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# The Ice Age

The earliest part of the history of Ireland is the domain, not of the archaeologist, but of the geologist, the palaeobotanist and the palaeontologist who document respectively the structure and development of the earth's crust and the fossil remains of plants and animals contained in the various layers and deposits. Strictly speaking, the archaeologist has no function until the advent of man, but since environment is all-important to human life, it is necessary to look first at the conditions which shaped the land of Ireland before human presence was first recorded there.

In geological terms the present era is known as the Cainozoic and is divided into two periods, the Tertiary and the Quaternary. The latter consists of two epochs, the Pleistocene and the Holocene (or Recent). The Pleistocene broadly coincides with what is popularly known as the Great Ice Age. This affected the whole of northern Europe, Britain and Ireland included, and also North America, and in very general terms may be said to have begun about two million years ago or even earlier. A figure of 600,000 years ago has been proposed for the known formation of ice masses in Europe based on evidence from the land surface, and one of perhaps 250,000 years ago for the first indication of ice formation in Ireland. Man, so far as we know at present, did not inhabit Ireland until Post-glacial times when the ice had melted but the presence of humans has been documented in Britain from about the middle of the Pleistocene Epoch.

The earth's history throughout the Great Ice Age was characterized by glacial and interglacial temperature oscillations. The ice advanced and retreated a number of times with varying intervals (interglacials) between. Each advance incorporated clays, muds, gravels and rocks within the moving ice and these were often transported for long distances and deposited where the ice melted. Later advances tended to destroy the deposits laid down by earlier ice so that the determination of the succession of glacial events is of great complexity. In Alpine Europe at least four major ice advances have been documented, named Güntz, Mindel, Riss and Würm, while in Northern Europe evidence has been obtained of three: Elster, Saale and Weichsel. A glacial succession has also been worked out for Britain and one for Ireland, although, as we shall see, the latter is by no means hard-and-fast. Each time the ice melted, warmth returned to the land, new vegetation spread over the ground and conditions were again favourable for animal and human life.

It must be realized that as the ice increased in amount over the land masses, more and more water was taken out of the seas and oceans and locked away so that sea levels were lowered and areas formerly under water became land. This is known as glacio-eustatic sea level change or movement. Shore lines were considerably altered and islands were joined to each other and to neighbouring continental land masses. As the weight of the ice on the land increased, the land was pressed down somewhat under it (glacio-isostatic movement), permitting the sea to return at least some of the way towards its old shorelines. When the ice melted, vast quantities of water were released, bringing about a rise of sea level, but the land, relieved of the weight of ice, also began to rise. The net relationship of land height to mean sea level is therefore a factor of the two effects; falling sea and sinking land as the ice increased and rising sea and rising land as the ice melted away. Efforts to establish the relationship of land height to sea level at any given time are complicated by the fact that the rising or sinking of the land was not uniform everywhere within a given area. Where the ice was especially thick and therefore very heavy, the land sank more, its surface under the ice becoming a basin-like hollow; and conversely, this area rose more, even developing a bulge, when the ice disappeared. This means that the movement in any particular place was frequently in the nature of a tilt. Another factor that must be taken into account is the possibility of tectonic activity, that is, independent movement of the earth's crust. The movements of land and sea in relation to one another have particular relevance for Ireland in the period following the retreat of the ice, the Postglacial Stage, because the earliest certain knowledge of human activity in this country dates from that time.

The various movements of the ice mass over the land surface of Ireland and over the Irish Sea have been the subject of specialized studies for more than a century, involving many disciplines. Unanimity of views is not to be expected and indeed the present-day burgeoning of new information has raised important questions about the validity of the conventional framework. The latter postulated two major ice advances in Ireland loosely corresponding to the last two advances in Britain and on the Continent. The earlier of the two was known as the Munsterian and the final one Midlandian. Evidence had also been tentatively put forward for a still earlier cold stage, the Connachtian, separated from the Munsterian in this scheme by the Gortian Warm Stage, so-called from the type-site in Co. Galway. A second and final interglacial or warm stage was postulated for the period between the Munsterian and the Midlandian Cold Stage, the latter lasting until about 10,000 years ago when the Postglacial Stage commenced.

