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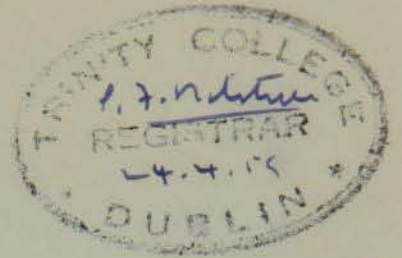
February 27, 1959.

This thesis has not been submitted as a degree or exercise at any university other than Dublin University. It is all my own work, with the exception of the assistance acknowledged in the introductory chapter.

G.D. Liversage

accepted 1

Bonus to Ph.D



Introduction ...
Part I: General Culture ...
Chapter 1 - Prehistoric Ireland ...
Chapter 2 - The Mesolithic ...

AN ACCOUNT OF THE MESOLITHIC

AND

SUPPOSED EPI-MESOLITHIC CULTURES OF IRELAND

AND

THEIR PLACE IN EUROPEAN PREHISTORY

BY

George David Liversage

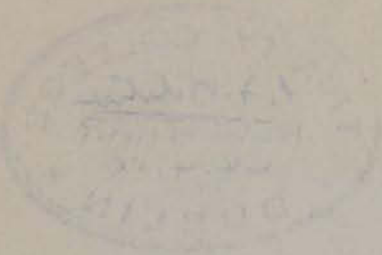
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Chapter 3 - Finds of ...
Chapter 4 - ...
Chapter 5 - ...



**Submitted in 1958 for the degree of Doctor of Philosophy,
at Trinity College, Dublin.**

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INTRODUCTORY

No apology is felt necessary for adding yet another to the general works about the Irish mesolithic. The basic work in this field is Mallam Movius' "The Irish Stone Age" (Movius 1942). More recent syntheses which include later work have been published by Mitchell (1949), Hodges (1953), and by Movius again in the general chapters of his report on the Larne excavation (Movius 1953). It might be thought that the number of new discoveries since these papers appeared has not been sufficiently great to justify a further general study as yet, but the author feels that some recent finds and some conclusions arrived at during the past decade in the field of Natural Science, justify this attempt. Some of this recent scientific work has a retroactive effect on past discoveries, and so the author has tried to check back over past discoveries in the light of the latest knowledge and rebuild after the soundness of the structural material has been assured. That the broad outline of the picture drawn by Movius in 1942 should still stand twenty years after he ended his research, indicates its basic soundness. His work will always provide the foundation for future mesolithic research in Ireland.

Parts I and II of this thesis are devoted respectively to the coastal and inland manifestations of Irish mesolithic and 'epi-mesolithic' culture. Part III attempts to relate the Irish mesolithic to that of the rest of Europe. This has always been a peculiarly difficult problem. The Larnian had

a unique character, probably on account of its insular position. The few clues which might explain its origin lead to the more obscure regions in our knowledge of European mesolithic history. Due to these difficulties many problems will have to remain unsolved until progress has been made in western Britain and France. I have done my best to formulate the problem and cut away some of the dead wood from current theories, in order to preserve their value. I can offer no solution.

New information is included along with the re-assessment of older work. Raftery's (1944) and Mitchell's (1949) list of inland Benn culture finds has been brought up to date. For the first time the complete extent of the Larnian culture along the coast has been determined. The flints are in a linear distribution, and variations in the industry along this line have been studied. Three seasonal excavations have been made at a site which cast light on the survival of Larnian communities along the coast. Studies have been made of the as yet unpublished chert industry found at Lough Gara after the 1952 drainage, and of the Larne axes, so far as the small number of discovered specimens and the difficulty of locating them in museums allows. A study, which included first-hand examination in most cases, was made of the mesolithic industries outside Ireland which seemed most likely to be related to the Larnian. This, and a follow-up study of the bevel-ended pebbles found in the Larnian middens, may have placed the foreign relations

of the Larnian in a slightly new light, but as usual have raised more problems than they have solved. Three recent excavations in Northern Ireland may have an important bearing on some of the views expressed here. The thesis will have to be looked on as an account of the position up until these discoveries were made, as the author was not in a position to obtain full and accurate information until the thesis had been completed, and any other sort of information might have been misleading.

As is usually the case in archaeological work, the author owes a great deal to the help of others. Credit for the discovery that Larnian flints are common along the coast of Co. Dublin belongs mainly to Miss G. C. Staacpole of the Royal Society of Antiquaries of Ireland. Her collection has been presented to the Department of Irish Archaeology of Trinity College, where the author had an opportunity to make a full study of it. I am grateful for the many times she showed me the sites with which she was so familiar. I have many members of museum staff to thank, especially Dr Joseph Raftery in Dublin and Mr Laurence Flanagan in Belfast. Dr Raftery also contributed the photograph of finds from Lough Gara. Other members of museum staff to whom I am indebted are Professor M. J. O'Kelly of Cork Public Museum, Mr Robin Livens of the Hunterian Museum, Miss Audrey Henshall of the National Museum of Antiquities of Scotland, Mr Boone of the National Museum of Wales, Mr Harper Kelley of the Musée de l'Homme, and the curators of the Fenby Museum and of the Museum of the Société

Jersaise. I had valuable opportunities to discuss questions with Monsieur l'Abbe Breuil, Monsieur P. R. Giot of Rennes, and Mr Charles Thomas of Edinburgh. My debt to Mr Frank Mitchell, who first set my footsteps on the road and guided my footsteps throughout the preparation of this thesis, is particularly great. I was maintained during the time I was engaged in this research by funds provided by Trinity Trusts and the trustees of the Maraswerth bequest. The excavations on Dalkey Island were financed by the Government of the Republic of Ireland under a Special Employment Scheme. My travel in Britain and France undertaken to examine relevant material outside Ireland was financed by the Iveagh Géological Fund.

I have only to add, in accordance with the regulations for the submission of work for higher degrees at Trinity College, Dublin, that this thesis is all my own work except for the assistance acknowledged above.

PART I
COASTAL CULTURES

Chapter I - Previous Research: Major and Minor Sites

The first discoveries of worked flints in the raised beach gravels of Northern Ireland occurred in the 1860's, when Boucher de Perthes' work on the palaeolithic remains in French river gravels and Darwin's Descent of Man were creating an intellectual ferment but had not yet been generally accepted. The first discoveries were in the gravel used for practical purposes, and particularly for ballast on the Belfast to Larne railway line. The names of William Gray, Robert Day, and other members of the Belfast Naturalists' Field Club, and of Du Noyer and Hall of the Geological Survey were prominent in the early investigations. Gradually discussion moved from whether the flints were really worked, and the 'Pre-Adamite man' theory, to whether they were found at all levels in the gravels, or only at the top. It appears that discussion of the last problem became quite acrimonious. In 1886 a committee was set up by the Belfast Naturalists' Field Club to settle the question. They took advantage of the cutting where the railway crosses the Curran on the way from Larne to Larne Harbour, and dug a little into its side. Their conclusions did not satisfy the whole Field Club, and in 1890 a second committee, which this time included Praeger, carried out a second investigation near the same place. This time they operated on a larger scale, and carried their investigations down below the level of the railway as far as water

seepage allowed them to go. This, perhaps the first scientific excavation ever carried out in Ireland, established conclusively that worked flints occurred at all depths, but were most abundant at the top (Praeger 1890).

Apart from these two excavations this was a period of observation and collection. Enormous quantities of material were amassed by collectors such as Knowles and Grainger. In 1904 Coffey and Praeger published jointly an important paper in which several sections in the Curran gravels were described (Coffey and Praeger 1904), and the importance of the flints was discussed in the light of views current at that time. It became generally recognised, thanks particularly to the writings of Knowles (e.g. Knowles 1884, 1914), that the raised beach implements belonged to a different class than those from ordinary upland or sandhill collecting sites where pottery was present; as Macalister put it, "They can be easily picked out from a pile of miscellaneous Irish flints". (Macalister 1921, p. 67).

The third excavation at Larne was carried out by Miss Layard, but though adequately published (Layard 1909) it did not add much to what was already known. A more important contribution came from Scotland when Breuil read a paper to the Royal Society of Antiquaries of Scotland in 1920 which included an account of the flints excavated some time before from the raised beach at Campbeltown in Kintyre. His observations have underlain subsequent writing on the Irish and west

Scottish Mesolithic ever since. The essentially upper palaeolithic nature of the material was obvious to him, and he called attention to various types that could be paralleled in France. He emphasised, however, that the flints were found in association with a raised beach, and the age of the implements would be determined by dating the beach (Breuil 1922).

In 1928 Bremer published a note on a number of objects that had reached him as Director of the National Museum. In particular he described a group of core perforators and axes collected by Knowles from the raised beach at Island Magee. Bremer considered that the group resembled the Asturian industry of Spain, where, according to him, quartzite pebbles chipped to a point at one end were associated in shell middens with roughly made core axes (Bremer 1928; Burkitt 1923). The question of the Asturian in Ireland was curiously metamorphosed when Whelan took up the cudgels for a connection between the large plunging flakes of the Larnian and the same Spanish chipped pebbles (Whelan 1930, 1938), and though Whelan's theory has been strongly criticised by Movius and others (e.g. Movius 1942, p. 205), Bremer's more cautious and reserved opinions have been forgotten.

The workers of the late 20's and early 30's were the first after Breuil who could bring a proper knowledge of flint typology to bear on the subject, and they were assisted to form their judgements by Breuil's comments on Campbeltown which they held in great respect, and by the development of geological opinion on the dating of the raised beach. Burchell

discovered and described the famous section at Cushendun, and recorded another at Island Magee cut during the construction of a small harbour. He arranged for Erdtman to date a peat layer in the latter section by its pollen content. Whelan discovered the site at Glenarm (Whelan 1938), observed the relation of the flints to the peat at Toome Bay which Erdtman dated for him (*ibid.*); and both contributed largely to the theoretical literature of the subject. Though some of their views, notably their tendency to have as many industries as sites, and Burchell's belief in a whole series of raised beaches at different levels (Burchell 1934) may appear a little extravagant to the present generation, their enthusiastic work would receive much more attention than it does, had it not been followed almost at once by the thoroughly up-to-date work of Movius for the Harvard Archaeological Mission on the same sites.

Movius excavated at four coastal raised beach sites which will now be described briefly with the present writer's comments.

Glenarm: excavated in 1934 (Movius 1937). The photographs and sections in the report indicate that the raised beach here was made up mainly of storm beach deposits resting on a shelf cut into the boulder clay. Jessen pointed out (*op. cit.* p. 189) that most of the beach must have formed during the emergence. The flints from the raised beach were of the coarse late Larnian type, and while some of them are likely to have survived from before the maximum of the transgression,

the fact that unrolled flints occurred on the top of the raised beach down to a level of about 8.80 metres (29 feet) above O.D., or 4.40 metres (14 feet) below the highest point of the storm beach, indicates that mesolithic occupation must have continued in the vicinity until the emergence was well begun. The topsoil over the gravel here contained the usual mixture of derived and later material, some of it rolled, but in this mixture it seems possible to distinguish, albeit rather subjectively, a very unusual industry. It is unrolled and struck in the Larnian manner, but it differs from the raised beach industry in tending to be less lamellar in form and rougher in workmanship. It is impossible to distinguish all the flints that belong to this group, but it certainly exists as one component in the mixture from the ploughed topsoil. Thus on two accounts, the unrolled flints, and this peculiar industry, we can see that groups who worked their flints in a similar way to the Larnians occupied the site at Glenam after the maximum of the transgression. In my opinion Mevius' description of the material found in the topsoil is somewhat misleading, as implements of this type are taken along with orthodox post-Larnian forms and treated as though they formed a single homogeneous industry, whereas really there is only a mechanical mixture.

Mevius' unrolled finds from the surface of the raised beach above 8.80 m. O.D. are tabulated in appendix A.

Cueheadun: excavated in 1934 (Movius 1940). This is the only raised beach site that has produced a reliable sequence. The site will be discussed by layers, using Movius' lettering.

Deposit A:- sand with some humus, making up the topsoil. It contained a mixture of flints as in the case of Glenara, some of which appear to be derived from below, some unrolled and perhaps in the Larnian tradition, and some of intrusive neolithic type made on fresh flint from the outcrops. A hearth in this layer, and some flakes of Tievebulliagh porcellanite, may have been associated with the latter culture. (Evans and Mitchell 1943).

Deposit B:- (height 7-10 m. O.D.). Stratified sand and gravel with some slight signs of storm beach formation. In the middle of this layer there was a disconformity between horizontal beds above and sloping current bedded layers below, indicating a period of erosion. The industry in this layer was of the coarse late Larnian type found at Glenara, Larne, etc., and since the material is found in deposits formed only during the last three metres of the transgression it is probably late Atlantic in age.

Deposit C:- (height ca. 6.30-7 m. O.D.). Clayey silty lagoon deposits which formed near low water mark in a shallow tidal estuary during Zone VIc, as shown by the scarcity of alder pollen. There were no archaeological finds, so it forms a very effective sealing layer for Deposit D.

Deposit D:- (ca. 4.30-6.30 m. O.D.). Fine sub-angular gravel and sand. This was a raised beach deposit that formed near the mouth of the Dun river obviously in late Zone VI before deposit C. The industry was rather finer than in Deposit B and is termed early Larnian by Movius.

Deposit E:- (height ca. 3.50-4.30 m. O.D.). Clayey or muddy lagoon silt, with many shells in places and more vegetable debris in its upper than in its lower part. On the evidence of the pollen, it formed in Zone VIIb. From the shells sent to her, Mrs Macmillan was able to deduce that the lower part at least formed under warmer conditions than the present, and at or below low water in a sheltered lagoon. The upper part of the deposit formed between tide marks. Remains of cod and of wild pig were found in this layer, and may have come from a settlement on the shore of the lagoon, but of course this cannot be proved. Flints as in Deposit B.

Deposit F:- somewhat sandy peat that had formed in a Phragmites swamp, presumably when the water coming down the river was being prevented from flowing away freely by the encroaching sea-level. The layer was about 10 cm. thick and only extended over part of the site.

Larne: excavated in 1935 (Movius 1953). The main deposit here is a deep series of gravels capped by storm beach forming a raised tidal spit jutting south into Larne Lough. The gravels rest on a bed of estuarine clay below which a little more raised beach gravel has on one occasion been found.

(Praeger 1890). Movius' paper indicates on faunal evidence that at the site of the 1935 excavation the estuarine clay formed at or below low water mark, and therefore the upper gravels must all date from a time when the level of the sea was rather high, i.e. from an advanced stage in the transgression. No implements were found in the gravels below the estuarine clay when Praeger pierced through to them (*ibid.*). Movius confirmed the finding of the previous excavators that the flints were concentrated at the top of the upper gravels, in the storm beach, but were present at all depths. Whether this is because the Curran formed more slowly as sea level stabilized itself at the end of the transgression, while there was no corresponding reduction in the rate of production of flint flakes, or whether there actually was a greater production of flakes, implying increase of population, cannot be answered. The flints throughout belonged to the coarse late Larnian industry. At Larne Movius refrained from giving an account of the abundant finds from the disturbed topsoil.

Rough Island: excavated in 1936 (Movius 1940a). All except the very top of the island is mantled in raised beach gravel. Movius considered that this had been deposited during the transgression, but the photographs in the report and the rather steep surface on which it rests suggest rather that it is a mantle of storm beach deposits thrown up during the regression. Moreover it masks erosion scarps cut into the boulder clay at about a metre below the highest level of the

beach, and so must be after these scarps were cut. A shell midden which contained a hearth rested on the highest part of the raised beach and extended on to the small central part of the island that had never been submerged. It must therefore date from after the maximum of the transgression. Both the midden and the top of the beach appear to have been much disturbed by cultivation, and shells and implements are still abundant on the surface. The collector, Hugh Kirk, considered it his best site, and had probably taken away many of the best specimens before Movius excavated, which may in part explain the poverty of the excavation's harvest. Movius tended to assume that the maximum of the transgression took place in the middle of the Atlantic period, and accordingly dated the flints in the raised beach to the earlier part of that period. On typological grounds he considered them to be early Larnian. Even on his own interpretation of the geology of the raised beach at Rough Island, they cannot be older than the flints in the current bedded layers below the storm beach at Larne, which he considers late Larnian. The flints are small, but not so finely struck as in the Boreal period material from Cushendun, and tend to be wide and thick in proportion to their length. I believe they were made from the pebbles available in the raised beach, which happen to be small, and this explains their character. The midden, in which Movius dug two rather small transverse trenches, consisted mainly of oyster shells and reached the maximum thickness of 25 cm. (10").

The flints recovered were very coarse and poorly struck, but seemed to be worked in the Larnian tradition with battered butts and wide striking platforms. In the cultivated earth above this a number of scrapers of good neolithic-bronze age type were recovered as well as a quantity of material that looks as if it has been derived from the midden. As we have said, the midden must have been post-transgression. There is no terminus ante quem, but it seems likely that the midden was sited as close to the sea as it could without actually being washed away. Since its lowest point is about 6.5 m. (21 feet) O.D. this is possibly the level of the highest tides at the time of its formation, which would indicate a very early stage in the regression. Though there is no palpable sign of neolithic influence in the Rough Island midden, it probably dates from the early neolithic period, according to present dating of the maximum of the transgression, as will be shown in the next chapter.

The next work after the burst of activity occasioned by the Harvard Archaeological Mission, took place after the war. Mr G. F. Mitchell excavated three middens that had been exposed in sand digging operations at Rockmarshall, Co. Louth (Mitchell 1947; 1949a). Midden I must have been deposited after the beginning of the emergence for it rested not only on gravel laid down during the maximum, but also on a distinct ridge of storm beach which must have been thrown up after the sea had gone down a little from its highest level. The sea

was still close enough to wash the edge of the midden and draw away some of the shells. Midden II had been largely quarried away before it received any scientific attention. Its relation to the raised beach was the same as that of Midden I. Midden III was situated on a low saddle in a morainic ridge out of reach of the sea. There was a greater depth of shells here, reaching over two feet (60 cm.) in places, and hearths were found. The flint industry is similar to, but not identical with the material from the same period or slightly earlier at Movius' sites. An account of the material from middens I and III is given in appendix A. The middens also contained elongated beach pebbles which had been selected and bevelled at the ends. Those from Midden III are now in the T.C.D. collection. Such implements have a widespread and definite distribution pattern which will be discussed later.

In 1949 the same excavator dug sections of a midden at Sutton, on the western side of the Howth peninsula (Mitchell 1956a). The main part of the midden rested on old soil above the limits transgressed by the sea, but on the western side a tongue of beach both rested on midden and had been covered by later midden material, thus very effectively synchronising the occupation with the maximum of the transgression. The presence of a polished stone axe in the midden further synchronises the beginning of neolithic influence with the maximum of the transgression. The flints were very similar to those from Rockmarshall, but include the most unexpected find

of a transverse arrowhead (Mitchell 1956a, fig. 9a). Since this is the only one known in the Larnian industry, it is hardly likely to be part of the ancestral equipment of the culture; moreover it is of a type which is only known in Europe in the Atlantic period or later, and is therefore so late that it can only have reached Ireland across water. Exactly how the form reached the midden dwellers at Sutton is a matter of conjecture, but it would be more cautious to suggest that it was in some way connected with the neolithic invasion, as were the stone axes, than to propose an independent second connection with late mesolithic developments across the sea. (2) This midden produced a small number of the same elongated stones with bevels worked or worn at the ends that were found at Rockmarshall. It is intended to reserve most of the account of the animal bones for a later chapter, but of particular interest here were remains of dog (Stelfox's identification) and (according to my own provisional identification) one sheep horn-core.

At about the same time Mr P. J. Hartnett, then of the National Museum, carried out the excavation of an Iron Age site at Feltrim Hill that was threatened with destruction by quarrying operations. In the process a good many neolithic finds of pottery and flint were made. Subsequently some surface finds of the same period were added to the Stacpoole collection, and are illustrated here as Nos. 116-127. The pottery is of a very uniform ware and good quality. There is

very little variation in forms or rim shapes, and the collection looks early. It matches fairly closely, but not exactly, some of the pottery in use at Dalkey Island after the disappearance of the epi-Larnian community. In time a better knowledge of the neolithic pottery sequence may settle its place more definitely. The pottery was accompanied by a number of neolithic leaf-shaped arrowheads and well made scrapers, together with waste flakes in the neolithic tradition of workmanship, but also by some flakes and cores that seem Larnian, and by the large stone flake illustrated as No. 122. The last is struck with a broad butt, a prominent bulb, and though only slightly leaf-shaped the secondary working on both sides of the butt makes it qualify formally as a Bann flake. All the flint used at the site was of the beach pebble sort used by the Larnians, and the trade in fresh flint from the Antrim outcrops seems not to have been in operation. It is possible that the neolithic folk obtained this commodity, and perhaps shellfish, of which there are some remains on the hill, from the coastal strand-looping population, and supplied in return the polished stone axes found at Sutton. The presence of Larnian debitage at Feltrim Hill shows that mesolithic survivors were actually chipping flint at this inland site, and the possibility of there being either Larnian slaves or wives at the neolithic site should be considered. It is to be hoped that this site will receive the detailed publication it deserves.

The latest development in the study of these coastal communities has been the discovery of further shell middens

on Dalkey Island, Co. Dublin. A flat area of about 650 m.² showing abundant signs of occupation was sounded at numerous points. At many of these the basal layer was a shell midden, nowhere more than about 15 cm. thick. From these soundings it seems probable that there are actually two separate middens, one occupying the southern, one the north-central part of this platform. Of the southern shell midden about 50m² were excavated; of the northern only about 10m² up to the present. The southern shell midden in particular was thin, and material from the immediately overlying prehistoric occupation layers had been mixed with it by root action, earthworm action, burrowing animals, and no doubt also by the walking of both animals and human beings over the midden. In order not to distort the picture of the earliest occupation it was necessary to weed out the finds from any parts of the midden where the types of flints or potsherds indicated the intrusion of later material, from those where there seemed to be no such intrusion. As a result of this weeding out, only in 10m² of the deepest and last excavated parts of the southern midden can the finds be treated as a reliable and uncontaminated group.

Both middens contained a Larnian industry indistinguishable from that at Sutton on the other side of Dublin Bay. This fact, together with the habit of eating shell-fish, marks the first inhabitants off from their immediate successors on Dalkey Island. The latter were neolithic folk who did not eat shell-fish, and whose flint industry was of quite a different type. This seems adequate to show that the earliest inhabitants of

Dalkey Island were ethnically Larnian. Their culture had, however, been overlaid by features borrowed from the neolithic invaders. Mrs E. M. Jope, who is in the process of studying the animal bones from the 1957 excavation, has informed me that the fauna from the southern shell midden is fully neolithic, and includes the usual domestic animals while lacking wild animals. The reliably stratified finds included a few attractively made smooth faced potsherds of neolithic type, with change-of-direction or applied cordon carination, and of very soft ware. Two polished stone axes were found in the southern midden. Obviously the community had reached a more advanced stage of assimilation to a neolithic way of life than the community at Sutton, but it is interesting to note that the flint industry was so conservative as to be unaffected.

The northern midden may represent an earlier stage of this assimilation, nearer to that at Sutton. There were stone axes and an axe polisher, but no pottery. On my own provisional field identifications, the animal bones included no cattle, but sheep and dog (or wolf) are present.

In both middens there were a large number of elongated beach pebbles. Many of them were bevelled at the ends.

The early place of these sites in the neolithic sequence can be seen not only from the vaguely early appearance of the pottery, but also from the fact that one of the layers overlying the midden and characterised by flints of neolithic type, contained the pottery with ledge shoulders and horizontal out-

turned rims, in some cases decorated by transverse scoring, that is related both to pottery of Ó Riordain's Class Ia at the beginning of the Lough Gur sequence (Ó Riordain 1954) and to Lyle's Hill ware (Evans 1953).

To these major sites can be added a number of minor sites where there has been surface collection but little or no excavation. Most southerly is the strip of coast from Balbriggan to Howth in Co. Dublin, where Miss G. C. Staepole of the Royal Society of Antiquaries of Ireland has been collecting energetically for the past several years. Chapter 5 of the present paper will be devoted to this area. Less intensive work farther north has located surface sites at other places in Leinster, among which the most important is unquestionably Greenore where a fine collection has been made by Miss Staepole and the late Miss Brodigan, of rolled flints brought by cultivation out of the top layers of the raised beach. The author has found a site in Greencastle townland, on the opposite side of the entrance to Carlingford Lough, where similar flints appear on a boulder clay ridge overlooking a stretch of raised beach gravel.

Strangford Lough is a rich region which was explored by most of the old collectors. Hugh Kirk was the specialist in this area. His collection, now in the National Museum of Ireland, is localised, but I am told that the locations were often put on from memory when the collection was sold to the museum, and may not be in all cases reliable. The collection shows the marked preponderance of large forms that can result from unconscious selection in surface collecting.

There are a number of sites by Strangford Lough where the ploughed earth is full of shell fragments. The best of these, on Rough Island, was excavated by Movius, where it was found that the shell fragments came from the disturbing of a midden below. The author knows of another such site with shells and many flints at the north end of Reagh Island, and of another from hearsay on the same island. Flints can be found in the raised beach on Rainey Island, and were found near the 50 foot contour during excavations of the early monastic site of Nendrum on Mahee Island.

Larnian flints may be found in fields or in raised beach deposits at many points around the shores of Belfast Lough. Most famous were a raised beach deposit at Holywood, and ballast pits (now grown over) at Kilroot. Recently the commercial digging of a trench under the town wall of Carrickfergus encountered Larnian flints in various natural deposits, including what is possibly a shallow layer of storm beach at a little over 35 feet (11 m.) above Irish Ordnance Datum (Jope 1950; Collins and Jope 1951). Flints have been found at sites on Larne Lough, such as Mill Bay and the site now covered by the cement factory at Magheramorne. At Larne they are not confined to the Curran. Knowles gives an account of his discovery of a very fine tanged Bann flake in a potato patch near the shore "as you go from Baystreet Larne to Waterloo" (Knowles 1914, p. 104 and fig. 41). Apparently the implement was unrolled, and from its low altitude find-spot, is likely to have been

younger than the maximum of the transgression. The same may apply to an incomplete similar implement found on Island Magee (op. cit. p. 106 and fig. 42). Accordingly Larne has been marked as a Bann flake find spot on Map II.

Larnian flints are very common all along the Antrim coast. In addition to the main excavated sites already referred to, flints occur at Cushendall in the raised delta of the river, and at many other places. The famous sandhill site of Whitepark Bay has not produced a Larnian flint industry, but has produced some small Bann flakes, thus adding to the evidence that these implements are characteristic mainly of post-Larnian times (see Knowles 1885, Pl. VI no. 47 and 48).⁽³⁾

There is a nineteenth century record of something very like a hoard of flints in submerged peat at Fortrush (Patterson 1896, 1896a; Mitchell 1949, p. 170). This is probably the same peat that Jessen has been able to assign to the early Atlantic period (Jessen 1949, pp. 130-35).

Mr A. McL. May has informed me (in litt.) that according to his observation Larnian flints are found along the north coast as far west as the river Roe. The present author has found a number of coarse rolled flints which appear more likely to be Larnian than anything else in the top layer of the raised beach at Greencastle, Co. Donegal, which is immediately opposite Magilligan's Strand at the narrow entrance to Lough Foyle. Investigation of raised beach gravels farther south along the west coast of Lough Foyle and elsewhere in Inishowen failed to produce any flints whatever. Accordingly the coastal

distribution of mesolithic flints has been indicated on Map II as extending from Howth to Greencastle. Some flints from Inch Island, Lough Swilly, in the T.C.D. collection, look as though they might belong to a blade industry with Larnian affinities, but are not sufficiently definite for inclusion on the distribution map. Some investigation of the Donegal coast immediately west of Lough Swilly might produce interesting results, but west of Inishowen pebbles of flint become very rare in the drift, and accordingly implements are unlikely to have been dropped about with the prodigal abandon that has made Antrim such a happy huntingground for collectors.

The evidence that brings this basin into existence are the led respectively the 'transgression' of the sea and the 'emergence' of the land. In view of the intimate connection between the raised beach and the coastal mesolithic evidence, it is necessary to discuss the matter in greater detail.

The indications of an earlier higher sea level may be either occasional or aggradational. The occasional features are shelves cut into boulder clay and usually occurring on the landward side in a steep bank marking the limit of erosion in that direction. The bank is a weathered brown boulder clay cliff. It is thought that the transgression did not last long enough to leave any appreciable mark on solid rock, or to cut the caves that occur at about the level, which are probably inter-glacial features (Stanger 1937).

The aggradational features consist of a variety of shore deposits which may be found along the present shore. Stone beaches are ridges of gravel that have

PART I

Chapter 2 - Changes of Sea Level and their Date

One of the leading features of the mesolithic (and supposed epi-mesolithic) remains of Ireland is their strictly waterside distribution by the sea, lakes, and rivers. Those found along the coast are often associated with old shore deposits - sands, silts, and gravels - now found above sea level. These raised shore deposits are commonly, if rather loosely, referred to as the 'twenty-five foot raised beach' or the 'Littorina raised beach'. The relative changes of land and sea levels that brought this beach into existence are called respectively the 'transgression' of the sea and the 'emergence' of the land. In view of the intimate connection between the raised beach and the coastal mesolithic cultures, it is necessary to discuss the matter in greater detail.

The indications of an earlier higher sea level may be either erosional or aggradational. The erosional features are shelves cut into boulder clay and usually terminating on the landward side in a steep bank marking the limit of erosion in that direction. The bank is a weathered down boulder clay cliff. It is thought that the transgression did not last long enough to leave any appreciable mark on solid rock, or to cut the caves that occur at about its level, which are probably inter-glacial features (Stephens 1957).

The aggradational features consist of a variety of shore deposits which match deposits which may be found along the present shore. Storm beaches are ridges of gravel that have

been thrown up out of reach of the waves at exceptional high tides or in storms. They are distinguished in section by the fact that the stones are jumbled in disorder and unbedded. There are a variety of inter-tidal deposits ranging from gravels and sands which once formed beaches to fine mud or silt deposited near low water mark. These deposits are laid down in superimposed beds of different sized material, and current bedding usually shows in section. Fine silts, muds, and clays, formed below low water mark are generally referred to as 'estuarine clays', conventionally rather than accurately, because Praeger, who pioneered the subject, used this term. The most extensive formations are the raised tidal spits which were laid down when the tide swept together long tails of gravel stretching out from the land and probably exposed at low tide, and the bars built up across the mouths of estuaries.

Molluscs may be found in any of the deposits, and the finer ones may contain small fossils such as Foraminifera, Ostracoda, or Diatoms. Few studies have been carried out on these smaller fossils, but where conducted, as at Somerset (Jessen 1949, pp. 125-27) and Larns (Movius 1953, pp. 136-68), interesting conclusions have been drawn, either about the depth of water present when the deposits were laid down, or about climatic conditions. Studies of the molluscs, which do not require the same laboratory treatment, have been much more generally carried out.

For deducing the height of the sea at its maximum the

storm beaches and the erosion ledges are the most reliable guides. On the present east coast the storm beach rises up to $1\frac{1}{2}$ m. above mean high tide level, and on the exposed west coast a great deal higher. The same may be supposed to have been the case at the time of the transgression. The erosion ledge at the foot of the old cliff should give the approximate height of spring tides, but allowance should be made for the collapse of the cliff on to the ledge.

The beach is highest in the north-east corner of Antrim, and becomes progressively lower as it is followed away in both directions. Heights given by Stephens (1957, p. 140) are for the highest points on the beach 37 feet (12 m.)⁽⁴⁾ at Portballintrae, 29 feet (9 m.) at Larne, 36 feet (11 m.) at Greensport, 28 feet ($8\frac{1}{2}$ m.) at Rockmarshall, and 24 feet (7 m.) at Bottle Quay, Howth. The figures are rather irregular, probably because some of the sites were more exposed to the gravel-heaping effect of the waves than others. If we take 14 feet (4 m.) O.D. as the height of the present storm beach, and if we assume that the raised and present beaches converge at the same rate south of Howth that they do north of it, the two should merge completely somewhere in Wicklow or Wexford. The last points where the raised beach has been properly observed and measured have been Dalkey Island, where the boulder clay had been washed off the underlying rock surface on the sheltered side of the island up to a level of 20 feet (6 m.) above Irish O.D., and the mouth of the Shanganagh river, where

the surface of the raised delta is at a height of 22.5 feet (7 m.) O.D.

Less work has been done on the raised beach of the west coast. Wright (1937, fig. 127) gives its limit as Sligo Bay. Investigations at present in progress have been finding traces of it in west Mayo.

To understand from these figures how far the sea has actually fallen since the raised beach was formed, some adjustments have to be made. If the top of the raised beach, which would usually be storm beach material, is taken to have been 1 metre above high tide level, and high tide level to have been a metre and a half above mean sea level, then mean sea level at the time of the maximum may be taken to have been two and a half metres below the measured levels of the highest points of raised beach. The present mean sea level is about two and one half metres above Irish Ordnance Datum (average 8.1 feet according to Dixon (1949) - the precise amount varies locally). Thus five metres have to be subtracted from the level above O.D. of any storm beach to show the difference between the present sea level and the sea level when it was formed. Thus at Portballintrae the sea was about 7 m. (or 23 feet) above its present level; at Rockmarshall $2\frac{1}{2}$ m. (8 feet); and at Sutton 1.3 m. (4 feet).

The same raised beach may be found around all the coasts of Scotland except the Orkneys, Shetlands, and part of the Outer Hebrides. It extends down the English coast down

about as far as Durham on the east and Blackpool on the west, where it also includes Anglesea (Wright 1937, fig. 127). It is highest in central Scotland, reaching a height of about fifty feet in the Firth of Forth and about forty feet in the Firth of Clyde and Loch Linnhe (various sources, summarised in Lacaille 1954, p. 55). When all the raised beaches are put down on a map it is seen that an oval area can be drawn that will enclose them all, and near whose centre the highest beaches will be found, and towards whose edge they become progressively lower. This area centres roughly about the Highlands of Scotland, which was a gathering ground for the ice sheet during the glacial period, and may be supposed to have been particularly depressed by its weight. With the melting of the ice sheet both the land and the sea rose, but owing to the faster rise of the sea the effect was to inundate low-lying regions such as the North Sea bed and parts of the Irish Sea (Farrington 1945). At a very late stage, when the rise of the sea had practically stopped, the land in certain areas such as north Britain, now rose faster than the sea, presumably because it had been particularly depressed during the ice age, and the effect was to lift the beach which had formed to a position several feet above sea level. The submergence, then, was part of a world-wide rise in sea level caused by the melting of the ice sheet, but the emergence was a local phenomenon caused by the exaggerated or prolonged rebound of the earth's crust in a limited area

centred around the Scottish Highlands. A similar sequence of events took place around the ice gathering grounds of Scandinavia, creating a series of raised beaches around the Baltic.

The transgression has been dated in terms of pollen zones thanks to the work of Knud Jessen and G. F. Mitchell. The zones in question are Zones VIb, VIc, VII, and VIII; according to the older notation of Jessen (1949) the last two are VIIa and VIIb. Zone VI is characterised by high values for hazel and the presence of pine, elm, and oak. In Zone VIb elm values exceed those of oak, in VIc oak exceeds elm. Zone VII (or VIIa) is initiated by a big rise in the amount of alder pollen in the deposits. Zone VIII begins when an abrupt fall in elm values takes place. This is often accompanied by the first appearance of the weed of cultivation Plantago lanceolata and is considered to be caused by the beginning of neolithic cultivation. Jessen's sub-zone VIIb, though not defined by this fall in elm pollen values, is usually found to begin at about the same level as Mitchell's zone VIII. A provisional framework of absolute dates for the pollen zones has been obtained by the Carbon-14 method, and this can be used to give a dating for the marine transgression and the cultures associated with it. According to this framework zone VIc may be dated to the sixth millenium B.C. (Mitchell 1955, p. 9). The beginning of zone VII occurs somewhere between here and ca. 3,900 B.C. (Mitchell 1956, p. 204;

1958), and the central part of zone VIIIa at ca. 2,200 B.C. (ibid.). According to this the boundary between zones VII and VIIIa should be dated to some time in the first half of the third millenium B.C., and as we shall see this date also gives the time of the maximum of the transgression, or the time when the rebound of the earth's crust came to exceed in speed the rise of the sea. The stone axe at Sutton provides independent support for the theory that the fall in elm values which ushers in zone VIII synchronized with neolithic immigration.

The pollen zones VI, VII, and VIII correspond with the older terms 'Boreal', 'Atlantic', and 'Sub-boreal' that had been given to climatic phases inferred from the study of macroscopic remains in Scandinavian bogs. The relatively dry Boreal period was supposed to have been succeeded by the warm moist Atlantic period, and then by the colder Sub-boreal period. Zone VII is ushered in by the marked increase of alder produced by the advent of moist Atlantic conditions. The same period, as shown by Praeger's studies of the molluscs of the estuarine clays and raised beaches of north-east Ireland (Praeger 1892, 1896), allowed a number of southern forms to live on the Irish shore where they are now extinct. Praeger, not having the precise palaeobotanical information that we have at our disposal was obliged to lump all his estuarine clays together, though some of the deposits he studies may have formed in the late Boreal rather than in the Atlantic period. In their

recent account of the molluscs and foraminifera from Movius' excavation at Larne (Movius 1953, p. 136-168) Earland and Fisher report that these remains from the gravels do not prove that the climate was warmer at any time, but that in the case of the underlying estuarine clay "There can be no doubt that this stratum was laid down under warmer conditions than those existing today in the locality". There is no pollen analysis of the estuarine clay at this site, but since the deposit extends up to ca. 3 m. O.D. (or 10 feet), and was formed at or below low tide mark, and a similar sediment about a metre higher in level across the mouth of the lough on Island Magee was dated to the Atlantic period by Jessen (Jessen 1949, p.139; Movius 1953, p. 115-19) the same dating probably applies here. The late Atlantic sandy or gravelly deposits that overlay the estuarine clay at Movius' excavation are said to "present such a typical cool-water fauna as might be found in the locality today". Mrs MacMillan also reported that the lower part of the lower lagoon silt at Cushendun, which formed in Zone VIb, formed under warmer conditions than the present. Thus on present evidence there was a warm period in late Boreal and early Atlantic times, followed by a reversion to cooler conditions.

There are two circumstances when a raised beach deposit can be dated by palaeobotanical methods - when a fresh water pollen bearing deposit of some kind has been covered over by raised beach material, and when polleniferous layers of silt

or mud occur actually in the raised beach. It frequently happened that the rise of the sea blocked up the outlets of streams that had previously flowed freely away, so that water-logged conditions developed with the formation of Phragmites peat or some similar deposit. As the sea continued to rise these marshes were inundated by salt water and overwhelmed by sands and gravels brought in by the tide. The levels of these buried marshes taken together with the pollen-analytical date when they were overwhelmed, give an indication of the progress of the transgression. Obviously it will be more significant to relate the levels of these transgressed bog surfaces to the level of the maximum of the transgression in their vicinity than to the present sea level. It seems probable that the stages of the transgression proceeded at uniform intervals below the level of the maximum: i.e. during the transgression the encroachment of the sea operated uniformly over all coasts since it was an actual rise in sea-level caused by melting ice.⁽⁵⁾ It is unlikely that the stages were parallel with the present sea level, since the uplift has warped the earth's crust into a hump with its highest point somewhere in Scotland. This may be illustrated by a simple example. A point at O.D. would be fifty feet below the maximum in the upper part of the Firth of Forth but only twenty feet below the maximum in Dublin Bay. It would be reasonable to expect the point in Scotland to be submerged several centuries earlier than the point in Ireland. It is not always easy to relate a transgressed land surface to

the highest strand line in its vicinity, but we are fortunate that at a number of sites in Ireland this has been done.

Marine deposits themselves do not usually contain fossil pollen, or not in sufficient quantity or sufficiently well preserved to permit counting, though they have been found in some fine-grained deposits that have not been subjected to prolonged desiccation after the regression.

Transgressed land surfaces have been studied at the following places:-

Portrush (Jessen 1949 pp. 130-135). Four sections were measured through sandy marsh deposits that had been covered by beach sand. The junction between the sandy peat and the raised beach ranged in height from 5.60 to 7.60 metres (18 - 25 feet) O.D., and the submergence had taken place during Zone VII (VIIa of Jessen). The highest point of the raised beach deposits recorded by Jessen is just under eight metres (26 feet), but it is probable that the sea rose to a higher level than this. It is recorded as 34-37 feet (10.5-11.5 m.) by Stephens (1957) four miles (6.5 kilometres) to the east at Portballintrae. The result of the investigation at Portrush was, then, to show that a land surface about five metres (17 feet) below the maximum level of the transgression was flooded during Zone VII.

Cushendun (Jessen 1949 p. 135; Movius 1940 p. 38-51). Here a Phragmites swamp at a level of 2.4 m. O.D. (8.5 feet) was transgressed during Zone VIIb and a salt-water lagoon

formed. With an interval when sand and gravel were washed in, lagoon silts continued to accumulate until the end of Zone VI, by which time they had reached a level of 7.2 m. (or 24 feet) O.D. The highest level of the raised beach is recorded here as 35 feet (or just under 11 metres). When this result is compared with that at Portrush a contradiction becomes apparent, because at Cushendun salt water deposits were being laid down at about four metres below the maximum height of the transgression before the end of Zone VI, while at Portrush, only 25 miles (42 kilometres) away, fresh water deposits continued to form at five metres below the same level until well into Zone VII.

