Connemara

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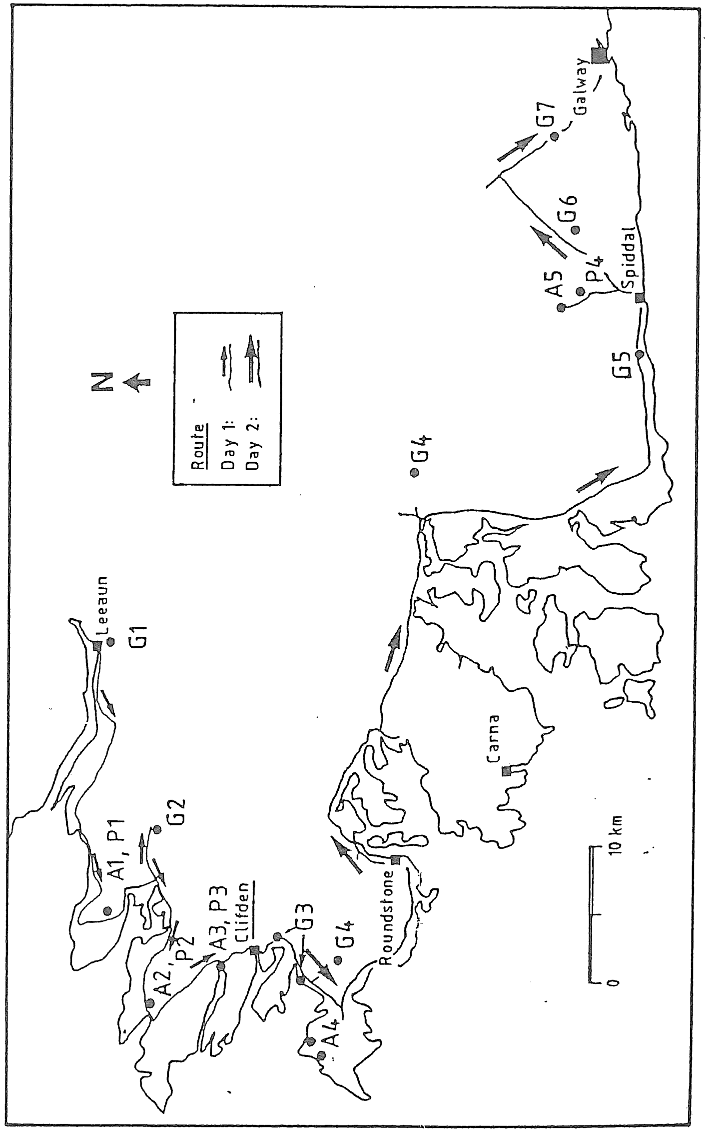
Treoir Allamuigh Uimhir 11

Field Guide No. 11



Map of Connemara showing excursion route and study sites (Archaeology: A1 - A5; Geology: G1 - G7; Palaeoecology: P1 - P4).

Connemara

a eagrú ag/edited by

M. O'Connell agus/and W.P. Warren

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Field Guide No. 11

Cumann Staidéar Ré Cheathartha na h-Éireann

Irish Association for Quaternary Studies

i dteannta le/in collaboration with

Cumann Staidéar an Duine agus an Timpeallacht

Man and the Environment Study Group

1988

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G1.1 Bedrock Geology

The bedrock geology of Connemara has two main components, the metamorphic rocks and the granites (Fig. 1). The metamorphic rocks include both metasediments and a metagabbro suite.

The metasediments are Dalradian (late Precambrian to early Cambrian). They contain basic volcanics and were metamorphosed and deformed during the Grampian orogeny (Late Cambrian to early Ordovician). The gabbro suite was intruded during the metamorphism of the Dalradian rocks, upon which they produced a major thermal overprint (Barber and Yardley, 1985). Their lithologies are ultrabasic to granite (acid) and were metamorphosed and deformed during the Grampian orogeny.

The granites are late Caledonian and include the Galway Granite batholith with several constituent plutons totalling five major granite varieties. Permo-Carboniferous dykes occur within the Galway granite.

Carboniferous limestone marks the eastern boundary of the area and Ordovician and Silurian, fluviatile and deepening marine sedimentary, rocks impinge on the northern boundary.