The more recent view regards the available evidence of ice advance in Ireland as being indicative of only one major cold stage. This is based on the known stratigraphic evidence but does not dismiss the existence of ice sheets in Ireland during earlier Pleistocene time (Warren 1979; Devoy 1983). W. P. Warren

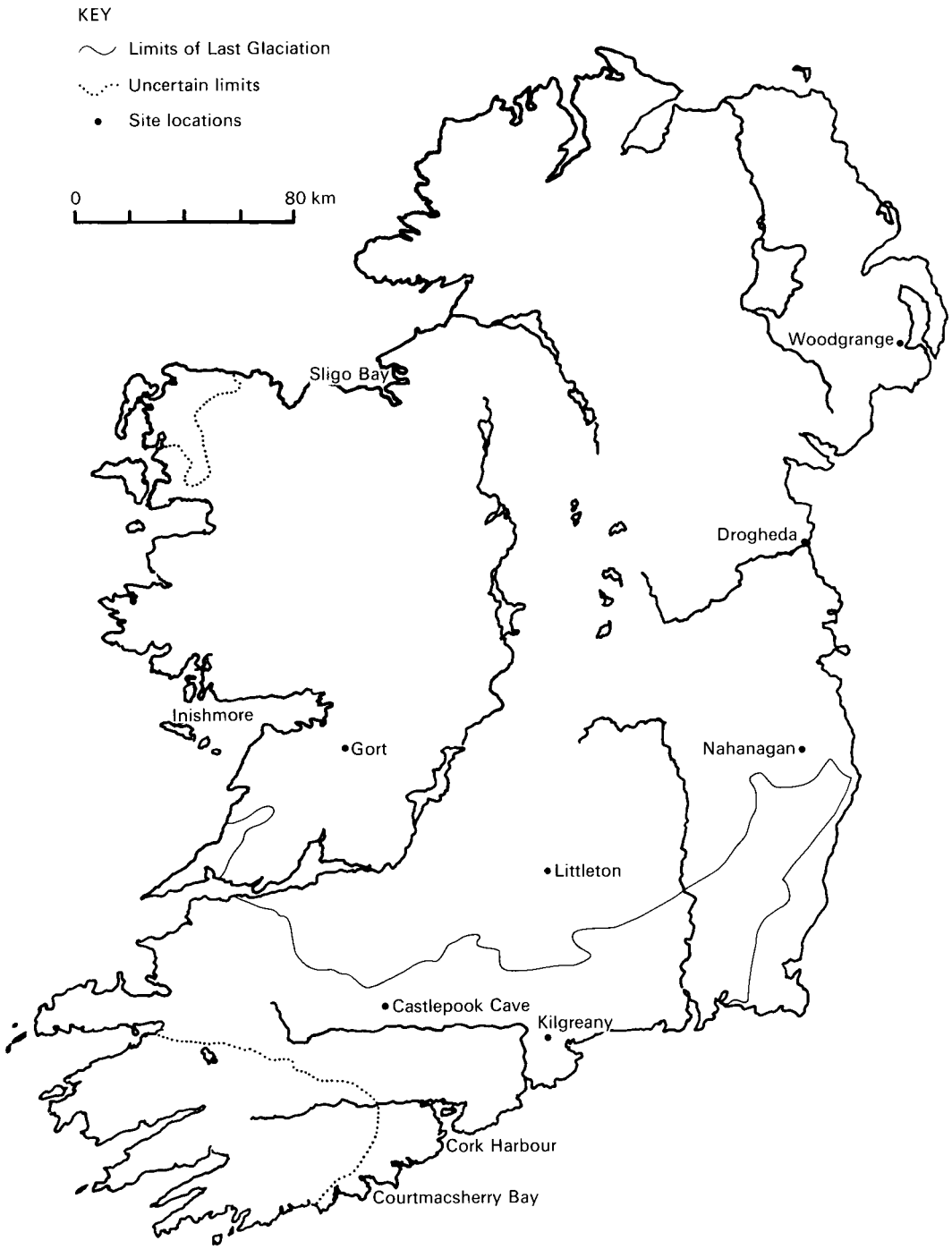
(1979, 327) asserts that on the basis of any stratigraphical approach the Gortian Warm Stage must represent, not a penultimate interglacial, but the final one, and he holds that most of the so-called Munsterian glacial deposits of the south of Ireland are in fact Midlandian in age and that only glacial deposits clearly earlier than the Gortian Warm Stage can be regarded as belonging to an earlier cold stage. These conclusions have been arrived at as a result of recent Quaternary research and studies of glacial geomorphology. For the student of archaeology, particularly of Irish archaeology, the broad general picture suffices because, as far as is known at present, there was no human presence in Ireland until the Post-glacial Stage.