Milewater Dock, Belfast (Charlesworth and Erdtman 1935; Jessen 1949, p. 136). Erdtman determined the pollen spectrum of a layer of peat that was found at a considerable depth below sea level during dock construction at Belfast. Jessen considers the spectrum to indicate Zone VIa. The depth of the peat was not recorded, but peat at Alexandra dock was recorded by Praeger as 27 feet (ca. 8 m.) below high water mark, which would be the equivalent of 13 or 14 metres below the maximum height of the transgression in the vicinity.

Jenkinetown (Mitchell 1951 pp. 152-53). Here fresh water deposits at about three metres O.D., which is five metres below the level of the maximum of the transgression in the vicinity, were transgressed at the beginning of Zone VIc. With a short interval in the middle of Zone VIc when a few centimetres of fresh water mud formed, salt water mud continued to accumulate

until the Zone VII/VIII boundary. By this time it had built up to a height of a little over 6 metres (20 feet) O.D.

Termonfeckin (Jessen 1949 pp. 143-44). Here a thin seam of Phragmites peat was buried under raised beach at a height of 2.5 m. above approximate high tide level, which would correspond roughly to 6.5 m. (21 feet) above O.D. The diagram of the peat belongs to the earlier part of Zone VII but Jessen writes "There is no doubt that some of the original peat-layer has been eroded away so that its surviving surface does not indicate the time at which transgression took place but is rather older". Jessen considered that the highest point on the raised beach was four metres (thirteen feet) above the bed of peat.

Pollen bearing marine deposits have been studied at the following sites.

Somerset, Co. Londonderry (Jessen 1949). Here the surface of a layer of fen peat at a height of 2.6 metres (8 feet) O.D. was transgressed early in Zone VIIa. Deposits accumulated in water up to a height of at least 4.1 m. (13 feet) O.D. The exact height cannot be determined as the surface soil is probably only the same material disturbed. A diatom count as well as a pollen count was made through these water-laid deposits in order to compare the frequency of salt-water and fresh-water forms. It showed that the water had been freshest at the beginning and end of the formation of the layer, and saltiest at the middle. Jessen considered that the peak in the

values for salt-water diatoms occurred at the Atlantic-Sub-boreal transition, basing this on a small pine maximum that he considered to have taken place at this time and to be restricted to this part of Ireland. If Jessen's reading of the pollen diagram is correct, the transgression reached its maximum here at the Atlantic-Sub-boreal transition, and if I am right in thinking that the top sample in the diagram represents the Sub-boreal oak maximum, the sea did not completely withdraw from the level of 4.1 m. above O.D. until the middle of the second millenium B.C. Since spring tides reach a level of 3.65 m. O.D. here, this indicates that the sea was at least half a metres above its present level at that time.

The Bann Estuary, Co. Londonderry (Jessen 1957 pp. 127-130). At this site a bed of wood peat at a level of 2.2 m. below O.D. was transgressed early in Zone VI, and deposits accumulated in salt water up to a level of 3.35 m. above O.D. The sea withdrew from this level leaving a sandy beach at a time that must be well on in Zone VIII, and Phragmites peat formed on the beach at a time which may be read as just before the beginning of Zone VIIIb or in Zone IX, depending which features one gives emphasis to in the pollen diagram.

Island Magee, Co. Antrim (Jessen 1949 pp. 139-40 . Movius 1953 pp. 115-19). This diagram shows that the transgression had progressed far enough for estuarine clay, a deposit that presumably formed near or below low tide level, to form up to present day high tide level at ca. four metres (13 feet) O.D., or 7 m.

below the maximum of the transgression in the vicinity, early in Zone VII.

When put together this information gives a reasonably consistent picture of the chronology of the late stages of the early post-glacial marine transgression. In summarising I propose to measure all levels down from the supposed level of the maximum of the transgression in the vicinity, obtained by subtracting one metre from all records of the highest points on the beach if piled up by storms. This method may be somewhat rough and ready, but it is more to the point than taking all measurements from present Ordnance Datum.

In Zone VIa a land surface at -13 or -14 metres was transgressed at Milewater Dock, Belfast. (6) In Zone VIb land surfaces were transgressed at -13 m. in the Bann estuary and at -9 m. at Cushendun. In Zone VIc a land surface at -4 m. was transgressed at Jenkinetown. In Zone VII a land surface at -5 m. was flooded at Portrush and one at -4 m. at Terwarzeckh. During the same zone deposits of types which form at about the level of low water accumulated at -10, -7, and -7 metres at Somerset, the Bann Estuary, and Island Magee respectively, though oddly enough they had been laid down as high as -4 m. at the end of Zone VIc at Cushendun. The incoming of the sea probably slowed down during the later part of the Atlantic period, and the retreat (caused by land uplift) began at the very end of this period, just as the arrival of neolithic settlers began to affect forest composition in Ireland.

Earlier land and sea relationships are a great deal less clear, and there is very little direct evidence. An emergence of at least 120 feet (36 m.) in the North Sea in Zone IV is indicated by dated peat at this depth at, for example, the Leman and Ower Bank. Since this is supposed to have been caused by a different sea level rather than by land movements, it can probably be applied to the Irish Sea too. It would be well, however, to be sure that there is no possibility of a bulge in the earth's crust in the North Sea peripheral to the depressed zone surrounding the remains of the ice sheet in parts of Scandinavia, before making this an unqualified assumption. Even this degree of emergence would be unlikely to leave a continuous land passage linking Ireland with Britain, and we are obliged to fall back on indirect evidence. The matter is one for experts in the fields involved, and the present author only intends to touch very briefly on some of the lines of argument.

The flora of Ireland has fewer species than the flora of Britain. Praeger (1939) gave the opinion that this was partly because Ireland presents less variety in natural conditions than Britain, but partly because Ireland had not been connected by a land link to Britain for so long in the post-glacial period as Britain had been connected with the continent. He did not think that the flora of Ireland had immigrated across the sea as there was no selection in favour of

Zone I. But even with no currents in the Irish Sea, it would still be possible that Ireland had become an island

species whose seeds float or which can be transported by birds or the wind. Of the elements in the flora, the history of the forest trees is best known. Jessen (1949) considered that it was unlikely that the forest species had survived the glaciation at the southern end of an enlarged island, arguing that investigation in Scandinavia and Germany had shown that the bare belt in front of the ice sheet was too wide for this to be possible. He therefore concluded that the forest had spread to Ireland overland. Unfortunately, though the botanists may favour the existence of a land bridge, they can give us no indication when the bridge was broken. The last forest species to spread naturally in Ireland, the alder, does not expand until the late Boreal period, when on the evidence of coastal peat beds, as shown above, the sea was only a few metres below its present level. Since the alder appears in the record when the land bridge was already severed, may not the same be true of the earlier trees, the elm, oak, hazel, pine, and birch? I cannot say why any tree should appear after the supposed land bridge had been cut, but presumably if it happened to one, it could have happened to any, and the date when the link ended cannot be determined from the date of arrival of the various tree species. Working from different data, Farrington (1945) has argued that the sea must have been at least 600 feet lower at a period that I believe would now be equated in glacial theory with Zone I. But even with so enormous an emergence then, it would still be possible that Ireland had become an island

by Zone IV.

There is only one point where it is possible to speak of the subject with confidence that the next development in Botany or Geology will not alter the picture. If the present Irish Sea ever were dry land, the flooding would first extend to a barrier of high ground joining south Wales with the Leinster coast. Further inundation would extend rapidly to a still higher barrier joining the north coast with the Scottish Isles, so that the Irish Sea would be a long gulf extending north and south. When the sea came within about 150 feet (46 m.) of its present level, this last ridge would be submerged. Even a very considerable degree of subsequent tidal scour would not affect the general picture described here. The distribution of mesolithic finds suggests that if Man came over by land at all, it was probably when only the last bridge was in operation.

It is regrettable that it is not possible to give a more definite answer to the question of a post-glacial land bridge.

P A R T I

Chapter 3: The Industry - Flaking Methods and Terminology

Over much the longest period of prehistory the study and classification of flint implements provides the main, often the only, evidence for the detection of cultural differences and development. On one hand the shape of the implements themselves reflects (not always very clearly) the purposes for which they were intended, and hence the occupations and way of life of their makers; on the other the basic flaking system, the method of approach to the raw block of flint, indicates an ancestral tradition, or points to basic cultural affinities not easily influenced by mere environmental factors. The same basic systems survived the changes of tens of millenia and spread over most of the inhabited globe, and when there has been a change in the basic system it has often indicated some movement of enormous significance - as the arrival of Homo sapiens in Europe was marked by the appearance of the blade industries, and similarly the arrival of neolithic grazier-gardeners in the British Isles by the basically different flaking system they practised. There are other factors to be remembered. The nature of the flint supply exercises a profound influence on the industry. A community which leaves an area with a good supply for one with a poor supply, will find itself unable to make the large and elegant implements which formerly characterised it, and will

develop a new range of inferior forms. On the other hand barely related industries which both exploit poor flint, will develop certain characters in common as a response to this fact. Finally apparently insignificant divergences occur as a result of no more than local individuality and isolation, and the typologist must take care not to exaggerate their importance.

Their basic flaking system shows the Irish mesolithic flint industries to belong to the blade industries family - that is to the family to which all west-European industries from the Chatelperronian to the Tardenoisian belong. This family is associated only with Homo sapiens; it replaced the Mousterian flake industries some time during the Würm glaciation, and lasted until it was replaced in the British Isles by the neolithic industries late in post-glacial times.

Essentially the system was to strike batches of parallel flakes from more or less cylindrical or conical cores, using as striking platforms prepared flat surfaces at about right angles (or a little less) to the planes in which the flakes were to be struck. By this system it was possible to strike flakes longer in proportion to their width than by any other method. This means more cutting edge per weight of flint and amounts to a substantial economy. Its best development can be seen in the perfect parallel sided blades that were struck where good flint was available; as for example in the Middle East and the Mediterranean region during the neolithic period.

These implements may be as much as twenty centimetres long while less than two centimetres wide, and perfectly regular. They are however, a rather special and certainly late development of the blade industries, and often enough short clumsy flakes with only a tendency to have parallel sides were all that came of the system.

We will now attempt to reconstruct as best we can from the surviving pieces, the flaking methods practised by the mesolithic inhabitants of the Leinster coast, with some reference to the differences found farther north where the flint supply is much more abundant.

In such a reconstruction it is usually found that the cores give the most information, but it should not be forgotten that the cores are residual. Cores are struck again and again until they are considered no longer worth taking flakes from. The exact stage at which this situation is reached is to some extent a matter of economics, and depends on the availability of flint. When it is abundant, cores are more readily abandoned than when it is hard to come by. It is seldom, however, that any industry casts away the cores which have just yielded its best and most typical implements, and consequently the best implements are generally unmatched by cores, and the most interesting stages in the flaking process are hidden from us.

The original material was in almost all cases pebbles derived from the boulder clay and picked up on the beach.

They show the usual signs of having been rolled by the waves, and much material that is being washed out of the boulder clay and incorporated in the beach to this day. In the vast majority of cases the material was flint, but occasionally chert or other rock was used. As a result of abrasion during transport in the ice, the size of the pebbles diminishes with distance from the outcrops, which in our case are in Counties Antrim and Londonderry. In Co. Dublin the most typical size is about five centimetres in diameter, whereas in Co. Antrim it is about twelve centimetres - there is everywhere a good deal of size variation. As to quality, the material is usually rather poor. Much of the Co. Antrim material is itself rather coarse, and a large proportion of the beach material has this quality and tends to fracture badly. A further cause of bad flaking may be incipient cracks and lines of weakness caused by the pressures to which the pebbles were subjected in the course of natural transportation.

The worker began by preparing a striking platform. This was done by knocking the end off the pebble, or alternatively by splitting it into two parts, usually with a one third/two thirds ratio between the parts. The one third fractions were finished with, and for that reason were thrown away and can sometimes be found now. They often show a bulb of percussion at one end and a series of conchoidal ripple marks spreading from the other, suggesting that the pebble had been split by laying one end on an anvil and striking the other.

With the small poor quality pebbles that generally occur on the Leinster beaches it frequently happened that the flaking was only carried out on one side, making one of our most distinctive forms. The striking platform and the face show flaked surfaces, but the back, sides, and bottom of the pebble still showed the original exterior. 24 (7) illustrates a core flaked on one side only. As the process was continued the cortex would be progressively stripped from the sides and back, so that the stages illustrated by 21-33 were reached. In 21 and 24 the cortex remains at the back and end opposite the striking platform; in 23 and 25-30 at the back only. In 31 the pebble has been chipped almost all the way around the striking platform, but the cortex on the far end has not been affected. 32 and 33 illustrate cores from which nearly all the cortex has been removed, and which have reached the conical shape ideally typical of fully-formed blade cores. Cores of this shape are rare in the Larnian, and it was more usual to find or prepare a new striking platform and strike off a series of flakes from this in a different direction from the original lot. Such a core is described as a multiple platform core. 22 and 26 illustrate cores in which one flake was struck in the opposite direction to the rest of the flaking. In 27 apparently an attempt was made to strike off some flakes diagonally across the core, but in neither of these cases was there a properly prepared second platform. In 34, however, there are two well prepared platforms at opposite ends of the core, and in 40 there are two

platforms set obliquely and used to strike flakes off quite different parts of the core.

The foregoing may give an undue impression of system. It is to be supposed that the ancient flint knapper worked within a framework of tradition that had been handed down to him from generation to generation, and was partly conditioned by the available quality of flint and the method of striking flakes known, but within this framework he was a complete opportunist. Consequently this description of his methods, though in my view it illustrates correctly the tradition - the ancient upper palaeolithic blade-industry tradition in which he worked, is necessarily based on somewhat selected material. A very large proportion of the cores found in Leinster are terribly lacking in character. The material appears to have been most refractory, and the skill (perhaps in some cases the ineptness) of the worker was not sufficient to detach any well formed flakes, with the result that the core was discarded in a very bruised and battered state, as are 18 and 19.

Only in one case has it been possible to do more than infer methods indirectly. The scanty material from Rockmarshall II⁽⁸⁾ included five flakes and a core which fit together. The material is of an unusual granular texture and has tended throughout to break in short stumpy flakes without very sharp edges. This is presumably why so much discarded material was abandoned near the core. The pebble was a slightly flattened

oval about eight centimetres long. First the knapper struck a large flake off one end, thus preparing his striking platform. From it he struck a number of flakes down one side of the pebble. Two of these are battered at the junction of the back of the flake and the striking platform, and the core itself is battered. We will be discussing the possible significance of this later. One flake was struck off the side of the core, using the face for a striking platform. Either the worker considered changing over and taking the rest of his flakes off the side from this new striking platform, but decided not to after seeing the result of striking one such flake; or else the purpose was to improve the shape of some flake that was about to be taken off the front and 'move' later. After this some more flakes were struck from the original platform.

Let us now turn to the flakes themselves. A very large proportion are irregular, either in plan - as viewed from over the dorsal surface - or in thickness, having rough excrescences which it had probably been their purpose to remove from the core. The better formed ones, however, frequently show a tendency to be either parallel sided or leaf-shaped. A leaf-shaped group is illustrated in 46-7, and a parallel sided group in 6-13, and 4. In both cases the meaning of the terms has been rather liberally interpreted in order to illustrate a representative sample of the flints.

Granted the essential facts that the Larnian flints are generally struck parallel to one another from a particular

kind of core, they exhibit certain other peculiarities. The striking platforms (see glossary) are wide, and often long (in the transverse dimension of the flake) as well. When the flakes are viewed from the butt end it may be seen that a considerable area of striking platform has been detached with each flake, and this is the character that distinguishes them most readily from the normal series of neolithic flints, where the striking platforms are usually considerably smaller. In actual measurements, the striking platforms of the excavated Larnian flints from Leinster varied from one to ten millimetres in width. The most typical widths were about five millimetres on most implements, and about three on small ones. Small implements with narrow striking platforms are rare, but they do occur in small numbers.

The bulbs of percussion are usually rather large, covering most of the struck end of the bulbar surface of the flake and forming a very distinct bulge. They are generally not so distinctly localised as on later implements. Probably the wide platforms and prominent bulbs of percussion were due to the technique used to strike flakes, but we have no way of determining what that was. It seems more likely to have been percussion than pressure. At any rate it produced certain recognisable features that assist us to identify the Larnian artifacts.

A third feature, less confined to the Larnian, may also be due to the method of striking. If the illustrations are examined it will be observed that most of the cores and many

of the flakes have a curious battered appearance at the junction of the back of the flake (or face of the core) and the striking platform. A lot of short little spalls of flint have been removed giving a shattered or bruised appearance to a band along the butt end of a flake, or the top of the face of a core. The battering may be seen clearly in cores 28 and 29, and in flakes 5, 60, 68, to number only a few. The battering often ends in a pronounced step up to the smooth back of the flake (or face of the core) which is produced where the battering includes flakes that have gone a certain distance into the material and then broken off with a sharp angle between their bulbar surface and their end. This is generally described as "step flaking" and it shows well in core 21, and in flakes 3, 64 and 72.

The explanation that most readily comes to mind is that flakes were battered at the butt in order to insert them into a haft or handle more easily, and that cores were battered by use as scrapers, wedges, etc. perhaps in wood working. These explanations may have some truth in them, but they do not alone explain all the facts. For one thing the amount of battering is by no means proportional to the quality of the flake or core or its apparent suitability for use as an implement. Exceedingly rough flakes which seem to have been produced at an early stage as debitage often show it, e.g. 72. It is found on three of the waste flakes and the core from Rockmarshall II described earlier in this chapter, which fitted together, and I have difficulty in believing that this

material found together and fitting was ever used.

Most informatively of all it may be found on core implements, e.g. those illustrated as 106-112. When handling these implements one receives the impression that the battering is greatest at places where the implement bulges, where the maker might have wished to take off just one more flake if he were to carry the shaping of the implement any further. This suggests that the Larnian flint knapper kept striking repeatedly at his block of flint, but only succeeded in striking off a good flake every now and again, i.e. for every good flake struck, several chips were knocked off. The result was this very characteristic battering. On the core axes this indicates the frustrated efforts of the knapper to improve the shape of his implement; and the battering on rejected cores his last efforts to strike some good flakes. On this theory much of the battering on flakes can be simply explained as due to the fact that they have been struck from cores with battered edges, which had resulted merely from the previous less well-aimed blows of the worker. A neolithic stone axe roughout and an Acheulian hand-axe in the T.C.D. collection show the same feature, which is not confined to Larnian implements.

The remarkable series of implements in the Pitt Rivers Museum, Oxford, made by Sir Francis Knowles and A. S. Barnes, also possess this feature, and there can be no doubt that it is an incidental effect in chipping flint.

This battering is very typical of Bann flakes, and has often been considered to be a deliberate feature to prepare

them for a shaft or handle. If battering really is only an incidental by-product of flaking, this feature is, of course, without importance, but there is no getting away from the fact that the battering is most marked and regular on good Bann flakes, and tends to be decidedly irregular on the scrap-pier trimming flakes. It often seems too to have been deliberately aimed to remove the central keel coming down the back of the flake, which would form a sharp spur at the edge of the striking platform if it were left alone (removed in 52 and 63). It is hard in fact to believe that the arrangement of battering can have arisen without design in all cases, and it seems to me that we must credit the knapper with deliberate intention. Some forethought was needed, for it seems usually to have been done before the implement was struck from the core. It can occasionally be seen that the edges of the implement, as they converge toward the striking platform, cut off the bulbar ends of some of the spall scars of the battering. Two slate implements from Movius' excavation at Newferry, one of which is illustrated here for the first time as 132, seem to be slate imitations of Bann flakes, and the butts have been deliberately thinned by the removal of a cleavage plane on each side, as if this were required for hafting or some such purpose; thus Bann flakes and other implements were perhaps deliberately thinned at the butt for some reason, though as far as the evidence goes this was done before striking from the parent core, by the controlled application of the sort of

battering that inevitably accompanied any attempts to flake.

One would expect that where an implement with a deliberately battered butt was struck, there would be a core left battered along the edge except in the place where the prepared implement had been removed. In fact I know of no such core. I can only conclude that any core that was sufficiently good to provide a finished implement with a deliberately thinned butt, was used to produce more flakes. Surviving cores are those which had been used until considered "finished", and the proof that they were "finished" to the primitive flint-worker was the plain fact that the edge would only batter and no more good flakes were forthcoming.

Whether the battered appearance of the edge of cores can ever be attributed to use remains problematic. I have not personally succeeded in imitating the battering, but the wear on neolithic scrapers resembles it in miniature, and there seems no reason to doubt that some of it could be caused this way. The fact that some cores appear to have been retouched, as we shall see below, and retouched cores are quite a normal mesolithic and upper palaeolithic flint type, gives further reason for considering it likely that cores were used for some purpose. However I do not think the evidence is sufficient to override the conclusion that battering on cores is in the main, as on the flakes, a by-product of flaking.

One particular aspect of flaking technique that is not particularly common in the Larnian should be mentioned. This

is core rejuvenation. It was described for the Upper Palaeolithic by Hamal-Mandrin and Servais (1923), and rather briefly by various writers on the English Mesolithic, where it frequently occurs. The idea is that at some stage in working down his core the prehistoric flint knapper decided that his core required drastic alteration and struck a special blow with the express purpose of improving its shape. This was done in one of three ways: (a) by striking off the whole existing platform as a flat disk to create a clean platform parallel with it; (b) by removing only the battered junction between the face and the old platform by a blow from the side, creating a core-rejuvenation flake with a battered keel; (c) by removing the entire face of the core, either by a blow from the striking platform, or by a blow from the opposite end. The latter has the result that part of the old striking platform comes away as the distal end of the rejuvenation flake. Core rejuvenation, though it does not create any implements in the proper sense, is a comprehensible and characteristic aspect of flaking technique, and as such deserves to be noted when it occurs.

There is, however, a special adaptation of one form of core rejuvenation to the needs of Larnian flint working. The type of flake which removes the face of the core and the apex, as illustrated in Clark (1954 Fig. 34, Pl. 3), and described by Rankine (1954) as the 'plunger', is struck from the main striking platform of the core, has a curved belly, and seems

to resemble in most respects the type of flake described by Movius as the 'plunging flake' or 'Larne Pick'. A large specimen from Larne is illustrated here as 72, and four small examples from the Staurope collection appear as 14-17. Movius was of the opinion that these were heavy tools for wood-working and "characterise a cultural development strictly indigenous to Ireland" (Movius 1942, p. 166), considering that he detected signs of use at their bulbar ends. Movius' raised beach material was badly rolled so that it would be difficult to distinguish utilisation from fortuitous damage, but it should be remembered that the utilisation of primary debitage material is a common character of most mesolithic industries, including the Larnian, and so utilisation of a flake need not indicate that it is a special tool type. The present writer is more inclined to agree with Coffey and Praeger (1904) who wrote "These are the outer waste flakes struck off in the process of reducing a block of flint to the proper truncated cone shape, from which the desired flakes could then be struck". (Coffey and Praeger 1904, p. 180). With the rough beach pebbles that were used as raw material, it was found that in order to give the core the necessary angle of a little under ninety degrees between the face and the striking platform, protuberances and excrescences would have to be removed from the pebble, and this was done by the same method that had been used for trimming the face and apex of cores in less refractory material. The worst of the outer part of the pebble was removed as the

bulging distal end of one of these flakes. This agrees with the fact that they are most frequent in the storm beach industries of Co. Antrim and less so along parts of the coast where the raw material was scarcer and in smaller pebbles, and rarer also in the earlier industry dating from the Boreal period at Cushendun, where material appears to have been better selected, with the result that this wasteful chipping down was less necessary.

There are in the Larnian a number of core implements - axes, axe-like implements without cutting edges, and points - which were made on a system entirely different from that which has been described above for flake tools. Instead of striking flakes in parallel batches from a platform across the long axis of the original block of flint, long keels were somehow made to run from end to end of the block, which was shaped by transverse flaking from these down its whole length. The keels might be either two in number, as in 106-109 and 111, or three in number as in 104-05, 112, 114-15. It is not clear how the original elongated and keeled shape of the flint was obtained, and the surviving material is too sparse and lacks the specimens abandoned early in manufacture which would cast light on the problem. An incompletely manufactured core axe from Farham, Surrey, was made from a natural cigar-shaped nodule (Clark and Rankine 1939, Fig. 13). In the core points the transverse flaking is carried much deeper at one end than at the other, as may be seen in 114, or is confined to one end

(see also 104 and 114). This is the only specimen

as in 115, but has the same essentially transverse character. Working this way from keels the knapper had to detach his flakes from a considerably more acute angle than was the case when working from prepared cores, and this may be one reason why there was no tendency to produce blades. The technique appears to resemble that employed to produce lower or middle palaeolithic hand-axes, but the Larnian axe manufacturer seems to have possessed less skill at this method of flaking than palaeolithic man. His flakes tended to bite deep into the flint giving his keel a sinuous outline (as in 106 or 112), and the flat flaking found so generally on Acheulean hand-axes seems seldom to have been achieved, and is illustrated here only on 109 and on the lower end of 111.

The author was able to make a special examination of a group of 25 of the 'axes' from Island Magee in the Knowles collection (N.M.I., no accession number). This is part of the group on which Bremer based his Asturian theory (Bremer 1928). The genuinely mesolithic age of the implements is shown by the fact that all are rolled, and more definitely by the fact that one has the black patination which shows that it comes from the estuarine clay layer, dated by Jessen to the early Atlantic period, or from the black gravels which underlie it. Three other Larnian axes definitely come from raised beach gravels (see Movius 1953, pp. 63-66).

Of the 25 implements 6 had cutting ends (see my illustrations 107, 109-111); the remaining 19 were blunt at both ends (see my 104 and 112). None of the sharp ended specimens

have been sharpened by the tranchet blow, the true transversely sharpened core-axe apparently being entirely absent from Ireland. 111 has been sharpened by carrying the flaking of the sides right around the working end, thus allying it with Troels-Smith's class 'mit spezieller Schneidenbehandlung'. Three have been retouched across the end, but without 'spezieller Schneidenbehandlung' (e.g. 148), and two have cutting ends formed where tilted transverse flake scars on the two faces of the axe meet at the end of the axe.

Among the blunt ended 'axes' only two are of trapeze-shaped section (which would relate them to Troels-Smith's 'assymetrische' class of core-axe); while the rest are of the symmetrical 'zweiseitig' class with two keels, one running down each end of the implement, though in some cases (e.g. 104) these appear 'zweiseitig' on one side, but on the other have an extra keel from which flakes were sometimes struck towards the other two keels. The 'zweiseitig' type of axe, significantly enough, did not become common in Scandinavia until quite a late period (Troels-Smith 1938), the short trapeze sectioned (or 'rhombic') axe being normal on Maglemose sites. At Star Carr, however, the axes were generally of 'zweiseitig' type in zone IV, and it seems that the Scandinavian axe sequence does not hold good for the British Isles. The 'zweiseitig' axe was apparently current so early that it could quite well have been included among the tools of the ancestors of the Larnians at a time when contact with Britain would have been comparatively easy. This, however, is not the

case with the specialized axe ('mit spezieller Schneiden-
behandlung'), which seems a genuinely late type. It would
be rash to strain the single implement, no. 111, which is in
any case not tranchet sharpened, and use it as conclusive
evidence for the late introduction of the axe into the
Larnian kit of flint implements.

Some explanation should be offered for the absence of
tranchet sharpening. It is possible that the Larne axe
branched off from the main stem of axe development at a stage
when the form of the implement had been developed, but before
the idea of sharpening by a tranchet blow had been hit upon.
This is open to the objection that it means that the early
pre-tranchet stages of axe development must have taken place
on the now submerged west coast of Europe, (for such a stage
in axe development is not attested at any of the main centres
of axe culture in its full development) and spread eastward
thence to the North Sea/Ancylus Lake area. Such a theory
could hardly be accepted, and a more likely explanation for
the blunt ends of the Larne axes is degeneration, also invoked
to explain many other features of their industry. Axes are
supposed to have originated in Zone IV in response to the
development of a forest environment, which gave the opportu-
nity, if not necessity, for working wood. The Larnians, it may
be supposed, were still in touch with this development when
it took place, i.e. they had either not reached Ireland in
Zone IV, or if they had, were still in touch with developments
on the far side of Britain. Later, though they continued to

make a small number of implements of axe-like form, their technique deteriorated, so that the majority of their 'axes' could not be used for cutting anything. It would seem likely that this deterioration took place because they ceased to require axes, and the most probable reason for this was their adaptation to a coastal way of life. If the axe was introduced at a later period than Zone IV, the same explanation may account for the degenerate character of the axes from Zone VII which survive to us.

So much for the Larnie 'axes'. So far we have only described primary flaking, that is flaking from cores. Flaking may be divided into primary and secondary. When the primary flakes have been struck they may have flakes taken from themselves. This is called secondary flaking. Naturally the flakes taken off have to be smaller than was the case with the primary flaking, and the purpose is to retouch the flake, giving it some feature that is required to make a more finished implement of it, i. e. a tang, a notch, a point, or a blunted edge. When applied to a core, the term 'retouch' means flaking applied not in the removal of flakes for their own sake, but in order to fit the core itself for some special purpose.

In the case of flakes the Larnian form of retouch consisted of the removal of small roundish flakes which bite fairly deeply into the flint. They make fairly steep angles with the surface of the flake from which they were removed, and never

there has been little need to differ from what they would

approach the flat skimming type typical of many neolithic implements, as for example 124 and 137. The actual scale of the retouch ranges from as large as in 81 to as small as on the left hand side of the butt of 68, but never attains the finesse and regularity of some of the best neolithic retouch. It occasionally shows a lamellar tendency as in 80 and 82. In view of the effects of unsuccessful flake production and battering on the edge of a core, it would not be possible to insist that any of the cores in the Stacpoole collection are retouched. 36 and 38, however, have been flaked along part of the edge in a way very similar to retouch on a flake, and in view of the fact that retouched cores occur commonly enough in the English Mesolithic, it seems probable that they have been retouched. The step flaking on 34 and 35 also has a rather purposive look. Both these are good cores, and it is hard to believe that the worker could not have taken more flakes off them if he had wished.

We should now turn from the discussion of the technique employed to the question of the sense in which our descriptive terms should be used.

There is not complete uniformity between authorities in their classification of flints. In preparing this thesis I have tried to follow the most reasonable and generally accepted examples. I have generally found J. G. D. Clark and D. E. A. Garrod the most useful models. Since both Dr Movius and Mr Mitchell have adhered to the generally current modes, there has been little need to differ from what they would

have done with the same material, and the few differences are only in the direction of simplification. It will be well now to run through the classification explaining the meaning of the words.

Cores are blocks of flint from which flakes have been removed. They may be single or multiple platformed, depending on whether they have one or more striking platforms. Those with multiple platforms may be double, triple, etc. Cores can usually be rested on their striking platform so that the face will stand up more or less vertically. If a core has been retouched for use as a tool rather than with the purpose of taking useful flakes from it, it is called a core-scraper. In The Stone Age of Mount Carmel Dr Garrod draws a distinction between straight fronted core-scrappers and oblique fronted core-scrappers according to whether the face of the core is roughly vertical or slopes back to a marked degree when the implement is placed standing up. If it were possible to be sure that my 37 had been retouched, it would count as an oblique fronted core-scraper. Since in my opinion it is not possible to be certain whether a Larnian core has been retouched or merely battered I have not found much occasion to use the term, though it has sometimes been applied rather generally to cores with battered striking platforms. Movius has applied the term 'steep scraper' to thick flakes that have been used as cores. This is a good illustration of the difficulty of fitting a vocabulary to the requirements of flint

typology. One would hesitate to describe what is really a retouched flake as a core, yet there is little doubt that the piece is really residual after the removal of flakes, and not an implement in itself.

Leaf-shaped flakes are flakes which narrow down from the middle toward both ends. A very characteristic Irish implement is a leaf-shaped flake which has been retouched along the edges near the striking platform. The old and accepted term for these is Bann flake, on account of their common occurrence at the collecting sites of the river Bann. I propose that the term leaf-shaped flake should be used for those which are not retouched at the butt, and the Bann flakes should be classed as form A if the retouch is on one side only and insufficient to modify the shape of the implement, form B if it is on both sides of the butt and not sufficient to modify the shape of the implement, form C if the retouch on one side has been carried right into the flake so that the butt is beginning to assume the form of a tang, and form D if the tanging has been executed on both sides. Sometimes leaf-shaped flakes or Bann flakes may have secondary working farther down the flake, sometimes apparently to sharpen the point, sometimes as a finger rest, or for some other reason.

The term blade is used for well struck, regular, parallel-sided flakes. Barnes (1947) liked to speak of long blades and short blades using the former term for the very fine long regular implements found in, for example, some of the neolithic

industries of the Mediterranean region, and the latter for the clumsier efforts of the Larnian, where the proportion of length over breadth is much lower. Clark on the other hand prefers to reserve the term blade for only the best and most regular material, without attempting to draw the line between flakes and blades with sufficient precision to compile separate figures for each class, and Lacaille has done the same. On this definition 96 and 139 are the only implements here illustrated that should be called blades. It is still desirable to call attention to the facts that many flakes have a tendency to parallel sides, having been struck off blade cores, and that the better cores are fluted with parallel blade scars. The best phrase to describe these flakes which possess a good deal of the character of blades, but cannot be called blades without interfering with the word's proper use to describe something of a higher quality altogether, is the phrase "eclat de tendance lamellaire", which may perhaps be translated tersely as "blade-flake". If the very rough bits of flint that break off at times in place of well formed flakes are described as chips or spalls, then blades, blade-flakes, flakes, and chips or spalls form a continuous series of flaking products passing progressively from the best to the worst. It is obvious that the series of categories exist, but the boundaries between categories, and so statistical subdivision, while it gives interesting information, is only approximate.

Plunging flakes have already been discussed in connection with the light they cast on the flaking system. They are flakes which are considerably thicker and wider at the distal than at the bulbar end, and in the Larnian often have a concave bulbar surface.

Besides Bann flakes and core-scrapers, the Larnian tool types with secondary working include a number of implements made on flakes for which usually the crudest and least distinctive flakes were chosen. Sometimes the piece chosen was not even a flake, but a chip of some kind showing various artificial fractures, but no bulbar surface (e.g. 78, 80, 82 and 91). The working edge may be straight or concave, but is more usually convex. The trimming seldom goes far around the flake. A series is illustrated as 73-84, 76, and 77 having straight edges, 84 a concave edge, and the rest convex edges. They are quite different from the rather uniform and well-made class of horseshoe scrapers found on British mesolithic sites. On the northern raised beach sites Movius (1953 et passim) adopts a rather elaborate classification, which is largely self-explanatory, but is sometimes difficult to apply to individual cases, and which tends to obscure the essential similarity between all tools in this class; moreover the categories cannot be traced abroad to be used as indicators of cultural contact. Scrapers from Larnie were divided into side scrapers, concave scrapers, notched scrapers, end scrapers, concave-end scrapers, steep scrapers, and thumbnail

scrapers. It seems to me that the essential character about these implements is their improvised character - the general disregard for what the implement might look like provided it only had a sufficient scraper edge - and consequently I have adopted the general classification rough scraper for them. An additional advantage of this term is that there is no inconsistency in applying it to scrapers that are not made on flakes, but on scraps of flint. In the same improvised tradition are a number of perforators or perforator-like implements with blunt points, which were perhaps reaming tools for widening a hole which had already been pierced. The working point might be made by placing two notches close together so that a spur stuck out between them, as in 91 and 93, or by choosing a corner of the flake and notching it on one side only as in 95, or by secondary work without notches as in 92 and 94. 97-99 have been made by breaking thin flakes across obliquely, without even taking the trouble to retouch the break. Of the illustrated examples 91-99 all are made on flakes except 91 and 93.

A well known upper palaeolithic and mesolithic type is the notched flake (coche or lame a encoche in French). These occur also in the Larnian and a series is illustrated as 86-90. In 87 the notch is certainly made by secondary working, but in the others it may only be the result of continued use in the same place, as (for example) in paring down a stick.

Some very rare types must now be discussed. A few

burins have been claimed by Whelan and Movius, and some possible examples occur in the Stacpoole collection. Burins are implements which have been given a chisel-like working edge by the secondary removal of one or more long spalls. In illustrations it is usual to point out the burin spalls by an arrow giving the direction in which the spall was struck. 101 is the only burin in the Stacpoole collection which could by any stretch of the imagination be considered typical. It seems to be an angle burin on a truncated flake (burin sur angle de troncature retouchée). 103 resembles a bec de flute (or screwdriver) burin, but only one of the facets across its end has been struck from the end, and the other may be no more than a break. 100 and 102 have secondary spalls struck from their bulbar ends, which is not the normal end in industries where there are undoubted burins. All these flints may resemble burins only by accident, and it would not be possible to insist that burins are present in the Larnian, though rare and atypical examples may possibly occur.

The rostrate or nosed scraper is an implement particularly characteristic of the Aurignacian in which a bulge on the edge of a core has been defined by two notches on both sides of it, and has been fluted by usually a delicate lamellar retouch. Though the implements have not been noted in the British Mesolithic, one has been published from Toome Bay (Mitchell 1955) and two more of the same were found in

the Stacpoole collection and have been illustrated here as 83 and 85. As with the burins, they are so rare that it would not be safe to insist that they represent the survival of an Aurignacian tool type in the Larnian.

Finally there is the group of rare core implements consisting of axes, axe-like implements with blunt points, and core perforators. In the early days axes and axe-like implements were referred to together as Larne Celts, but with the fall out of fashion of the term "celt" Movius re-named them "Larne Axes". This is open to the objection, as pointed out earlier in this chapter, that many of the implements are blunt at both ends. While the rather clumsy expression "axe-like implement" seems necessary where accuracy is required, for general purposes I propose to refer to the whole class as "Larne axes" and expect the reader to remember that they are often not axes. The term "pick", as an alternative to axe-like implement, suffers from the confusion that picks should be sharp ended.

A number of core implements were found by Movius at Cushendun and he coined the expression Cushendun Pick to describe them. Apparently identical implements from northern Europe are described by Clark (1936) as core perforators, and there seems to be no reason for preferring Movius' local term to the general one.

It is to be hoped that the meaning of the terminology used and its relation to what will be found in other papers

PART I

Chapter 4 - The Utilisation of the Implements

The collection of the evidence on the utilisation of prehistoric implements is a valuable addition to the study of their typology. It can confirm the conclusions as to their purpose that would be drawn from their shape and it can provide a key to typological development by showing what accidental forms the inhabitants found most useful. Apart from such lucky finds as the microlithic points found in the body of an aurochs at Vig, in Zealand (Clark 1936 p.89) or stuck into a human vertebra at Tevioc, Brittany (Pequart 1929, p. 386) the use of the implements has to be deduced from the wear that it has caused. This means that an attempt must be made to find some objective criteria for distinguishing between deliberate and fortuitous wear on an implement, and no attempt should be made to conceal the possible weaknesses of the method.

A useful control is provided by the material of similar consistency to flint, but never subjected to deliberate use, that is preserved under similar conditions. This material is the debris of modern civilization - glass, porcelain insulators, hard pottery, etc. It may be found in beach gravel, in cultivated earth, among cobbles on trackways, and its edges are nearly always abraded and chipped. The coarse

chipping followed by smoothing found on such objects when rolled in beach gravels resembles exactly that found on flint implements from the raised beach. The finer nibbling on these objects in fields indicates that damaging agencies also operate where cultivation takes place; such are probably pressures and movements in the earth, or against pebbles in the earth, caused by cultivation, subsidence after cultivation, soil creep, and growing roots. On roads the agencies are obviously feet and wheels. Under all these conditions the damage may also resemble a coarse and careless retouch.

The probability that flint implements have suffered fortuitous damage after their original period of use becomes a certainty when it is observed that many of the chips along the edge of the implements bear a different patina from the rest of the implement. Moreover when a random series of flints from the Stacpoole collection is compared with the undisturbed material excavated from the midden layer of the Sutton site, it is found that by far the greater part of the surface material has damaged edges, but in the midden layer just slightly more than half. The conclusion to be drawn is that only flints which have lain in the ground undisturbed since their primary abandonment can be taken into account. Even here factors such as frost action, treading under foot during the primary occupation, and root growth may have caused chance injury, but perhaps not to a serious degree.

The damage observable on flints from completely undisturbed primary deposits takes the form of slight

notching of flaking scattered along the cutting edges of the implement. Sometimes it is bifacial. Occasionally it assumes the form of step flaking, but more usually of resolved flaking. Points are often blunted. Care must be taken to distinguish this from a natural jaggedness of the edge that occurs when the edge of a flake has gone through a grained or fissured patch in the flint and a direct relation between the indentations of the edge and the fissures may be seen. Also when the edge of a flake is very thin, i.e. when the two surfaces which meet in it are almost parallel to one another, the edge is so extremely fragile that it appears to break back without having been used, but if used will break back distinctly further. There is always an element of subjective judgement in the numerical assessment of utilisation of flints, but analyses which include separate figures for used and unused implements are frequently published, and it does not seem that the subjective element is sufficient to destroy the usefulness of the method.

The most immediate result of such an examination is to show how extensively unretouched flake material was used. The same has been noticed in English mesolithic collections, and seems, in fact, to have been a normal habit among primitive flint-working savages. Our own mental outlook toward tools is coloured by the fact that we are taught by our own experience to look on tools as things that are manufactured

in advance and kept in possession so that they will be available for use when required. These attitudes may be necessary with metal tools, but they are the product of causes which were largely absent in the pre-metal ages. Some of the features of stone-age industries become more comprehensible if it is supposed that flint could usually be found lying around a settlement, and when a person required a piece to cut, scrape or bore, he (or she) either picked a suitable flake that happened to be lying about, or struck at a core until a suitable flake was detached. It is possible that at times groups of cutting implements were made up together when a particularly good flint came to hand, and the curious groups of primary flakes found at Newferry (Movius 1936, p. 24) and Dalkey Island represent caches of these that were never recovered. It is quite clear, in all events, that the simple wants of the Larnians were normally met by primary flakes - essentially debitage material, and that retouched implements were only made in exceptional cases.