The disposition of the rocks, with the Galway Granite in the south, the metagabbro along its northern boundary and the metasediments to the north help to establish the general pattern of glaciation through erratic tracing. The

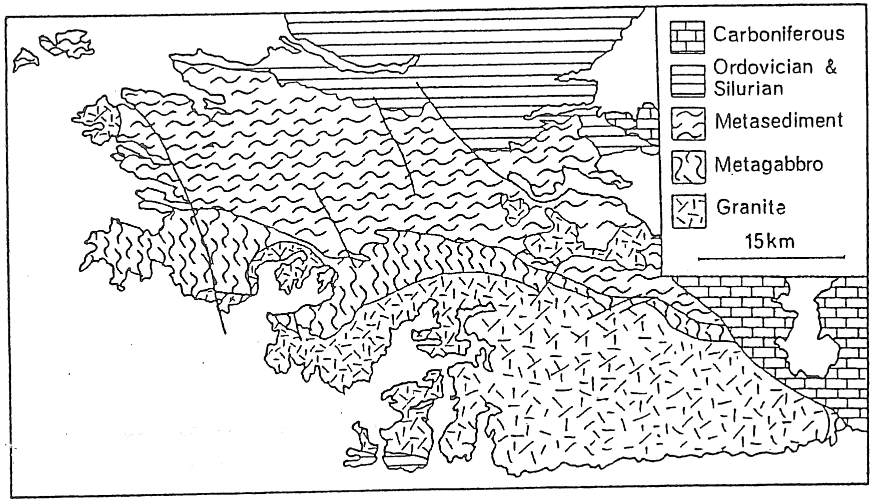

Fig. 1 Outline Bedrock geology of Connemara. Based on the maps of the Geological Survey and Barber and Yardley (1985).

characteristic pale quartzites of the Beanna Beola and Maumturks are particularly useful. However, the complex arrangement of the rocks and the difficulty in distinguishing many of the metasediments makes it difficult to define local ice movements on the basis of erratics alone.

1.2 Quaternary Geology

The landscape of Connemara is quintessentially glacial. Its expansive stretches of bare ice-dressed rock mark it clearly as a northern correlative of the glacially scraped Burren of Co. Clare, notwithstanding the non-carbonate nature of the Connemara rocks and the postglacial rendering down of many of the features of glacial erosion in the Burren.

Although the extensive glaciated nature of Connemara hás been recognised since the 1860's and 1870's when the Geological Survey produced its maps and memoirs and the broad pattern of former ice movement as expressed in the striae, roche moutonnées and drumlins was succinctly outlined by Kinahan and Close in 1872, some confusion has been introduced through the fashion of the last sixty years to place whimsical lines on the map in the absence of hard evidence on the ground and to concoct glacial events to suit the vogue of the day.

It is not possible, in Connemara, to recognise deposits or features of more than one glacial period. Glacial sediments are patchy in distribution and, where flat-lying, are usually covered by postglacial peat. Drumlins are common and are generally dispersed or occur in small swarms.

As noted by Kinahan and Close (1872) their orientation is remarkably consistent with that of the striae and roches moutonnées. Small moraines occur in some of the valleys in Joyces Country and a small esker chain occurs near Kylemore.

Fifty-seven years after Kinahan and Close published their paper, Charlesworth (1929) wrote of the deglaciation of Iar-Chonnacht. His characterisation of deglacial ice limits followed his schematic style which was a product of his "broad brush" approach to field observation. He accepted the pattern of glaciation outlined by Kinahan and Close (1872) but suggested that during dissolution, the ice retreated to four main centres: The Beanna Beola, the Maumturks, the Partry Mountains and Mweelrea. Some of the ice lobes which he envisaged do not however seem to equate with the ice direction indicators. In subsequent years, however, some small scale maps of glacial features in Ireland showed ice limits in Connemara that were based on no evidence at all (see Farrington and Stephens, 1964).

More recently, Orme (1967) reviewed the glaciation and deglaciation of Connemara. Orme followed Kinahan and Close (1872) in his broad interpretation of direction of ice movement but placed more emphasis on drumlin orientation than on striae and roches moutonnées so that the detail is slightly different. Orme was, however, trying to distinguish the extent of "Weichsel glaciation" and, for no explained reason, suggested that neither the Maumturks nor the Partry Mountains were overtopped by ice and that the Beanna Beola probably formed nunataks at that time.