In common with glaciated areas everywhere, Ireland first experienced a period of intense cold, following which ice caps developed on high peaks in Cork and Kerry in the south and south-west, in Donegal and Antrim in the north, and in Wicklow in the east. As conditions became more severe, glaciers began to move out from these areas and local glaciations developed which augmented the initial ones and coalesced with them. The eastern ice floes were joined by a great mass of ice which came thrusting down from Scotland by way of what is now the Irish Sea. The movement of this eastern ice has been traced as far west as Co. Cork. Fluctuations took place many times with ice masses forming and reducing.

During the less severe periods, animals entered Ireland and remains have been found in caves and lowland areas. One of these was the woolly mammoth, the remains of which have been found in counties Cork, Waterford and Antrim and also in Galway Bay. The reindeer, the Irish giant deer, the brown bear, the Irish hare and the spotted hyena were also present. The only known find of the latter from this country comes from Castlepook Cave in Co. Cork, excavated in the early part of this century. A mammoth bone from the same cave has been dated by radiocarbon determination (see p. 341) to 35,000 years ago (Mitchell 1976, 59).

It is believed that part of the south of Ireland remained unglaciated throughout, or certainly during the final stages of the Ice Age. This area consisted of a strip of country, or perhaps of a series of non-contiguous patches, lying between Waterford in the east and the Dingle peninsula in the west. If humans were in Ireland during the Pleistocene Epoch they should therefore be looked for here. Although it would have been too cold for humans to have survived in Ireland during the last cold period, the fact that Munster may not have been covered by ice could mean that traces of human occupation dating to the Palaeolithic or Old Stone Age may yet be found. Such sites are known in south-west Britain from just before and after the period when Britain and Ireland were last under ice.

One other effect of the glaciation, resulting from the rise and fall in relative mean sea levels, may be mentioned. This concerns a much-discussed erosion feature of the south and east coasts of Ireland. A remarkably level rock platform




2 Limits of the last glaciation (after F. M. Synge). Glacial and postglacial sites

at about +5.2 ± 1 m Ordnance Datum (Belfast) occurs along the south coast (Devoy 1983), rising to between +9 to +20m ODB further north, the difference in present height being due to the land tilt mentioned above. It was first documented by Wright and Muff (1904). Its most notable exposure is to be seen at Courtmacsherry Bay in Co. Cork (Mitchell 1957, 33), where the top of an extensive rock outcrop has been planed off to a level surface by wave action at a time when mean sea level was higher than it is at present. At its landward end the rock is overlain by a layer of water-rolled pebbles covered by sand which in turn is covered by a great mass of boulder clay (till) deposited over it subsequently.

## Palaeolithic man

The Ice Age was not a time of uniform glaciation, as has been shown, but was interspersed with less severe, and even warm, periods. Conditions at these times were suitable for plants and animals and it follows that they were also suitable for humans. Evidence of human activity in the form of assemblages of hand-axes of stone is available from Britain, dating from the penultimate interglacial in that country, that is, the Hoxnian. Its age is estimated at 200,000 to 250,000 years ago, and from then on, various Middle and Upper Palaeolithic sites have continued the story of Old Stone Age occupation in Britain. There is no evidence of this in Ireland at present.

Finds of supposed implements from a number of areas have been claimed to be of Palaeolithic date, but none of these finds is convincing and none of them is now accepted as evidence of the presence of Palaeolithic man here. We may mention a collection of objects from three sites around Sligo Bay in the north-west of Ireland – Coney Island, Rosses Point and Ballyconnell – which it was suggested showed features of the European Levallois flake-technique. The objects are from shore sites and though they are made from soft limestone, they are fresh and unrolled despite the fact that this coast is exposed to the force of the Atlantic wave action. Even if the pieces had not been accessible to the waves but had merely lain in the ground from Old Stone Age times, their surface characters would have been reduced by solution of the stone itself. They are either of recent natural origin, or if man-made, must be the result of some modern activity of fishermen or others in the area (Movius 1942, 105–14).