The comparison between primary flakes of three kinds showing signs of use and not showing signs of use at Rockmarshall III and in the midden layer at Sutton yields the following figures.

Rockmarshall III

	Utilised	Not utilised
Leaf-shaped flakes	5	0
Blade-flakes	3	8
Others	110	119

Sutton Midden Layer

Leaf-shaped flakes	10	1
Blade-flakes	12	8
Others	32	40

This information, limited as it is, goes far enough to suggest that leaf-shaped flakes were the favourite kind of primary flake among these epi-mesolithic communities, leading blade-flakes by a considerable margin. Whether there is any significance in the greater use of blade flakes than others may be doubted, since in general the tendency seems to have been to choose well-struck in preference to badly-struck flakes, and the latter category is considerably swelled by the badly-struck. The preference for leaf-shaped flakes is emphasised when it is remembered that they are much more likely to show secondary working than any other type with the exception of rough fragments made into scrapers, and that the ensuing epi-Larnian cultures are characterised by a special development, both numerical and qualitative, of

this particular form (see Part II of the present paper). In contrast the blades, which in the ancestral palaeolithic industries were the main objective of the flaking method still in use in the Larnian, and the most favoured form for retouch as burins and a variety of shouldered or blunted-back implements, are no longer especially cared for. We face the paradox that in a method of flaking that originated for the production of blades as primary object, now blades are only produced as a by-product, and if there is any primary object in the mind of the knapper it is the leaf-shaped flake. This is perhaps an indication of the degree of degeneration that had set in.

PART I

Chapter 5 - The Distribution of Finds in Leinster

We have so far confined ourselves to a number of speculations and deductions based on the typology and apparent use of mesolithic flint material, and may turn now to the evidence from our special field of study, the Leinster coast. Here the most concentrated work has been done in the area shown on Map I, where Miss Stacpoole has concentrated her greatest efforts.

It will be convenient to consider the various localities on the Leinster coast from the south northwards. South of Dalkey there is a long stretch of eroded coast-line marked by a boulder clay cliff running from Killiney Hill to Bray. The precipitous headland of Bray Head hardly provides a place where signs of coastal occupation would survive readily, and to the south, from Greystones to Wicklow, there is a long shingle beach with blown sand and lagoons behind it, meaning poor conditions for the flint collector. The coast south of Wicklow has not been properly examined, but the coast-line at the maximum of the transgression should be running very close to the present one here, and would not survive so well as further north. No flints have been found south of Dalkey Island, but this is not a sufficient reason for supposing that their makers never extended their activities any farther south.

Recent excavation at Dalkey Island described in Chapter I, showed that a community making Larnian type flints lived there after the uplift of the land had begun, since their objects were found in humus overlying a rock surface cleared of boulder clay at the time of the maximum of the transgression. Pottery and stone axes provided a synchronism with the full neolithic period.

At the maximum of the transgression Howth Head, on the opposite side of Dublin Bay, was also an island, though it may have been accessible at low tide. During the emergence this sand dried out and much of it blew eastward onto Howth, where by piling on top of the mesolithic midden it preserved it from complete disturbance by cultivation. The surface collecting at this locality was the richest and most concentrated anywhere in the province, and the excavation (Mitchell 1956a) showed that the industry was contemporary with the maximum of the transgression and overlapped with the neolithic settlement of the country. I have only had the opportunity to inspect after ploughing the upper of the two fields in which the midden lies, but here the surface finds are confined almost entirely to the midden and immediately surrounding area, from which it seems likely that they all belong to the single occupation that formed the midden. Immediately south of the midden in the upper field is a marshy patch where presumably modern pits of some kind have been dug. It is drained by a small stream flowing westward toward the raised beach. It

seems quite likely that this marshy spot provided a spring of fresh water when the midden was occupied, and the presence of a water supply explains the particularly intense concentration of Larnian settlement at this place.

The raised beach gravels themselves between Howth and the mainland appear to be absolutely without worked flints. They were inspected separately by Mr Mitchell, Miss Stacpoole, and the author during the winter of 1956-57 when a large ditch was dug into them in connection with a sewer scheme.

Despite searching, very few flints have been found between here and Robswalls. The latter site is spread out over several fields that are too high to have been touched by the marine transgression, situated at the top of a hard limestone cliff which seems unlikely to have been eroded back any great distance since the sea returned to its present level. The site was at the end of a headland with the Malahide estuary to the north and another estuary, now marked only by a large expanse of estuarine clay and alluvium, to the south. There is no obvious sign of any water supply.

North of this a thin scatter may be found along the shores of the Malahide estuary in its seaward part, for perhaps a mile west of the town of Malahide, but the upper part of the estuary seems to be quite devoid of flints, and the flint distribution only resumes at Kilcrea. At Kilcrea, about 300 metres east of where the road debouches onto the beach an interesting section is exposed in the cliff face

for 30 metres or so.

hill wash now under cultivation	ca. 1 m.
fine lightly rolled gravel resting on boulder clay	5 - 20 cm.

The gravel may have been washed from the surface of the boulder clay, and so amount to a raised beach deposit. If so, the operation took place in a sheltered estuary where the stones were not much rolled. At the top of the gravels but under the hill-wash a number of dark patches were observed, and occasional small pieces of charcoal can be found in them. Further east, near the railway embankment, there is a layer of dark silt underlying well developed raised beach gravels. This probably owes its colour to manganese staining, and is noticeably different in appearance from the hearth layers. These hearths rest on raised beach, and their height is ca. 50-100 cm. above present day high water level. Thus a terminus post quem for the hearths would be the time when the sea withdrew from this level, probably some time in Zone VIIIa. No flints have been found associated with the spreads, but occasionally formless bits of artificially flaked flint may be picked out of the section face in the overlying layer of hill wash. Most of the flints from this townland in the Staopole collection have been found on the beach at the foot of the cliff, which extends for about half a mile from the road to the railway embankment. As far as definable they seem all to belong to the Larnian tradition. If any were originally associated with the dark

layers, they must be post-mesolithic in date, for they must date from a time well after the maximum of the transgression.

Farther east in the same townland, near the railway embankment, raised beach material has built up as a sort of shelf along the north edge of a ridge of boulder clay that was never transgressed. The flints are concentrated at the inland edge of the gravel shelf and on the ridge, but are not particularly abundant at this point.

Flints are virtually absent from the shores of the raised inlet (see Map I) north of Kilcrea, but reappear on the top of another boulder clay ridge in the townland of Corballis. At one point about two hundred metres west of where the coast road turns north the scarp dug into the edge of the ridge in order to accommodate the road shows a section comparable to that visible at Kilcrea.

Hill wash now under cultivation	ca. 1.25 m.
Fine slightly rolled gravel resting on boulder clay	5 - 15 cm.

Again I understand the gravel layer to be an eroded surface from which the pre-transgression soil has been cleared, and thus essentially a raised beach. Since it is between three and four metres above high water level, it can only have been near high tide level at the time of the maximum of the transgression. Above it, and separated from it by a thin layer of earth, lie two small spreads of periwinkle shells. For their deposition the terminus post quem must be the formation of a

layer of soil above the already raised gravel, and the terminus ante quem the beginning of the deep overburden of hill wash, possibly a product of recent intensive agriculture.

Across the mouth of the Malahide estuary extends the peninsula of Malahide Island, a formation of blown sand over and against the eastern side of a raised tidal spit. A thorough examination of several sand pits dug into the raised beach material has produced no flints whatever. A number of specimens have, however, been found along the shore, and it would be interesting to know from where they were derived. One flint of definitely Larnian appearance was found in what appeared to be a lump of blown sand held together by grass roots that had slumped down onto the present beach as a result of being undermined by a spring tide. The blown sand here rested on a solid surface, probably boulder clay, at just about the level of present day spring tides; if the flint really is Larnian and this association correct, it indicates that Larnian flints were being manufactured in Co. Dublin not only after the sea had withdrawn to its present level, but also after a considerable quantity of sand had blown up onto the exposed land surface as well. Unfortunately the evidence for such long survival is not particularly good.

Following the coast northward, flints remain scarce until the headland in the townland of Portrane is reached. Here there is a considerable concentration confined mainly to a single field, and apparently out of reach of the waves even

at the maximum of the transgression. A number of elongated stones have been found here, including three with bevels worn at the ends. It may be that there was a midden here that has been ploughed up and perhaps entirely destroyed by ploughing. There is no sign of a water supply for a settlement.

The coast between here and the village of Portrane has produced very few flints. Farther west an examination of the spot heights on the Ordnance Survey maps along the Donabate - Portrane road indicates that there must have been a considerable area flooded here between two ridges at the transgression maximum. Though the area is marked as limestone on the Geological Survey maps, drainage ditches in the grounds of the asylum show that there is a deep deposit of brown silt here which must be either a marine or an alluvial deposit, and the stream seems altogether too small to have brought it down as alluvium.

The eastward end of the headland formerly separating this now dry inlet from the Rogerstown estuary, near the tower-house at Portrane, is apparently without implements.

The Rogerstown estuary, like the one at Malahide, has a raised beach bar masked by blown sand stretching most of the way across its mouth. A small number of flints have been found along its west shore, but none in situ either in the beach deposits or in the overlying blown sand. A midden, largely of oyster shells, stratified in the blown sand, has conveniently provided dating evidence in the form of a fragment of

china. As in the other estuary, very few flints can be found in the upper part of this one, and the concentration does not resume until Rogerstown and Whitestown are reached.

At Rogerstown there is a long cliff section with a thin seam of raised beach gravel, better rolled than at Kilcrea or Corballis, capped by up to a metre of hill wash. In places there is a cemented layer of lime deposited at its base. Flints occur on the beach, but it has not been possible to find whether they come from the raised beach or the hill wash. Some are also found in the fields along the shore, where they obviously derive, in the first instance, from the hill wash. The scatter in the fields continues through Whitestown on to Rush, where, though the site is a headland of solid limestone that is unlikely to have been much eroded, the scatter is nowhere intense. Between Rush and Kenure there is another area masked by blown sand, but a point along the cliffs where there are the ruins of a megalith (probably a passage-grave with a long rectangular chamber - see Hartnett (1957), p. 268) in the townland of Kenure, has produced the most intensive concentration known in the province after that near the midden at Sutton.

The concentration occupies an area of three or four fields, bounded on the north by a dry valley that must have been a small inlet at the time of the transgression maximum, and seems to be greatest in the immediate area of the megalith. Two polished stone axes have also been found here. It

is not possible to say whether the Larnian occupation preceded the building of the megalith or not, and it is probable that any primary stratification there may have been entirely destroyed by cultivation. Excavation under the field wall and under the remains of the megalith itself, which is incorporated in the wall, might do something to clarify the problem. Certainly the well exposed cliff section at the edge of these fields and close to the megalith gives no indication of a shell midden or of any occupation layer below the cultivated earth.

Kenure marks the northern limit of the area intensively examined, but there remain the two islands, Ireland's Eye and Lambay. A few flints have been found by Mr Mitchell on the former, but one would hesitate to assign them to any culture. Some on Lambay do, however, seem certainly in the Larnian tradition. They were found in cultivated fields; the raised beach gravels that fringe the south-west corner of the island seem sterile.

Farther north, though work has been less intensive, it seems clear that the distribution of flints originally continued up to Carlingford Lough with much the same frequency. Miss Stacpoole reports a number of fields with flints between Kenure and Balbriggan. North of Balbriggan there is a long stretch where the raised beach has been undercut and washed away by subsequent coastal erosion, followed by a stretch where blown sand has accumulated, the two stretches reaching

to Clogherhead. Just north of the village of this name there are, however, a number of fields with many Larnian flints. Between the headlands of Clogher Head and Dunany Head there is much blown sand, but in places flints have been found; there are a few more near Annagassan. The rest of Dundalk Bay has, so far at least, been found completely barren, and this includes the raised tidal or delta spit of Soldiers' Point. It is only some distance eastward along the north shore of the bay that the flint scatter appears to resume. At Rockmarshall some middens were excavated as described above, and in adjoining townlands a certain amount of similar material now in the T.C.D. collection has been found on the surface. My own researches have failed to find any indication that the scatter is present at the outer extremity of the Carlingford peninsula, but it is doubtful whether they were pressed far enough for this to be of any importance. At Greenore, however, there is a considerable area of raised beach where flints have been found in large numbers in fields. It appears that they are derived in a well rolled state from the top layer of the raised beach. The lower layers, as exposed in the cliff along the present shore, do not seem to contain implements. Apart from the few implements found in the raised beach in the immediate vicinity of the excavated middens, this is the most southerly point where the gravels themselves have been found to contain implements. It is not possible to say exactly when this top layer was formed; it may be entirely

a storm beach heaped up during the regression, but the abundance of rolled and the rarity of unrolled implements, does suggest, however inconclusively, that the occupation took place during a late stage of the transgression rather than at an early stage of the regression.

Let us now return to the area of particularly intensive work in north Co. Dublin. We have described a number of sites where the scatter of flints spread generally along the shore, is particularly intense - at Sutton, Robswalls, Portrane and Kenure. A table may be compiled to compare these sites, indicating the numbers in the more significant classes and the total number of implements suitable for typing and counting. This, of course, was only a small proportion of the total number collected by Miss Stacpoole, some of which were post-Larnian and many indeterminable. All implements which appeared to be Larnian are counted in the totals, except for primary flakes without battered butts, which were felt not to be sufficiently characteristic to distinguish between Larnian and non-Larnian specimens. For purposes of comparison comparable figures from the excavated middens are added.

	<u>Rough Scrapers</u>	<u>Barn Flakes</u>	<u>Leaf-shaped Flakes</u>	<u>Cores</u>	<u>Total</u>
Kenure	9	2	28	89	320
Portrane	9	5	7	91	293
Corballis	7	0	11	17	116
Robswalls	8	0	7	138	269
Sutton	3	3	22	65	-

	<u>Rough Scrapers</u>	<u>Bann Flakes</u>	<u>Leaf-shaped Flakes</u>	<u>Cores</u>	<u>Total</u>
Rockmarshall I	1	2	55	7	-
Rockmarshall III	0	2	5	4	-
Dalkey Island (south midden)	2	2	11	4	-
Dalkey Island (north midden)	0	1	6	5	-

No figures are given in the total columns for the middens because there was no need to select the material, and so the totals are not comparable to those from the surface collection. A fuller account of the material from Dalkey Island and Rockmarshall is given in the appendix.

Examination of the table shows that the implements are not divided between the different classes by any means identically at the different sites. The variation is greater than one would expect from a series of random samples taken from a pool of the total material. Corballis has more than its share of cores. Portrane more than its share of Bann flakes. Cores are rarer at all the middens except Sutton than they are at the surface sites. Nevertheless there is a certain basic similarity underlying the figures from all the sites. To this may be added the similarity in technique - the use of beach pebble flint, the blade technique, the wide striking platforms, prominent bulbs, and heavily battered butts that help to define the Larnian. Taken together the industry from these sites forms

a sub-group within the Larnian confined to sites from Rockmarshall southwards.

The material from Greenore is slightly different. The implements are distinctly better struck and from larger blocks of flint, the proportion of leaf-shaped flakes to blade-flakes is lower, and there are none of the largest and best Bann flakes. The fact that the entire collection is rolled, while no flints at all have been found in the corresponding raised beach formations farther south, suggests that this material is slightly older than that from Leinster.

It is impossible to draw up a completely accurate account of the material because the edges are so badly abraded that retouch cannot always be distinguished, but a table is given with some reservations in appendix A. There is a site in Greencastle townland, on the opposite side of the entrance to Carlingford Lough, where a flint industry very similar to that from Greenore can be found on a boulder clay ridge immediately overlooking a stretch of raised beach gravel. We may take this to be the most northerly point in our area of special study. Antrim and the rest of Down had already been well searched by the old collectors. Before drawing these various lines together in the form of conclusions, we should give some special thought to the economy of the coastal Larnian inhabitants.

PART I

Chapter 6 - Economy

One of the things which Archaeology shows us best is the basic economy of extinct societies. In the case of the Larnian inhabitants of Ireland we are justified in assuming their mode of life a priori to be food-gathering and not food-producing, for food production is known to have been introduced to western Europe by the movement of a new people from the Mediterranean or west Asian region. The first indication of the economy of the Irish mesolithic population comes from the distribution of their relics, which are so firmly tied to the coast that there can be little doubt that the shore dominated their existence and the interior was of little interest to them. The food refuse at the primary sites that have been discovered indicates a heavy dependence on the sea. Of course all these sites date from a time when neolithic settlers had reached Ireland and were perhaps known to the midden inhabitants, but as there is no sign of neolithic influence at Rockmarshall or Rough Island, it seems fairly safe to assume that these middens at least, faithfully reflect the aboriginal Larnian economy. The food refuse consisted almost entirely of shells - limpets being the main food at Rockmarshall, Sutton and Dalkey Island, oysters at Rough Island. Presumably the proportions of different kinds of shellfish was a purely local

question determined by the available supply. In the lower lagoon silt at Cushendun (Deposit E), some fragments of wild pig (Sus scrofa) and cod (Gadus morrhua) were incorporated along with a few flint implements, all in secondary position (Movius 1942, p. 128). It is possible that the wild pig was washed down by the stream and the cod remains washed up by the waves, but Movius considered that all these remains were derived from a Boreal settlement site on the edge of the lagoon. If this opinion is correct (which cannot be proved) it would be of great interest, as it would indicate that both hunting and off-shore fishing from boats were known to the early Larnian inhabitants of Cushendun, cod being a fish that is not usually caught from the shore. Unfortunately it will not be possible to settle the question of what fish were caught by the Larnians until a substantial quantity of fish-bone is excavated from a midden that is demonstrably early enough to have been uninfluenced by neolithic innovations. In view of the fact that a knowledge of boating can be inferred from the presence of certain fish remains (see Clark 1948), and the question of boating along the western coasts of Britain in pre-neolithic times is important to our understanding of the original mesolithic settlement of Ireland, the land bridge with Britain, the degree to which the Larnian was isolated from British and European developments, and the flint supply of mesolithic

Scotland, obtaining this information should be one of the major aims of future mesolithic studies. Two double-ended bone points from Rockmarshall I have been claimed as possible gorges (Mitchell 1947), but of course these might have been used for fishing off the rocks.

In addition to the shellfish and small quantity of fish and crustacean remains not further identified, and too few for any useful conclusions to be drawn from them if they were, the middens have produced a few mammalian bones which are not without interest. Red deer (Cervus elaphus), so common on Chanian sites, is not represented at all. Wild pig (Sus scrofa) is only represented by the possibly natural remains at Cushendun, and at Sutton - according to the report by a large and a small specimen. The remainder are not game animals:- a small cetacean, most probably the common porpoise (Phocoena phocoena), and fragments from a small young carnivore, most probably a fox or cat, from Rockmarshall I; part of a human femur from Rockmarshall III; hare and birds, one of them probably a large gull, from Sutton. They are a mixed lot, and so far as they indicate anything at all, suggest scavenging rather than hunting. The porpoise might have been washed dead onto the beach, and perhaps the young animals were not sufficiently active to escape when encountered by chance, and so made a welcome addition to the larder. Of particular interest is a dog radius from the midden at Sutton, and a dog phalange

from the turf line under the midden and therefore well stratified. They are said to represent an animal about the size of a sheep dog. Unfortunately at Sutton neither the evidence for dog nor for hunting (the pig bones) can be taken as certain proof of the presence of these factors in the original mesolithic culture, as the midden is known to have been contemporaneous with neolithic settlement in the country, and anything found there may have been acquired from these immigrants. This would also apply to a sheep horn core from Sutton, if the author's identification of this rather damaged pair of fragments is correct. For further discussion of the significance of this find the reader is referred to Part III of the present paper. The south midden at Dalkey Island seems as we have said, to contain a purely neolithic collection of animal bones, and so casts no light on the economy of the Larnian proper. The finds from the north midden still await authoritative identification.

It ought also to be possible to draw some conclusions concerning the economy of the period from its flint implements. Generally the uses of these articles are too conjectural, or too commonplace, to be of such use, but it is clear that the microliths that are known on various evidence to have armed the hunting weapons of contemporary British and continental tribes, are so rare in Ireland as to be virtually absent. There are four from Cushendun, two

doubtful specimens from Larne, and one from Rough Island; and only one, the possible trapeze from Larne, is of a type known to have been a hunting weapon in other places. The Bann flake, apart from being fairly rare in the pure Larnian, seems on account of its usual asymmetry unlikely to have been a spear point, and there is nothing else that seems at all likely to have served as a hunting weapon. We may conclude that the evidence from the middens and the distribution of finds to the effect that hunting played a negligible part in the mesolithic economy is entirely corroborated by the evidence from the flint industry.

Movius has put forward the suggestion (Movius 1953, p. 79) that "In the Early Larnian the economy apparently consisted of hunting, fishing, fowling and collecting activities in a forest-fenland kind of environment. But in the Late Larnian a coastal type of existence, mainly based on the collecting of edible molluscs and fishing, seems to have been adopted". Movius' description of the Late Larnian economy is quite correct, but it should be noted that there is no evidence whatever of the early Larnian economy which he supposed existed on the now flooded floor of the North Channel. I shall later give some reasons for suggesting that it may not have been very different from the late Larnian economy.

P A R T I

Chapter 7: The Coastal Cultures - Summary

Let us now set out briefly what we can draw out of the preceding chapters with a minimum of speculation.

In the late glacial and early post-glacial times the sea stood considerably lower than it does at present owing to the vast quantities of water, taken ultimately from the sea, that were frozen up in the ice-sheet. Britain was connected with mainland Europe, and it is likely, but not directly demonstrable, that Ireland was also connected with Britain, so that many of the plants and animals of the country arrived by land after the melting of the ice-sheet from Ireland. Toward the end of the Boreal period, it seems that the rise of the sea became much slowed down, so that local land movements of no great range became noticeable, and different parts of the west European coast follow their own sequence. Along the north-east coast of Ireland the marine transgression reached about its present level in the late Boreal or early Atlantic period, and attained a somewhat higher level at the end of the Atlantic period. At this point the rate of land uplift came to exceed that of the rise of sea-level, which was now much retarded, and the regression began. Man may have entered the area at an early period by a land bridge, if such ever existed, but there is

no evidence of his existence until the sea was at approximately its present level, in the later part of the Boreal period. The presumption is, therefore, that if he was in the region any earlier, he was only to be found in the old coastal areas that are now submerged.

The excavated sites can be fitted into a rough time sequence - early Larnian dating from the late Boreal period at Cushendun deposits D - F; late Larnian dating from the Atlantic period at Cushendun deposit B, Glenarna, Larne, Island Magee, Rough Island raised beach; and late or epi-Larnian dating from the Atlantic/Sub-boreal transition or the Sub-boreal period at Rockmarshall middens I - III, Sutton, Dalkey Island, Rough Island midden, and in the case of the unrolled material at the top of the raised beach at Glenarna. Only a small degree of change or development can be seen in their flint work over this period of ca. 3,000 years. The early Larnian shows a more skillful technique of blade production and a more discriminating choice of raw flint than the late Larnian, which is remarkably coarse and shows a tendency to large pieces in the regions where large lumps of flint were obtainable. In the epi-Larnian there is an increased tendency to leaf-shaped forms and greater use of retouch, including inverse retouch. Regional variation is perhaps more noticeable than chronological variation. This can only be seen at the Atlantic/Sub-boreal transition and immediately afterwards, when the maximum of the transgression left a sort of high water mark of flint

implements along the coast of Ireland. In Co. Antrim the flints tend to have a high proportion of large coarse forms and of fairly large stubby but regular blade flakes; in Strangford Lough there are some assemblages of much smaller size from the same period (such as were mistaken for early Larnian at Rough Island), but the large sized industry is also present, as may be seen from an examination of the Kirk collection in the National Museum of Ireland. Around Carlingford Lough an industry appears in which the flakes tend to be rather longer and narrower, and in which there is a better leaf-shaped element. From Rockmarshall to Howth there are abundant unrolled remains of a Larnian industry noticeably more carelessly struck than in the Carlingford industry, in which there is a high proportion of pebble cores. All this variation in the flint industry of a single culture at a single period, illustrates one of the pitfalls in the study of Pre-history through flints, and if there had been no evidence of chronological contemporaneity and of essential unity in their way of life, it might have led to a rich variety of Carlingfordian, Strangfordian, Suttonian, etc. 'cultures', which the prehistorian would undertake to set in chronological and developmental sequence. Students of scattered and undated microlithic industries should take note!

The extreme range between which Larnian flints have been found near the coast is from Greencastle, Co. Donegal to Dalkey Island, but they are only found rolled and actually

incorporated in extensive beach deposits from Greencastle to Greenore, Co. Louth, and have never been found in deposits of early Atlantic or earlier age except in Antrim and Down,⁽⁹⁾ though this may only be because early deposits are only occasionally accessible. The absence of flints from all raised beach deposits south of Carlingford Lough seems, however, to be pretty certain. It seems, therefore that only north-east Ireland was inhabited during most of the mesolithic period, and the spread into Leinster only belongs to the Atlantic/Sub-boreal transition.

The essential characteristics of the Larnian flint industry can be listed as follows:-

- (a) It is a blade industry.
- (b) Retouch is rare and flat retouch absent.
- (c) The technique of flake production is unusually crude.
- (d) Clear examples of such normal mesolithic tool types as microliths, burins, horseshoe scrapers, and transversely sharpened core axes, are absent.
- (e) Retouched forms consist almost entirely of notched flakes, roughly made scrapers, and perforators.

As an industry it stands very much on its own. It has no obvious parallels, and there is very little internal typological evidence to indicate its descent from any other west European industry. Thus its relations have always had to be discussed on more general grounds. This has been done by

looking for possible candidates in the final palaeolithic or early mesolithic period, and choosing the one which non-typological considerations make the most likely. The few concrete typological clues will be summarised now, though full discussion will be postponed until after the survey of comparative material in Part III.

- (a) The Larnian is definitely a blade industry.
- (b) It possessed in small numbers an abnormal and probably degenerate form of core axe.
- (c) It possessed also a very small number of microliths, whose forms may best be paralleled in the final Palaeolithic or very early Mesolithic of Wales.
- (d) The primary occupation sites have yielded a series of pebbles brought to a blunt convex ridge at the end. These have approximately contemporary counterparts at many points on the west coast of Europe, but there is no evidence that they were an original feature of the Larnian.

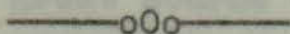
The surviving equipment of the Larnian culture consists only of these flint and stone tools. The only exceptions are two probable gorges from Rockmarshall III and some indeterminate worked wood from Toome Bay (see Part II below). Since five shell middens with bone tolerably well preserved have been excavated with the discovery of only these two bone tools, it

seems reasonably sure that the Larnians made very little use of bone as a material for tools. It is unlikely that bone artifacts of Obanian type will make an appearance if they have not done so yet.

The middens have given us a picture of a strand looping and probably scavenging people. Hunting, for which they were not equipped, played a negligible role in their life, but need not have been entirely unknown. In general they were dependent for food on what the shore provided in the way of fish, crabs, and above all molluscs. Fish were probably sometimes caught with gorges; perhaps also with traps. There is, in fact, no evidence yet as to what food gathering techniques the people were acquainted with. On other subjects such as shelters, boating, ritual, physical type, we suffer from a similar lack of evidence. A possible inference from the unimportant position of hunting is that leather was scarce and clothing consequently scanty, an important point in trying to reconstruct in the imagination a picture of the cultural status of an extinct people.

There is known to have been contact between the neolithic folk who immigrated in the third millenium and the mesolithic aborigines. The latter continued to occupy the coast for some time - perhaps some centuries - after the former appeared. There are indications that they assimilated cultural traits from the newcomers - first stone axes as at

Sutton and the northern midden on Dalkey Island, later domestic cattle and pottery, as in the southern midden at the same place. On the evidence of the pottery, these folk were supplanted quite early in the neolithic period at Dalkey Island. Mesolithic survival is more abundantly attested in the interior of the country, to which we shall now turn.



Made in north-west Ireland. The collections are once again to thank, and the great source of material was the Ross valley, and particularly the mud that was being dredged from the bed of the river to a lough through a narrow channel. In 1867 John Evans first published the fact that implements were to be found in this region, after he had discovered the richness of Treen Bay (Evans 1867). The collection was made, and it was discovered that finds were often in connection with the layer of diatomite which was laid down in a considerable area around Lough Beg and the outlet of the lake at a time when the area had been, at least partially, flooded (Jackson 1899). The most impressive of the many collections was that of W. J. Meade, who has also published the best and fullest general account of the material (Meade 1912).

In the early 1930's Whelan discovered at Treen Bay a quite different flint industry associated with some peat which underlay the diatomite. He published the final version of his views on this site in 1934, where he remarked

P A R T II

INLAND CULTURES

Chapter 1 - Previous Investigation

As in the case of the cultures discussed in Part I of this thesis, the first of the inland discoveries were made in north-east Ireland. The collectors are once again to thank, and the great source of material was the Bann valley, and particularly the mud that was being dredged from the bed of the river in a Lough Neagh drainage scheme. In 1867 John Evans first published the fact that implements were to be found in this region, after he had discovered the richness of Toome Bay (Evans 1867). The collectors congregated, and it was discovered that finds were often in association with the layer of diatomite which was laid down in a considerable area around Lough Beg and the outlet of Lough Neagh at a time when the area had been, at least periodically, flooded (Jackson 1909). The most impressive of the many collections was that of W. J. Knowles, who has also published the best and fullest general account of the material (Knowles 1912).

In the early 1930's Whelan discovered at Toome Bay a quite different flint industry associated with some peat which underlay the diatomite. He published the final version of his views on this site in 1938, where he remarked

on the "marked Aurignacian facies" of the industry and indicated that Erdtman had dated it pollen analytically to the Boreal/Atlantic transition. Thanks to his discovery a complete pollen diagram through the peat was done by Jessen (Jessen 1949) and in 1951 a small but important ^{excavation} was carried out by G. F. Mitchell, which obtained fuller information about the archaeology and stratigraphy of the place (Mitchell 1955).

In 1935 a full-scale excavation of a site in the diatomite discovered in commercial digging was carried out by Movius, with attention to the Palaeobotany by Jessen (Movius 1936). Here a flint industry with typical Bann flakes was found, together with stone axes, and sherds of late neolithic pottery lay at the same level near by. Jessen's work showed that the date was Sub-boreal. Newferry is the only site where material of the Bann culture has been both found in primary position and properly published.

More recent dredging on the Bann has produced a series of bone implements that appear not to have been observed before (May 1939; Whelan 1952). They have come from the bed of the river at the 'Cutts' a little above Coleraine, and Whelan considered that there was "strong presumptive evidence" for their being associated with Bann flakes, as at one site the material, though generally abraded, contained an unabraded group with some of each. At any rate they are unlikely to be chronologically mesolithic as some have been tentatively identified as made of ox bone by Dr Wilfred Jackson (see Whelan

1952 appendix, and May 1939). Many are pointed at both ends, and May has remarked that some are slightly grooved around the centre, which suggests they were gorges; however, since some reach the length of 20 cm. they cannot all be gorges. Whelan has suggested various uses both for the double and the single pointed types, and describes interesting ethnological parallels. In view of the uncertainty of their dating I do not intend to deal further with them here, and they remain one of the unanswered riddles of the Bann. (10)

Dredging in other rivers also has produced a great deal of material of all ages, including a quantity that can be assigned to the Stone Age on typological grounds, but no site approaches the Bann in richness. Thanks to the efforts of the late Dr Adolph Mahr, much of this material has found its way to the National Museum, and a description of sites and material has been published (Mahr 1937, pp. 290 ff.). The most important sites were on the Shannon, especially at Killaloe, where a hydro-electric dam was being constructed, and on the Barrow between Athy and Monasterevin, but similar material has been found in small quantities near water in many parts of the country. Excluding the metal and other obviously late finds, the material consists of polished stone axes, occasionally of very large size, and very occasionally of stone clubs. Mahr considered that the axes were of a particular 'Riverford' type, being most generally implements of layered sedimentary rock, usually slate, which

appeared to have obtained their original elongated shape naturally and to have been only partially chipped and polished. In Mahr's view the concentration of these implements at fords and the outlets of lakes indicated scenes of particularly intense fishing activity, perhaps in the form of seasonal 'drives', and that the people responsible for the axes were the same as the people responsible for the Bann flake culture as excavated at Newferry, though the collections from river beds outside the Bann drainage area did not at that time include any industry in flint or chert. Mahr's comparison of the very few Irish clubs that accompanied the axes with Finnish parallels in stone, Ertebølle parallels in wood, and Gravettian parallels in bone, and his conclusion hence that the concentrations of implements at these points were caused by a spread of the north European Forest Culture (borne by tall Nordic invaders, of course!) and was therefore in origin mesolithic both culturally and chronologically, may appear to us quite unsound, but his observation that the distribution of these sites tallied remarkably well with the distribution of the kingdoms of the Cruithni as drawn up by Eoin MacNeill on literary evidence, gives us an interesting indication of the latent interest in combined archaeological and philological studies (Mahr 1937, p. 328 ff.).⁽¹¹⁾

During the years that followed Dr Oliver Davies carried out field investigations in the lakes district of south Ulster with characteristic energy, and a trickle of material

with possibly mesolithic affinities reached the National Museum from other sources. Attention was called to finds of Bann flakes by Davies (Davies 1942) and Raftery (Raftery 1944). These and further finds were discussed and related to the coastal Larnian by G. F. Mitchell in a review article on Mevius' book The Irish Stone Age. By far the most notable discoveries, however, were those which in 1952 accompanied the draining of Lough Gara. At present only a single short article has appeared in a learned journal (Cross 1953), but the material with which we are concerned here consists of stone axes (often of 'Riverford' type) and a chert industry which includes Bann flakes. It is found spread over the foreshore exposed by drainage, and especially in concentrations associated with scatters of stones, sometimes with sand, piles driven into the marl, or horizontally lying timbers. These are considered by Mr Cross to be rude crannogs.

This concludes our brief survey of the research that has been done on the inland cultures.

P A R T II

Chapter 2 - Finds of Bann Culture MaterialThe Bann Valley

The finds come mainly from the area extending from the outlet of Lough Neagh to the mouth of the Bann, and have been found usually either in or near the lower River Bann itself. Collecting was intensive in the late nineteenth and early twentieth centuries, but little opportunity for systematic investigation has presented itself. Owing to the homogeneous nature of many of the finds and their very real concentration in this area, similar material every where is generally described as belonging to the Bann culture. The literature includes Evans (1867), Jackson (1909), and Knowles (1881) but the best general description of the material is Knowles (1912).

This last paper is essentially a description of Knowles' collection, which has now unfortunately been dispersed. The collection includes a large number of leaf-shaped flakes, many of which have been trimmed on the sides of the base or even tanged. The latter two types are generally referred to as Bann flakes. There are also Bann flakes with notches worked into one or both sides, narrow rods steeply dressed on one or both sides, (similar to those later described as microliths by May and Batty (see Batty 1938; May and Batty

1948). The collection also included a number of scrapers and pieces of neolithic type and pieces with flat retouch, but these are not numerous when compared with the flakes retouched in typical Bann manner. Of particular interest is the large group of core implements. These include a variety of picks and axes and heavy core points similar to those of the coastal Larnian, but sometimes considerably better made with regular shape and straight keels up the sides. Some axes are partially and some totally polished. There are also blade cores. There are many stone axes, some of which are of clay-slate and can be described as of 'Riverford' type. There are finally a number of polished stone implements which resemble clubs, picks, or chisels, some of which, as well as some of the axes, reach very large size. Though flint was the material generally used for the flake industry, implements of chert occasionally occur, my illustration 139 being made of this material. This recalls the parallel chert industry of the central lakes district, but since Carboniferous chert occurs a little west of the Bann in Co. Londonderry, it cannot be taken as evidence for contact with the former region.

The Bann flakes, the blade cores, and the unpolished core tools can be paralleled on the sites of the coastal Larnian culture; the polished stone axes, the pieces with flat retouch, and some of the scrapers, fall readily into an ordinary neolithic context; but the 'microliths' and some of the more abnormal stone implements seem to be nearly unique.

Newferry (Movius 1936)

It was already known that many of the Bann valley finds came from the layer of diatomite found at the outlet of Lough Neagh and around Lough Beg. Finds often came to light in the course of commercial digging, and in 1935 Dr Movius of the Harvard Archaeological Mission was able to excavate a site where such finds were made. He found spreads of ash both stratified in and at the base of a layer of diatomite that Jessen was able to date by pollen analysis to the Sub-boreal period. In and around the hearths there was a flint industry of Bann type which included Bann flakes and completely lacked anything of neolithic type. There were also two short flat polished axes of some hard igneous or metamorphic rock, not basalt, one poor axe of decalcified limestone, two axe chips, an axe polisher of sandstone, and two worked pieces of slate. The latter (see no. 132) appear to have been chipped all around to give them the shape of Bann flakes, and to have been thinned at the butt on both surfaces by the removal of some rock on either side. The hard stone axes are of rather unusual shape. It is hard to believe that the axe of decalcified limestone can have served any useful purpose, but it cannot be overlooked that when ground the stone may have been much harder than it is today.

The finds (in the Belfast Municipal Museum) may be set out as follows:-

Waste Material

Small chips and flakes	ca. 100
Good primary flakes	93
Leaf-shaped primary flakes	32
Core fragments	3
Bulbless portions of flakes	17

Finished Implements

Bann flakes	23
Strong flake points	15
Notched flakes	2
Leaf-shaped flakes with working elsewhere than on butt	6
Flake with slight tanging	1
(excluding the small chips and flakes)	Total
	<u>292</u>

Both fresh and glacially smoothed flint were used as raw material.

The industry seems to be incomplete or one sided. There are no well formed cores, no decortivating flakes, and large well shaped flakes, including the leaf-shaped variety, seem to make up a larger proportion of the material than they usually do on occupation sites. Three clusters of well formed flakes were found, two of which are illustrated in Fig. 2 of Movius' report. On previous occasions such clusters had been taken as evidence that Bann flakes were

hafted as multiple-pronged fishing spears, but the fact that the flakes here were clearly unsuitable as spear-heads seems to rule this out. A cluster of particularly good flakes was also found during the excavation of the epi-Larnian site on Dalkey Island, and it seems most likely that they were merely bundles of flakes struck at some other place and brought out to the sites. This would explain the lack of balance in the industry at Newferry. Perhaps the chips and fragments came from flaking up this flake material further.

The most notable point indicated by the table is that leaf-shaped and Bann flakes make up a much larger proportion of the total material than they did at any of the coastal sites. At Newferry they made up about one half of the finished implements and about one eighth of the total material (excluding the small chips and flakes) which is a very much larger proportion than at any of the coastal middens or sites of the Stacpoole collection. This may be in part due to the absence of debitage material from the early stages of flaking and to the deliberate selection of useful flakes to take out to the site on the flats, but the number of well made leaf-shaped flakes and Bann flakes is still so noticeable that it suggests that it was an essential feature of the industry, and this receives support from other sites that will be described, and from the Knowles collection.

The implements described here as 'strong flake points' and by Movius as 'fabricators' are unusual (Movius 1936, fig.

3, 14-17), and so far as I know the only other example came from the north midden at Dalkey Island. They are not described by Knowles. They are thick pointed flakes that have been worked secondarily down the sides, often inversely, over most of their length, by the removal of rather large secondary flakes. Movius compared them with the upper palaeolithic lames écaillés which are considered by French typologists to have been used as tools for trimming other flints, becoming scaled themselves in the process. It does not seem right to explain by far the greatest quantity of secondary working at Newferry as merely the by-product of other trimming; moreover these implements have been definitely worked to points; such illustrations of upper palaeolithic lames écaillés as I have been able to compare suggest a much lighter form of scaling. Movius' two implements described as 'side scrapers' (ibid. fig. 3, 18-19) seem to be broken or aberrant examples of this type, and true scrapers are absent from Newferry.

Commercial digging nearby has produced sherds of neolithic pottery said to be associated with hearths and with the same flint industry as Movius excavated, from the base of the diatomite only a short distance from Movius' site. One (or possibly two almost identical) pots are represented by several rim sherds and a good part of the wall of the pot (Movius 1936, fig. 6 and Pl. VIII). It is a plain bowl with no shoulder and has a somewhat, but not very, elaborated rim form. About two centimetres below this is a pinched out

pseudo-cordon, which looks as if it could be a version of a shoulder pushed right up almost to the rim, with the narrow band between it and the rim imitating in miniature the cavetto neck of Peterborough pottery. It is decorated by short scorings or impressions on this rim, and also by long parallel vertical scorings both inside and outside the body of the pot. Childe (in Mevius 1936) has pointed out rather generalised parallels with the grooved decoration and rim mouldings of some of the Eilean-an-Tighe pottery. Really the pot is without precise parallels. The outstanding features are (a) its unusual variation of the developed rim (b) decoration by long parallel scorings, and (c) horizontal lugs. I know of no pot which combines all these features. Some pottery from Dalkey Island has the long parallel scoring and the horizontal lugs, and scoring runs up onto the lugs in the same way that it does on the Newferry pot. This Dalkey group also seems to have had heavy developed rims, though not of quite the same form as the Newferry pot. Unfortunately it is not certain what place it takes in the Dalkey Island series, nor even whether it belongs with a neolithic or with a Larnian flint industry. It seems, however, to be the nearest present parallel to the Newferry pot.