Orme (1967) also suggested a lateglacial readvance (the Kylemore readvance) based on the occurrence of hummocky ground close to the Beanna Beola and Maumturks. No

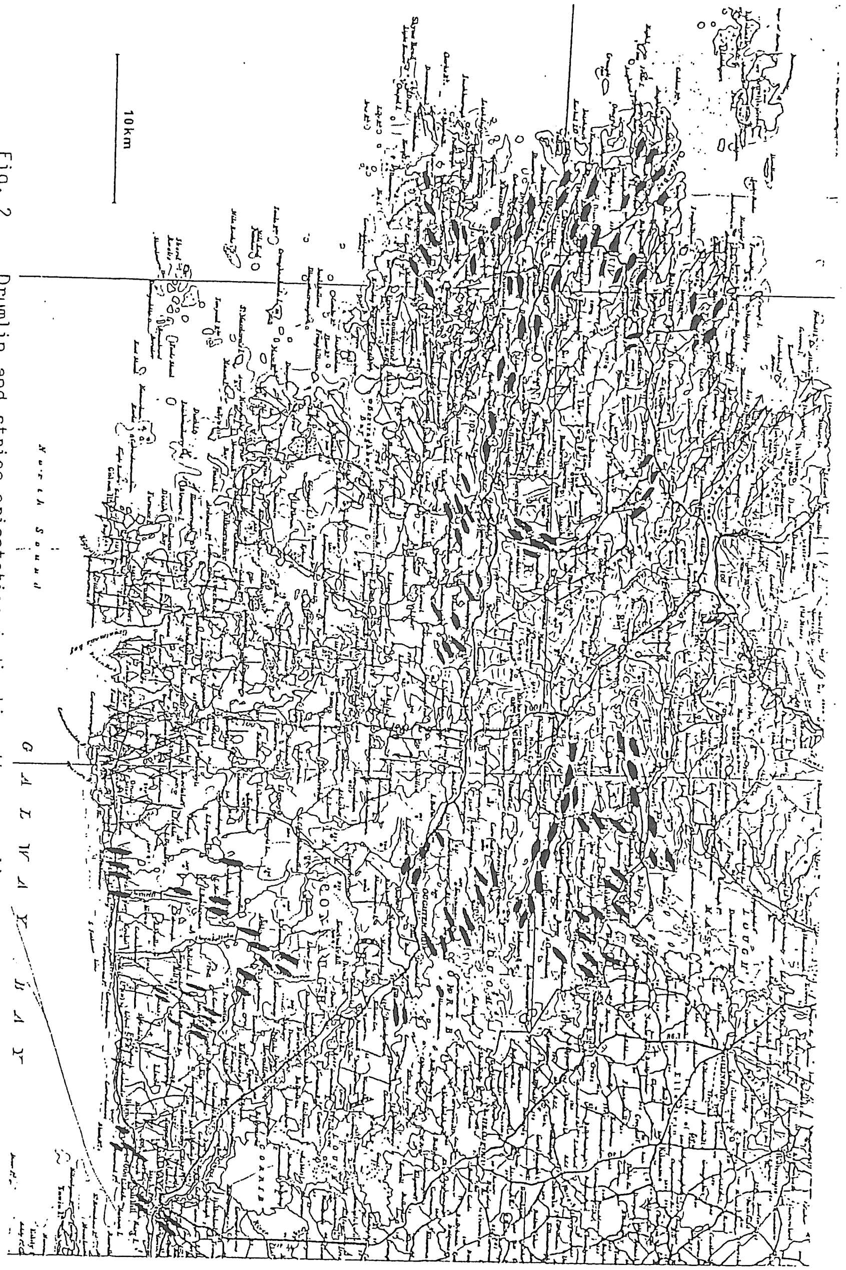

Fig. 2 Drumlin and striae orientation indicating the overall pattern of glaciation in Connemara. Drumlins (heavy black) are symbolic and not to scale. Striae (arrows) are representative of striae in the general area. Source: Geological Survey of Ireland.

explanation was given to why this should not simply represent the final stages in deglaciation rather than a readvance.