More serious were the claims made by E. K. Tratman (1928), leader of the Bristol Spelaeological Society's excavation in the Kilgreany cave, near Cappagh, Co. Waterford, a site which lies beyond the limit of the last ice advance. Here, 'Kilgreany B', the lower of two skeletons found in a horizon which also contained the bones of extinct fauna – Irish giant deer, for instance – was considered to be that of an Upper Palaeolithic man. At a higher level in the deposit, a female skeleton, 'Kilgreany A', had been found. When subsequently the remainder of

the cave deposit was excavated by the Harvard Archaeological Expedition to Ireland, Hallam Movius (1935) showed that the whole of the deposit had suffered disturbance. Bones of domestic ox and sheep occurred in the same layers as the remains of extinct mammals; modern objects of iron, glass and pottery were associated with the bones of Late Glacial fauna; charcoal from a hearth in the same horizon as the 'Kilgreany B' skeleton was Postglacial, yielding oak, ash and hazel. Neolithic or New Stone Age pottery sherds, an amber bead probably of Bronze Age date and an Early Christian Period ornament were also found in the cave, while not a single artefact that could be considered to be of Old Stone Age date or type was found in the cave or adjacent thereto. Finally, the anthropometric data of the human skeletons do not place them within the range of known Upper Palaeolithic types. Radiocarbon dates have since confirmed that the skeletons belong to a later period, the Neolithic. The 'A' skeleton has been dated to 4580 ± 150 BP* and a slightly earlier date was obtained for the other.

In recent times G. F. Mitchell picked up a flint flake from a gravel deposit in a quarry near Drogheda, Co. Louth, on the east coast of Ireland. It was a waste piece resulting from the knapping (deliberate breaking-up) of a flint nodule. Mitchell diagnosed the gravel deposit as being of Irish Sea origin. During the glacial period when ice was moving southward from Scotland along what is now the Irish Sea, the flake was picked up with stones and gravel and was eventually washed out of the melting ice on to the Irish coast. The flake suggests that Old Stone Age hunters were at one time in what is now the basin of the Irish Sea. Palaeolithic flint experts are satisfied that the flake was struck by a technique in use in Britain during Palaeolithic times (Mitchell and Sieveking 1972). If this is indeed the case, it shows how near to Ireland Palaeolithic Man came and in fact provokes the question, why not *to* Ireland?

In 1974, a visitor to Inishmore, the largest of the islands of Aran in Galway Bay, found a small flint hand-axe amongst the stones of the *chevaux de frise* (a defence network of upright stones) that surrounds the great stone fort of Dún Aenghus. Experts accept that the axe is of Acheulian/Mousterian type, that is, Middle to Upper Palaeolithic, but its authenticity as an Irish artefact is highly suspect (Murphy 1977).

## Late Glacial and Postglacial stages

About 14,000 years ago the global climate changed and the ice sheets began to retreat northwards with consequent amelioration of the previous cold conditions. Temperatures rapidly became warmer so that there was an expansion of the vegetation already present and an immigration of new species of both flora and

* For explanation of the convention used in quoting radiocarbon ($^{14}C$) dates see Appendix A. For laboratory name and sample number see Appendix D.

fauna. The first part of the Late Glacial Stage is therefore an interstadial episode in the cycle of glaciation and it was followed by a sharp return to cold conditions.

In the Postglacial Stage which commenced about 10,300 years ago the climate again began to improve and thus began the present 'warm stage' in which we now live. Mitchell (1976, 35) observes that there is no reason to think that this 'relatively genial climate of today is any more firmly established than that of previous transient "warm stages" . . . [and] will in all probability be succeeded in due course by yet another "cold stage" '.

Palaeobotanists have divided the Late Glacial and Postglacial Stages into a number of zones differentiated according to the plant pollen trapped in muds and lake beds. Pollen analysis (p. 345) enables the vegetational history of a particular area to be reconstructed and from this, temperature and other environmental conditions can be estimated. When these results are correlated with those from other areas, an overall picture of the prevailing environment can be gained. While not necessarily accurate in detail, it is adequate in very broad outline. The advent of radiocarbon dating (p. 341) has enabled the zonation to be placed within a chronological framework. The zonation scheme given below for Ireland is that of Jessen (1949), modified in the later stages by Mitchell (1951). Provided it is accepted that it is valid only within broad parameters and that only very major episodes are represented, the scheme gives a valuable vegetational, environmental and climatic record.