Lough Enagh (Davies 1940)

This site is an island in a small lake near the head of Lough Foyle. The lowest archaeological layer was a turf line of brown peaty soil sealed by a gravel layer containing cord-ornamented hollow-necked pottery with heavy rims, similar to

that found at Island MacHugh and other northern sites, and considered to be late neolithic. The turf line contained a few potsherds of less decorated type, flint hollow scrapers, and four leaf-shaped flakes of typical Bann type (Davies 1940, fig. 5, nos. 18, 39, 45). It is not necessary to suppose that all the material from the turf line, which may represent merely sporadic occupation on the island without any accumulation of earth, all belongs to a single occupation. Hollow scrapers belong to the intrusive neolithic flint industry and the evidence from this site is not sufficient to prove that they belonged to the same industry as the Bann flakes, since at other sites these always appear to have been part of a blade industry with Larnian affinities. Unfortunately all the finds from here seem to have been lost with the disappearance of the Londonderry Museum, to which Dr Davies had presented them.

Mullaghanny, Co. Donegal (Davies 1948)

A number of flakes that seem in the Bann culture tradition have been found by the Londonderry collector, Mr Lowry. Included is a good Bann flake (Davies 1948, illustration E) found in Mullaghanny.

Lough Eskragh, Co. Tyrone

I have to thank Mr A. E. P. Collins of the Northern Ireland Archaeological Survey for information about this at present unpublished site. Bann flakes have been found in possible, but not certain, association with late bronze age finds.

Creevykeel, Co. Sligo. (Hencken 1939)

Near the east entrance to this court cairn a number of pieces of worked chert were found. One (Hencken 1939, fig. 6B) looks as if it might quite well be in the Bann flake tradition, but as the implement appears to have been lost it is not possible to insist on this point from the illustration alone. For this reason Creevykeel is not shown on Map I.

Annagh-ma-Kerrig bog, Co. Monaghan (Davies 1942;
Mitchell 1949)

A particularly large Bann flake of flint, which is still in private possession, has the legend 'found in Annagh-ma-Kerrig bog' written on it. This is in or near the townland of Mullaghmore. Mr Mitchell's illustration (Mitchell 1949, fig. 3) shows it to be of the tanged kind.

Urlaur, Co. Mayo

This implement may be seen on display in the National Museum. It appears to have been retouched in the neolithic manner, and though the implement may originally have been a Bann flake, it cannot by itself be taken as evidence for Bann culture settlement at the locality where it was found, and so it is omitted from the distribution map.

Drumanone, Co. Roscommon

This site is a portal dolmen excavated recently by Mrs Topp and not yet published. It is significant as providing the only satisfactory dating evidence for inland Bann flakes apart from Newferry. The finds were:-

(a) a well formed Bann flake of flint, slightly trimmed on both sides of the butt and bearing other secondary working.

(b) the distal end of a broken chert flake, which may have been a second Bann flake.

(c) a polished stone (? slate) axe.

(d) two round pebbles of quartz 2-3 cm. in diameter.

Unfortunately no pottery was found, but the site leaves little doubt that Bann flakes were in use near Lough Gara in the late neolithic or early bronze age when the cult (no burial was found) that involved the construction of dolmens was in vogue. The finds are in the National Museum of Ireland.

Lough Gara (Cross 1953)

This site has only been published in brief preliminary form, and the following account is based largely on Mr G. F. Mitchell's field notes which he has kindly placed at my disposal, and on my own recollections of assisting him in the field there in April 1955.

The drainage of the lake in 1952 showed that a large quantity of prehistoric material had been lying on its bottom near the shore. There were a number of typical bronze age or later crannogs, and a certain amount of loose bronze age and later material was scattered about. There were also over a hundred patches of gravel or stones, sometimes with sand, timbers set upright in the mud, timbers lying flat, or stones, in at least one case set as a sort of surrounding wall. These

were described by Cross as a type of crannog, earlier than the other, and dated by the chert industry of Bann type and stone axes that were found concentrated on them, and also scattered about the recently exposed foreshore.

There are reasons for thinking it unlikely that the gravel spreads and chert industry are in primary position. If the occupation had actually been on the marl surface during a time when the lake was low and the marl was exposed, there would have been signs of tramping and disturbance around the spreads, discolouration by organic refuse, and probably also by the growth of vegetation. On the other hand if there had been pile dwellings over deep water none of these conditions need have arisen. Nevertheless the fact that material of different ages did occur on the same surface suggested that the sequence had been condensed and the present surface of the marl was an erosion surface - though when the phase of erosion took place is still a mystery. The question whether the material is in primary position or not has a vital bearing on its date, because at Coolnagranshy a particularly fine example of the gravel spreads with which Bann flakes etc. are found was investigated pollen-analytically by Mr Mitchell. It rested on shell mud accumulated during the late Boreal period (Zone VIc). Another scatter situated in a bay between the townland of Lemcloon and Pawnymucklagh, though not dated directly, can, if in primary position, be given a terminus ante quem because fifty metres away at the margin of the bay

the deposition of chalk mud ceased and drift mud began to form late in the Boreal period, and it is unlikely that the same change in sedimentation was much delayed where the stone and gravel spreads were found. Thus if the scatter was deposited on marl this would only have been possible before the end of Zone VI.

A number of pieces of charcoal were found here at a late Boreal horizon in the drift mud. The pollen diagram gives no indication of a forest fire, but this negative evidence is not necessarily conclusive indication that the charcoal comes from human settlement. A very restricted conflagration in the tangled undergrowth surrounding the lake could have provided enough charcoal, especially with the aid of an offshore wind, to drift all over the lake, but would not have been observable in a pollen diagram except in its immediate vicinity, if there.

If, as we shall suggest in the next chapter, the chert industry and associated axes belong to the Sub-boreal period, the bay between Lomcloon and Tawnymucklagh must, at the time when their makers lived there, have been covered in peat that has subsequently been eroded away. In that case the Lomcloon and Tawnymucklagh settlement was a bog settlement comparable to that which produced beaker and other pottery at Rockbarton, Co. Limerick (Mitchell and O Riordain 1942) or observed in a valley near Carrowkeel (Mitchell 1951, p. 162). The piles might be posts which were driven into the underlying marl

on the sites, for pines are extremely rare, but were much

through the peat, or which had sunk under their own weight to a lower level than they were placed at. The same explanation may extend to the other gravel spreads, and we should perhaps imagine at Lough Gara a series of bog settlements that have been dropped onto the eroded marl surface as a result of the cutting back of peat cliffs at the edge of the lake during a phase of low lake level. This is preferable to the picture of pile dwellings. A third possibility is that the posts are the remains of later structures, as for example fish traps, and have nothing to do with the finds of early artifacts.

The special significance of Lough Gara is that it is the only site outside the Bann valley where the whole lithic industry of which Bann flakes are the best known component, can be seen. The raw material is in most cases brown Carboniferous chert. A small proportion of the flakes are made of stone or flint. Some of the flint shows the fresh white cortex that is characteristic of the Antrim flint quarried during the neolithic period and traded widely. Fresh nodules seem not to have been exploited until neolithic times, the mesolithic shore dwellers confining themselves to the rolled nodules they could find on the beach. Though an association of the fresh flint with the Bann flakes cannot be proved, it is probable, and adds to the cumulative evidence for a post-mesolithic date for this material.

The first stages of manufacture may not have been done on the sites, for cores are extremely rare, but more rough

debitage is present than at Newferry. Leaf-shaped flakes and Bann flakes make up about the same proportion of the material as at Newferry (for an account of the material from Lomcloon in the T.C.D. collection see appendix A). A good many of the leaf-shaped flakes bear secondary working elsewhere than at the butt, and most often this is at the tip as if to sharpen or re-sharpen the point. There seem to be no good examples of the tanged kind of Bann flake in the entire National Museum collection from Lough Gara. A good number of the flakes tend to be lamellar, though it is doubtful if any are sufficiently regular to qualify as blades. Secondary working is not infrequent, apparently intended sometimes to provide a scraper edge, sometimes a finger-rest, and sometimes to create a point. Some flakes are notched. Inverse retouch is common, a point which the Lough Gara industry differs from the coastal Larnian where it is rare. Some scrapers recall the coastal 'rough scrapers'. Some very large flakes appear to have been used as choppers. A few flakes have been struck from polished axes, as may be seen from the polishing and striae visible on some of their faces. The only implements of definitely neolithic type are of high quality - two leaf-shaped arrowheads and a very fine denticulated hollow scraper - and as there seem to be no chipping floors with neolithic typedebitage, these implements rather suggest objects obtained from a neighbouring people. All the larger flakes agree in having prominent bulbs of percussion and wide striking platforms very

reminiscent of the coastal and Newferry material, and not often seen on ordinary neolithic material. Photographs of some typical flakes and stone axes from the National Museum collection are illustrated as 148-158 at the end of this volume.

Unfortunately none of this material has been found in a sealed primary context, and until this is done its age must remain uncertain.

Mahanagh, Co. Leitrim (Davies 1942; Raftery 1944)

This Bann flake of chert from the south end of Lough Allen appears from Dr Davies' illustration (Davies, 1942, fig. 4) to be a perfectly typical untanged specimen.

Carrickmaguirk, Co. Longford

This implement, illustrated as my 133, was found in a bog. The site was afterwards visited by Mr Mitchell who took pollen samples. The level where the finder said he had found the implement could not be examined directly as it had flooded, but if its position was reported accurately to within two feet, the implement must be Boreal in age. The find is a large chert flake typical enough of those found at Lough Gara, with a very little retouch on the left side of the butt, and a little inverse working near the tip. If the finder was right about its position, and if it had not been buried, it must indicate settlement in the central lakes area of Ireland as early as the Boreal period, and the appearance of a type of implement in that part of Ireland at that ^{time} which remained

rare on the coast until the Sub-boreal period, and was absent from the Boreal deposits at Toome Bay.

Various sites near Crossakeel, Co. Meath (Mitchell 1949)

Two dots on Map II represent this material in the National Museum from the Kevin collection. The finds are stone axes and various flint and chert implements, including normal neolithic/bronze age types such as arrowheads, scrapers, and hollow scrapers, but also including Bann flakes, of which a tanged and an untanged specimen are illustrated as 134 and 135. Especial interest attaches to 136 and 137. They are large flakes with big bulbs and striking platforms, and so typical of the Bann industry; 137 in fact appears to have been a Bann flake originally. Both have been retouched in a way that is not found in the Larnian or on any of the implements from Newferry, but which is quite typical of the neolithic industries. 136 has long even secondary flaking right around its edge, and 137 has been given the flat re-touch used on arrow- and spear-heads all over its dorsal surface. While it is possible that neolithic folk had retouched chance finds of Bann culture material, the fact that there is no indication of older implements having been broken to yield fresh cutting edges, and the very large size of the implements compared with usual neolithic material, does suggest that they may be a hybrid product, where neolithic retouch was applied to Bann culture flakes. The point cannot be insisted upon.

Castlerebban Co. Kildare

After the recent destruction of a 'moat' the local children collected a small amount of material which was bought by the National Museum. As well as stone axes and neolithic flints, it included one good Bann flake of chert. It is not clear whether this was associated with the moat or not. In view of the concentration of axes dredged up in this region, it would be interesting if a concentration of Bann culture flakes could be shown to coincide. A further find of a Bann flake is mentioned in Mitchell (1949, p. 180).

Lough Gur Co. Limerick (Raftery 1944)

Implement 140 of chert was found near the shore of the lake. It is not really a typical specimen, the bulb is not so prominent as usual; the inverse working on the right hand side of the butt is not typical of the Bann industry, though it cannot be said to be typically neolithic either; it is not battered on the dorsal surface at the bulbar end; and the width of its original striking platform cannot be seen because it has been battered since striking, as may be seen by the fact that some of the spalls have come off the bulbar surface. On account of its untypical appearance it has been omitted from Map II.

Coologe Co. Limerick (Ó Riordain 1946)

This is the most southerly find spot of a Bann flake so far recorded. The implement was found in a bog, but no information is available about its depth. It is an example

that has been given the appearance of a tang by working two notches, one normal, the other inverse, about two centimetres up each side from the striking platform. Only on one side does the retouch trim off a corner of the striking platform itself. The implement has been severely abraded along both edges, presumably by use, and has been trimmed at the point as though to resharpen it. The find is in Cork Public Museum.

Toome Bay, Co. Londonderry (Mitchell 1955)

This site indicates that there was inland settlement in Ireland on at least two occasions in the Boreal period, though with a flint industry very different from that for which a Boreal date at Lough Gara has sometimes been claimed. An implement recalling an Aurignacian nosed scraper was found resting on glacial sand and sealed under Zone VIb peat (Mitchell 1955, fig. 8). About 100 metres farther east an oval area over fifty metres long with burned stones, charcoal, and charred wood was found. This occupation layer rested in part on a ridge of sand, and in part on a thin layer of peat dating from Zone VIc, and it seems probable that Lough Neagh was inhabited continuously between the dates of these two finds. A large piece of charcoal from this burned layer has given a radio-carbon date of 5,725 B.C. \pm 110. The flints from the occupation layer were coarse and rather lacking in character (an account is given in appendix A), but a number of pieces of wood which seem to have been artificially shaped were also present. Two pieces may have had angular holes

bored through them, pierced perhaps by a bone splinter used as a punch; two showed possible traces of diagonal cutting; and one had some irregular hollows sunk into it in such a way that it may have been the remains of a socketed shaft suitable for arming with flints, the shaft having split longitudinally so as to carry away half of all the sockets. The remains recovered from this small excavation were too few and fragmentary to cast much light on either the methods of working wood practised by, or the types of wooden tools made by the people of this culture, but since our knowledge to the present of pre-neolithic wood working is virtually confined to the Baltic region, the site at Toome Bay, of which much still remains for excavations, is of considerable potential interest.

Mr Mitchell carried out his archaeological and palaeobotanical investigation because it was already known that flint implements occurred in some relationship to peat which had been dated by Erdtman and Jessen to the Boreal period. Whelan had made a very interesting collection of flints which he considered to be earlier than this peat layer; this collection is now in the National Museum of Ireland in a collection labelled 'Lough Neagh peat'. The collection is described in Whelan (1938), where he considered it to belong to a different culture than the more or less contemporary group in the lower layers at Cushendun. The Toome Bay material does, in fact, look very different, and Whelan's view is understandable, though a different supply of raw material is a more

probable explanation than a major difference in the tradition of flint work.

Among Whelan's more interesting finds are the following; a number of pieces which, like Mitchell's find from below Zone VIb peat recall the nosed scraper; a core perforator and a similar implement worked on a flake illustrated as my 130; a few flakes showing a slight tendency to be leaf-shaped (e.g. my 131); a rather small broken axe of Larne type (my 128); and a number of cores, including two of excellent workmanship, e.g. my 129; Whelan also claims a pair of burins, but after examining the implements I find myself unable to accept them, as some of the burin facets he indicates really belong to the primary flaking of the implement, and the rest are very shallow and superficial, so that they look accidental.

It is difficult to know whether the stratigraphical position of this material may be relied on. All Mitchell's material actually excavated from the Boreal peat and the occupation layer in it are grey. His material from the various sand layers, all of which is in secondary or tertiary position, is without exception yellow. It seems that when flint was washed into secondary position it must have changed colour, presumably upon exposure to the air. One does not know how long it takes for the colour change to develop, but all of Whelan's material is yellow. This may merely indicate that it was collected in secondary position on the present beach after being washed out of the peat, but as the strati-

graphy of the site is shown by Mitchell to be rather more complicated than would at first sight appear, it may be that some of the material was collected under other conditions. A good many post-Boreal flints were found in Mitchell's excavation, and some of these may have found their way into what Whelan intended to be an exclusively Boreal collection. The collection as a whole does, despite its yellow colour, look very like Mitchell's excavated material, and can, though with some reservations, be treated as supplementary to it.

The general character of the flint work here is extraordinarily coarse. There are hardly any blade-flakes, and the flint has fractured in a very erratic manner. In this respect the contrast with the rather good blade technique of Cushendun is extreme. The two blade cores mentioned above are exceptions to the general rule. Most of the excavated material is uncharacteristic. It is hard to know what importance to attribute to the nosed or pseudo-nosed scrapers, which are certainly interesting finds, and paralleled in the Stacpoole collection. Whelan's broken axe (128) would be important if its stratigraphical position were above reproach, as showing that these implements had been diffused to Ireland as early as late Boreal times.

Both typologically and chronologically this material stands apart from the rest of the material of mesolithic affinities found in the interior of Ireland.

Mention has already been made of the discovery of Bann flakes at coastal Larnian sites both earlier and later than the maximum of the transgression. One more coastal site must be mentioned, which is outside the known area of mesolithic settlement in this country.

Raghly, Co. Sligo (d'Evelyn 1904; Mitchell 1949 p. 181)

At the Irish Field Club Union meeting in Sligo in 1904 an outing was made to various sandhill areas to collect antiquities. One of the finds was a leaf-shaped flake of chert, obviously of the Bann flake family (d'Evelyn 1904). Its present whereabouts are unknown.

This may give us the flint of the culture, but the possibility of a later survival is indicated by Dr A. S. F. Gallies' tentative support of a late bronze age date at Lough Sarragh, and Dr Neffery's of a post-Roman Iron age date of the Lough Gara crannog which he excavated.

As for the possibility that it also existed earlier, with the implication of early settlement in the central Inish district, I have given some reasons for believing that the boreal dating for flint at Coolnagranahy and Carrickmaguire

P A R T II

Chapter 3 - Date and Significance of the Inland Material

There are two unambiguous indications that the Bann culture material which we have described in the last chapter was in existence in the neolithic and bronze ages. There are the diatomite hearths at Newferry and the dolmen at Drumanone. The rest of the evidence is inconclusive, but tends on the whole to support the same dating. At Lough Enagh there is a terminus ante quem in the coarse cord-ornamented pottery of Island MacHugh type that came from the overlying layer; at Lough Gara and Castlerebban there is a probable association with polished stone axes; at Creevykeel there is a possible second connection with megaliths; at Crossakeel some of the finds are at least not later than when fine flat flaking went out of use; and two of Knowles' finds at Larne are later than the maximum of the transgression.

This may give us the floruit of the culture, but the possibility of a later survival is indicated by Mr A. E. P. Collins' tentative support of a late bronze age date at Lough Eskragh, and Dr Raftery's of a post-Roman iron age date at the Lough Gara crannog which he excavated.

As for the possibility that it also existed earlier, with the implication of early settlement in the central lakes district, I have given some reasons for believing that the Boreal dating for finds at Coolnagranshy and Carrickmaguirk

does not have to be accepted at its face value. From the typological point of view there are objections to so early a dating. None of the material from the centre of Ireland comes at all close to matching the undoubtedly Boreal material from Toome Bay. The latter is a homogeneous group of small coarse flakes, very seldom retouched, and contrasts very strongly with the large well-struck material with its rather high proportion of secondary working, both normal and inverse, that has come from Lough Gara. The latter, does, however, match very well the undoubtedly Sub-boreal material from Newferry. This makes it hard to accept a Boreal rather than a Sub-boreal date without some very compelling reason. The implication of a Boreal date would be that while the Toome Bay industry flourished at Lough Neagh, a fully developed industry extraordinarily similar to that which prevailed at Lough Neagh three thousand years later, had made its appearance in the central lakes district. During the whole Atlantic period it co-existed with the coastal cultures on a small island apparently without exerting any influence on them, but in the Sub-boreal period it suddenly and unaccountably spread to the Bann valley and began to affect them, so that they developed a tendency to more and better leaf-shaped forms.

By rejecting the Boreal dates, which I do not believe to have been properly established, it is possible to build up a more plausible account. In the Boreal period the

coastal Larnian put out a feeler to Lough Neagh. We have no evidence for inland occupation in the Atlantic period, and it is possible that the Toome Bay expansion was not a success, so that only the coast was inhabited at this time. In the Sub-boreal period two developments simultaneously affected the Larnian. These were a tendency to have more leaf-shaped forms, and an expansion of the area settled to take in many of the lakes and rivers of the interior and the coast south to Dublin Bay.

It is possible that the developments were linked and the development of larger leaf-shaped forms was the result of adaptation to the Carboniferous chert supply of the interior, and only affected the coast as a sort of echo of this development. Since this development had reached Sutton as early as the Atlantic/Sub-boreal transition, it would therefore have begun earlier in the central plain, and the implication would be that the chert areas were settled some time in the Atlantic period. Of this there is no direct evidence, and it is quite possible that the leaf-shaped developments began on the coast, and followed later but to an exaggerated degree in the interior.

The whole question, however, is rather conjectural, and it is to be hoped that future discoveries will shed better light on it.

Thanks largely to the lack of evidence various writers have seen the origin and nature of the Bann culture in dif-

ferant lights. Whelan (1939) connected it with Scandinavia by way of the Fosna and Finmark tanged point cultures. Mahr (1937) also connected it with Scandinavia, but through his supposed 'Riverford Culture'. Movius (1942) made them an autonomous Irish development emerging from the Larnian, where he points out that both the general appearance of the industry and the leaf-shaped element can be paralleled. Raftery (1944) rejected Movius' theory of autonomy and rather ambivalently connected them with both the Baltic and with the Western Neolithic: "The Bann Valley Culture," he writes, "might then be looked upon rather as a local aspect of the general Western Neolithic culture than as a distinct culture in itself" and "In the earlier stage of the stone age the impulse to fabricate flints of Bann Valley type might have been instigated from some of the lithic cultural areas of the Norwegian coast".

Some of these authors have been guilty of taking the Bann flake out of its context, and treating it as an individual find, as for example a bronze type would be treated. This method of approach ought not to be applied to flint implements, with which the unit of study is the industry taken as a whole. The Newferry and Lough Gara industries taken as a whole only suggest kinship with the coastal Larnian. They suggest a definite absence of kinship with the Western Neolithic. Other theories can be dismissed on grounds of methodology. Movius wanted to attribute the Bann

culture directly to settlers who had been driven from the coast by the neolithic invasion. There are objections to so simple a theory of origin. The flint industry at Newferry differs distinctly from any found on the coast, being larger, better made, and having the implements present in different proportions. All that can be said on the strength of the flints is that the two are related. Moreover there is no evidence that the inhabitants really were driven from the coast. At Glenarm and Dalkey Island coastal settlement is known to have continued; and on the theoretical side there should have been no conflict for space between the newcomers and the Larnians, since the former usually went inland to high ground (as for example at Feltrim Hill; see also Watson 1945) where the soil was lighter, while the Larnian dependence on shellfish tied them strictly to the beach.

Really less interest attaches to the exact time and reason when the Bann culture branched off from the Larnian stem, than to the question of their cultural status. There has been a tendency to classify them as food gatherers merely on the strength of the similarity between their flints and those of the Larnians, or else to deny them any separate status at all, and to look upon their tools merely as the fishing equipment of neolithic folk. Their flint industry was quite distinct from that of the intrusive Western Neolithic grazier-gardeners, the distinction being fundamental. The distinction is between the native tradition tracing its

ancestry back to the upper palaeolithic blade industries, and the intrusive tradition whose origin is obscure. If Clark's suggestion that "Here, surely, we have to do with a seasonal fishery, an activity in which peasants reverted for a time to the ways of their hunter-fisher forebears, rather than with a 'culture' of surviving hunter-fishers" (Clark 1948, p. 72) is taken to mean that the Bann culture folk also practised agriculture, the suggestion is a very likely one. All we know about the economy of the inland Bann culture folk is that their water-side distribution, contrasting as it does with the upland distribution of the Westerners, suggests that the economy of the two was not in all respects identical. Unfortunately the primary sites, Newferry and Drumanone, produced no bones to cast light on the matter, but since the Bann folk absorbed polished stone axes, and sometimes pottery and megalithic burial, from the newcomers, may they not also, like the coastal epi-Larnian inhabitants of Dalkey Island, have learned something of the arts of cultivation and stock-breeding?

P A R T III

The Larnian in the Context of European Prehistory

Here we face such problems as who were the Larnians? Where did they come from? Who were their nearest relatives? Can we attribute the peculiar features of their culture to any particular cause? How do the Larnians compare with other shell-midden folk who developed in parallel with them? What importance can we see in the process of assimilation to a neolithic way of life and how does it compare with analogues outside Ireland?

The initial question is the problem of the land link with Britain. We have shown that the fauna and flora of Ireland are likely to have immigrated into the country by a land-bridge in the post-glacial period, but that their presence cannot be taken as proof of such a land bridge since there may have been refuge areas south of the ice sheet on parts of the continental shelf that are now submerged, and since alder, at least, is known to have made its first appearance in the pollen record of the country at a time when there was certainly no land bridge. Furthermore even if it could be proved that such a bridge had existed, it would have little bearing on the archaeological question unless it could be shown whether it was submerged before or after Man had crossed to Ireland. Many of the animals and plants may have crossed over in the late-glacial or early post-glacial

periods, but there is no evidence that Man reached Ireland until considerably later. There could have been a post-glacial land bridge, yet Man may only have arrived by sea after it had been submerged. This would indicate that at least at that time the ancestors of the Larnians possessed a knowledge of boating. It would be particularly interesting to know whether this was the case, since the question whether the Larnian culture went its own way in complete isolation or not hangs upon this point. In Part I it was suggested that some features of Larnian axe typology might indicate that the axes were derived fairly late from the British sequence. The bevel-ended pebbles may also, as we shall see, indicate foreign contacts across the sea. Nevertheless there is not yet evidence enough to prove beyond any doubt that the Larnian folk could themselves build and manage boats, nor that they were in contact with developments elsewhere in prehistoric Europe, which would mean the same thing.

Another basic question is when did the ancestors of the Larnian adopt the waterside and largely shellfish-eating way of life with which they are connected. We shall later suggest some reasons for supposing that this may have happened at an early date, far back in early post-glacial times. For the moment let us assume that this adaptation took place early in some other part of the west coast of Europe, and that the people arrived in Northern Ireland by some sort of

drift northwards along the coast, as has been suggested before (Mitchell 1949; Clark 1956). In that case a certain amount of information about the state of the marine transgression at their first arrival might be gained by comparing the distribution of the earlier Larnian sites with the map as it would have appeared at various stages of the transgression. At a stage with the sea 50 fathoms (90 m.) below its present level most of the Irish Sea would be dry land and the west coast of Europe would extend from Brittany around a bay where the entrance to the Channel now is, and then around past the Scilly Isles to form another wide bay between Pembrokeshire and south Leinster. Further transgression would rapidly flood the low-lying land at the head of this bay until brought to a halt by the rather higher area between north Antrim and parts of Argyll. At this stage the Irish Sea would be a long gulf with its head around Kintyre and the Firth of Clyde. The ocean to the north would break through to this gulf when about 20 fathoms (35 m.) below its present level, and Ireland would become an island.

It should be obvious that the distribution of the earlier Larnian finds in Northern Ireland and their absence from Leinster suggests that Man arrived when the transgression was at the second or third of these stages. That is to say either they came by land around the head of a long gulf at the head of which lay the flint-bearing region where sites in south Wales, a group in Cornwall, a group in Jersey,

they made their lasting settlement, or they came by sea across the straits separating Ireland from Scotland. The former hypothesis depends on the assumption that the adaptation to a coastal way of life developed early, and that the early settlers reached the north end of the Irish Sea by migration along what was then the shore.

The coast along which this migration would have taken place in Boreal or earlier times is now everywhere flooded, and there is no possibility of obtaining direct evidence to support the theory. There are, however, a number of sites at other places along the Atlantic coasts of Europe which recall the Larnian either in having a coarse blade industry made from beach pebble flint with few or no microliths, or in having the characteristic bevel-ended pebbles found in the Leinster middens. From the distribution of these sites, many of which are neolithic in date, it would be possible to postulate that they are the remnants of a culture which once thrived along now flooded areas of the Atlantic coast, and that the Larnian is another remnant of this hypothetical culture, which for convenience we will describe as the 'proto-Larnian'.

The sites fall naturally into groups. The best studied are those of the Obanian culture of north-western Argyll. South of this are a number of sites around the Firth of Clyde which have previously been described as 'Larnian', a group of sites in south Wales, a group in Cornwall, a group in Jersey,

and a group in Brittany. Farther south are tenuous links with material at south French and Iberian sites.

We will consider first the Obanian sites. They are all shell middens - in caves near Oban itself, and in the open on Oronsay and Risga. The material consists of:-

1. Polished bone and antler slivers: these are broken pieces of bone or antler, usually 6 to 10 cm. long, though larger pieces identifiable as parts of limb bones also occur, whose edges, and more particularly whose ends, have been worn down and polished by some sort of use. Oblique facets have often been worn at the ends. These are often found on both sides of the end so that they meet in a sort of blunt chisel- or gable-like ridge, as though the bone had been used indifferently either way up. If the bone was wider across than thick it has always been used with one of the flat sides down, so that if there are two bevelled end-facets the ridge where they meet always runs the long way across the end of the bone. The wear is smooth and polished, the bevels and rounded edges being much less rough than the natural surfaces of the bone. Striae sometimes occur on the polished surfaces. Anderson has suggested, on Eskimo analogies, that they were used for scraping skins (Anderson 1894), and the view has been supported by Breuil (1922) and Lacaille (1954). Additional use for something more violent than dressing skins is indicated in the case of some which have been chipped at

times been prepared or polished by bevelling. The reader

the ends after the facets had been formed. Others have been polished to facets after chipping.

2. Utilised stones: the middens, particularly Gnoc Sligeagh, contained an enormous number of elongated stones which seem to have been especially selected on account of their shape. They varied in size from about 6 cm. to exceptional examples as much as 30 cm. long. Many showed no visible sign of use, but many had been chipped or pocked in one way or another. A larger proportion of big ones appeared unused than of small ones. The most common alteration was for one or both ends to be bevelled, often on both sides so as to have a chisel or gable shaped end as in the case of the bone slivers. With the stones, however, in contrast to the bones, the altered surfaces were rougher than the natural surface of the pebble. In general the larger the pebble the more definitely pocked the bevels appeared. In fact it seems possible to divide the objects in Argyll into two classes - small finger-like specimens of round section and less than 10 cm. long with facets only slightly rougher than the natural surface of the pebble, and larger specimens, usually flattish in section, with distinctly rougher facets. The second alone has a wide distribution, the first, so far as I can see, being confined to the Obanian sites with the exception of a single example from Jersey. Sometimes the stones are chipped at the ends, and the chipping has sometimes been preceded or followed by bevelling. The reader

will remember that the same thing was noticed in the case of the bone and antler slivers. Discussion of the various views that have been expressed as to the use of these stone objects is given in Appendix B. They generally go under the names of 'limpet-scoops', or 'limpet hammers', but there is no universal consistency in the use of these terms.

3. Flints: the Obanian flint industry is very poor. This is due to the scarcity of raw material in the region. Indeed Breuil remarked that the material from Caisteal-nan-Gillean seemed not to be a normal flint kit, but a residue after the material had been used to the last degree possible (Breuil 1922). He identified a number of very poor scrapers and a micro-burin. The best collection comes from the midden at Risga. I was able personally to examine three envelopes of flints marked 'Risga (excavations)' at the Hunterian Museum, thanks to the kindness of Mr R. G. Livens. The material seemed to be blade debitage, and some of the larger flakes had the wide striking platforms and prominent bulbs characteristic of the Larnian. The only finished implements in these envelopes were two small crude Bann flakes and an end-of-blade scraper. A series of implements from Risga midden is also illustrated by Lacaille (Lacaille 1954, figs. 106-108). Several other bags from the Bishop collection labelled simply 'Risga' may not come from the midden at all. There are 109 flakes from Cnoc Sligeach in the National Museum of Antiquities of Scotland. In contrast to the Risga

group they are mostly flat and roundish, and do not seem to be blade debitage. Some prepared flakes were struck with a natural platform on the outer crust of the pebble, and this, so far as I have been able to ascertain, is usually a non-mesolithic feature.

4. Personal ornaments: the only thing to mention is that 42 tiny cowrie shells, each with two perforations, were found at Cnoc Sligeach. They may have been strung as beads.

5. Food refuse: the staple food seems to have been molluscs. The presence of red deer (Cervus elaphus) and wild pig (Sus scrofa) bones show that the Obanians also hunted. Seal bones on Oronsay (Halichoerus gryphus and Phoca vitulina) indicate sealing, and perhaps some of the barbed bone points were sealing harpoons. The variety of bird bones at Cnoc Sligeach is sufficient to suggest that occupation was more than seasonal, but the layers of blown sand at Caisteal-nan-Gilleann show that it was intermittent. Some of the fish seem to indicate line fishing and the use of boats (Clark 1948, p. 61). Boating would be indicated anyway by the fact of settlement on Oronsay, which is several miles off shore. Bishop thought that the common and fiddler crab remains found at Cnoc Sligeach must indicate the use of creels, but as Clark has pointed out, these might have been caught on the shore or while line fishing (loc. cit.). Of particular interest are the ox remains

(horn cores, in one case with frontal bone) from MacArthur's Cave, which are stated by Turner to belong to the domesticated Celtic variety (Turner 1895). These remains may be seen at the National Museum of Antiquities of Scotland, and it would be interesting to have a recent opinion whether they belong to a domesticated breed of cattle or to the small British variety of Bos primigenius. If they are of domestic cattle and really were in the Obanian layer as described, it must indicate that these animals had already been introduced into the district by neolithic immigrants, and perhaps that the Obanians had learned to keep cattle. The absence of cattle bones from Oronsay may indicate that the immigrants had not spread that far yet.

6. Worked bone and antler: the most generally known implements are the 'harpoons', whose resemblance to Azilian harpoons from the south of France has been made the basis of a theory of Azilian penetration to west Scotland despite the chronological difficulties in such a view. Let us consider for a moment the actual resemblances between Obanian harpoons and other types. In this brief survey the implements from the river Dee near Kirkudbright, from the river Irvine at Shewalton, and from Victoria Cave, Settle, Yorkshire, will be included. These resemble the Obanian examples but differ completely from the Maglemosian leister prongs of eastern Britain, which are the only other type known in the British Isles. For the typology of barbed bone points the base is

more important than the point, and only three are complete with base. Of these one, from MacArthur's Cave (Anderson 1895; Lacaille 1954, fig. 81 no. 9) has the unperforated lobate butt that is certainly one of the Azilian types (see Thompson 1954), and a second, from the same site, and very similar to this in general shape (Lacaille 1954, fig. 81 no. 10) has the button-hole shaped perforation that is par excellence the sign of the Azilian. Fig. 81 no. 11, which appears at first sight to be complete, is probably only a fragment which has been used at the broken end in the manner of the bone rubbers described above under the heading 1. The harpoon from Victoria Cave, with the hindmost pair of barbs turned forward resembles nothing illustrated by Thompson (op. cit.), but is close enough to a Swedish harpoon of the Sub-boreal period illustrated by Clark (1946, Pl. I, no. 3), and to a Danish specimen illustrated as no. 160 in Mathiassen (1948); similar ones are said to occur in Sweden and Finland (ibid. p. 65). The remaining fragments could be compared either to Azilian or to Baltic examples, though not very convincingly in either case, except perhaps for the monoserial fragments from Druinvargie (Anderson 1898; Lacaille 1954, fig. 82, no. 11-12) whose big pointed teeth recall some of Clark's Baltic types. The Baltic and Obanian specimens are both made from split lengths of bone or antler, while the Azilian ones are made by outlining 'blanks' on the surface of the antler by deep grooves, and prizing these

loose from the cancellous tissue behind (Clark 1956; Thompson 1954). As Clark points out (loc. cit.) this need not indicate Baltic contacts, as the Azilian technique may have degenerated by the time it reached Argyll.

On chronological grounds the Baltic comparisons are more satisfactory, since they are roughly contemporary, while the Azilian sites are several millenia older. In the floating chronology that is all that is possible at present for cave sites in southern Europe, it is not very easy to say exactly when the harpoon fell out of use, and it may have endured longer than the simple and possibly oversimplified scheme Azilian-Sauveterrian-Tardenoisian suggests. Clark, in a notable recent paper, has suggested that the harpoons reached Scotland from southern France by way of the now submerged coastal strip. Since virtually nothing is known about the bone equipment of the post-Azilian hunting tribes of France and Britain, the possibility that the harpoon passed from the Azilians to some of the Sauveterrians, and thus to the Obanian sites is worth a thought. On the other hand its absence from the Larnian middens does not favour its being derived from an old coastal population ancestral to both Larnian and Obanian, and the fact that the Obanian antler mattocks point undoubtedly towards an eastern origin, strengthens the case that can be made tentatively on typology, for a North Sea/Baltic origin for the harpoons.

Three of these antler mattocks have been found on Obanian sites - at Risga, Cnoc Sligeach, and Druimvargie, and two of these were designed to have the shaft inserted through the hole left by the removal of a tine. This feature points most immediately to the other side of Scotland, where an identical implement was found in the carse clay at Meiklewood, apparently in association with the skeleton of a whale, so as to suggest that it had been used as a blubber mattock (Childe 1935, pp. 17-18; Lacaille 1954, pp. 171-72; Clark 1947, p. 91). Clark (1956) points out that such implements have a wide European distribution in the late Atlantic, and perhaps early Sub-boreal periods, and there can be little doubt that the Obanians must have been subject to some sort of influence from this quarter, whether or not it was also subject to Azilian influences.

I am indebted to Mr Livens of the Hunterian Museum for the information that recent acquisitions of Obanian material from the Bishop Collection include some angular pieces of bone which may be gorges or fish hooks.

Two of the sites - MacArthur's Cave and Cnoc Sligeach - are stratigraphically related with the raised beach. Both rested on shingle, and must therefore be within the limits transgressed by the post-glacial sea. It seems that occupation during the transgression would be almost sure to be followed by the dispersal of the midden by the rising of the waves. There is a seam of midden at MacArthur's Cave

sealed by shingle, but this could easily have been a single summer's occupation during the regression followed by a winter's storm. At Cnoc Sligeach storms had also disturbed the midden, but this time only along the seaward side, so the event must have taken place during the regression. A survey of raised beach levels in the neighbourhood of these sites might shed further light on the problem.

The Obanian emerges from all this as a homogeneous and extremely isolated epi-mesolithic culture - that is as a culture which persisted in a food gathering way of life after the beginning of food production in the general region. The Obanians had a fair knowledge of navigation, knew line fishing, and were well able to hunt the red deer, but their flint industry which might have been our best clue to their affinities was poor. They may have been forced up from now flooded areas by the rise of the sea, but they may equally have been a Sauveterrien group that came down to the sea at quite a late stage and adapted themselves to a largely coastal existence. The presence of micro-burins supports the second view. They possessed a type of pebble tool which seems to indicate either that they were not completely isolated, but had contacts with mesolithic or epi-mesolithic tribes possessing these objects farther south, or else that this implement was an ancestral type common to both the Irish and to the west British mesolithic, including the Obanian.

Unfortunately no other early west British cultures can be defined so clearly as the Obanian. Flints have been collected on the surface at various points around the Firth of Clyde, particularly at the mouth of the River Stinchar in Ayrshire, and have been found in stratigraphical position on three different occasions at Campbeltown on the Mull of Kintyre.

Two of the Campbeltown sites were found during the course of commercial digging in the nineteenth century, and were described by A. Gray (Gray 1894). According to his account the flints were found stratified in the raised beach. At Millknowe a dark band three to six inches (8-15 cm.) thick and seven yards (7 m.) long appeared in the section, and contained charcoal, unidentifiable crumbs of bone, and flints. The dark band rested on beach shingle with a little sand, and was sealed above by two feet of the same, covered in turn by three feet (1 m.) of 'rich black loam' (presumably hill wash). There were black pockets at other levels in the beach. Altogether Mr Gray recovered 'over three thousand' flints.

At Dalruan the section was:-

Dark loamy soil	2½ feet (75 cm.)
Sandy gravel (raised beach)	2 feet (60 cm.)
Fine sand with occasional small stones (raised beach)	2 feet 2 inches (65 cm.)
Fine gritty shingle and sand	Depth not determined

Most of the flints came from the lowest layer described, the fine gritty shingle and sand, but 'several' were found higher up; i.e. the occupation layer was sealed by 4 feet 2 inches (125 cm.) of raised beach.

Levelling might relate these finds more closely to the stages of the transgression, but if Gray's report is accurate, it seems that they must precede the final withdrawal of the sea from the level of the top of the raised beach where they were found. There are, however, two points which make it difficult to accept Gray's account unreservedly, though of course it may still be correct. In the first place it seems surprising that black pockets should have been covered in without being swept away. In the second place both Breuil's account and my own examination of a small quantity of material from these sites in the Kelvingrove and the National Museum of Antiquities of Scotland, indicate that nearly all the Glasgow and Edinburgh material is unrolled. At Larne only 12 percent of the material was unrolled, but at Millknowe a high proportion of the flints may have come from the black band where they should anyway be unrolled. The Glasgow and Edinburgh material seems to be very highly selected, and shows no signs of the 'broken nodules and flint flakes lying in hundreds' described by Gray, which may help to account for the rarity of rolling.

According to Breuil, who was apparently working on this selected material, there were end scrapers and variously

retouched or utilised flakes. The objects illustrated as nos. 1 and 2 of his Fig. 1 (Breuil 1922) appear to be microliths. The author also saw one very good thrice struck angle burin and a second more doubtful burin in the N.M.A.S. collection. The general aspect of the Edinburgh material is that of a very well struck small blade industry, but this appearance may be largely spurious owing to selection of the best pieces. At any rate this material seems to belong to an industry with microliths, and one which seems rather more skillfully made than the industry from the Albyn Distillery, which should be later in time. It probably dates from the Atlantic/Sub-boreal transition - with a margin either way. Typologically there is nothing except the fact that it is a blade industry found in association with a raised beach to connect it with the Larnian. It could either be an industry related to this, but enriched by microliths and burins; or it could be a local degenerate facies of the Sauveterrian. The Millknowe occupation site must have been in use long enough to allow the accumulation of an occupation earth which is still as much as six inches thick, even after five thousand years of decay and consolidation. Gray particularly notes the absence of shells. Unless this is due to the acidity of the soil, it seems unlikely that the inhabitants can have been true coast dwellers whose subsistence depended mainly on what they could get from the sea.