In the absence of any more recent detailed study of the glaciation of this area Kinahan and Close (1872) provide the best overall picture of the glaciation of the area: a very large dome centred on the area just east of the Beanna Beola, but covering both them and the Maumturks and radiating north beyond Clew Bay, northwest over Clare Island, southwest over the Aran Islands and south over Co. Clare. Its movement east was hindered by ice spreading from the Midlands, which influenced flow directions along the margins. The extraneous ice impinged on the Galway Granite area within the Galway, Oughterard, Casla Bay triangle for a time, as is explained in the guide (Fig. 2).

The pattern of deglaciation has not yet been studied in detail, although some work is in progress, but is likely that some of the complexities evident in the striae pattern result from changes in ice flow direction during deglaciation.

As there is no evidence of any interglacial sequence either within Connemara or elsewhere that would point to an older age for any or all of the glacial deposits, they are all regarded as Fenitian (last glaciation) in age (see Warren, 1985). Given the close association between the features of glacial erosion and the glacial deposits, it is likely that, in the absence of any evidence to the contrary, the striae and roches moutonnées also relate to the Fenitian stage.

1.3 Soils

The extensive tracts of bare rock surfaces and thin till together with low permeability and high rainfall have acted together to produce extensive areas of blanket bog relieved by generally acid lithosols and podzolised soils (see Gardiner and Radford, 1980). The environment is generally an acidic one and favours acidophile vegetation. However, in areas underlain by Connemara marble, fields are often conspicuously greener and it is likely that these soils are less acidic.

2.0 Palaeoecology (M.O'C)

Connemara, with its variety of geology, a flora noted for its rare Lusitanian and North American elements, a long but possibly patchy (both temporally and spatially) history of human settlement and a landscape the physiognomy of which is largely determined by blanket bog - one of the youngest extensive layers on the earth's surface - has until recently, attracted scant attention from the palaeoecologist. Jessen's (1949) studies at Roundstone supplemented by a later unpublished study of Watts (cf. Watts, 1983) are the only investigations to-date into late-glacial vegetation and environment in the region (but see G4). It was not until 1980, that the first pollen diagram with a full complement of NAP curves was published (Dolan profile, nr. Roundstone by Teunissen and Teunissen-van

Oorschot, 1980). In 1984, when a research programme aimed at reconstructing the post-glacial environment of the region was initiated by the author, no ^{14}C-dated pollen diagram was yet available and only a couple of radiocarbon dates were available *in toto*. At present about 50 dates provide the basis of a sound chronology for the main vegetational and environmental developments of the post-glacial. In addition to the investigations presented/referred to in the accounts which follow, studies have also been carried out into the vegetation of the Connemara National Park (Bowler, 1986; Heijnis, 1987), post-glacial vegetation development at L. Corcal in the southern part of the Carna peninsula (McDonnell, 1988) and the history of lake island woodland vegetation (Bradshaw and Hannon).

3.0 Archaeology (MAG and JH)

Connemara and its antiquities have attracted the attention of many historians and archaeologists over the last few centuries and several articles and books have been published dealing in whole or in part with different aspects of its history and prehistory. One of the earliest writers was Roderic O'Flaherty who in his *West or h-Iar Connaught* was among the first native historian and antiquarian to deal specifically with the area from the native Irish perspective.

In the early nineteenth century some of the founding fathers of Irish Archaeology and Celtic Studies dealt

briefly with Connemara. George Petrie (1972) and John O'Donovan (1838, 1839) put some of the local history and many sites on record for the first time.

Later in the 1860's and 1870's there were other notables like Kinahan who, as a local correspondent, contributed over fourteen articles on the area alone, mainly to the Journal of the Royal Society of Antiquaries of Ireland.

At various stages in the nineteenth and the first half of the twentieth century, different chronological periods and site types have attracted particular attention. Kinahan (see above), Bigger (1895), Westropp (1911) and Macalister (e.g. Macalister, 1896) carried out fieldwork and wrote especially about the island sites which received a disproportionate attention by comparison with the mainland ones - many of which still awaited discovery.

Megalithic tombs received only passing mention from the early writers and most of this early work has been summarised by de Valera and Ó Nualláin (1972). In the last decade, however, many new megalithic tombs have been found (Gibbons, 1985; Gibbons and Higgins, 1988). Among the first standing stones published were those in Streamstown (Ormsby, 1914). Other prehistoric field monument types, especially settlement and ritual sites, which were almost unknown in the area until recently, have also come to light.