## Pollen zones

The effect of the Late Glacial amelioration of climate can be seen in pollen Zones I and II and is documented in Ireland by a number of pollen diagrams, in particular one from Woodgrange, Co. Down; hence the name Woodgrange Interstadial or Warm Phase which has been applied to the period in question. Plant remains were scanty at first, consisting mainly of alpine-arctic types and northern grasses, some of which had probably persisted throughout part at least of the final glaciation. With the rise in temperature, this vegetation burgeoned and there was considerable immigration of new species. Sub-arctic plants, grasses, herbs and flowers such as the gentian and the mountain avens grew in open places, while stands of dwarf birch and juniper shrubs were established. There was immigration of animals also, the most notable being the Irish giant deer, formerly but erroneously known as the 'Irish Elk'. The richness of the vegetation would have provided ample sustenance for this species and also for reindeer. Remains of the giant deer have been found at some two hundred locations in Ireland (Mitchell 1969, 24), all in Zone II muds. There are some twenty records of reindeer but no other mammals have been recorded from Irish Late Glacial deposits.

About 10,500 or 11,000 years before the present (BP) a period of severe cold

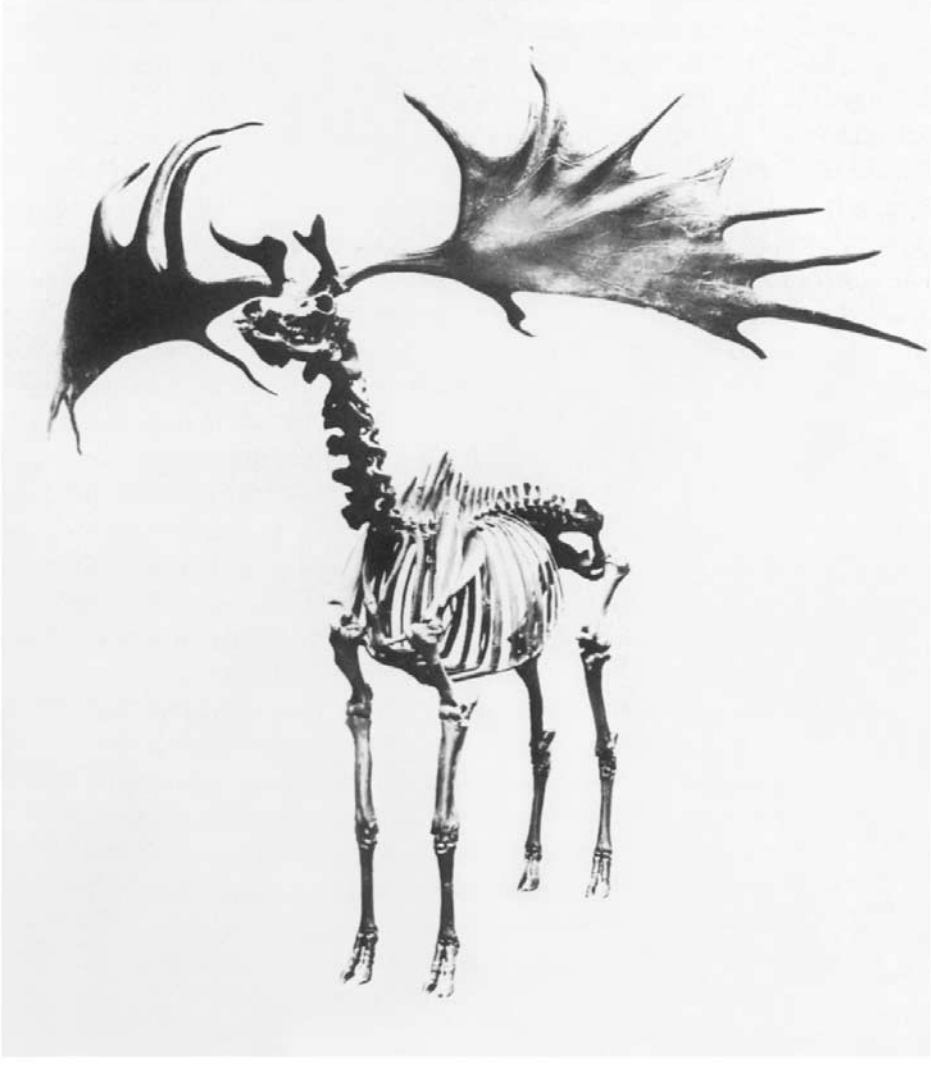
Table 1 *Pollen Zones and vegetation changes in Ireland in Late and Postglacial times*

| | Approx. years BP | Pollen Zones | Characteristic vegetation | Archaeological periods |
|---|---|---|---|---|
| Postglacial | 1500 | | | |
| | Sub-atlantic | VIIIb | Oak receding<br>Development of secondary woodland<br>Pine declines | Iron |
| | 3500 | | | |
| | Sub-boreal | VIIIa | Elm declines<br>Oak rises to a maximum | Bronze |
| | 5200 | | | |
| | Atlantic | VII | Pine falling<br>Mixed woodland of oak, elm and a preponderance of alder | Neolithic |
| | 7500 | | | |
| | Boreal | V and VI | Expansion of hazel<br>Growth of pine, oak and elm | Mesolithic |
| | 9600 | | | |
| | Pre-boreal | IV | Scrub and bushes<br>Birch, willow, poplar and juniper | |
| | 10,300 | | | |
| | Late glacial 14,000 | I, II and III | Park tundra<br>Alpine-arctic | |