Inspired, perhaps, by Movius' admirable work in Ireland, an attempt was made in 1935 to find more implements in the

Campbeltown raised beach, and a site at the Albyn Distillery at a distance of ca. 200 m. from the Millknowe site was excavated (McCallien and Lacaille 1941). The report makes it clear that at the Albyn Distillery most of the flints were (a) unrolled, (b) above the raised beach, not in it, and (c) associated with a three inch layer of dark soil overlying the beach and sealed by hill wash only. This makes it impossible to accept Lacaille's statement that "they originate from shore occupation sites dating back to the period of rising sea-level, and they were incorporated into the beach formation during the emergence" (McCallien and Lacaille 1941, p. 91). It seems quite clear that McCallien's trench encountered a primary occupation site occupied after the beach at this point had been lifted clear of the waves, which would otherwise either have washed away the dark earth and rolled the flints, or have covered it with a protective coat of gravel as happened at Millknowe. Since the raised beach here "extends much farther inland and rises many feet higher" (ibid. p. 60) the emergence must have been in progress some time before the site became available for settlement. The small number of rolled flints found show that the site was not yet completely out of reach of the waves. With the information about the date of the beginning of the emergence placed at our disposal by Jessen and Mitchell, we can see that the site must have been neolithic in date, though it was perhaps epi-mesolithic in

culture. Unlike the other Campbeltown sites, the Albyn Distillery material has not been selected. This hinders comparison with Millknowe and Dalruan, but even when allowances have been made, the material seems rather different. Well struck blades are almost entirely absent and squat irregular flakes preponderate. The finished forms include a considerable number of round scrapers, some nicely worked (absent in the material available from the other sites), microliths and micro-burins. The author can see no reason to connect the material with the Larnian, but the low proportion of blades and the high proportion of very small or broken flakes, might indicate neolithic influence, which would be quite in accordance with the dating evidence.

Finally, near the coast, several surface finds have been made of flints which are said to resemble the Larnian (Lacaille 1954, pp. 150 ff.). The most important collection comes from fields near the mouth of the River Stinchar, apparently on the raised delta of this river (Lacaille 1945). None of the flints have been found in situ in the gravels, but some of them are rolled. This does not prove that they precede the maximum of the transgression. The presence of microliths and the general appearance of many of the flints shows that there must have been late or epi-mesolithic settlement in this area, but it is doubtful whether further conclusions are at present warranted.

The inference to be drawn from this Firth of Clyde material is that there was a poor microlithic industry in

existence at certain points on the Clyde coast soon after the maximum of the transgression, and its flint technique may in some cases show influence from neolithic methods (cp. material from Shewalton Moor, Lacaille 1954, pp. 284-288). There is no evidence yet that there was a truly coastal culture like the Obanian, but this may some day come forward. A slightly older microlithic industry found actually in the beach, seems rather superior in technique.

There is little of interest south along the coast when we leave Ayrshire before Aberystwyth. A flaked core axe is said to have been found in raised beach gravels at Silloth, Cumberland (Lacaille 1954, p. 121), but apparently has been lost.

Normal Sauveterrian industries have been found in the Isle of Man, but do not concern us directly here. More interesting are finds of tanged flakes, which Clark has connected with the Bann culture (Clark 1935, pp. 74-75). It is hard to suggest alternative possible connections; nevertheless the tanged points are not typical Bann flakes - they are more distinctly tanged than usual in Ireland and the size is small. Convex scrapers, associated with tanged points at Cronk y Chule and Kirkill, are altogether absent from the Bann culture. Further research is required.

Some finds of flints from Newborough Warren, Anglesea (Clark 1932, p. 47), may include mesolithic types, but cannot be of much use in the present enquiry.

There is, however, an interesting group of finds from a site near the sea at Aberystwyth (Thomas and Dudleyke 1925). The finds were made at the base of a layer of hill wash which rested on boulder clay, but since the flints may have been lowered by earthworm action it cannot be assumed that they are earlier than the hill wash; nor can it be assumed in the absence of shell refuse that the people were especially coastal in their way of life. In any case the sea was probably somewhat lower when the site was occupied, and the site therefore further inland. The industry is a microlithic one made from beach pebble flint, and includes micro-burins (Clark 1932, p. 46; Grimes 1951, pp. 137-38). It has an unusually high proportion of scrapers, a feature which it shares with the other Welsh sites, Daylight Rock, Caldey, and Nab Head. "About thirty of the tongue shaped pebbles known as 'limpet scoops'" were found. (Thomas and Dudleyke 1925, p. 85). Only two of these could be 'limpet scoops' as defined by the present author, but the report's illustrations do not make the precise character of the abrasion at the extremities of Figs. 5 and 6 clear.⁽¹²⁾ Among the others, one has longitudinal striations, and one has pocked hollows opposed to each other at one end.

In Pembrokeshire a considerable amount of surface flint and 'limpet scoop' collecting has been done. The key sites for the interpretation of this material are Daylight

Rock and Nanna's Cave on the island of Caldey. We will briefly discuss the excavations on Caldey, and then pass on to the surface collected material.

The only site which showed a pre-neolithic stratified sequence was Nanna's Cave (Lacaille 1955, pp. 96-120). Here a basal bed of yellow silty sand was overlain by a layer of reddish rainwashed loam, the two containing distinct flint industries. According to Professor I. A. Cornwall's appendix to the excavation report (Lacaille 1955, pp. 159-65) the lower layer consists largely of wind-borne material implying drier conditions with less vegetational cover than the overlying hill wash does. Leach (1916) was able to equate stratigraphically the reddish loam with the layer of stalagmite which occurred inside the cave, and since it is likely that the stalagmite began to form with the damper conditions of the Atlantic period, the same is thought to apply to the loam. On the pedological evidence it can only be said that the yellow silty sand is Boreal or earlier, but the only animal bones belong to temperate species, pig and ? ox. This makes it appear that unless an identical layer formed in both late glacial and post-glacial times, the layer must be post-glacial and the industry therefore mesolithic. A Pre-boreal or Boreal dating for the earlier industry, and an Atlantic dating for the later fits in well with the little other evidence there is for the dating of these industries.

No micro-burins were found in the yellow silty sand at Nanna's Cave, where few implements of any kind were found. In size the implements are intermediate between an Upper Palaeolithic and a normal mesolithic assemblage, and some of the scrapers, burins, and retouched flakes recall the Upper Palaeolithic in a general way. The microliths consist of number of rather large and crude blunted back points, (one of which is double ended), and a rough triangle. The industry recalls that from Burry Holmes (Grimes 1951, pp. 10-14, 137) where micro-burins again have not been found (though Nanna's Cave looks cruder and may have been earlier); to a lesser extent it recalls the better made industry from the mesolithic layer at King Arthur's Cave, where also there were no micro-burins (Taylor 1928; Clark 1932). It seems to represent a sort of local early Mesolithic north of the Bristol Channel, which grew out of the Upper Palaeolithic in the same region.

Above this in Nanna's Cave, in the reddish rainwashed loam, only a little flaked material was recovered. It includes one micro-burin, and a few very small flakes with steep dressing, which seem to be typical specimens from a microlithic industry. There were also a number of elongated beach pebbles, the ends of "one or two" of which, though not described precisely, show signs of attrition which "cause the stones to resemble the narrow so-called limpet-scoops found in Obanian occupation-refuse" (Lacaille 1955,

p. 117), and some pieces of bone which had been rubbed down at the ends like the Obanian examples. A dog tooth was found in this layer.

The main site on Caldey is Daylight Rock. This is an open-air site in hill wash. The microlithic industry includes crude triangles, lunates, and micro-burins, and in considerably larger number than in Nanna's Cave. It can be seen in the material at the National Museum of Wales that out of a very large amount of primary debitage there are very few microliths. The scrapers, some of which are rather finely made, equal or exceed in number the microliths. This is not a usual feature of microlithic assemblages, and should be significant. No elongated beach pebbles are reported from Daylight Rock, which shows that it differs in at least one respect from Nanna's Cave.

The third excavated site on Caldey is Potter's Cave. Here the only pre-Peterborough layer was of reddish rain-wash which probably dates from the same period as the reddish loam at Nanna's Cave. The few flints found were rather lacking in character, but a short bifacial tool seems to have been worked to a special cutting edge at one end, and may be a poor example of a core axe sharpened without the tranchet blow, thus resembling the Larne axes.

Care must be taken in dealing with the Caldey material not to yield to the temptation to treat the evidence as more precise than it really is. Two cautions are needed. In the

first place the dating is not quite so definite as Lacaille would have us believe; in the second none of the assemblages of flints have to belong to a single occupation in the strict sense. The layers in the caves and at Daylight Rock accumulated over a long period of time, and flints may have been chipped and implements lost on widely separated occasions. At Daylight Rock there was no sealing layer.

Nevertheless there is valuable information. Selected stones, some possibly end-bevelled, occur in a post-Boreal pre-Peterborough context, and thus may be of the same age as the Obanian and Irish specimens. Daylight Rock gives a much larger group of similar age, but without 'scoops'. Unless Daylight Rock's high proportion of scrapers is the result of later admixture, which seems unlikely despite the fact that the site is unsealed, both on grounds of the character of the scrapers themselves, and of the fairly homogeneous appearance of the whole industry. It appears that we have here a microlithic industry with micro-burins and triangles in which the obliquely truncated lanceolate point is rare, and where the proportion of scrapers to microliths is very high.

Apart from these stratified sites, there are several places in south Wales where flints have been found on the surface, but restricted to particular small areas so that there is a strong presumption that the material forms an associated group. Sometimes the surface collecting was

supplemented by digging, but in no case was any true stratigraphy reported.

Probably the earliest of these sites is Burry Holmes (Clark 1932, p. 47; Grimes 1951, p. 10), where a group of non-geometric microliths were found, among which the obliquely blunted point is most typical.

But of particular interest to us are a series of surface sites around Milford Haven investigated and published with admirable precision by T. G. Cantrill of the Geological Survey (Cantrill 1915). It seems that at some sites the proportion of retouched implements to waste flakes and cores was higher than at others. 'Limpet scoops' only occur on the sites where the flint industry is poorest! A resumé of some of Cantrill's statistics will illustrate this point. The numbers are Cantrill's.

Site 5	1 scraper, 52 waste.
" 10	1 ? arrow-head, 40 waste.
" 23	51 flints, mainly "chipped nodules". 2 <u>scoops</u> .
" 26a	1 scraper, 64 waste.
" 27	90 waste. 6 <u>scoops</u> .
" 36	1 scraper, 2 borers, 101 waste.
" 37	1 barbed and tanged arrow-head, 1 scraper, 2 notched flakes, 1 borer, 198 waste. 28 <u>scoops</u> .
" 41	1 notched flake, 2 borers, 67 waste.

It will be observed that at two of the sites which produced elongated pebbles with bevelled ends (23 and 27) the indus-

try was even poorer in retouched forms than at the others. At the third (37) the juxtaposition of a barbed and tanged arrowhead with limpet scoops indicates that we should be on our guard against a double occupation of the one site. The association of 'scoops' with a particularly poor flint industry seems to occur consistently, but cannot be taken as proved.

Similar surface collections were made by A. L. Leach in the Gower peninsula and the Tenby district. In general less material seems to have come from Leach's sites than from Cantrill's, and the collections are not so fully described, so it is not possible to make so much use of Leach's material here. It is interesting to note that flints have been found in submerged peat at a number of sites in the district. Good microliths are included, but there are no associated groups large enough to define the industry. Another interesting point is that of all the groups the only one with a uniformly dense white patina is an upper palaeolithic group from a surface site near Gop's Cave, which suggests that all other groups are distinctly younger than upper palaeolithic. For the account of these sites see Leach (1913).

Another probably, but not certainly, associated group came from a headland named Nab Head, where the sod was being weathered away (Gordon-Williams 1926). Gordon-Williams collected from the surface and dug over the denuded area, and

also dug several strips in the sod near by, where the finds were found "scattered in soil and subsoil". About 3,000 flints were recovered and about 8 "scoops". The flints are described as including about 60 scrapers and 47 'points' which appear to be microliths; thus scrapers outnumber microliths as at Daylight Rock, but unlike this site, Nab Head produced 'scoops'. According to Grimes (Grimes 1951, p. 130) micro-burins, crescents, and triangles are present. So was at least one poor specimen of the transversely sharpened core axe. There were also 33 shale beads and an interesting figuring of very degenerate palaeolithic type, described by Breuil with great delicacy in Gordon-Williams' paper. It is doubtful whether any of these objects can be assumed to be associated with each other, but they may be.

From Grimes (1951, pp. 138-39) it appears that collecting has taken place here subsequently to 1926.

While dealing with Pembrokeshire mention should be made of two isolated surface finds of transversely sharpened core axes in the county (Grimes 1951, fig. 7). They belong to Troels-Smith's two-sided type (see Troels-Smith 1938) and are rather poorly made.

It is quite a remarkable fact that all the Welsh sites mentioned - Aberystwyth, Caldey, Nab Head, Burry Holmes, and Leach's and Cantrill's sites - are all near the sea, and most of them near the edge of a coastal plateau which falls steeply two or three hundred feet to the sea. The

overall distribution pattern of British mesolithic sites shows no such coastal bias. No doubt the fact that the raw material for flint chipping in Pembrokeshire comes from the beach helps to explain this distribution. Selection by collectors of scenic cliff walks in the neighbourhood of resorts may also have contributed. Nevertheless the coastal distribution of mesolithic sites in Pembrokeshire is a remarkable fact, and taken in connection with a similar state of affairs at many other points around the Irish Sea, may be of some real significance.

Our final site in this region takes us inland to King Arthur's Cave, Monmouthshire, where mesolithic material has been found. Excavation has been carried out both inside the cave and on the platform in front of it (Taylor 1928), but only on the platform was there a mesolithic layer. This is described as a 'hearth', but appears to have been a dark layer immediately underlying a layer with beaker pottery and other comparatively late finds. The associated fauna was temperate, except that Cervus giganteus and Rangifer occur "very rarely" at the extreme base. There were microliths but no micro-burins. The microliths are small and include triangles, but the main forms have straight re-touched edges and are unusually long and thin. Associated with the flint industry were a number of river or beach pebbles which had been brought to the cave deliberately by the inhabitants. Some of these showed wear or shaping, but

none had the characteristic double bevelling of the ends seen on the Obanian, Pembrokeshire, and Leinster examples. An early date for this mesolithic site is suggested by the absence of micro-burins and the generally un-Sauveterrian appearance of the microlith assemblage. On the other hand the average size of the implements is small for an early group, and such forms as the typical large obliquely truncated points common at Star Carr, Broxbourne, and (more locally) Burry Holmes, and also the shouldered and penknife points of Mother Grundy's Parlour are not common; nevertheless fig. 4, 1-5 of the excavation report may have affinity with the obliquely truncated point, and 3 with the shouldered point. Clark (1932, p. 38) inclines to the view that this is an industry which developed out of the local Gravettian without being influenced by the Sauveterrian.

Bearing in mind that stratigraphical association in a single stratum of a cave fill does not necessarily prove that the associated artifacts belonged to a single 'culture' or a single short period of time - as has been indicated in connection with Caldey Island - it might be suggested tentatively that the rather geometric-looking triangles of Taylor (1928) fig. 4, 25-31 really belong to a later phase in the formation of this layer than the early-looking forms. The layer may have accumulated continuously from late-glacial until bronze age times.

This search for clues to the origin of the Larnian

leads next to west Cornwall, where elongated beach pebbles, and particularly those with bevelled ends, attract our attention. Marsden's papers (1919, 1919a) on his sites near Land's End do not enable the reader to form a clear picture of the flint industry, but the illustrations and the high proportion of pebble cores present suggests that it has much the same rough character as the Pembrokeshire industry. There is no doubt about the fact that elongated pebbles with bevelled ends are present, as Plate F, no. 6 of Marsden (1919) is a scoop bevelled at both ends. It seems likely, as in Pembrokeshire, that the 'scoops' were used by at least some of the communities that were responsible for the microlithic industry. Marsden enumerates seventeen sites. The best of these, the Greeb, produced many scoops and many microliths. The situation seems to parallel that in Pembrokeshire, where most of the flints are found at localised 'sites', some of which also have 'scoops'. Also in west Cornwall implements have been collected from four sites in the neighbourhood of Gwithian (Thomas 1958; 1958a). "They present an elaborate version, complete with microliths, microburins, wide range of pebble tools of the few industries of this period known in Cornwall and so described by J. G. D. Clark, in 1932" (Thomas 1958). It is not yet made clear whether these pebble tools are of the elongated double bevelled kind, or merely chipped or plain pebbles.

Incompletely described pebble tools again occur in the south east of England, at sites in the Weald. Some of them have been identified as made of Cornish siltstone, indicating that they had been carried a long way since being picked up (Rankine 1954, 1956). It is hard to see any practical motive that would have led men to carry pebbles all that distance when the equivalent might have been obtained much nearer at hand, but of course explanations are possible; they may, for example, have been tied to something as weights. What it suggests is some cult interest in these pebbles, and one is reminded of the painted pebbles of the Azilian. In the absence of any precise account of the signs of wear or shaping on these pebbles, there is no support for any theory that would connect them with the Obanian or west British 'limpet scoops'.

Neither 'limpet scoops' nor coarse flint industries with a coastal bias are restricted to Britain and Ireland. The island of Jersey is very rich in both, and has produced better dating for the former than we have generally found. Let us take first the coarse flint industry. The material used was the small locally obtained beach pebbles. The basic flaking method was that which produces blades and blade cores. In Britain this character would mark the industry as mesolithic or in the mesolithic tradition, because the later industries are based on the rather different western Neolithic flaking technique with flat cores flaked inward

from the edges, thus producing fewer blades. Unfortunately this criterion does not apply in Jersey, which seems, like a large part of France, to have been dominated by a neolithic blade industry with transverse arrowheads and Chassey pottery.

As in Pembrokeshire and Cornwall, the flints are picked up at the top of cliffs overlooking the sea, but despite certain resemblances, the industry is not the same. Almost the only reworked implements are thumb scrapers which occur in large numbers. Neither transverse nor barbed and tanged arrowheads have been found at these surface sites. Since the former were found in large numbers at the Chassey occupation layer at the Pinnacle (Godefroy and Burdo 1950), and the latter, as well as occurring in the chalcolithic layer at that site, turn up from time to time in the island's passage graves, it seems unlikely that the surface scatter belongs to either of these periods. That means that it should be either mesolithic or middle bronze age and later. It is generally thought unlikely to have been mesolithic, as only one microlith has ever been found on the island. Mesolithic industries which are probably late and in which scrapers have come to outnumber microliths have been pointed out in Wales, and we shall shortly be coming to Teviec where good microliths were found almost entirely as grave goods and the habitation material of the midden was without them. This raises the question whether the surface

ally been of the highest standard, it is just possible that

industry of Jersey could not be mesolithic without micro-liths; but the later bronze and iron ages remain strong candidates.

The Jersey 'limpet scoops' are absolutely typical and identical with the Cornish, Welsh, Irish, and larger Scottish examples. Not only are they found frequently on the surface, but have often been excavated. At the Pinnacle they were found in the Chassey layer, but were absent from the overlying S.O.M. and Bell Beaker layer (Godefroy and Burdo 1950). In megaliths, however, they are associated with both these kinds of pottery, and with the still later 'Jersey Bowls', even at sites where Chassey pottery was absent. (For an account of sites and finds see Hawkes (1939)). Thus they were found at Hougue Maugel in a round barrow with lugged flower pot vases, and at Mont Ubé passage grave with bell beakers, Jersey bowls, and later forms, as well as at sites with Chassey pottery or vase supports, such as Grosnez Hougue and the Dolmen de Geonnais. They also turned up in an occupation layer with flat bottomed cordoned pottery on Icho Isle, and in possible but not certain association with a vase support sherd on the island of La Motte. Small finger like specimens like the small Obanian ones turned up in the probably middle bronze age occupation layer at Petit Port. It is curious that they should be confined to the Chassey layer at the Pinnacle and yet elsewhere turn up in late contexts. Since excavation on Jersey has not generally been of the highest standard, it is just possible that

the specimens from beaker and later sites represented rubbish survivals from an earlier period. The concentration of 'scoops' on the surface near the Mont Ubé passage grave is enough to suggest that contamination of the material of the mound or the surface underneath it would be likely. The only conclusion to be drawn is that these implements were well known on Jersey at least during the neolithic period, and quite probably later as well, and are thus approximately contemporary with those at Dalkey and the Obanian sites, though they may have persisted later.

'Scoops' also occur on Guernsey. Some are illustrated in Fig. 28 of Kendrick (1928), but I have not had an opportunity to examine the material and their occurrence is not so precisely recorded as it is on Jersey.

Since such large numbers appear in the Channel Islands, one would expect 'limpet scoops' also to occur in west France, at least along the coast. The mesolithic site of Téviec is notable for having produced a large and varied 'industrie de galets'. This is not published in great detail and most of the original material was destroyed during the war, but since there is no doubt that the inhabitants made considerable use of pebbles, particularly those of elongated form, it will be worth referring to this interesting site.

The site is on a small island with no fresh water supply, separated from the mainland by a channel about a

mile wide but of no great depth (Péquart 1928, 1929, 1937). The authors were inclined to think that a lower sea level left it attached to the mainland at the time when occupied, in view of the difficulty of bringing fuel, game, and water out to the island. P.-R. Giot, who has made a study of sea levels in the district agrees with this view. On the island there were 26 mesolithic burials accompanied by grave goods and piled over with stones among which there were hearths, apparently ritual. All around there was an accumulation of shell midden material, apparently indicating settlement on the same site as the cemetery. The site produced a good collection of microliths, which, according to verbal information from M. Giot came entirely, or almost entirely, from among the grave goods of the burials, the midden itself being very poor in good flints. Triangles and hollow-based points are present as well as trapezes which may be transverse arrowheads, and awls. Geometric microliths of (late) Tardenoisian type are absent. It seems that the site must be fairly late in the mesolithic period, but exactly how late would be hard to say. No alder was identified in the charcoal, and though this is not decisive proof that the site pre-dates the Atlantic period, a late date in the Boreal period would be acceptable on all counts. The community seems to have had a good knowledge of hunting, judging by the occurrence of pig, red deer, and roe deer bones, but large quantities of molluscs were also consumed.

There were fish bones of inshore species, and bird bones which include both summer and winter residents. The people had dogs.

The utilised pebbles are unfortunately no longer available for study, except for those from three grave groups now in the Carnac, Lyons, and Bordeaux museums. I have only had an opportunity to examine the small group at Carnac, and found bevel-ended pebbles to be absent. The publication does not describe the 'industrie de galets' in particular detail, but since all the material seems to have been worked over with meticulous care, it seems unlikely that anything so characteristic as definitely bevel ended pebbles would have been overlooked. The fact remains that considerable use was made of beach pebbles, especially those of elongated shape at this site.

A not very different story was unearthed on the island of Hoëdic, another outlier of the Quiberon peninsula (Péquart 1932, 1954). A shell midden has also been described in Finisterre, at Beg an Dorchenn, sometimes known as 'Presqu'île de la Torche'. Pontois excavated here some time ago, and describes a section in which a shell midden over a metre thick was sealed by blown sand, over which there was an occupation layer with coarse pottery of what Pontois considered to be the earliest Breton type (le Pontois, 1928). He reported finding hut circles in the midden, but the flint industry was coarse and indeterminate. The site was badly interfered with by German fortifications

during the war, but a passage grave and gallery grave sharing a single mound have been investigated more recently by P.-R. Giot (Giot 1947,). The mound overlay a midden with coarse pottery. No trace of Pontois's earlier midden was found. Neither the pottery nor the flint industry from this midden has been illustrated by Giot, but I understand from verbal information that the latter is coarse and uncharacteristic. It is difficult to know how much reliance to place on le Pontois' discovery, and it is unfortunate that so little information should be available, but it is at least interesting to have this reference to a third Breton mesolithic midden.

Le Rouzic has called attention to a number of flint sites on the Quiberon peninsula which are not middens. The main character of the flint industry is its lack of identifiable forms, but le Rouzic is prepared to distinguish it from that on other sites with polished stone axes, barbed and tanged arrowheads, imported flint, etc., on negative evidence. The sites of this coarse industry are, in le Rouzic's words, situated on "presque toutes les pointes rocheuses de la côte ouest de la presqu'île de Quiberon" (le Rouzic 1930). The richest site produced microliths (le Rouzic 1931), but unfortunately one cannot be certain that all the sites are mesolithic, as coarse flint industries can appear at other dates (see discussion of coarse flint industry of Jersey). This headland distribution of coarse flint sites recalls the situation in Leinster, where

Larnian type flints are most numerous at headlands, and also the coastal and sometimes headland distribution of the Pembrokeshire and Cornish finds discussed above.

To find 'limpet scoops' it is necessary to look at Breton neolithic sites. They were included among the finds from stone cists on the Ile de Thinic (le Rouzic 1934, p. 487 and fig. 2, nos. 11-12), associated with the round bottomed pottery which probably precedes beaker in the area. I have it from M. Giot that bevel ended pebbles were also found at Er Yoh in Morbihan. Thus their age in Brittany seems to be neolithic just as it is further north.

Farther south shell middens are recorded in the Spanish province of Asturias (Whelan 1930; Burkitt 1923) where there is no flint industry, presumably owing to absence of the raw material. The only recorded artifacts are oval pebbles worked to points at one end by flaking from one face only. These are the implements in which Bremer saw parallels to the heavy core points from Island Magee, and in which Whelan saw parallels to the large plunging flakes that are so common in the Larnian. As in Brittany mollusc eating and pebble utilisation are features which suggest a facies of the culture adapted to a coastal existence, and though any claim that an industry without microliths is mesolithic is automatically suspect, Obermaier gives some reasons for believing that this culture actually is post-Azilian and pre-Neolithic (Obermaier 1924, p. 354).

Farther south along the Iberian coast a series of late mesolithic middens in the Tagus estuary have produced marine shells some miles above the present limit of salt water (Obermaier 1924, pp. 324-26). It seems that there must have been some kind of post-mesolithic rise of the land in this region similar to that which affected the northern part of the British Isles. The equilateral triangles, lunates, and trapezes at Mugem, together with the fact that pottery appears in the top layers of the midden, seem to indicate a late mesolithic date. For a detailed account of the industry from one of the middens see Roche (1951).

While dealing with material in south-western Europe it should be noted that a few early mesolithic cave sites in southern France have produced a surprising assortment of utilised or painted pebbles. By far the best known site is the Mas d'Azil, where they were decorated with designs in red ochre. A considerable number of these stones have been chosen for their elongated form, and one in the Musée St. Germain is actually bevelled at one end. This bevel is quite flat and smooth, and has obviously been made by rubbing against something, and consequently there is no real connection between it and the 'limpet scoops' of Brittany and the British Isles, with their pocked convex bevels. The painted pebbles are usually interpreted as signifying some sort of cult, though they seldom occur except at the Mas d'Azil. An unusual number of unpainted plain or utilised pebbles occur at a few

other Azilian sites. At the Grotte de Goerris far more utilised pebbles were found in the Azilian layer than in the Magdalenian layer below (St. Périer 1927); and at the Trou Violet there were a variety of utilised stones, including long stones chipped at the ends, and there were also stones with striae and unused stones deliberately brought to the cave (Treat and Vaillant-Coutourier 1928). It will be recalled that the British mesolithic site at King Arthur's Cave also produced pebble implements in some number, though without the double bevelled type, and that Téviec seems to have produced the same.

From the preceding account of sites and cultures at points along the western coasts of Britain, France, and the Iberian peninsula, a number of points emerge.

1. Poor blade industries with few or no microliths are found at coastal sites scattered along this coast, e.g. in Ireland, in Pembrokeshire, Jersey and Brittany. It might be argued that this is due only to the fact that these industries are based on refractory beach pebble flint, but the fact remains that superior industries have been based on the same flint supply at several times and places, while this sort of degeneration has not been remarked in the areas of eastern Britain with a poor flint supply. The rarity of microliths probably indicates that hunting did not play a very important part in the life of these people, an inference which is supported by the restriction of these indus-

tries to areas near the sea, though of course the accessibility of the beach with its supply of flint pebbles may be of significance.

2. Bevel-ended pebbles have a similar distribution to the poor blade industry - in Argyll, at Dalkey Island, Sutton, and Rockmarshall, in Pembrokeshire, in Cornwall, in the Channel Islands, and, apparently, in Brittany. They have only been found in association in Argyll, Ireland, the Channel Islands, and Brittany, where they are in all cases neolithic. ⁽¹³⁾ The occurrence of very similar specimens in later contexts at Ballybunnion in Kerry and Knocknalappa in Clare must be taken as a warning that they are not absolutely restricted to the neolithic or mesolithic/neolithic transition, but it seems that the large number of specimens from Pembrokeshire and Cornwall, especially since they occur associated on chipping floors with early flints, must belong to this period (see Appendix for further discussion of bevel-ended pebbles).

3. Water-worn pebbles of a variety of forms, including elongated, but excluding bevel-ended 'limpet scoops', have been found at a number of other sites which in this case show an extreme west-European distribution. The sites in question are Tévéc, King Arthur's Cave, and some Azilian caves near the Pyrenees. These sites are more widely separated from each other in time and space than the 'limpet scoop' sites. While the dateable 'limpet scoop' sites

belong clearly to the neolithic period, these other sites are mesolithic, and while the 'limpet scoops' seem to go with a very poor flint industry, this seems not to apply to the other 'industries de galets'.

4. A symbolic or ritual interest in pebbles can sometimes be detected. At the Mas d'Azil and some other Azilian sites pebbles were painted with magic or other designs. In Britain, the transport of pebbles of Cornish siltstone to the Weald, if not purely practical, may have a similar explanation.

Two alternative interpretations come to mind to explain these four points and the curiously discontinuous distribution pattern they present.

A. After the ice age certain groups responded to the changed environment by moving down to the coast and using fish and molluscs to supplement their diet when it was threatened by the disappearance of the large periglacial herds. Being less dependent on hunting than the inland tribes, they had less occasion to require microliths, and this side of their flint industry remained underdeveloped. With the improvement of the climate they spread northward along the coast, and are, in fact, the Azilian coastal migration whose existence both Mitchell and Clark have favoured (Mitchell 1949; Clark 1956). We only find late sites of this culture because of the rise of the sea. They are distinguished by a coastal distribution, a coarse

flint industry with few microliths, and in some cases by bevel-ended pebbles, and still more occasionally by harpoons which may have Azilian affinities. The Larnian is the most abundantly represented branch of this culture, and owing to Ireland's complete (or almost complete) insulation from the inland hunting tribes of the period, the group which came nearest to depending wholly on the sea for sustenance. The degeneration from a Magdalenian or Azilian hunting economy to a purely strand looping one was a slow process, and we have no reason to suppose it was carried to its logical conclusion anywhere but in Ireland. Continued contact and perhaps hybridisation with the inland cultures would have retarded its progress elsewhere. Nevertheless most of the mesolithic sites of the extreme west stand a little apart from the others, and this (according to this interpretative scheme) is because they represent a relict population from this coastal mesolithic which formed before Europe's west coast was cut up into a number of islands.

B. The alternative explanation is that the resemblances, such as they are, between these sites, is the result of conversion. At various times and places mesolithic communities took to a greater or lesser degree to strand looping. This may only have been a seasonal occupation, but while they were so engaged the people would not have much occasion to lose finished microliths on their sites. Some other explanation has to be made for the superposition of the 'limpet scoops' on these groups. The sites

are all late, and may be connected with the separate late diffusion of a number of cultural traits along the west coast, of which the 'limpet scoops' alone are definitely preserved for the archaeologist. It may be that sheep bones at mesolithic sites, where unaccompanied by cattle bones, could belong to the same current of influence. The Obanian harpoons are (according to this interpretative scheme) northern rather than western in their inspiration, or may, like the rest of the Obanian culture, be derived from the Sauveterrian.

Suggestion A makes the adaptation to a coastal way of life and early development and its scattered occurrence in the late mesolithic period the result of the breaking up of a single continuum by the flooding of the Irish Sea and English Channel. According to Suggestion B there was no such general adaptation, but a number of separate developments. The question cannot be resolved, but it would assist us to assess the probability of a general adaptation if we knew whether there had been such a general adaptation anywhere else in response to the same fundamentally climatic stimulus. Accordingly we shall turn to the problem of the origin of the shell-midden culture of northern Europe.

This was the region of what Childe has called the 'Forest Cultures' of northern Europe (Childe 1931). During much of the early part of the post-glacial period, before the rise of the sea inundated the lowlands between East

Anglia and the Netherlands, a single cultural region extended from eastern Britain eastwards as far as the Baltic states of Soviet Russia. The scarcity of forest culture finds in west Britain seems to indicate that Scotland and the Pennines, jutting out as an inhospitable ridge into the north Atlantic, acted as a western barrier to the further spread of the Forest Cultures. The few finds of core axes and Ertebølle type antler implements west of this barrier are late, and in any case do not invalidate the general truth of this statement. If it could be shown that in the Baltic-North Sea region a coastal culture developed as a distinct adaptation from the well known inland cultures' adaptation to the growth of the forest, it would go a long way to encourage us in the view that we should look for the origin of the Larnian in a similar adaptation in Atlantic Europe.

The present consensus of opinion seems to be that there were distinct coastal communities in Scandinavia at least as early as late Boreal times, but owing to the marine transgression, it has, as in our own region, to remain largely hypothetical.

It will be well to review briefly some of the evidence. In late Atlantic and early Sub-boreal times a culture called the Ertebølle flourished along the Danish coasts of the Littorina Sea. The considerable differences between its material equipment and that of the preceding Maglemose

culture has long made its origins one of the problems of Danish Prehistory (see for example Shetelig and Falk (1937) pp. 45-46).

The fully developed Ertebølle culture of the late Atlantic period was characterised in its stone industry by a preponderance of flake over core axes, by the relatively large size of the axes, by the combination of many transverse arrowheads with few other microliths, by a superior blade technique, by the possession of pottery, and by a number of lesser points; its bone industry was characterised by a poverty in forms and in decoration relative to the Maglemosean. Theleister prongs are gone, but new forms have appeared in the antler sleeves, and the hatchets with the haft inserted through the hole left by the removal of a tine.

This is the typical assemblage of the late Atlantic period. Coastal sites from early in the Atlantic period have also been traced. Their equipment is not quite the same as that of their inland contemporaries, but had not yet acquired the peculiarities of the late Ertebølle. At Carstenminde, for example, features which distinguish the assemblage from that of the Maglemosean were a high proportion of rhombic arrowheads, round stone axes pecked into shape and ground to a cutting edge, and the decoration of bone implements by deep instead of the usual shallow incised lines (Veback 1938). These peculiarities are thought

to indicate that the culture found at Carstenminde must have diverged from the Maglemosean some time before - probably as early as in the Boreal period. There are other early coastal sites of a similar character. The peculiarities give a hint where we may expect to find the affiliations of the early coastal culture. The rhombic arrowheads point in the direction of the Gudena culture of Jutland, a western contemporary of the Maglemosean. The round pebble axes and the large symmetrical core axes may point toward the region around Oslo Fjord. Troels-Smith has suggested that the Nøstvet axe, or symmetrical core axe of stone, may have originated in Norway and have spread south to Denmark (Troels-Smith 1938). Deeply engraved ornament has been found on several bone objects, most of them near the coast of Denmark. At a further remove, it has been pointed out that the rhombic arrowheads and deeply engraved ornament, and even some of the patterns used, recall the Zone III Ahrensburg culture, indicating in the early coastal culture, as in the Fosna and Finmark culture, a longer survival of Ahrensburg types than in the Maglemosean. A possible inference would be that the cradle of the early coastal culture of Denmark was along the eastern coast of what later became the North Sea at the time of the Ancylus Lake, especially in the deep gulf occupying the position of the present Kattegat and Skagerrak where a single coast line linked Norway with

Jutland, so that it occupied an intermediate position between the south Norwegian and the Gudenaas cultures. When the land barrier between this gulf and the Ancylus lake was submerged, the folk may have spread southward, following the migration of the shellfish into the Littorina Sea, where they developed the characteristic culture of late Atlantic times along the now raised Littorina shores of eastern Denmark. The author puts this suggestion forward in the most tentative way. It is outside his proper field of study, and is only introduced here to show that there does seem to have been a distinct cultural evolution in at least one of the coastal areas subsequently submerged by the rising sea level.

It should be remembered that there is no evidence that this early coastal development was strictly littoral and dependent on the sea like the Larnian. Even in the developed Ertebølle culture of the late Atlantic period the number of sites which are not shell middens (see Clark 1936, p. 138), and the quantity of game bones in the middens, indicate that the sea took an ancillary rather than an essential role in their existence. The hypothetical antecedent of the early coastal culture may not, indeed have been a coastal culture at all, but simply a culture of the lowlands. The fact remains, however, that there is a certain amount of indirect evidence for settlement and separate cultural development in the area below sea level.

These shore lines have been raised along the Norwegian coast north of Bergen, instead of being flooded, but unfortunately their study does little to cast light on the question. Numerous camping sites of the Fosna and Finmark cultures have been found on the raised beaches. On typological grounds they belong to the Atlantic period or later (Freundt 1948). Unfortunately no food refuse of any kind has survived in association with their stone implements, and so it is impossible to tell what part the sea played in their livelihood. Their use of tanged points of a kind that had fallen out of use in more southerly regions at the end of the palaeolithic hunting period, and their probable connection with some of the naturalistic animal art rock scribings of the region (Clark 1936, p. 180 ff.) suggest that they are more likely to have been hunters than collectors.

Besides trying to guess the origins of certain features of the coastal cultures whose remains can be found, a second form of approach to the problem of submerged coastal cultures is to look for traces of, or imports from, the coastal cultures at dateable inland sites. The following example will illustrate the constant influence or 'pull' of coastal developments on the inland communities. In late Ertebølle times the equipment of the inland regions of the Danish islands took on a very Ertebølle appearance, but it was not until the Sub-boreal period that the absolute predominance of flake over core axes, which occurs on coastal sites in

the Atlantic period - e.g. at Dyrholmen II (Clark 1950, p. 95) - reached the interior - e.g. at Hallebygaarde in Aamosen bog (Mathiassen 1943). In earlier times some unusual objects found at inland sites have been interpreted as either imports from the coast, or as indicating contact of some kind with the coast. If this sort of argument is correct, coastal cultures can be inferred as early as the late Boreal period. An object of seal bone, perhaps an amulet, found at Svaerdborg should indicate seal hunting at that period, and hence perhaps people especially accustomed to live near the coast where they would develop the technique for hunting these animals. Round stone axes found at the same site, and also in the lower of the main occupation layers at Øgaarde, have also been taken as indicating contact with some old coastal culture. Large oblique arrowheads, certain bone points, and deeply cut decoration on bone, are all features at the same site which seem to show that the early coastal culture existed at a period earlier than any of their actually known sites can be assigned to. Svaerdborg and this horizon at Øgaarde belong to the late Boreal period (Mathiassen 1943; Clark 1950).

The conclusion is that the submerged areas around Denmark are likely to have been occupied in the Boreal period by a folk whose equipment differed in some respects from that which has been made so familiar by excavations at inland sites; but this is only indirectly established.

We have now mentioned several aspects of the mesolithic period in Europe which we consider relevant to the place of the Larnian in European Prehistory. We should now return to our particular field of study, the Larnian itself. Among all those communities whose lithic material included microliths, discoid scrapers, and burins, the Larnian stood out as a unique industry which lacked these things. It has no sites outside Ireland, no obvious ancestry and no close relatives. It is true that the flints from certain Scottish sites have been described as Larnian, but the present author does not consider that any of them may be properly so called. On the Scottish sites microliths, micro-burins, and well made scrapers are found, while the Larnian 'rough scrapers' are absent and the perforators present only at the Albyn Distillery and surface sites. The common element of coarseness is the result of their both being blade industries made from beach pebble flint. I have suggested that the Scottish coastal finds may come from a separate offshoot of the British Sauveterrian which independently adopted a coastal way of life in that region. Certainly the micro-burins and microliths (including late forms) in the Scottish industries suggest a later divergence from the main stem of mesolithic development than in the Larnian, which lacks them.

It might be possible to infer the stage at which the Larnian branched off from this main stem by an examination

of the industry. Unfortunately the indications are contradictory. The axes, one of which, as we have pointed out, must have come from in or below the early Atlantic estuarine clay at Island Magee, should indicate a divergence at least as late as Star Carr, and perhaps considerably later.

Normally, however, axes are accompanied by abundant microliths, and the virtual absence of these, even of the practically ubiquitous early lanceolate points, suggests an earlier branching off. Do the microliths give the right indication, with the axes as a later accession? Or did the Larnians come over provided with both axes and microliths, and lose the microliths while their axes merely degenerated, the whole process taking place before Cushendun's early layers? The typological lateness of some of the axes, together with the typological earliness of the Cushendun microliths, slightly favours the former alternative.

The extraordinary simplicity of the Larnian - its almost complete lack of sophisticated forms and its vast preponderance of primary flake material - must surely indicate something deeper than accidental divergence due to isolation. Taken together with the exclusively waterside distribution of their sites and the scanty and heterogeneous fauna of their middens, it suggests a basic economic difference. It seems that their economy was based almost entirely on collecting, and hardly at all on hunting. Moreover the inferiority of the flaking technique seen in the upper

gravels at Cushendun as compared with that in the lower layers, places this in the light of a degeneration. So far as one knows, one only sees the end of this degenerative process, the part that took place at the end of the Boreal, and during the Atlantic period. Its earlier stages have been flooded by the marine transgression. But despite Movius' opinion to the contrary (Movius 1953, p. 76), degeneration seems to have been well advanced at the time of Toome Bay and early Cushendun, for the flint industry (at the latter site anyway) is only slightly different from that at Larne itself, and both are waterside sites with nothing to suggest a different economy from that which prevailed later. There are no truly inland Larnian sites known, and surely if they had been hunters they would have roamed onto the Antrim plateau in pursuit of game even before the marine transgression had brought the shore up as far as the present one. It seems a tolerably safe inference that the Larnians were from a very early time poor hunters.

