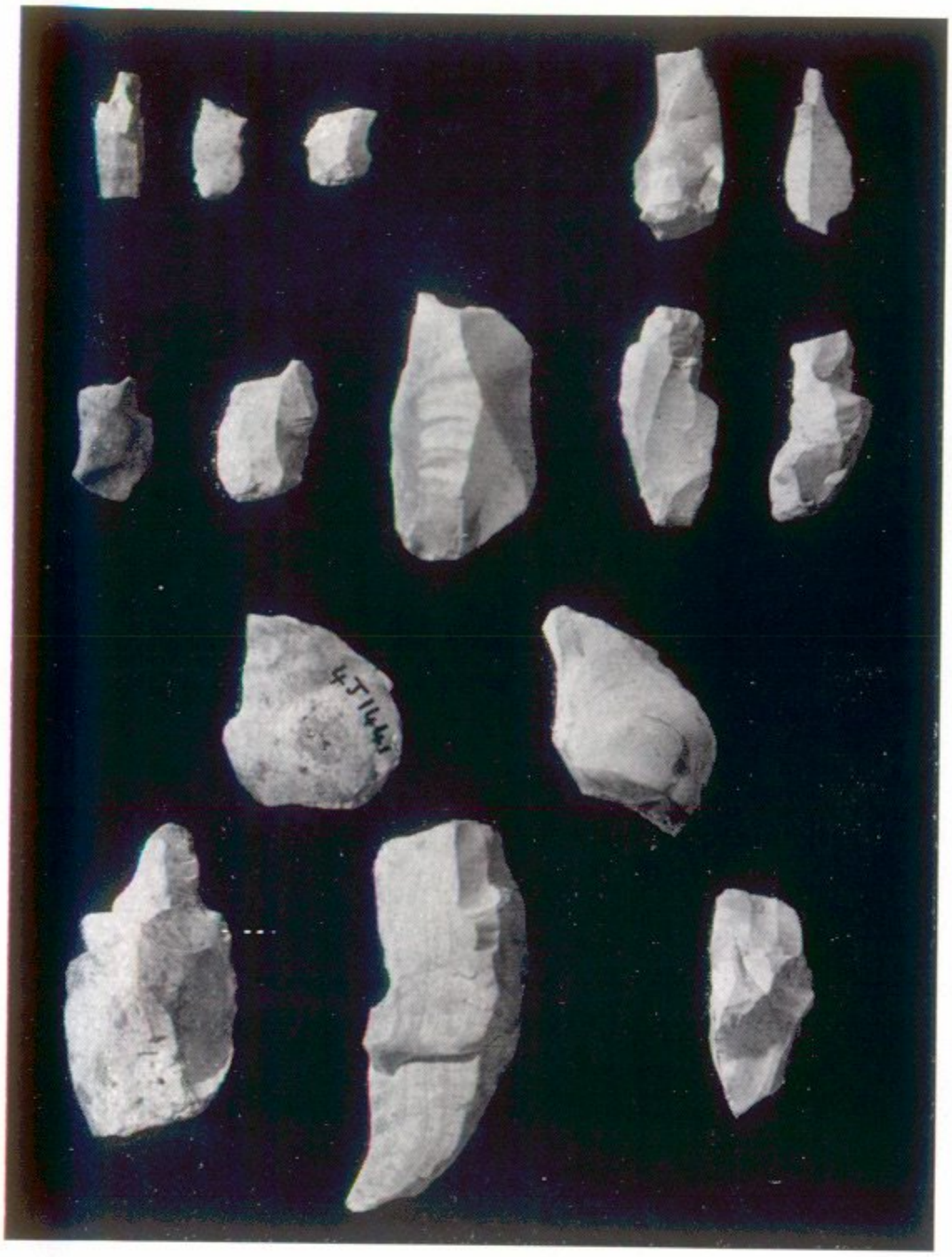
b Lealt Glen from above Lealt Bay. Human figure on moraine or beach ridge (*c.* 66 ft.), sheep on possible outwash mound in left distance (*c.* 113 ft.)



a Check Trench; white line follows top of Deposit 3; triangle marks charcoal concentration



b Trench A (S. Pit edge) westwards from trench D after removing top half of Deposit 4



Lealt Bay gravers, also illustrated in fig. 12. *Top row* (l. to r.) Nos. 204–6, 217–18; *second row* Nos. 210–14; *third row* Nos. 215–16; *bottom row* Nos. 207–9 (all $\frac{8}{13}$)