*Source:* after G. F. Mitchell 1965

and tundra-like conditions returned, known as the Nahanagan Stadial or Cold Phase after the site in Co. Wicklow where it was first documented. The climate must then have resembled that of northern Siberia today. Pollens of Zone III show that plants of more northern type had appeared and that woodland was reduced. Ice probably increased in mountain areas and the relative sea level, which had risen during the interstadial stage, was once again lowered. Areas of land would have been exposed off the coasts and, according to some authorities, land bridges may have existed between Ireland and Britain during this time. This is a matter of continuing controversy and some scholars hold that in all probability no firm land connections existed after about 20,000 years ago (Devoy 1983). The resolution of this question would have important implications for the immigration of humans to Ireland.

Zone IV, c. 10,300 BP, the Pre-boreal Phase, signals the beginning of the Post-glacial amelioration of climate that has continued ever since, known as the Littletonian Warm Stage after the bog site in Co. Tipperary (Mitchell 1965; 1965a) which produced one of the best early pollen sequences for vegetation changes in the Postglacial. A marked modification of the environment was observed in the pollen diagrams. Open tundra gradually gave place to woodland of birch, willow, poplar and juniper. Peat began to form in places as swamp growth increased. In Zones V and VI, *c.*9,600 BP, the Boreal Phase, birch was



3 Giant Irish deer (*Megaceros giganteus*)

still present in the earlier part but hazel began to expand greatly. The lowlands and lower mountain slopes became covered in woodland and the heathlands seem to have disappeared. Pine also became prominent and while hazel continued to increase at the expense of birch, the oak and the elm made their appearance. The climate was relatively dry and not unlike that of the present day, although perhaps less stormy because forest was able to spread right down to the western coastline. Relative sea level was rising throughout this period and if land connections with Britain had previously existed, they would now have been severed. It is known that man was in Ireland at this time but whether he arrived dry-shod or in open boats is a question not yet resolved.

Towards the end of the Boreal Phase the sea had begun to invade the low-lying coasts of the North Sea and the Irish Sea and the northern coast of Ireland was also affected. This process continued during Zone VII, c. 7500 BP, the Atlantic Phase, and the maximum rate of sea level rise was attained, i.e. the Maximum Transgression. At this maximum a shore-line was formed, but subsequently the land again rose, lifting this shore-line to an average height of *c.*7.6m above present sea level in parts of the north-eastern corner of Ireland. Further south, because this land movement was part of the tilt mentioned previously (p. 2), the old shore-line was lower and nearer to that of the present day. Where the shore-line has been raised above present sea level it is known as a 'raised beach' and it is a feature of special interest in the north-east of Ireland because much of the evidence of Mesolithic or Middle Stone Age Man is associated with it. As the north-east was rising, the south may have either remained stable or else undergone some subsidence. Robert Devoy (1983) has shown that in the Cork Harbour area the sea level at *c.*8000 BP was only about 15m lower than at present. Furthermore, there are indications that in parts of west Cork and Kerry the land may have risen slightly. This improves the chances of finding Mesolithic activity in these areas. As against this, however, it has been pointed out that erosion may have had greater effect on the unconsolidated deposits of the Cork and Waterford coasts than submergence, thus providing a negative factor in regard to the finding of archaeological remains. In the course of the Atlantic Phase, the climate, though still relatively dry, is thought to have become more humid and oceanic and a temperature a few degrees higher than the present-day one was attained, the so-called 'climatic optimum' of the Postglacial Stage. The forest was by now a mixed one of oak, elm and a marked preponderance of alder. Raised peat bogs also began to form.

During the transition between the Atlantic and the Sub-boreal Phases relative sea level reached its maximum. Since the eustatic and isostatic movements were not uniform throughout Ireland, the maximum transgression has no fixed date but in general it may have occurred as early as 6000 BP along parts of the northern coast and as late as 5000 BP farther south towards Dublin Bay on the