Another important point is were the Larnians familiar with boating. This is important not only to help us envisage their degree of civilization, but also for the light it casts on the possible existence of a land bridge, on how early Man first reached what was to become Ireland, and on the question of later foreign contacts. As usual, the evidence is not at all conclusive either way. The Dalkey Island, Rough Island, Oronsay, and Risga middens could only

have been reached by boat, Oronsay by a crossing of several miles, but all these sites were later than the maximum of the transgression, and so we cannot be sure that the boats were not introduced by the neolithic invaders. The flints in the raised beach on Rough Island are slightly earlier, but unfortunately even here there is a suspicion that these flakes may not have been struck until the land was beginning to emerge from the sea in the neolithic period. The most substantial single piece of evidence is the presence of flints in the raised beach at Millknowe and Dalruan, Campbeltown, where they probably date from before the maximum of the transgression. At that time Kintyre was probably reached by a sea crossing from Ayrshire. Strictly speaking Kintyre can be reached along the shore, but the trip is extremely long and devious, and there are no intermediate mesolithic sites. A crossing from Ayrshire would be very similar to a crossing of the North Channel, but since the Campbeltown folk were not Larnian, this need not apply.

There is also a little flint evidence in favour of navigation. This is the arrival in Ireland of certain flint types which only occur elsewhere after the Irish Sea basin had been flooded, and therefore can only have been diffused to Ireland by sea. Such are the Larne axes, and the single transverse arrowhead from Sutton. The arrowhead is a unique find. It belongs to a late type similar to those from Peacehaven, Sussex, illustrated in Clark (1932, fig. 53) and

the stages of its development through the trapezes of the Sauveterrian is absent from Ireland. It is unlikely to have been introduced to Sutton by the same foreign contacts which brought the stone axes, for these were with the normal western neolithic culture, whose gear did not include transverse arrowheads. The arrowheads may have arrived through some incidental foreign contact opened up by the neolithic invasion, but it may also have arrived as part of a hypothetical non-western neolithic movement which may have introduced 'limpet scoops' and sheep - as in suggestion B above. In either case navigation is suggested, but there is ample other evidence for navigation at the period to which the Sutton midden belongs.

The Larne axes are older, for at least one belongs to the early Atlantic period, as shown by its blue-black estuarine clay patina, and one from Toome Bay (Whelan coll.) may be Boreal. Axes were in existence early enough for them to have been an original feature of the hypothetical proto-Larnian before isolation from Britain. They first appear both in Denmark (Klosterlund) and Britain (Star Carr) in Zone IV, and a land bridge north of the North Channel in Zone IV is a distinct possibility. Typology is perhaps a doubtful clue for the more precise placing of the Larne axes, since none of them are sharpened by the transverse blow, but we may nevertheless compare with other features of the European axe sequence, for what this may be worth.

In Denmark Maglemose axes were generally of a small type, rhombic in section. Symmetrical or 'zweiseitig' axes, with all their flaking from two keels running down each side of the implement only became important later (Troels-Smith 1938). Unfortunately the Danish sequence does not apply to England, for here 'zweiseitig' axes are in a majority even at early sites, such as Star Carr (Clark 1954), Flixton I (Moore 1950), and Broxbourne (Clark and others 1934), and some of them are quite large. Therefore the fact that all but one of the Larnie implements are 'zweiseitig' need only be an indication of relationship with British axes, and not evidence for a late date. The predominance of the 'zweiseitig' axe in Britain seems also to be indicated by the many Thames finds. Of these I have only succeeded in finding illustrations which belong to this type (see Evans 1872). Another criterion proposed by Troels-Smith (op. cit.) is whether the cutting edge has been especially prepared by radial flaking, so that the flake scars fan out toward the cutting edge where the transverse flaking along one keel has been carried right around the end in an arc, and up the keel on the other side (spezieller Schneidenbehandlung). This feature is absent at Klosterlund, and is thought to be fairly late, but earlier in Norway than in Denmark. Our illustration 111 is the only Irish example 'mit spezieller Schneidenbehandlung', but 164 may also, on account of its shape, belong to a late type.⁽¹⁴⁾ It seems not to occur in any of the early dateable contexts.

The only inference we can draw from the Larne axes is that their peculiar lack of transverse sharpening and frequent lack of any cutting edge at all, is a further example of the isolated and degenerate character of this industry, but that two are likely to be derived from types which belong to the period when Ireland and Britain were certainly separated by sea. Hence they imply that navigation over this not inconsiderable distance was sometimes practised. On typological grounds the early Atlantic period would be a quite satisfactory time for these ultimately Forest Culture influences to have reached Ireland. It is worth noting that the molluscan evidence makes this just after the climatic optimum of the region, which might have made long-distance boating safer. The most probable immediate source of the axes was southern or eastern England (the Province B of Clark 1932), where a well developed axe culture flourished in mesolithic times. Nevertheless the axe evidence is not very definite, and it is still possible that they were an original feature of the Larnian derived from Zone IV English prototypes. At whatever time they were diffused, their degenerate character is probably due to their lack of importance to an exclusively strand-looping population.

While on the subject of navigation and diffusion of cultural traits across the sea to Ireland in pre-neolithic times, we should return to the problem of the 'limpet

scoops'. Suggestion B, above, was to the effect that these indicate a late mesolithic folk movement of some kind along the Atlantic coast of Europe. The sheep bones unassociated with cattle bones that have been identified tentatively at Sutton and Dalkey Island north midden may have resulted from the same movement. Of course the finds at Sutton and Dalkey Island are not conclusive of mesolithic sheep, but since cattle bones usually outnumber sheep bones on neolithic sites by several times to one, the point is suggestive. Can it be that some sort of intercourse between the inhabitants of Brittany, Jersey, Cornwall, Pembrokeshire, Ireland, and Argyll served as an accompaniment or precursor to the first spread of the megalithic religion? In time it seems not to have been very remote from the latter, but the fact that it affected a quite different population seems to show that it was quite distinct from it, and may well have blazed the trail the religion followed. According to the present trend toward higher datings for the earliest neolithic phase in the Irish Sea area (Mitchell 1958) it is quite impossible that the spread of megaliths along the coasts of Atlantic Europe can have been occasioned by the search for ores. It is interesting therefore to note that intercourse was not connected solely with the spread of the tombs, and that the latter may have followed a well worn path. One is presented with the picture of mesolithic elements farther east being disrupted and dislodged by the

arrival of the neolithic economy, and thus introducing the antler mattock etc. to Scotland, and the 'limpet scoop' to Ireland, while the neolithic grazier gardeners followed quickly on their heels. This stream of foreign influence is not, of course, to be confused with the earlier one that may have diffused axes to the Larnian.

This brings us back to our suggestions A and B of a few pages back, which are not merely alternative ways of explaining the 'limpet scoop' pattern, but radically different ways of interpreting the whole Irish mesolithic, and indeed some features of the mesolithic of extreme western Europe. The time is not ripe for choosing between the alternatives. Much more up-to-date work, especially in Cornwall and Pembrokeshire, will have to be done first. It is the author's intention merely to present arguments for each, and to leave the matter.

The strongly individual character of the Larnian, both as a flint industry and as a way of life, speaks for a long divergent development. If it did receive any of the accretions from abroad that we have suggested, the accretions must have been of a minor character, and amounted merely to the absorption by the Larnian folk of a few foreign traits rather than to any introduction of a new way of life by a folk-immigration. The special character of the Larnian must go back so far that we can be certain that the lowlands between Ireland and England were occupied

by their forbears. Whether they reached Ireland itself by a short sea crossing, or by occupying the isthmus at the head of a gulf reaching up the Irish Sea to somewhere near the present coast of Antrim, and then being cut off when the Atlantic broke through the isthmus, is a matter of no importance. In either case it seems likely that at this remote period there would have been traces of this population on both sides of the Irish Sea, or Irish Sea gulf, as the case may have been. We have suggested several times that various mesolithic groups on the eastern side of the Irish Sea, and indeed down as far as Brittany, may be surviving traces of this proto-Larnian population. Of course these traces date from a much more recent time than the division of the proto-Larnian into an Irish and a British branch, and it is only to be expected that the two branches should have grown apart. The differences could easily have resulted from the borrowing of hunting practices and equipment by the British group, while the Irish group sank into an increasingly scavenging existence owing to their isolation. However the British groups with a simplified flint industry and 'limpet scoops' do not prove the survival of a proto-Larnian population there. This is one of a number of hypotheses. Indeed the industry at these sites is nearer to an ordinary Sauveterrian series than it is to the Larnian, so the suggestion that all these sites, including the Obanian, represent an impoverished late Sauveterrian independently

acquiring coastal features, has a great deal to recommend it. If that is the case, there is no surviving trace of the hypothetical eastern division of the proto-Larnian. If this explanation could be accepted, it would become very difficult to see the 'limpet scoops', for which, as we have seen, all the surviving evidence points to a late date anyway, as an original feature of the Larnian. It would become reasonably clear that they must be a late feature introduced across water. In this case all the evidence from axe typology, the distribution of sheep and dog bones, the presence of sites on islands - even if they are late sites - the headland distribution of flints in Ireland, and on a larger scale along the west coasts of Europe (Brittany, Cornwall, Pembrokeshire, Kintyre), would fall in together and point cumulatively to the existence of a reasonable knowledge of boating west of Britain, corresponding to what is known by direct evidence in the eastern area (from actual dugouts on Danish sites, in the carse clay, etc.). In that case the first arrival of the Larnians may quite well have been by boat. An early date, however, is still indicated by the very real industrial and cultural (in the proper sense) divergence between the Larnians and any other known mesolithic group. This seems to be as far as one should venture to commit oneself in the present state of knowledge.

It is regrettable that the discussion should end on such an ambivalent note. Perhaps it would be desirable to

finish by a summary of the place vis-a-vis the Larnian, in the present author's view, of the various cultures with which its name has often been linked.

Creswellian: probably ancestral to the Larnian in the loose sense that the British final Palaeolithic is likely to be ancestral to the Larnian, though a direct descent from some continental palaeolithic group via the submerged coastal strip cannot be ruled out. The relationship does not show in the flint industry, except that the Cushendum microliths may be related to types in the Welsh final Palaeolithic.

Azilian: possibly related via the submerged coastal strip. The relationship, however, does not show in the flint industry, and the Obanian harpoons seem absent from Ireland, and may in any case relate better to certain Baltic types, or be derived from some vanished inland bone industry. Selected unpainted pebbles at certain sites may give better indication of the northwards influence of the Azilian. Its connection with our subject seems still to be unproven.

Forest Cultures: the axes in the Larnian can hardly be anything but ultimately inspired by the Forest Culture. In west Britain and Ireland they are distinctly rare and peripheral to the main distribution of these implements. On typological grounds the Irish axes are derived from British rather than north European prototypes. The most probable immediate source is Clark's Province B. Forest Culture

influence of the mesolithic/neolithic transition can be seen in the antler mattocks from Obanian sites. Their immediate prototypes are on the other side of Britain in the carse clay. Beyond that they may have come direct from the continent, or via southern England, where nothing is known about bone tools in the late Mesolithic, but where flake axes and transverse arrowheads indicate fresh influence from the continent at this time.

Sauveterrian: no influence on the Larnian has been suggested. Relationship, probably ancestral, suggested tentatively by the author with the Scottish Argyll and Ayrshire microlithic industries, and through these perhaps with May and Batty's microliths from the sand dunes of the Bann estuary, but not with the Larnian proper.

The author would be satisfied to have the negative and destructive end of his enquiry valued more highly than his efforts to provide alternative hypotheses. The main negative conclusions may be summarised as:-

1. There was no adaptation between Cushendun layers D-F and Glenarm, i.e. between the "Early" and the "Late" Larnian to a forest environment, if indeed, there was any substantial change in the environment with which the inhabitants had to deal. No Larnian tools except the rare axes with cutting edges were intended for woodworking, and the early Larnian way of life was essentially the same as the late Larnian.

2. Rough Island is not an early Larnian site.
3. None of the Scottish 'Larnian' sites possessed a flint industry close enough to the Larnian for the comparison to have any meaning.
4. Millknowe and Dalruan present a different industry than does Albyn Distillery, and possibly an older one. The latter is neolithic in date, though the industry is largely of mesolithic type.

The unique mesolithic folk whom we have been discussing did not vanish instantly with the arrival in Ireland of the ever-spreading neolithic grazier gardener culture. On various evidence it seems likely that the shock woke them out of some of their age-old lethargy. Quite definite developments seem to have affected their flint industry; they spread widely over previously uninhabited parts of the interior; and they absorbed various cultural traits from the newcomers. The flint developments were most marked in the north and inland. They consisted in a considerable increase in the use of retouch, both normal and inverse, in a tendency to still larger sized implements (though not necessarily larger debitage material), and (especially inland) in a great development of the type of implement already foreshadowed on the coast, made from a leaf-shaped flake by trimming the sides of the butt. Implements of this type show that a culture with Larnian affiliations spread very widely over the central plain of Ireland, probably in

some sort of relationship with the tortuous waterways of that region. Here it turned from utilising the rare imported or ice-borne flint of the region to its abundant dark Carboniferous chert. Since nothing is known about this culture except its stone equipment, I have preferred to call it epi-Larnian rather than epi-mesolithic, as the term 'epi-mesolithic' has unproven implications regarding their economy. The culture probably survived for a long time - on the evidence of Drumane dolmen - into the Bronze Age (if the portal dolmens really are derived from (and therefore are later than) the mainly bronze age 'wedge' class).⁽¹⁵⁾ On more doubtful evidence it may have survived into much later periods. The coastal settlements on the other hand seem to have died out early - on direct evidence early in the neolithic in the case of Dalkey Island; on indirect evidence from the lack of their finds (except at Whitepark Bay) on the usually late neolithic sandhill sites. Whether they were absorbed into neolithic communities along the coast, or simply were annihilated it would be hard to say. Inland the extraordinary difficulty of the terrain must have helped them to hold on. Its difficulty is well attested by Elizabethan military accounts of the sixteenth century, and that was after the introduction of the iron axe and mediaeval economic developments had cleared the forest considerably. In this sodden jungle the aborigines lived on for a longer time. There are several ethnographical

parallels at the present day, which show earlier races driven back into jungle or desert fastnesses by more advanced races, but acquiring some cultural traits from them.

The importance of the epi-Larnian industries is that they show us in Ireland a phenomenon which took place all over the world as the first agriculturalists and herdsmen spread out from their south-west Asian homeland. As they came into contact with the more primitive food gathering tribes, wave after wave of these adopted the food producing ways that had been discovered by others. The archaeologist can detect some element of continuity with the pre-agricultural inhabitants of the region, from which he can deduce this process of acculturation. The flint industry, on account of its extreme conservatism, often indicates best this element of continuity. We may cite some examples.

The First Northern, or TRB culture, though intrusive in Denmark, is thought to be a mesolithic group which acquired its neolithic features through contact with the Danubians, perhaps in Poland (Becker 1954; Childe 1958, p. 67). It acted in turn as the agent for the transmission of farming and animal domestication to the Forest Culture aborigines of Scandinavia. A whole series of sites have been found which show the stages of this transmission, ranging from some completely food gathering Ertebølle sites in the Danish isles, which pollen analysis has shown to be later than the arrival of the TRB culture (see certain sites in

Mathiassen 1943), to various 'sub-neolithic' and 'epi-mesolithic' dwelling places where hunting and food production were combined in varying proportions, and which were characterised by their 'pit-combed' pottery (for summary, mainly from the point of view of seal hunting, with references, see Clark 1946). It was here, probably, in the remoter lands of the Baltic and beyond, that we find the best parallels to the Bann culture, but with a larger area to spread themselves in, and perhaps less competition from neolithic intruders, the people appear to have had a more vigorous and diversified civilization.

Farther south in western Europe, it is hard to find such precise information. The Campignian is a flint industry with marked late mesolithic features - flake and core axes, sometimes transverse arrowheads. If we are to believe Hougier it lasted a long time and changed gradually from a food gathering to a food producing culture during this time (G.C.P.F. pp. 76-81). If this is so it is more likely to have been through contact with food-producing neighbours than as an autochthonous development. An unusually good collection from such an industry has been found at Carneville, Departement Oise (unpublished, material at Musée de l'Homme, Paris), and includes two kinds of transverse arrowheads, flake and core axes, scrapers, and various other forms. The industry from the Pinnacle, Jersey, with Chassey pottery, has the transverse arrowheads, but lacks the flake axes

(Godefroy and Burdo 1950). In Spain the flint industry of the megaliths is a typical blade and microlith industry that looks as if it could easily have developed out of the mesolithic industry of, say, the Tagus middens (Marquez and Leisner 1952).

In Britain the only well-attested mesolithic survivors are in Argyll, Ayrshire, and Berwickshire, (Obanian sites, Shewalton Moor, and perhaps Dryburgh Mains), and there is no evidence how they came to terms with the new economy. There are accounts of microliths in bronze age contexts - at Rowberrow Cavern (Clark 1932, p. 39), in two Staffordshire barrows, and in Beacon Hill barrow (*ibid.* p. 108-09). These accounts are not conclusive that the microliths are of the same age as the barrows, and the absence of any sign of microlithic work in what it is becoming increasingly obvious must have been a long neolithic period, makes them almost doubtful. It looks rather as if the mesolithic inhabitants of England, unlike those of Scotland and Ireland, vanished soon after the arrival of the Windmill Hill invaders. It has been suggested that the makers of the coarser and more decorated types of neolithic pottery in the British Isles were the resurgent mesolithic natives with traits absorbed from the invaders (Piggott 1954, chapter X *et passim*). This theory is not based on any direct information from animal bones showing that the 'secondary neolithic' cultures were more dependent on wild animals than the 'primary neolithic'.

Nor is it based on any definite continuity in material equipment. The little faunal evidence there is suggests that economically the two were alike (e.g. Skara Brae). There is nothing to relate Piggott's 'light' and 'heavy' flint industries with the Sauveterrian, and the few sites which show a good association between 'secondary neolithic' pottery and a flint industry show the former accompanying a flake industry with flat retouch, that it would be very hard to distinguish from that which is found with 'primary neolithic' pottery. In Ireland, where 'sandhills' pottery appears related to 'Peterborough' ware, the flint industry found with this pottery at Island MacHugh (Davies 1950) and at Townley Hall (to be published shortly by the present author) is of perfectly normal 'western' type, except that it includes a high proportion of hollow scrapers of a type that seems to be a specific Irish provincial development. The best of the arguments for separate 'secondary neolithic cultures' in England seems to be the lowland distribution of the 'secondary' as compared with the highland or chalkland distribution of the 'western' sites, and few would say that this by itself is a strong argument in favour of a mesolithic origin for either of these groups. In the present author's opinion the case for acculturated mesolithic survivors in any region can only be based on direct evidence of a transitional or hybrid economy, or a substantial continuity from mesolithic to neolithic of some element, or preferably elements,

of their equipment. In the epi-Larnian flint industry of Ireland, and also in the survival of the strand-looping and mollusc-eating way of life, we have in Ireland evidence of such continuity. Together with the Obanian of Scotland it provides the only good evidence for mesolithic ethnic survival in the British Isles, and it alone provides the only indication so far of the acculturation of mesolithic natives. This is its contribution to the broad pattern of European Prehistory.

BIBLIOGRAPHY

DESCRIPTION
OF ILLUSTRATIONS

ILLUSTRATIONS

APPENDIX A

APPENDICES

The following material from the boxes in the
 Belfast Municipal Museum, covered "various material from
 (some) other part NOTES AND wholly dropped in
 site on the stone block, and therefore
 should be re-arranged in one.

BIBLIOGRAPHY

Scrapers	DESCRIPTION	1
Perforators	OF ILLUSTRATIONS	

Notched Flakes (in these cases the
 notches are worked inwardly)

Flakes with	ILLUSTRATIONS	6
(they resemble notched blades or blades)		

Total

Flakes and blade-flakes		7
	Total	7

Belfast Museum I

The following material is in the collection of
 Trinity College, Dublin.

Flakes and blades

Raw Flakes	6
Scrapers	1

APPENDIX A

Glenarm

The following material comes from two boxes in the Belfast Municipal Museum, marked "unrolled material from (upper) older part of beach". It was probably dropped in situ on the storm beach during the emergence, and therefore should be epi-Larnian in age.

Finished Implements

Scrapers	1
Perforators	4
Notched flakes (in three cases the notches are worked inversely)	6
Flakes with retouched edges (they resemble backed flakes or blades)	5

Waste

Flakes and blade-flakes	55
Total	<u>71</u>

Rockmarshall Midden I

The following material is in the collection of Trinity College, Dublin.

Finished Implements

Bann flakes	2
Rough Scrapers	1

Rockmarshall Midden I (contd.)

Flakes with bulbar end crudely worked to point	2
	<u>Waste</u>
Blade-flakes	18
Leaf-shaped flakes	1
Flakes	65
Cores	7
Core rejuvenation flakes	1
Plunging flakes	6
Unclassifiable	9
	Total
	<u>102</u>

Rockmarshall Midden III

The following material is in the collection of Trinity College, Dublin.

	<u>Finished Implements</u>
Bann flakes	2
Leaf-shaped flake with secondary working	1
Perforators	3
Notched flakes	2
	<u>Waste</u>
Leaf-shaped flakes	5
Blade-flakes	11
Flakes	119

Rockmarshall Midden III (contd.)Waste

Cores	4
Plunging flakes	3
Unclassifiable	<u>11</u>
Total	<u>161</u>

Dalkey Island north midden

The following material is in the temporary possession of the author, and will in due course be presented to the National Museum of Ireland in accordance with the terms under which funds were granted for the excavation.

Finished Implements

Bann flakes	1
Strong flake points	1

Waste

Leaf-shaped flakes	6
Blade-flakes	2
Flakes	51
Cores	5
Plunging flakes	1
Unclassifiable	<u>3</u>
Total	<u>70</u>

Dalkey Island south middenFinished Implements

Bann flakes	2
Rough scrapers	2

Dalkey Island south midden (contd.)Waste

Leaf-shaped flakes	11
Blade flakes	10
Flakes	168
Cores	4
Core-rejuvenation flakes	1
Plunging flakes	2
Unclassifiable	3
	<hr/>
Total	203
	<hr/>

Material from Lomcloon (Lough Gara) in collection of Trinity College

This group is typical of the much larger total quantity of material from the foreshore at Lough Gara.

Finished Implements

Bann flakes	2
Leaf-shaped flakes with secondary working	4
Rough scrapers	1

Waste

Leaf-shaped flakes	10
Blade-flakes	10
Flakes	85
	<hr/>
Total	112
	<hr/>

A P P E N D I X B

Bevel-ended Pebbles

In the interest of clarity we will draw a distinction between the small finger-like specimens which have been found exclusively at Obanian sites and one site in Jersey, and the larger ones which have a more widespread distribution. The facts observed by the author concerning the smaller type are that the bevelled facets are slightly rougher than the naturally smoothed outer surface of the pebbles, and that the ends have sometimes been chipped in addition to being faceted. Bishop came to the very natural conclusion when he was digging Cnoc Sligeach that they were so numerous that they must be connected with the most basic activity of the inhabitants - food preparation. He suggested that they had been used to scoop limpets out of their shells, and that this use had worn the ends to their present shape (Bishop 1914). To Breuil, on the other hand, the bevelling on the ends of the smaller pebbles was the same as that on the bone splinters also from the Obanian sites. He was not inclined, apparently, to attribute much importance to the greater smoothness of the altered surfaces of the bones. In his opinion both had been used for polishing, probably in the preparation of skins (Breuil 1922).

The larger type of pebble is less in evidence at Cnoc Sligeach, and pebbles of this type are usually chipped at the ends. It is not clear whether Bishop noticed that

distinct though slight bevelling is usually present as well, having taken place sometimes before, sometimes after, the chipping. He considered that they were simply stones which had been used for knocking limpets from the rocks and whose ends had become bruised in the process, and called attention to the fact that the inhabitants were still known to knock limpets off with long beach pebbles. These implements he called 'limpet hammers' to distinguish them from the type described in the last paragraph. Other writers have not stuck to this classification, and a great deal of confusion has ensued. Cantrill noted that bevel-ended pebbles of this large type which he found on his own sites in Pembrokeshire were too wide across the end to fit into limpet shells, and that the flint chipping floors where they occurred had yielded no sign of shell (Cantrill 1914). Gordon-Williams also doubted whether they had been used for this purpose on the grounds that there was no practical necessity, and cited ethnographical parallels (from south Wales!) of the use of the thumb for this purpose. He thought the bevels had not been made by use but for use, and suggested that they had been intended for holding flint cores firmly in position when they were being struck; this explanation did not completely satisfy him (Gordon-Williams 1926). The fact that Cantrill and Gordon-Williams' 'scoops' come closer to Bishop's 'limpet hammers' than to his 'limpet scoops' is indicative of the confusion that reigns in this subject. Breuil thought that the larger of the Obanian specimens were flint-working

tools. In a personal interview he demonstrated to me how one end of them had been placed at various angles against the striking platform of a core, and had been struck at the other end in order to detach a flake by indirect percussion, or how they had been used as 'retouchoirs' in pressure flaking. For various reasons I am not entirely satisfied with his explanations. In the first place it seems strange that if they were connected with such a universal prehistoric activity as flint working, they should have such a restricted distribution in space and time. Secondly, as Clark has pointed out (Clark 1932 p. 15), their frequency on the Obanian sites seems quite out of proportion to the very limited amount of flint there; a great many blows would be necessary to form each bevelled facet, and even allowing for a high proportion of unproductive blows which merely battered the edge of the core's striking platform, it seems that for every finished scoop there should be some dozens of flakes. Thirdly a great many elongated pebbles at the sites show no sign of use, which seems to imply that an enormous number of spare hammer stones were kept for dealing with an extraordinarily exiguous supply of flint. The iron age specimen from Ballybunnion in the Stacpoole collection came from a site which has produced no flaked flint.

Movius (Movius 1942, pp. 183-85) suggests that they were carpenter's tools intended for use as rough chisels or adzes. Since the ridge across the ends at the meeting of the two bevelled facets is always blunt, it does not seem that

this is possible, but of course use as wedges cannot be precluded. Similar implements in Jersey and Cornwall have been dismissed simply as 'rubbers' or 'mullers'.

It can be seen that there is a great deal of divergence between the various views expressed as to the purpose of these objects. My own observations have not enabled me to come to any firm conclusion.

It is worth noting as a first point that bevel-ended pebbles are not confined to the type and period we have been discussing. There is a distinct class of oval pebbles bevelled to a very marked degree that are found in a different and probably later cultural context. The following list of examples that have come to the writer's attention makes no claim to be complete.

Scamridge, Yorks.	Evans (1872) pp. 221-22
Weaverthorpe	"
Little Solsbury Hill	"
Dorchester, Oxon.	"
St. David's Head, Pembrokeshire	Material in Tenby Museum
Stacpole Warren	"

These implements differ from the 'limpet scoops' not only in shape, but also in having had much more of the stone worked away at the ends to shape the bevels. While it is possible, of course, that these stones were pecked into their characteristic shape with a blunt convex ridge running across the end by use as hammer stones, it is much easier to believe

that they were deliberately pecked into shape. Unfortunately this argument from their appearance is offset by three opposite indications. There is continuous variation in the Dalkey Island limpet scoops from examples with slight pecking to examples with marked bevels at the ends, as if the latter only resulted from a continuation of the use which shaped the former. Moreover many (in fact the majority) of the stones in the middens show no sign of use, which argues against their having been brought to the sites only for manufacture into a special tool type. In the third place, many show combinations of bevelling and chipping at the same end, which could have resulted from use as hammer stones. In fact the only feature hard to explain by this hypothesis is the bevelling.

The chipping and bevelling may of course have resulted from different kinds of use; i.e. the chipping from use as hammer stones, the pecking from something else. In this case the chipping resulted only from the occasional use as hammer stones of elongated pebbles brought to the site and sometimes bevelled for some other purpose. Flint fabrication, as suggested by Breuil, would be the most obvious secondary or occasional use, but it is not sufficient alone to account for the large numbers of elongated pebbles found at the sites and all their features.

On a priori grounds food preparation would be the most obvious use of such common articles. Scooping limpets out of their shells does not exhaust the possibilities in this direction. Striae sometimes faintly visible on the bevels

might have resulted from crushing or grinding some substance against another stone.

I am myself unable to make any fresh suggestion what they were intended for. The possibility of a cult origin cannot be ruled out. The important thing is that they have a significance as a culture indicator quite independent of their purpose and method of manufacture. When using them thus, as in drawing up distribution maps, care has to be taken to describe the incidence of a real type, and not to select arbitrarily those which happen to suit the distribution pattern one has in mind. I believe the distribution pattern given here to be quite genuine. The oval pebbles mentioned earlier in this appendix are quite distinct in appearance from 'limpet scoops' and do not appear in association with them. The greatest difficulty is the case of an elongated pebble with a deeply worked double bevel found in the Ballybunnion (Co. Kerry) sandhills (Stacpoole Collection in T.C.D.), where it was in probable association with finds of the Roman Iron Age, and right outside the area of mesolithic settlement in Ireland. Even this, however, is not identical with the Dalkey Island examples, being on an unusually large pebble and very deeply bevelled. Its affinities seem to be more with the oval ones cited above. Moreover these non-Larnian non-Obanian examples are rare at their sites, whereas the 'limpet scoops' are very abundant. I believe we are perfectly safe in treating the bevel-ended pebbles in neolithic contexts, or contexts of the mesolithic/

neolithic transition, as a class to the exclusion of the more oval and deeply worked later kinds.

N O T E S

1. Some flints in a raised beach deposit may be of the same age as the layer in which they are found; others may be much older - even several centuries; but that any travelled long distances, as implied by some writers, before being incorporated in the beach, or that the group as a whole is significantly older than the deposit in which it is found, seems to me most improbable. We have to face the fact that the beach was inhabited by mesolithic man in his quest for food and flint, and that implements contemporary with this occupation must exist.
2. In the British Isles it is not a Western Neolithic form. Some arguments for the less cautious interpretation are given in Part III.
3. Bann flakes are particularly typical of the inland industry in Ireland, and their dating is discussed in Part II.
4. However carefully these heights may have been levelled, it is only their approximate heights that matter. All conversions therefore between feet and metres have been given approximately.

5. It is obvious that the principle can be relied upon better for periods shortly before the maximum than for earlier periods.
6. That is, of course, if the peat under Milewater Dock is at the same level as the peat under Alexandra Dock.
7. Numbers refer to the illustrated finds at the end of this volume.
8. In the collection of the Department of Irish Archaeology, Trinity College, Dublin.
9. In the case of Down the unpublished site of Ringneill is referred to.
10. It should be noted that the Bann runs for its entire course through a non-calcareous region, and that its waters are rich in silica. Hence bone would be unlikely to survive for a very long period on its bed.
11. Mahr was under the impression that MacNeill had considered the Gruithni to be pre-Celtic. Actually MacNeill had withdrawn this opinion in a footnote to the paper to which Mahr referred (information from a lecture delivered by Myles Dillon to the British Association at its 1957 Meeting.)
12. No pebbles are included in the material from this site in the collection of the National Museum of Wales.
13. The Rockmarshall middens may be assigned to the 'neolithic period' because they are later than the maximum of the transgression, though they can only belong to the very beginning of this period, and appear to be completely mesolithic in culture.

14. This implement could easily be a flake axe, but is so much retouched on both sides that it is hard to be sure. Flake axes are generally late in northern Europe, and are rare in the British Isles.
15. The origin and date of the portal dolmens are both obscure, but they are almost certainly no earlier than late neolithic.

16.11

see 16.11.11.11.11.

16.12

A flint plate distinguished by regularity, by having parallel sides, and by a high relation of length to breadth.

16.13

A flint exhibiting the qualities of a blade but to a lesser degree; i. e. less regular and parallel-sided, and shorter in relation to its width.

16.14

A mark or percussion; a swelling that can be seen on the broken or flaked surface of a flint around the place where the blow was struck which detached the flake.

16.15

The cleavage surface of a flint on which the blow of percussion which caused the flint to detach the flake may be found.

16.16

A flint which has been a broken fragment of a flint which was not a flint at the time of its detachment.

16.17

A flint which has been a flint at the time of its detachment.

GLOSSARY OF TECHNICAL TERMS

RELATING TO FLINT TYPOLOGY

- BACK** See DORSAL SURFACE.
- BATTERING** The name is to some extent self-explanatory. It is a feature frequently to be observed on the edges of flint artifacts where flakes have been struck. The edge is broken and irregular owing to the removal of numerous small splinters of flint.
- BELLY** See BULBAR SURFACE.
- BLADE** A flint flake distinguished by regularity, by having parallel sides, and by a high relation of length to breadth.
- BLADE-FLAKE** A flake exhibiting the qualities of a blade but to a lesser degree; i. e. less regular and parallel-sided, and shorter in relation to its width.
- BULB** = bulb of percussion; a swelling that can be seen on the broken or flaked surface of a flake nearest the place where the blow was struck which detached the flake.
- BULBAR SURFACE** The cleavage surface of a flake on which the bulb of percussion which caused the blow that detached the flake may be found.
- CHIP** A rather vague word for a broken fragment of flint which does not exhibit a bulb of percussion.
- CORE** Residual portion of a block of flint after the flakes have been struck from it.

- CORTEX** Strictly the outer crust of a nodule of flint where it has been altered (by dehydration) to a chalky texture. Also used loosely for the heavily weathered outer surface of a rolled pebble of flint.
- DORSAL SURFACE** The surface of a flint flake opposite the bulbar surface; i.e. the part that was outermost on the core immediately before the flake was struck.
- FACE** The side of a core from which flakes have been removed, or from which flakes are in process of being removed.
- FLAKE** A piece of flint that has been artificially removed from another piece in such a way that the surface of fracture exhibits a bulb of percussion.
- FLAKE SCAR** The impression left on the core after the removal of a flake. The bulb of percussion will show in negative as a hollow.
- KEEL** The edge at the intersection of two faces of an implement of elongated shape. The edge runs longitudinally for most of the length of the implement.
- NODULE** Properly reserved for the rounded lumps of flint which occur naturally in certain chalk beds, when in their original condition.
- PRIMARY FLAKING** Removing flakes from a core with the object of preparing the core for the removal of flakes of some desired size or shape.
- RETOUCH** See **SECONDARY FLAKING**.
- SECONDARY FLAKING** Removing small flakes from a flake or core with the object of working the flake or core to some shape desired for use.

- SPALL A rather vague term similar to CHIP.
- STRIKING
PLATFORM The part of a core that is struck in the process of detaching flakes; the portion of the detached flake that received the blow that separated it from the parent core.

Abbreviations used in the Bibliography

- A.A. Acta Archaeologica.
- Aarbøger Arbøger for Nordisk Oldkyndighed og Historie.
- A.C. Archaeologia Cambrensis
- l'Anth. l'Anthropologie.
- A.J. Archaeological Journal.
- A.N.L. Archaeological Newsletter.
- G.C.P.F. Les Grandes Civilisations Préhistoriques de la France. (Livre Jubilaire de la Société Préhistorique Française) Paris 1954.
- I.N.J. Irish Naturalists' Journal.
- J.C.L.A.S. Journal of the County Lough Archaeological Society.
- J.H.A.A.I. Journal of the Historical and Archaeological Association of Ireland.
- J.R.A.I. Journal of the Royal Anthropological Institute.
- J.R.S.A.I. Journal of the Royal Society of Antiquaries of Ireland.
- P.B.N.F.C. Proceedings of the Belfast Naturalists' Field Club.

Abbreviations used in the Bibliography (Contd.)

- P.B.N.H.P.S. Proceedings of the Belfast Natural History and Philosophical Society.
- P.P.S. Proceedings of the Prehistoric Society.
- P.P.S.E.A. Proceedings of the Prehistoric Society of East Anglia.
- P.R.I.A. Proceedings of the Royal Irish Academy.
- P.S.A.S. Proceedings of the Society of Antiquaries of Scotland.
- U.J.A. Ulster Journal of Archaeology third series only.
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1. Killybegs	Large flint with some quartz, probably worked.
2. Killybegs	Large flint, possibly worked, showing possible signs of use.
3. Killybegs	Large flint with some quartz, possibly worked.
4. Killybegs (Blaze road)	Large flint with some quartz, possibly worked.
5. Killybegs	Large flint with some quartz, showing considerable signs of use.
6. Corbellis	Small flint, blank.
7. Corbellis	Small flint, blank.
8. Killybegs	Small flint, blank, showing possible signs of use.
9. Corbellis	Small flint, blank, showing possible signs of use.
10. Corbellis	Small flint, blank, showing possible signs of use.
11. Corbellis	Flint, apparently utilized.
12. Killybegs	Flint, showing leaf-shape, probably used.
13. Corbellis	Small flint, blank, showing possible signs of use.
14. Corbellis	Small flint, blank, showing possible signs of use.

2.	DESCRIPTION	OF ILLUSTRATIONS
1.	Sutton (blown sand)	Large flake, showing some of the worn outside of the original pebble of good flint, probably imported. Probably unused.
2.	Sutton "	Large flake with worn cortex, not however greatly rolled. ? imported material. Probably unused.
3.	Robswallis	Rough flake showing outside of pebble and preliminary flaking down at the butt.
4.	Kilcrea	Blade flake well made on unusually good flint; battered butt. Probable signs of use.
5.	Sutton (blown sand)	Large rather well struck flake, probably unused.
6.	Sutton "	Large rather well struck flake, showing indubitable signs of use.
7.	Corballis	Small rolled blade-flake.
8.	Corballis	Small rolled blade-flake.
9.	Kilcrea	Small well struck blade-flake showing possible signs of use.
10.	Corballis	Rather damaged flake; damage perhaps fortuitous.
11.	Corballis	Flake, apparently utilised.
12.	Kenure	Flake approaching leaf-shape, probably used.
13.	Corballis	Blade-flake showing recent break, probably unused.
14.	Corballis	Plunging flake; it looks as if the face of a core has been deliberately removed to rejuvenate it - perhaps because the right hand flake (which seems to have been the last) had gone astray and bitten too deeply,

14. Corballis
(contd.) for the other scars are very well formed blade scars. The flake has been damaged at a later period.
15. Robswalls This plunging flake was apparently struck across the face of a core, from the side. It has a very small bulb and striking platform, and for this reason might be post-mesolithic, but its technique strikes me on the whole as typically enough Larnian.
16. Kilcrea Plunging flake removing the face of a core, the most likely reason seeming to be that a clear face going right through to the far end of the original pebble unencumbered by cortex was desired.
17. Robswalls Plunging flake off face of core, perhaps removed because core had become too steeply ridged for convenience. Shows possible signs of use on left side near butt.
18. Kilcrea Pebble of very poor cherty flint. A platform has been prepared and four unsatisfactory flakes struck off, after which the pebble seems to have been discarded.
19. Portrane Pebble of flint from which one end has been struck so as to provide a platform. From this a few unsatisfactory flakes have been struck, and judging by the battering, efforts were made to detach many more before the pebble was discarded as useless.
20. Rockmarshall I Flat pebble from which several small flakes have been struck, at one end from a prepared platform. None of the flakes seem to have been big enough to be useful, but the core itself may have been intended for use.

21. Dalkey Island (Site I, cultivated earth) Core which seems to have yielded a number of fairly serviceable flakes, and then for some reason only to have chipped and battered which led to its being discarded. Possibly this was due to its being flint of poor quality.
22. Robswalls Core coming to a chisel edge at the bottom. Flakes have been struck from both sides of the chisel edge.
23. Malahide Island Single platformed core with smooth rolled exterior on the back. It has been considerably battered and has had small flakes detached about the middle of the face. This strikes me as more likely to have been in an attempt to work the core further than in an attempt to retouch it, but of course certainty is impossible.
24. Portrane Single platformed core, slightly battered, and showing much pebble exterior.
25. Kenure Core, the back side of which is the outside of a beach pebble. Less battered than most.
26. Portrane Core with two prepared platforms, that at the bottom prepared by striking one flake, that at the top by striking two. The lower platform makes an unusually acute angle with the face. Both platforms are battered, and the flint seems to have been faulty so that none of the last flakes struck have run true. The back of the core is the outside of a beach pebble.
27. Robswalls Core consisting of about half of a beach pebble from the split face of which small uneven flakes have been removed. At the top there is a small platform, but the flakes struck from the bottom have been struck from the

27. Robswalls
(contd.)

outside of the pebble. It looks as if this fragment of flint failed to produce any serviceable flakes after considerable trying.

28. Kenure

Core showing a little of the outside of the original pebble. The striking platform bears a different patina from the rest of the implement and was an older break, perhaps natural. After yielding a number of flakes which ran the whole length of the implement the edge of the striking platform was very severely battered, especially where a high keel between two flake scars juts out. One short flake in particular has completely removed the upper end of this keel, as may be seen in the left hand sketch. Thus the upper part of the core has been reduced to a fairly regular polygonal shape, while the lower part is still markedly assymmetric. It is impossible to say whether this occurred in preparing for and/or trying to remove good flakes, or was intended to shape the core itself for some purpose.

29. Portrane

This was once a rather wedge shaped double ended core like 26, but was then flaked and battered right around one corner and along the back, giving it an overhanging profile similar to 28. Some of the flakes are quite regular but too small to have served as implements in their own right, and the flaking or battering has been carried right around onto the pebble exterior at the back which was entirely unprepared for flaking. There is a strong case for a core scraper or retouched core here. Coarse battering imposed on this ? retouch may have resulted from some sort of severe use.

30. Robswalls This core retains some of the original exterior of a beach pebble on the back and one side. Two flake scars, only one of which is visible in the sketch, survive on the lower part of the core (as drawn) and must originally either have met the present striking platform at an unusually oblique angle, or have survived from an earlier set of flaking from a different platform. On this second assumption the core must have been rejuvenated by slicing off the old platform to create a new one at a slightly different angle, from which very short flakes were struck. Possibly this was to shape the core as an implement rather than to obtain flakes, for the flakes obtained must have been very small.
31. Corballis This core is of unusual shape in that the diameter of its platform is greater than the length of the flaking face. All the flakes struck were small, and it may again be a nucleiform implement rather than a core. The surviving exterior is that of a beach pebble. The edge is only slightly battered.
32. Lambay The back of this core shows weathered cortex, but whether it is sufficiently weathered to have been transported by ice this far, is questionable. It may have been a pebble imported from further north. The curve of the back is unusually regular, and if continued so would suggest a pebble 9-12 cm. in diameter; in that case it must have gone through the stages of being several larger cores before being reduced to its present small dimensions. The battering is mainly limited to the two points where the keels between flake scars stick out most. This may suggest that the keels were removed in preparation for the striking of further flakes at these two places, but that the flakes were not struck. The battering in question may be seen on the extreme right and near the left of the striking platform in the lower sketch.
33. Portrane Small conical core showing some beach pebble exterior. It shows no definite battering.

34. Corballis Well made double platformed core. The back of the core is more or less flat and is covered with very well weathered cortex. Evidently the block from which this core survives must have been very large. As the core has been somewhat rolled it would be unwise to speculate how much of the battering is artificial and how much natural.
35. Kenure Core with oblique front clearly made from a fairly large pebble. It has flaked well and the edge is only slightly battered.
36. Rush This core, like 28 and 29, has been given a pronounced overhang in one place. This operation has been effected in part with small even flaking that is so regular that it is easy to consider it retouch.
37. Robswalls Core with very oblique front. Flaking on face very flat-- conceivably retouch.
38. Whitestown Core with pebble exterior on back. Flaking along angle may be retouch.
39. Robswalls Core with exterior of beach pebble on back and one side. It represents about half the original pebble. Has flaked rather poorly and has a number of large chips removed along the edge just where there were keels between earlier flake scars. This may represent attempts to strike flakes which failed and only struck off these short chips.
40. Portrane This core has one main platform, and a subsidiary one which appears to have been battered but not very successfully flaked. An outjutting part of the face has been fluted in a manner which strongly suggests retouch. The deep scar to the right (as drawn) and the battering to the left may have been intended to exaggerate the position of this salient point, in which case it could, like 83, be classed as a rostrate scraper.
41. Robswalls Double platformed core. The upper edge may have been retouched. At the lower end the face has been flaked back until it meets the back of the core in a keel

41. Robswalls
(contd.) which has been battered on both sides. The bottom thus has a chisel edge, the bi-facial battering of which may possibly have resulted from use.
42. Kenure Core showing exterior of beach pebble on back, one side and bottom. The small flake scars shown in the left hand sketch just under the striking platform, may represent retouch, but might also have resulted from a series of efforts to slice off that side of the core, which bulges rather. If so the efforts failed. The edge of the core has two sharp spurs which may have been intentional.
43. Kenure A flake which has been treated with a great deal of secondary transverse battering and flaking from three keels, which are the two edges of the bulbar surface, and a single keel (down the back of the flake) prepared before striking. The bulbar surface has no secondary work on it.
44. Kenure This core borer seems to have been an ordinary single platformed pebble core which was allowed to develop a projecting point at one end of the edge, and thus appears to be a core borer with only one keel. It is possible that this feature is only accidental and that the piece has been misclassified.
45. Robswalls This is a fragment from a large pebble with only moderately rolled cortex (? imported), that has been flaked along one edge. It is suggested that the purpose of this was to create a point at one end, but this is speculative.
46. Kenure Leaf shaped flake with only slightly battered butt. The slightly damaged edges may be from use, but the point was broken off at a secondary period.
47. Rogerstown Leaf shaped flake with only moderately battered butt. Much of the breaking of the edges seems to belong to a secondary period.
48. Sutton
(blown sand) This leaf shaped flake has a very broad butt with little battering. Its edges

48. Sutton
(contd.) and point have been damaged perhaps through use, and the implement has been polished by blowing sand.
49. Kenure This well struck leaf shaped flake is very small. Its butt end has been battered down, and from the cutting across of the right hand scar, it can be seen that this was done prior to striking.
50. Corballis Leaf shaped flake of coarse grained siliceous concretion. The keel down its back has been removed near the butt, and the implement's edges are considerably broken.
51. Rockmarshall
I Leaf shaped flake with battered butt. As it is an excavated specimen it can be taken that the nibbling all around its sharp edges and at the point is the result of use.
52. Sutton
(blown sand) Leaf shaped flake with well battered butt. I consider that the irregularity of its edges is due to the grain of the flint itself and is not subsequent damage.
53. Kenure Leaf shaped flake with higher than average central ridge which has not been very effectively removed by the battering of the butt. Most of the damage to its edges appears to belong to a secondary period.
54. Corballis Leaf shaped flake with battered butt. A concavity has been made by trimming from the bulbar surface near the end. It would be useless to speculate whether this was intended for a hollow working edge or for a finger rest to help use the other edge of the flake for cutting.
55. Rockmarshall
III Large heavy leaf shaped flake with some of the rolled exterior of the original beach pebble showing on its dorsal surfaces. It has a rough flat trimming on part of its edges, possibly to re-sharpen them after they had become blunted by use.
56. Portrane Leaf shaped flake with severely battered butt. The apparent small shoulder on the right hand side is due to a break at some

56. Portrane
(contd.) secondary period. It has been slightly trimmed on one side of the tip, perhaps to give a purchase for cutting with the other side, perhaps to re-sharpen the point. The trimming has not been carried far enough to alter the original shape of the flake.
57. Portrane This flake shows a good deal of the original chewed drift pebble exterior and was not carefully prepared on the dorsal surface before striking. It has nevertheless been trimmed on both sides, perhaps to a scraper edge, perhaps to re-sharpen cutting edges. It is intermediate between the leaf shaped flake class and the scraper class. I have classed it with the former on account of its undoubted leaf shape. The shoulder is the result of a break at a secondary period.
58. Whitestown Butt end of blade broken at some secondary period. The blade is unusually thin, regular, and well formed, but has the characteristic wide platform of a flake struck in the Larnian technique. The butt is only slightly battered. The butt has been retouched normally on the right and inversely on the left rather lightly. Allied form to type B Bann flake.
59. Sutton
(clay with shells) Type A Bann flake with lightly executed trimming on right side of butt. The notches further along the implement were quite possibly worn by use.
60. Kenure Rather squat Bann flake type A. Trimming on right side of butt has been heavily executed and has something the nature of battering. The butt is heavily battered on the dorsal surface, and slightly battered on the bulbar surface. This last fact indicates beyond any doubt that some of the battering was done after striking the implement. The edges are considerably broken, but much of this is of secondary period.
61. Whitestown Type A Bann flake: lightly executed retouch has been carried in a curve around the left hand side of the butt.

62. Whitestown Type B Bann flake: the butt has been very lightly retouched, normally on the left and obversely on the right. There is a notch near the point on the left hand side which may have been worn by use or may have been deliberately made.
63. Rockmarshall I Type AX Bann flake: retouch has been carried from the butt right along one side.
64. Kenure Type A Bann flake with slight working on the right hand side of the butt and a notch which may have been worked farther up the right hand side. The working at the butt takes rather the nature of battering.
65. Portrane Type AX Bann flake: inverse working on the right hand side of the butt is fine but uneven. This trimming has cut away a corner of the striking platform. It is also inversely trimmed near the point, perhaps to re-sharpen the point.
66. Portrane Butt end probably of type B Bann flake showing an old break. Has irregular steep retouch on the right and the same on the left a little along from the striking platform. This trimming has not impinged anywhere on the platform itself.
67. Portrane Butt end of a flake broken off at some secondary period. It has been steeply but irregularly trimmed on both sides, and may originally have been a Bann flake type B.
68. Kilcrea Very small type B Bann flake. Has lightly executed retouch up both sides of the butt. The edges were considerably broken, after which it was slightly rolled.
69. Rockmarshall III Butt end of flake worked to a slight tang and broken in antiquity. The trimming consists of two notches worked a little along from the striking platform. The corners of the platform have not themselves been touched. It may have been a type D Bann flake.

70. Burrow
(Portrane) Butt end of flake broken in antiquity. It has been steeply trimmed up one side from the platform and may have been a type A Bann flake. It is heavily rolled, perhaps from recent wave action on the shore.
71. Rogerstown Butt end of flake showing a recent break (no gloss). It has been retouched up the left hand side and slightly shouldered on the right. Seems to be a related form to a type C Bann flake.
72. Larne 'Larne pick': this flake shows an old battered striking platform (upper left in right hand sketch) from which a number of poor flakes were detached. Subsequently this face was struck off laterally, along with a large amount of the chewed surface of the original flint boulder. A platform had been prepared for striking it off, and several blows were struck from it and removed small chips before the flake itself came off. Whether these small flakes were struck in preparation for the big one, or simply represent attempts which failed to strike the big one, is not a question that can be answered. The edges of the flints show considerable further battering which must be secondary since it is at the junction between the dorsal and the bulbar surfaces. This battering is probably the result of rolling.
73. Kenure Scraper and borer. This is a large thin flake whose bulbar end has been broken off. Concave and convex scraper edges have been worked at the end, so that there is a point where they meet. There is no excavated parallel for a Larnian scraper as well worked as this, and it cannot be proved to belong to this industry. The retouch seems typically Larnian and unlikely to be neolithic-bronze age.
74. Whitestown Scraper made on a decortivating flake, most of the back of which is the outside of a weathered lump of drift flint; roughly executed retouch around the end and much of one side.

75. Kenure Scraper on end of flake, showing the rolled exterior of a beach pebble on the left hand side.
76. Kenure Scraper on very large flake which has been broken off at both ends. The retouch is relatively flat, and the implement, like 73, has no excavated parallels. I am inclined to think that the retouch can only be Larnian.
77. Kilcrea Scraper on flake shaped fragment of flint. The scraper edge is less rolled than the other angles of the implement, and probably is the only artificial flaking on the flint whatever, a perfectly natural pebble of suitable shape having been trimmed as though it were a flake. This view may be a mistake, nevertheless, as the heavy rolling makes determination difficult.
78. Sutton
(disturbed) The stages in the preparation of this unusual implement seem to have been (a) the selection of a suitably shaped rough waste flake; (b) steep inverse trimming down its right hand edge (seen on left of left hand sketch); (c) the striking of the transverse flake across the back of the implement shown in the right hand sketch. For this the trimmed edge was used as striking platform. It cannot be proved that this implement belongs to the mesolithic settlement excavated at Sutton, but the implement bears a uniform white patina and the technique (retouch, prominent bulb, and wide platform) seem Larnian.
79. Kenure Scraper executed with rather large scale retouch across the end of a flake or blade-flake with the butt end broken off.
80. Malahide Rough fragment of flint with a scraper edge applied.
81. Burrow
(Portrane) Scraper made by heavy retouch on large coarse flake showing some of the exterior of a beach pebble.
82. Whitestown Piece of flint showing no bulb of percussion, but probably one of the pieces of a split pebble, coarsely retouched to form a scraper.

83. Sutton
(clay with shells) This appears to have been a very unsatisfactory core with two battered edges, one of which may be seen at the top in both sketches. The core is now past yielding useful flakes, and the battering may show that the knapper tried hard without success to strike some. A nose has been defined by a notch on one side created by a single deep flake scar. This nose has been fluted in a manner reminiscent of the Aurignacian.
84. Portrane Scraper made by working a concavity into the edge of a rough decortivating flake.
85. Robswalls Core having three much battered edges, but which has clearly failed to give any well shaped flakes for some time. A projecting corner has a couple of scars on it which suggest fluting.
86. Rogerstown Small flake with a notch, either worked or created by use, in its right hand edge.
87. Portrane Flake with a deep notch worked into its left hand edge. A good deal of the other side of this flake broke away at some later period.
88. Portrane Burnt flake with a notch worked inversely or created by use in its right hand edge.
89. Portrane Flake, burnt, and with bulbar end broken off. Two notches have been made in its edges at some time later than the original striking of the flake.
90. Portrane Small flake with bulbar end broken off in antiquity and a notch in its left hand edge.
91. Whitestown 7 This is not a flake, and does not bear any certain primary flaking whatever. Two hollows have been worked into its sides, meeting in a blunt point.
92. Greenore Borer made by roughly trimming the end of a flake.
93. Whitestown This lump of flint does not bear any

93. (contd.) definite primary flaking. It has been roughly worked to a point.
94. Kenure Borer made by roughly pointing the end of a flake. Some of the secondary working runs across the bulbar surface.
95. Portrane Flake with bulbar end broken off. It has been worked by steep retouch to a sharp point. Part of the retouch is across the broken proximal end of the flake.
96. Rockmarshall III Blade with battered butt and probably damage from use on the edges. The end has been worked to a point in the centre by the minimum amount of retouch, only two flakes having been struck, one on each side. The point is rather blunt, perhaps as a result of use.
97. Rockmarshall III Borer worked on a flake by diagonal removal of the bulb. The point has been created by the minimum amount of retouch, probably the removal of only two flakes. It is a little blunt, perhaps from use.
98. Sutton (middens) Small flake worked economically to a point on its central axis by the removal apparently of two flakes. Implement is heat-cracked.
99. Rockmarshall Flake with bulb removed worked economically to a point by chipping piece with arc shaped edge.
100. Rush Flake with scar resembling a burin facet struck off one side of the bulbar end. Probably a burin de fortune.
101. Robswalls Flake whose end has been broken off and the break retouched. On the left hand side a spall has been struck off so that the implement is formally an angle burin, though the burin facet may have occurred by accident. This is the closest approach to a burin yet found in Ireland to the best of my knowledge.
102. Corballis This flint shows no sign of a bulb or of rippling, and may not be a flake. At one end it has been worked to a rough point in the Larnian manner. At the side it shows two adjacent facets resembling burin facets. It would be

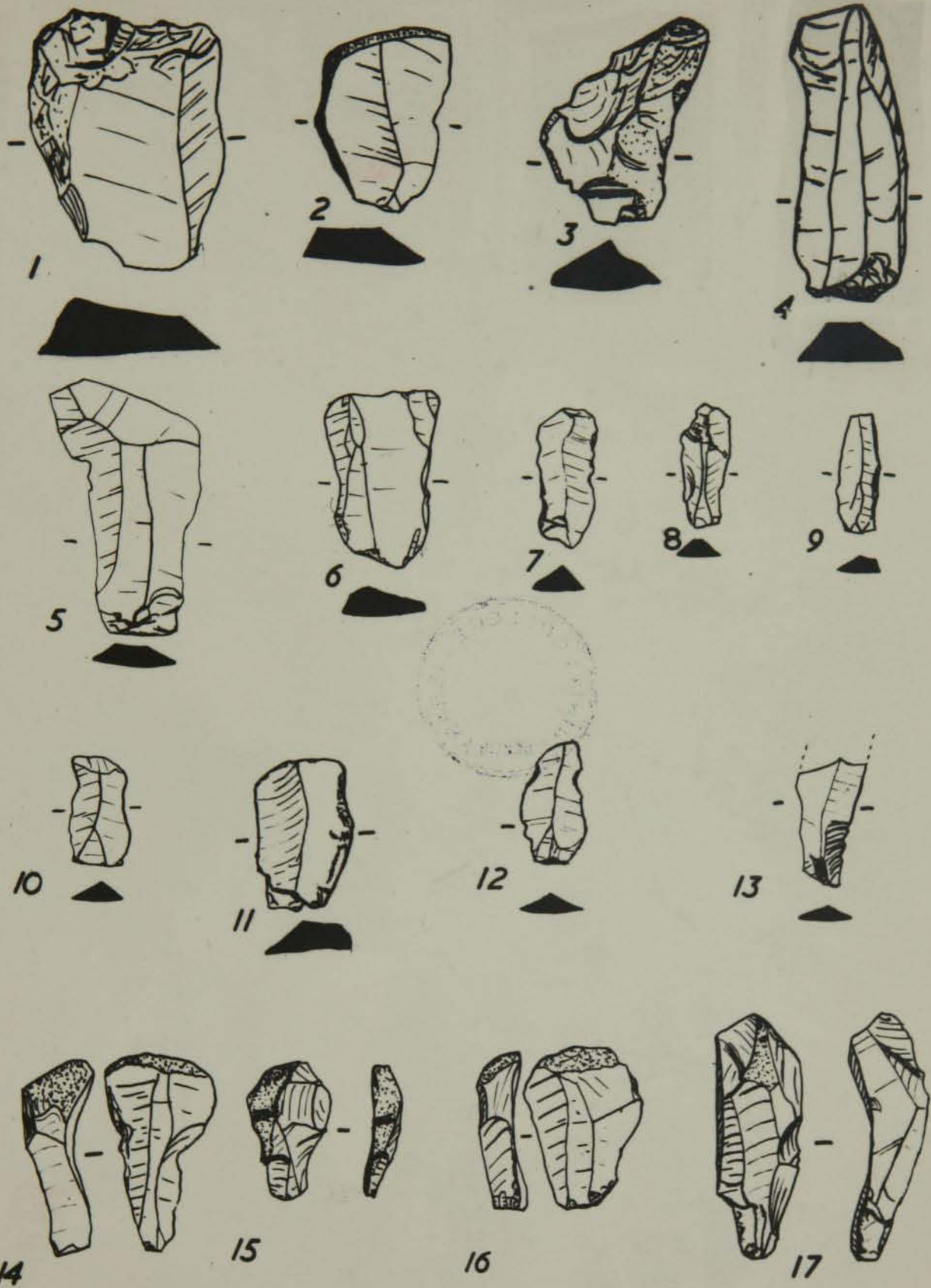
102. (contd.) rash, however, to insist that the implement was a deliberately made burin.
103. Kenure This small flake has been broken across diagonally on the left side. From this broken edge a spall was struck which makes the implement superficially resemble a bec de flute burin, but I am inclined to doubt whether this was deliberate.
104. Island Magee Larne axe: from Knowles collection in National Museum of Ireland, no reg. no. It is blunt at both ends and flaked from three keels.
105. Strangford Lough Core point from Kirk collection. The blunt end is the outside of the original pebble. It has been flaked to a point at the other end from two keels, and the implement is fairly symmetrical though made of poor quality flint which has flaked badly. N.M.I. 1932:2299.
106. Island Magee From Knowles collection in N.M.I. no reg. no. This is a fairly flat specimen with two keels. It is heavily rolled and is quite blunt at one end but slightly pointed at the other.
107. Island Magee Larne axe from Knowles collection in N.M.I. no reg. no. It has a cutting edge at the upper end (as illustrated) and so is really an axe despite not being transversely sharpened. The battering of the cutting edge is probably the result of rolling.
108. Larne Larne axe from Kirk collection N.M.I. 1932:5226. This implement is slightly pointed at one end and blunt at the other. It is the smallest Larne axe known to the author, and is quite elegantly flaked. It has been rolled, and despite the care with which it appears to have been made, is unlikely to be a neolithic pick-like implement.
109. Island Magee Larne axe from the Knowles collection in N.M.I., no reg. no. The implement is well made; it is a fairly regular oval in plan, and the edge is quite straight in side view; the flaking is flat and few flakes have bitten deeply. Either end could have been used as an axe.

110. Island Magee Larnie axe from Knowles collection in N.M.I., no reg. no. It is blunt at the upper end (as drawn) but the other end has an axe-like edge which may possibly have been created by tranchet blow, but if so is not a very good example of this technique.
111. Island Magee Larnie axe from Knowles collection in N.M.I. no reg. no. The lower end has been given quite an arc-shaped cutting edge by the fan-like disposition of the flake scars. This is the technique described by Troels-Smith as 'spezieller schneidenbehandlung'. The implement is large and from its black colour must have come from the estuarine clay stratum at this site, or from below it.
112. Island Magee Larnie axe from Knowles collection in N.M.I., no. reg. no. This very large core implement is blunt at both ends, and at one end still shows the original cortex.
113. Strangford Lough Implement allied to core point from the Kirk collection in N.M.I. reg. no. 1932:956. It is a large plunging flake ("Larnie pick") that has been worked to a point at the bulbar end.
114. Strangford Lough Core point from Kirk collection in N.M.I. reg. no. 1932:956
115. Strangford Lough This implement from the Kirk collection N.M.I. reg. no. 1932:9 is intermediate in form between the core point and the Larnie axe. It is fairly long and regular, but one end has been worked to a point and the other end shows the original exterior of the raw material.
- 116- Feltrim Hill Western neolithic sherds. From Stacpoole
121. collection at T.C.D.
122. " Large stone flake from surface material in N.M.I. It has been trimmed near the butt on both sides, and is thus allied in form to the Bann flake.
123. " Rough core of Larnian type from 1947 excavation in N.M.I. labelled 'fort'.

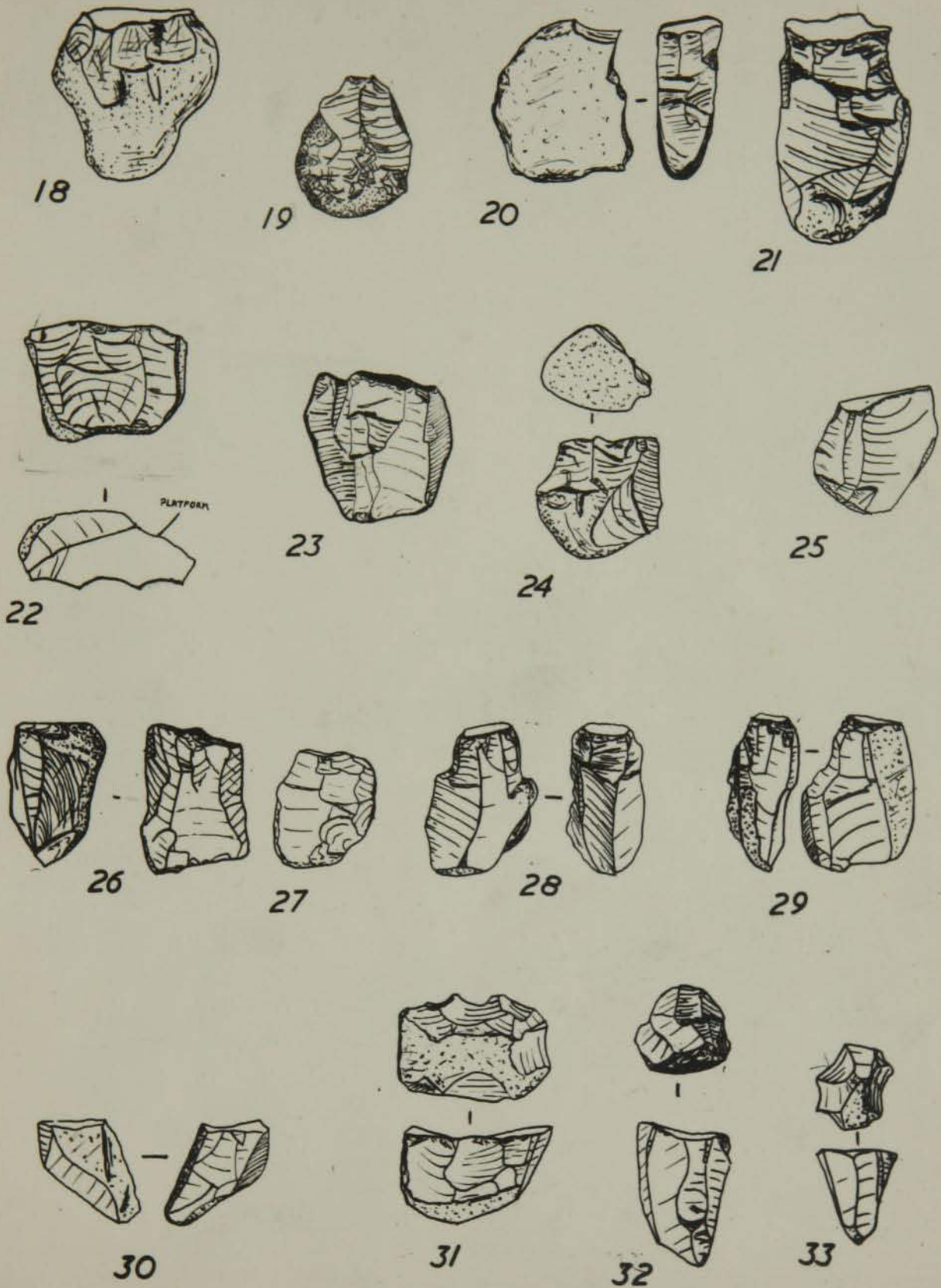
124. Feltrim Hill Neolithic leaf-shaped arrowhead from 1947 excavation material in N.M.I. labelled Site A.
125. " Neolithic button scraper from 1947 excavation material in N.M.I. labelled 'trial trenches'. The retouch is regular and looks quite different from that of the Larnian, as does the flake on which the scraper is made, with its small well-localised bulb.
126. " Larnian plunging flake from Staaspoole and Brodigan collection in N.M.I.
127. " Leaf shaped flake of Larnian appearance from 1947 excavation material in N.M.I. labelled 'Site A'.
128. Lough Neagh
(peat) Larnian axe from Whelan collection (N.M.I. 1936:336). It appears to have been broken off at the right hand end (as drawn). The lower of the two sketches shows a doubtful transverse sharpening blow at the left. One of the flakes opposite it was struck off after it. The implement possesses a cutting edge.
129. Lough Neagh
(peat) Small blade core of an evenness probably unparalleled in Ireland. Whelan coll. in N.M.I. 1936:330.
130. Lough Neagh
(peat) Core point from Whelan coll. N.M.I. 1936:326. A broken piece of drift flint has been worked to a rather sharp point.
131. Lough Neagh
(peat) Leaf shaped flake (very rough) from Whelan coll. N.M.I. 1936:358. The butt is severely battered.
132. Newferry
Co.
Londonderry This implement is included in the material from Movius' excavation in the Belfast Municipal Museum, but does not appear in the excavation report. It is a small slab of shale or slate that has been shaped by breaking around the edges, to the shape of a Bann flake. The end which would correspond to the bulbar end has been thinned on both faces, apparently in imitation of the thinning secured by battering at the bulb of a typical Bann flake.

133. Carrickmaguirk
Co. Longford This large flake of chert may, on account of the slight edge trimming to the left of the butt, be classed as a type A Bann flake. It has also been trimmed inversely near the point, possibly to re-sharpen the end.
N.M.I. P1853.
134. Ballinlough
Co. Meath Type D Bann flake from Kevin collection.
N.M.I. 1942:822.
135. Crossakeel
Co. Meath Type A Bann flake from Kevin collection.
N.M.I. 1942:1380.
136. Crossakeel Large chert flake from Kevin collection.
N.M.I. 1942:1377.
137. Ballinlough Kevin collection N.M.I. 1942:829. This implement has flat neolithic retouch on one side only, and in the drawing it resembles a partly made leaf-shaped javelin head. However the javelin heads are normally manufactured with the point at the bulbar end of the flake, while this has the point at the distal end. The flake has the wide platform and prominent bulb characteristic of Larnian flaking technique, and appears simply to be a leaf-shaped flake in the Bann flake tradition re-touched in the neolithic manner.
138. Toome
Co. Londonderry Whelan collection N.M.I. 1936:960. This is a particularly large and well tanged Bann flake of type D with some inverse secondary working at the tip.
139. Toome Whelan collection. N.M.I. 1936:975. Fine chert blade with butt trimmed on both sides in the Bann flake manner. Severely utilised on right hand edge.
140. Lough Gur
Co. Limerick N.M.I. 1943:284. This is a rather untypical Bann flake of chert found loose at Lough Gur. The striking platform is missing. This seems to be because it was battered at the butt after striking, so that chips have spalled off both back and belly of the implement, and all that is left of the striking platform is a ragged stump better visible in the right than the left hand sketch. The right hand side of the implement (dorsal view)

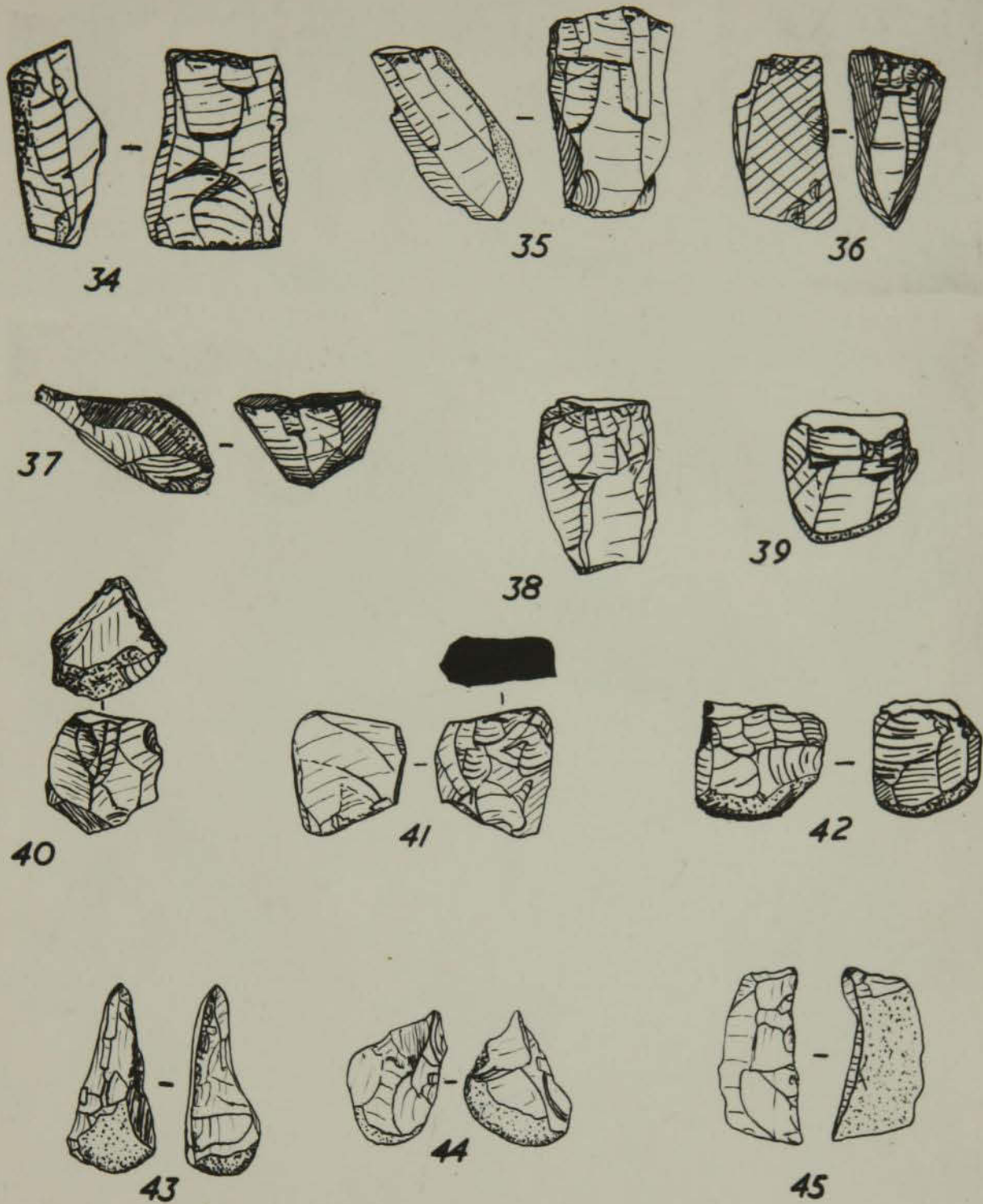
140. (contd.) near the striking platform has been retouched bi-facially; the left is unretouched. The tip of the implement has been retouched inversely on the right side, and normally on the left.
141. Sutton
(raised beach) Elongated slab of sedimentary rock chipped, presumably by use, at both ends and on one side.
142. Sutton
(raised beach) Oval pebble pocked by use at both ends.
143. Rockmarshall
III Long thin beach pebble chipped at both ends. The chipping at the upper end (as drawn) was preceded by lightly pocking the end into a double bevel.
144. " Long flat beach pebble chipped on one side of one end.
145. " Disk of red stone. Since preparing the plates I have come to the opinion that it is perfectly natural.
146. Sutton
(midden) Large disk of conglomerate or breccia from the edge of which one flake has been removed, presumably by use.
147. " Slab of stone with indications of chipping around the edge. Since preparing the plates I have come to the conclusion that it is perfectly natural.
- 148- Lough Gara
150 Three stone axes in N.M.I. Found on the foreshore of Lough Gara.
- 151- "
153 Eight flakes and blades typical of the industry found on the foreshore of Lough Gara.
- 159- Dalkey Island
162 (south midden) Four bevel ended pebbles typical of this class of artifact.
163. Island Magee From Knowles coll. N.M.I. no accession no. An axe of "zweiseitig" type retouched across the end.
164. " From Knowles coll. N.M.I. no accession no. A core axe of unusual form; slightly rolled. It is possibly a flake axe with rather flat retouch on both faces.



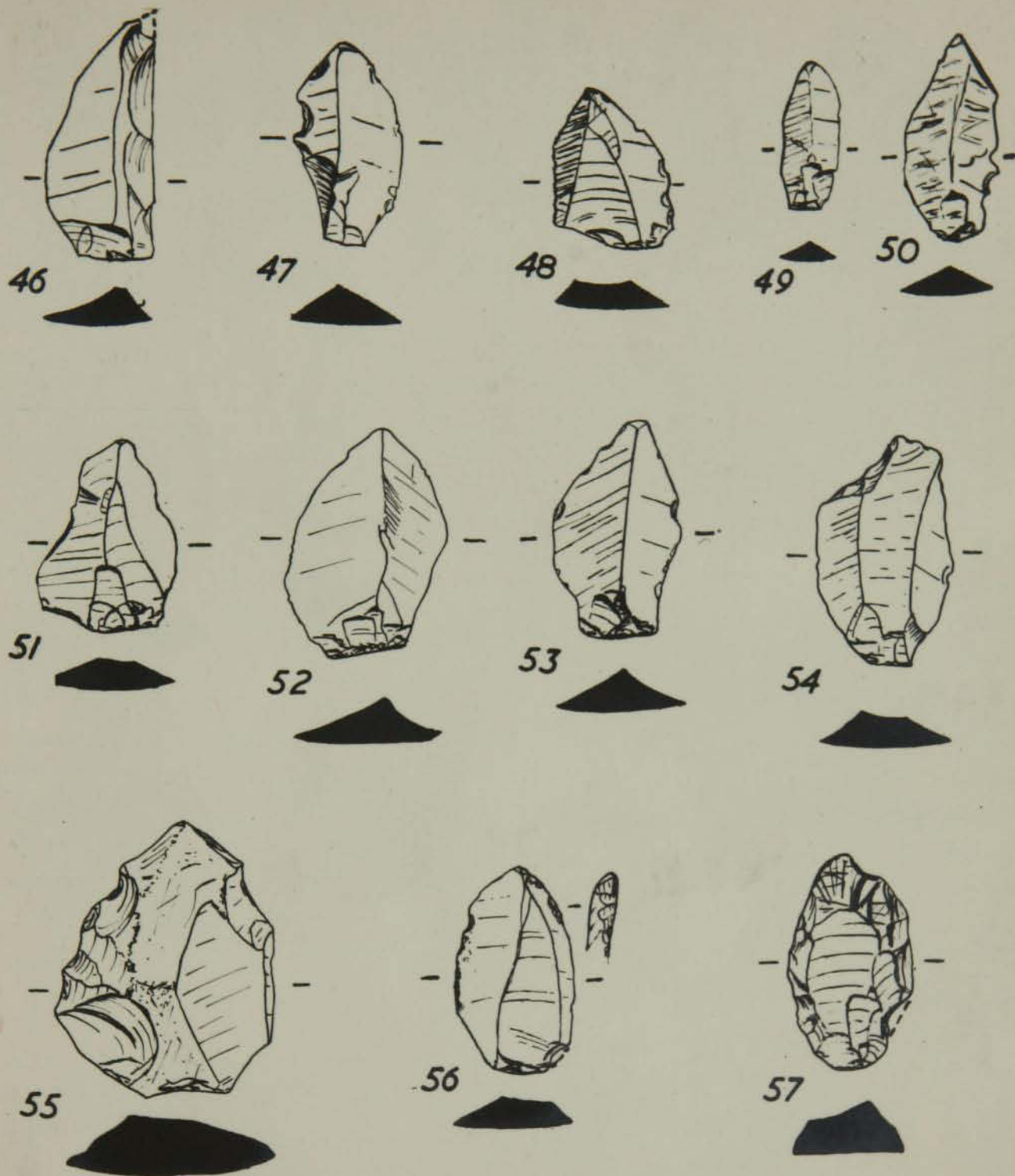
Flakes, blade-flakes, and plunging flakes. Scale ca. 1:2



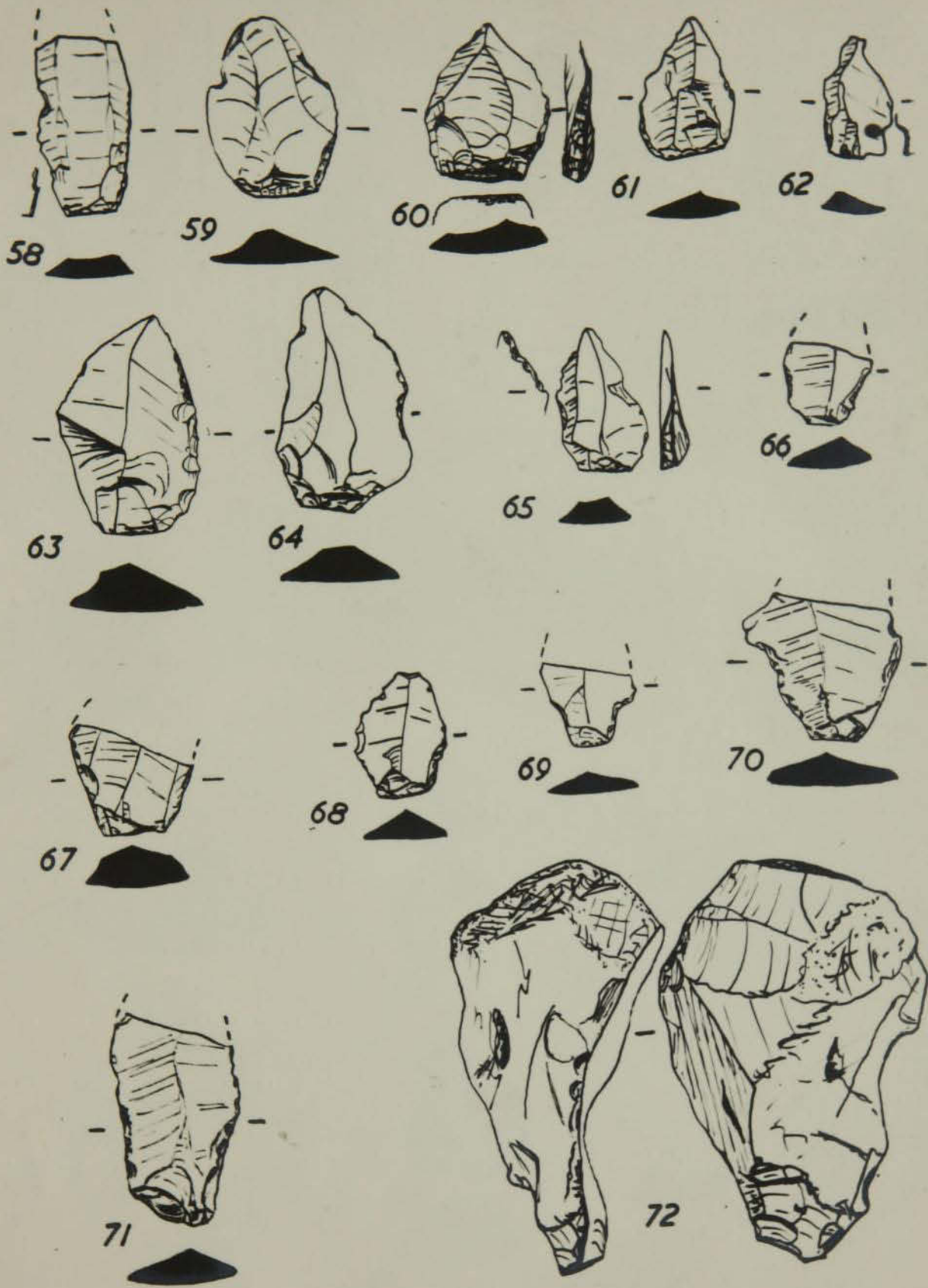
Cores. Scale ca. 1:2



34-42 cores; 43-45 core-perforators. Scale ca. 1:2

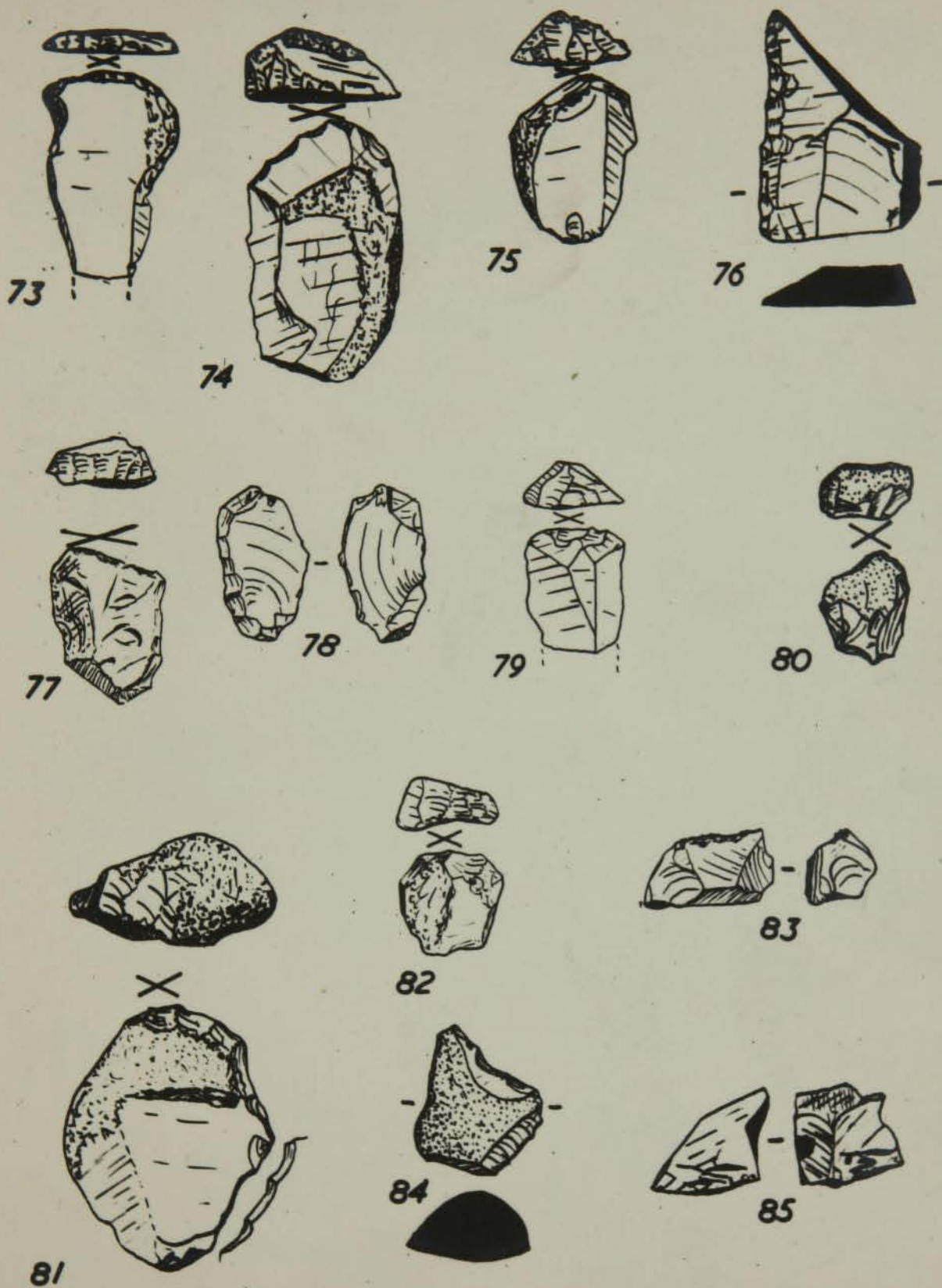


46-54, leaf-shaped flakes; 55-57, Bann flakes. Scale ca. 1:2



58-71, Bann flakes and related forms; 72, "Larne Pick"

Scale ca. 1:2

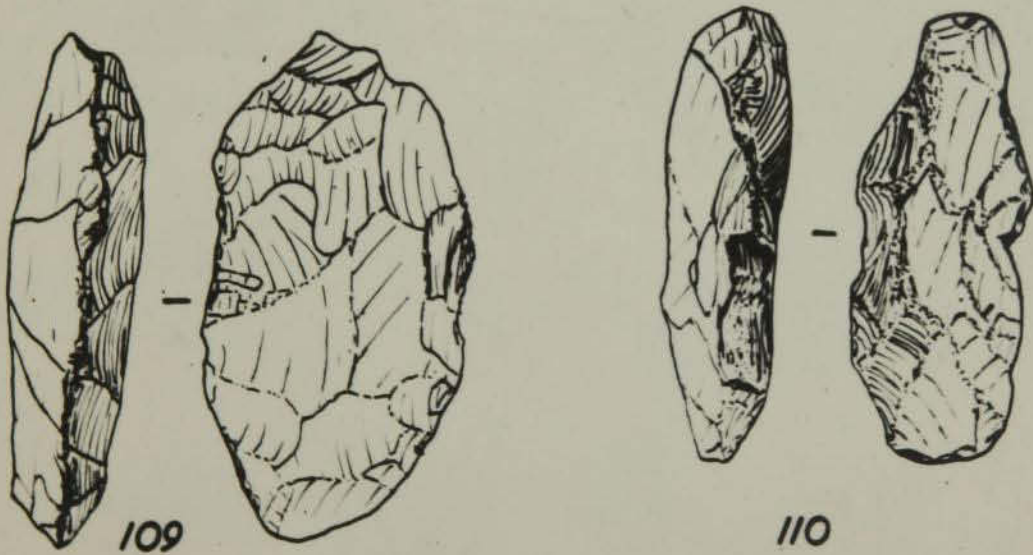
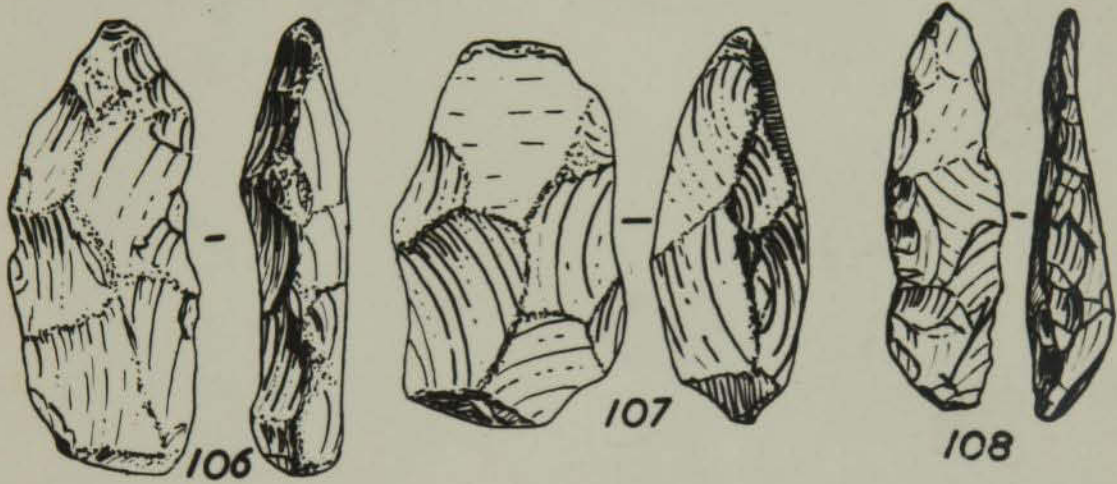
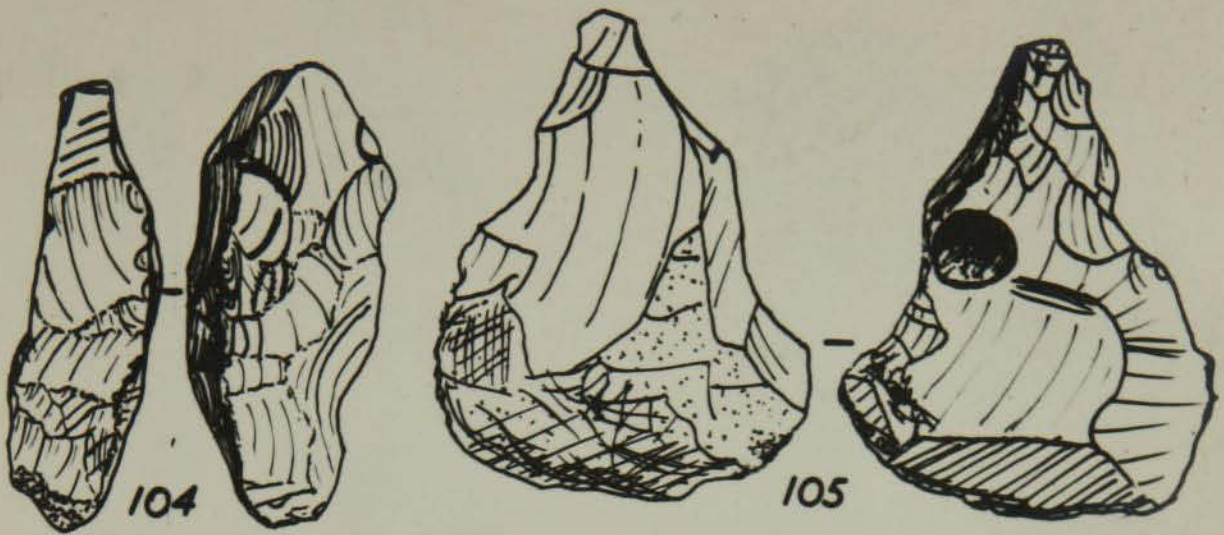


73-82, 84, scrapers; 83 & 85, possible nosed scrapers.

Scale ca. 1:2

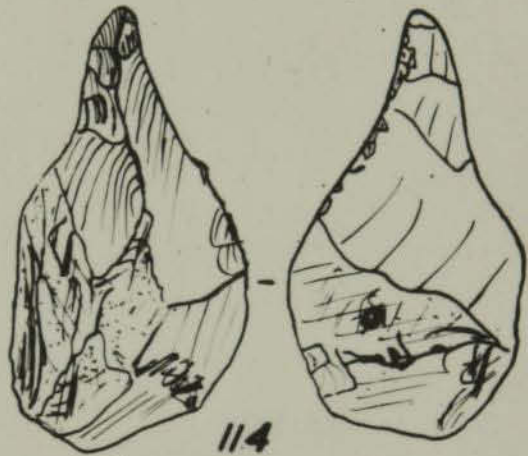
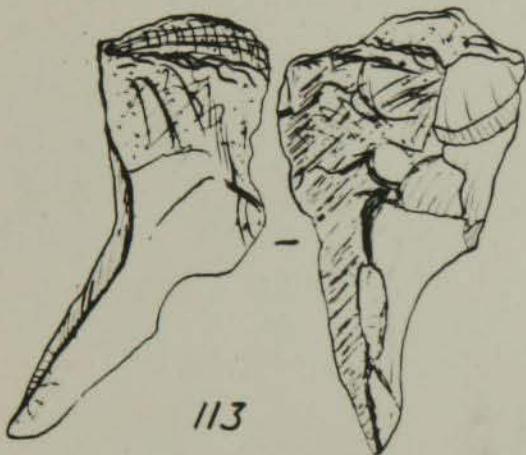
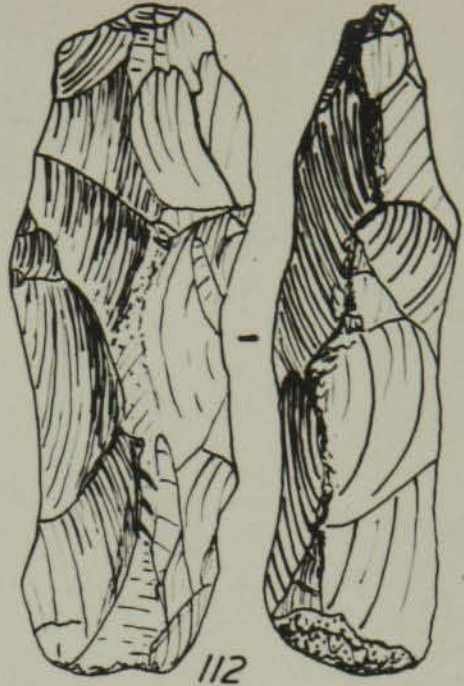
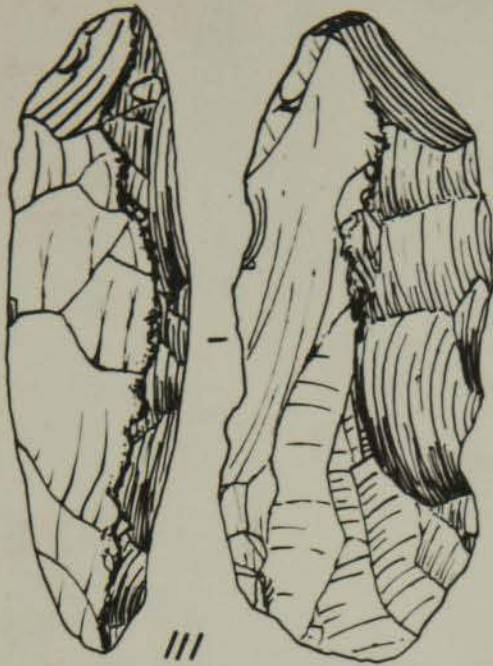


86-90, notched flakes; 91-99 perforators; 100-103 possible burins. Scale ca. 1:2



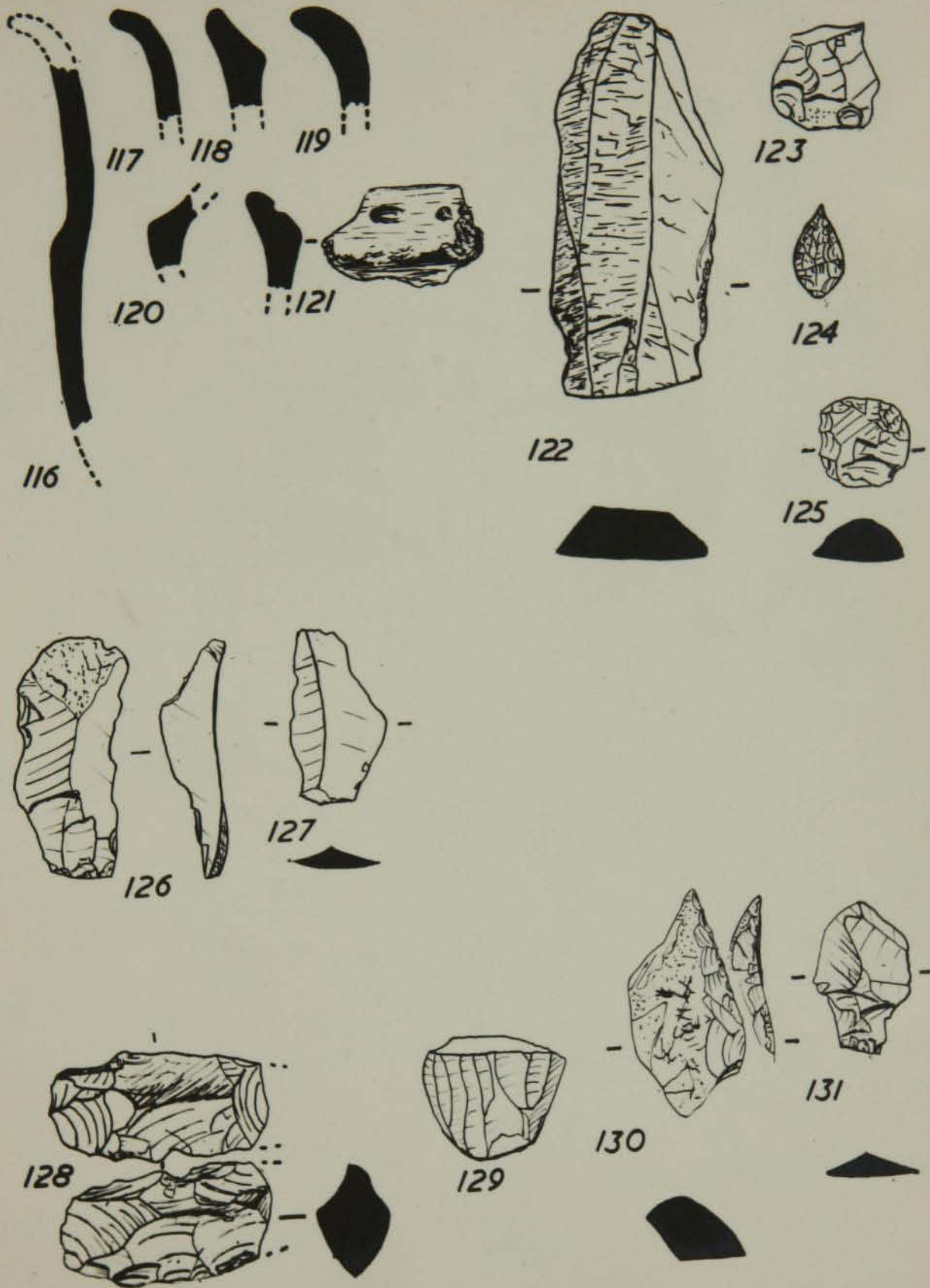
104, 106-110, "Larne axes"; 105 heavy core perforator.

Scale ca. 1:2

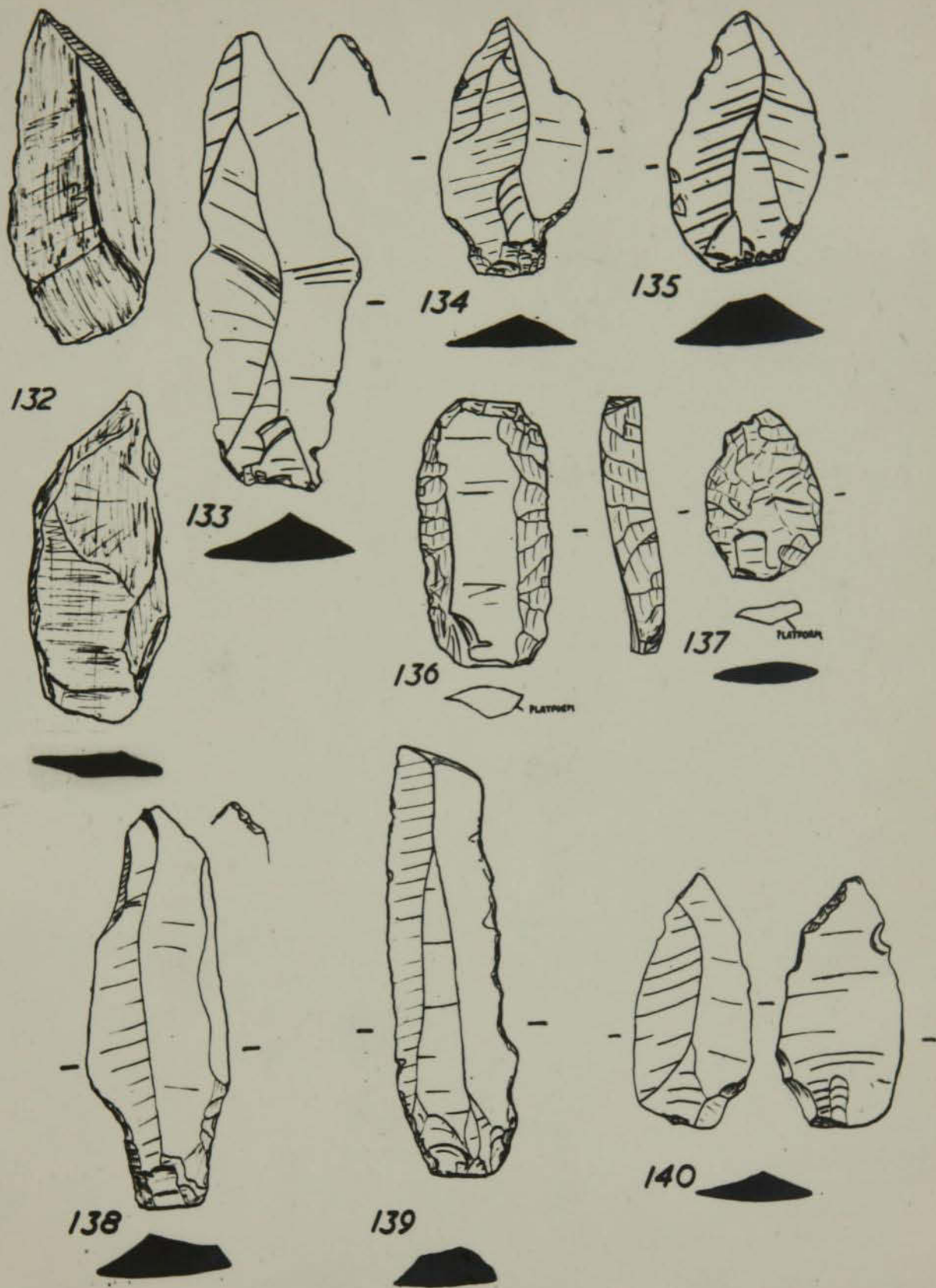


111-112, "lame axes"; 113-115 heavy perforators on flakes

or cores. Scale ca. 1:2

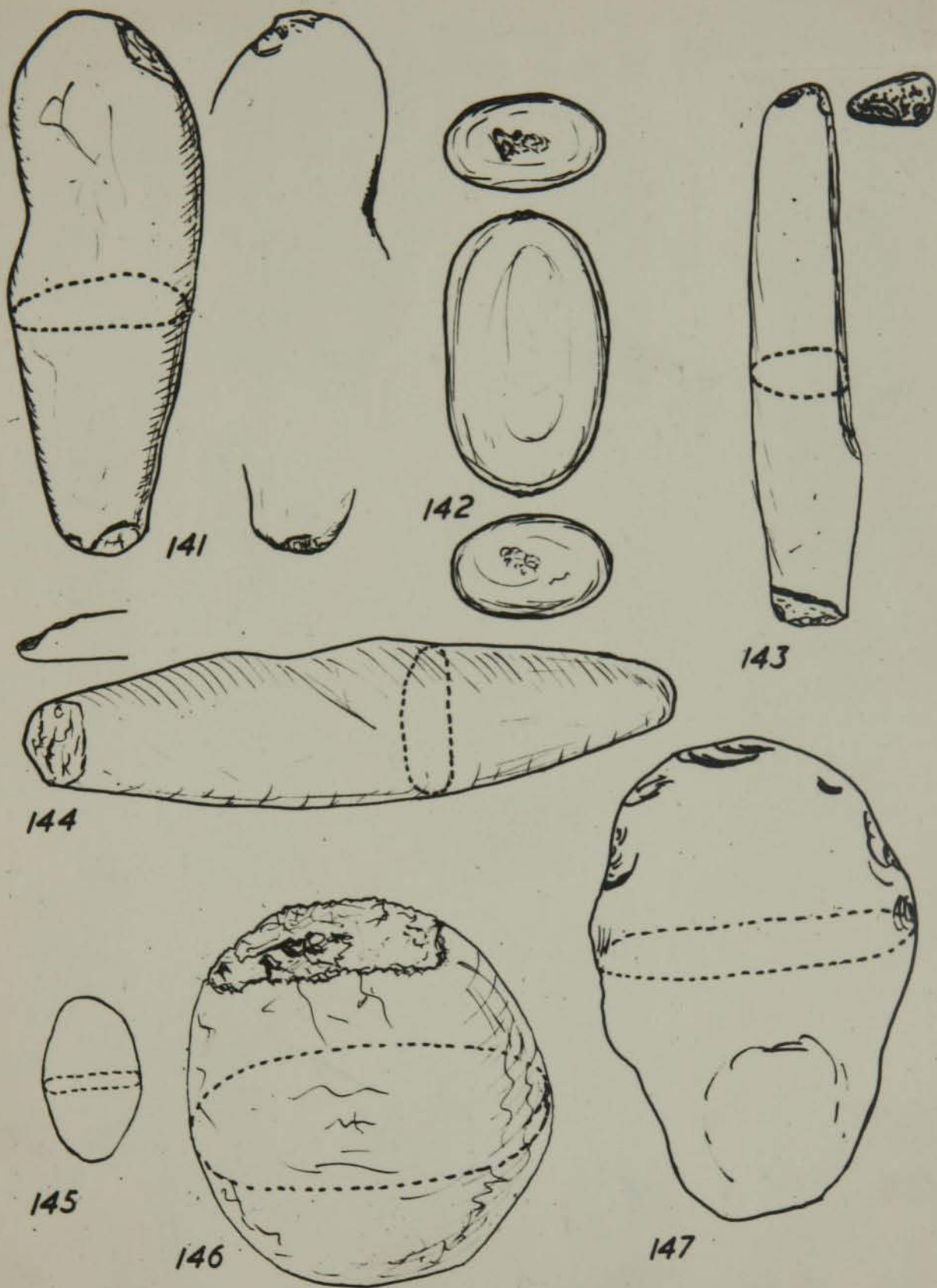


116-121, Neolithic A sherds; 122-125, finds from Feltrim Hill;
128-131, finds from Toome Bay. Scale ca. 1:2

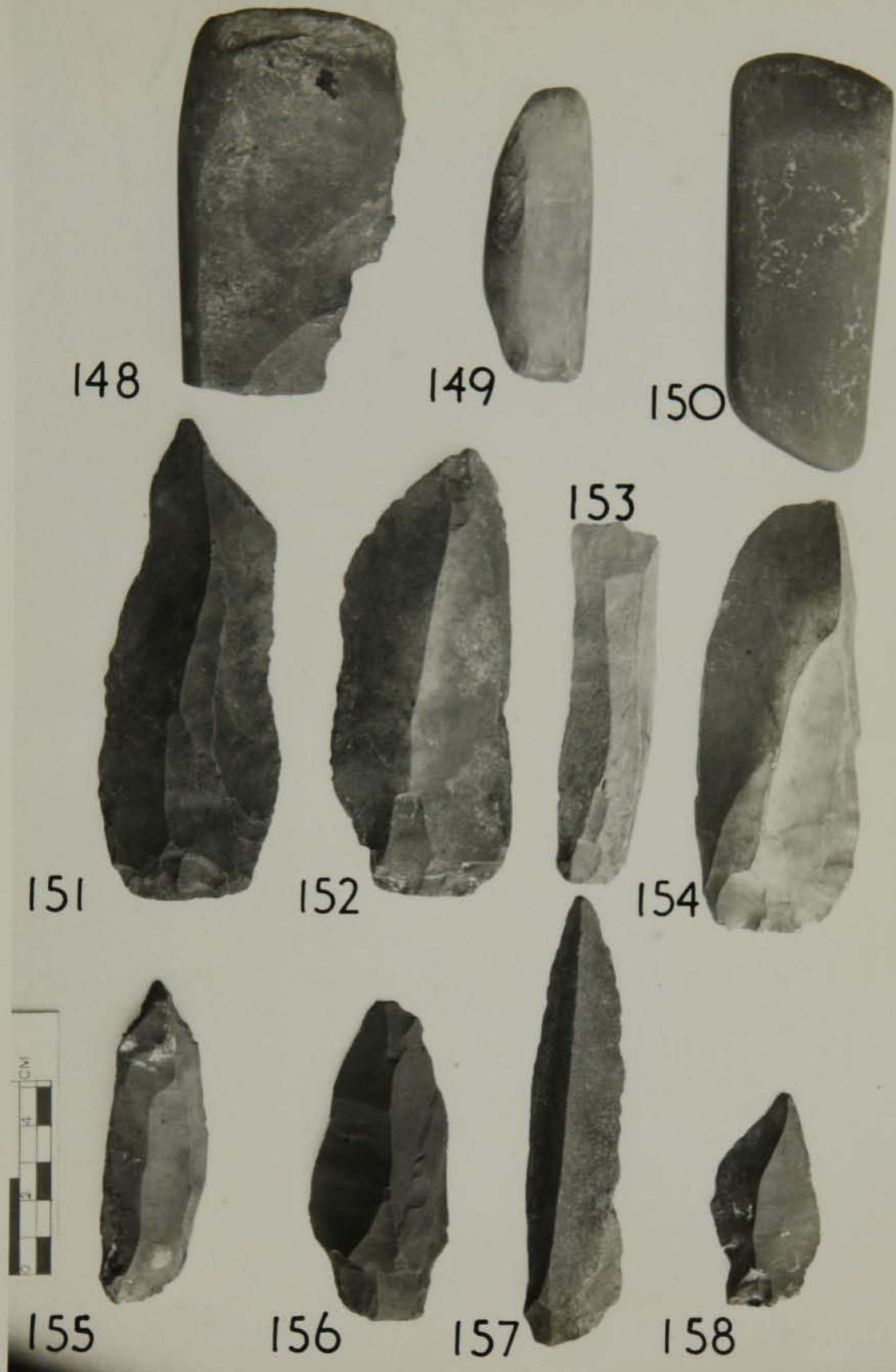


132, stone implement from Newferry; 133 chert, Carrickmaguirk;
 134-37, flint and chert, Co. Meath; 138-39 flint and chert

Toome Bar; 140 chert, Lough Gur. Scale ca. 1:2



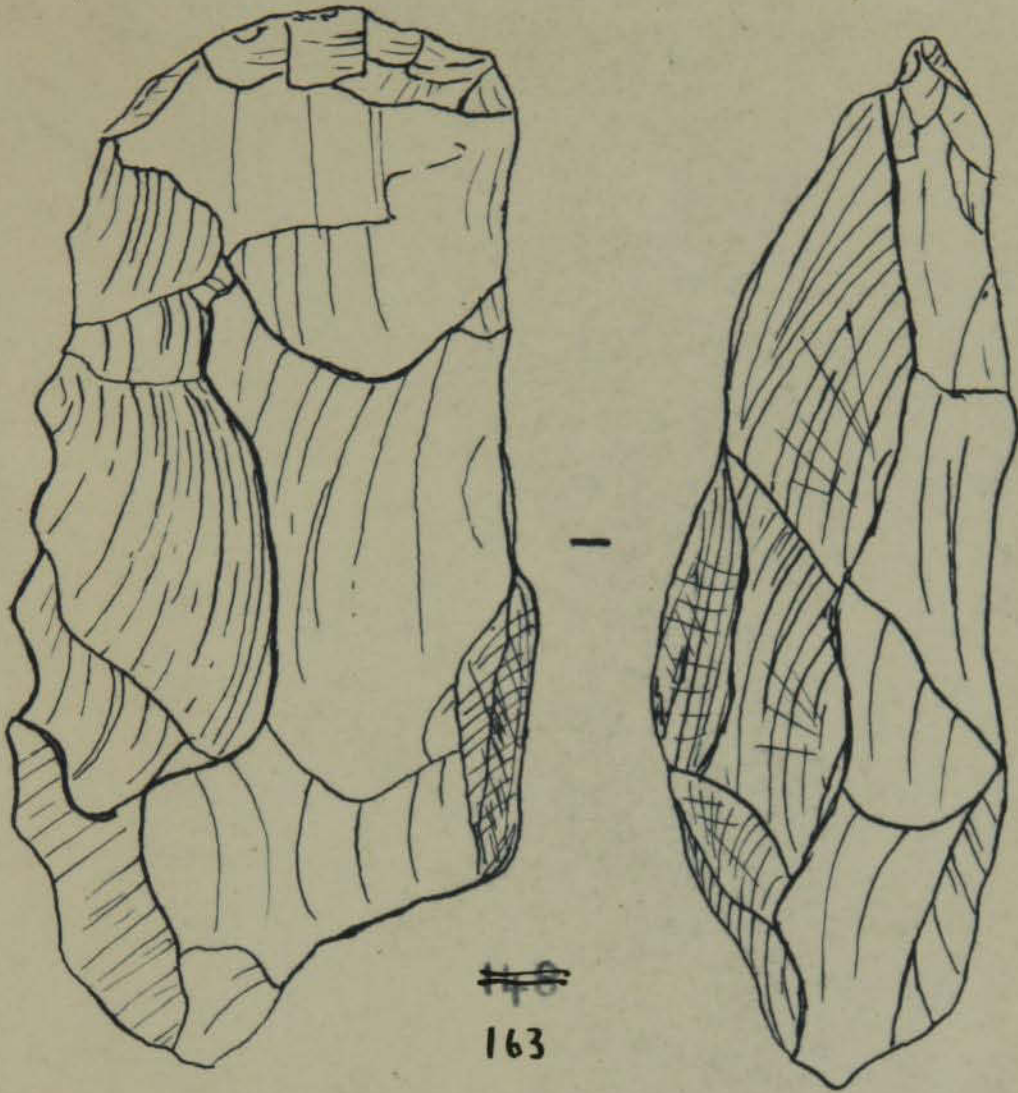
Stone. Scale ca. 1:2



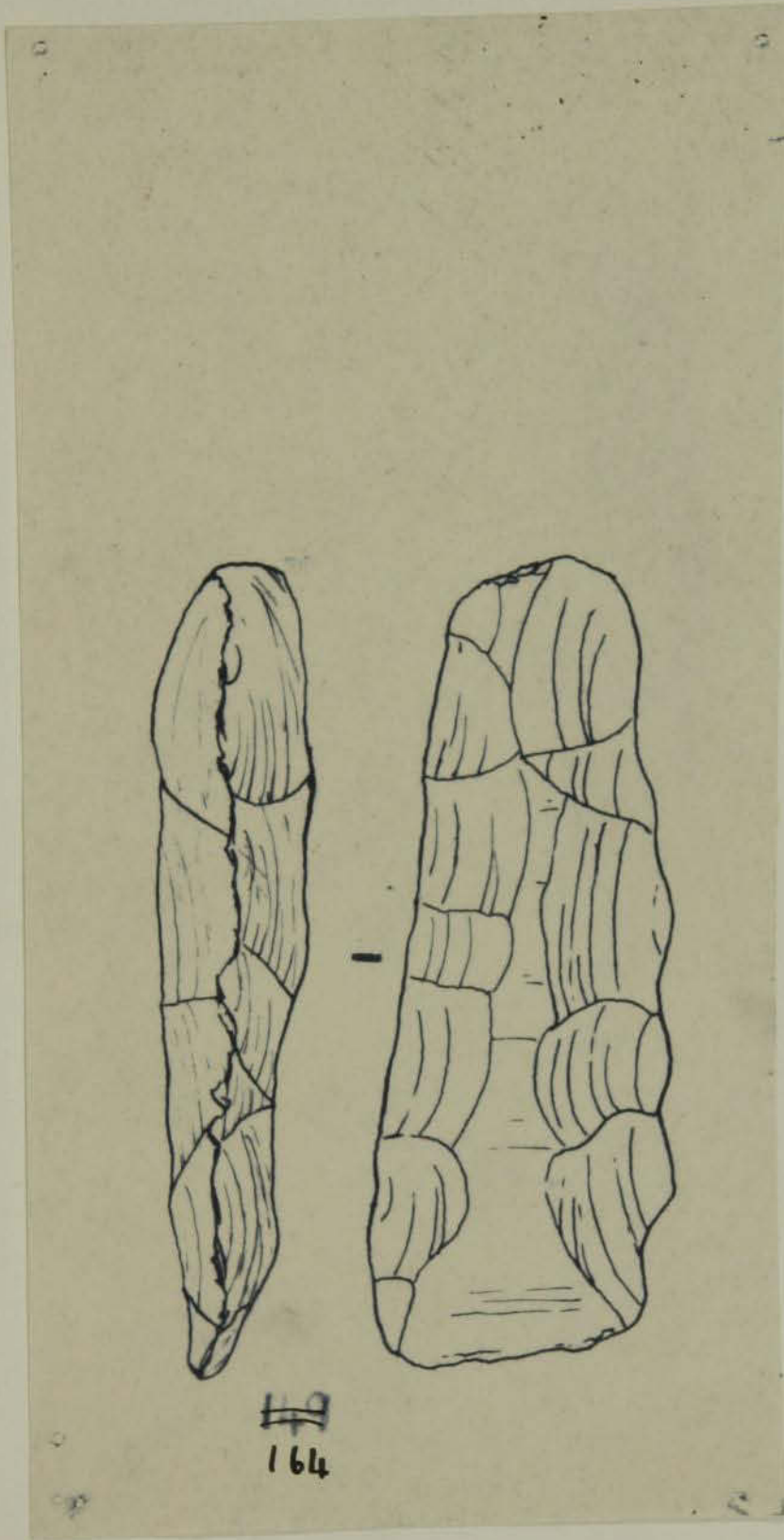
148-150 stone axes and 151-158 chert implements, Lough Gara.
 Scale as shown. (courtesy of National Museum).



"Limpet scoops" from Dalkey Island. Scale as shown.



163, Larné "axe". Scale 1:1



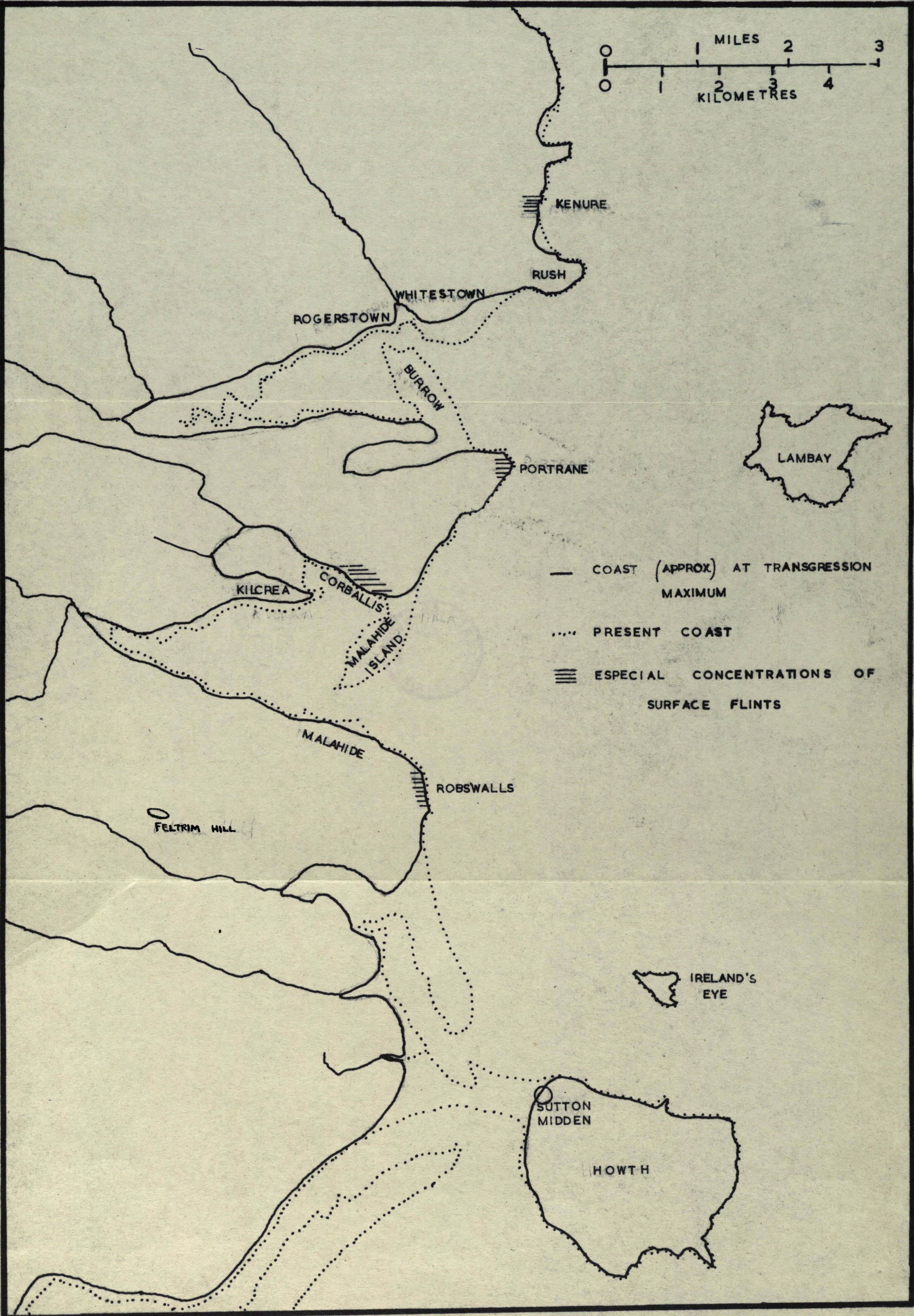
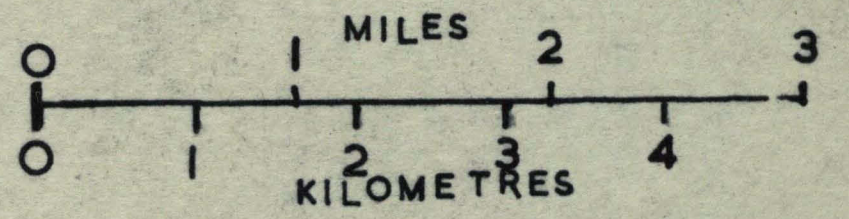
164, Lorne "axe". Scale 1:1





MAP I

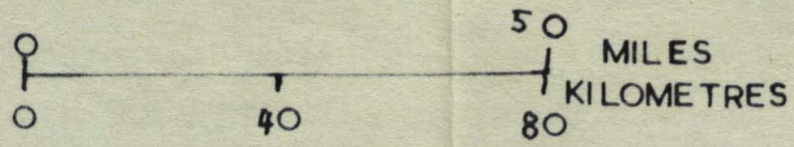




- COAST (APPROX) AT TRANSGRESSION MAXIMUM
- PRESENT COAST
- ≡≡≡ ESPECIAL CONCENTRATIONS OF SURFACE FLINTS

MAP II





- RAISED BEACH EXCAVATION
- SHELL MIDDENS
- FIND SPOTS OF BANN FLAKES
- X INLAND MESOLITHIC EXCAVATION
- COASTAL SCATTER OF MESOLITHIC FLINTS
- BEDS OF CRETACEOUS CHALK