Small finds have received less attention in general until the publication of articles by Raftery (1945, 1973) and Hartnett (1952) which included some finds from Connemara. These finds serve to indicate that the distribution of field monuments alone gives a false

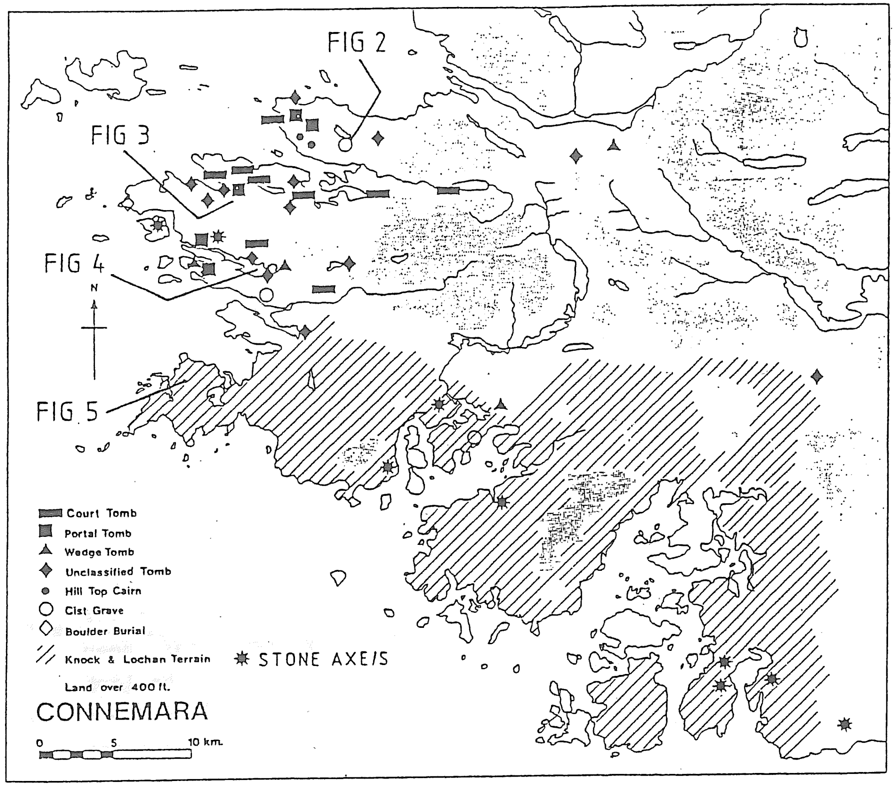

Fig. 3 Map of west Connemara showing the distribution of the main archaeological field monuments.

impression of the overall settlement pattern in the area. The interesting finds of six polished stone axeheads, including one rare porcellanite and one mudstone example found recently by Gibbons in the Carraroe area, is a case in point. As the distribution map shows (Fig. 3), they come from an area of south Connemara from which there are no records of megaliths or other prehistoric settlement evidence.

The coastal midden sites of Connemara have attracted a substantial measure of attention since Petrie's research dating to the 1830's and published in (1972). Bigger (1895), Brunicardi (1914), O'Rourke (1945) and Keary and Dunne (1973) have all contributed on the topic. The O'Rourke article, which dealt briefly with excavations at Dog's Bay, is the first published excavation report from Connemara, while Keary and Dunne's note provided the first radiocarbon date for a midden site in Co. Galway.

In a short but important note of 1960, Raftery published the results of a Viking burial investigation at Eyrephort. This is the only known example to-date from the west coast.

The evidence relating to island cashels or crannogs has been reviewed and updated by Gibbons et al. (1988). The early Christian period, especially in relation to the islands, has received much attention and there are numerous notes and more substantial articles by O'Donovan, Petrie, Bigger, Westropp, Macalister and Kinahan on sites of the period. A full bibliography may be found in Higgins (1987).

Mesolithic evidence from the Oughterard, Belclare and Corrib catchment areas is also worthy of note (Higgins, 1978; Higgins and Gibbons, 1988).

An archaeological survey of Co. Galway was commenced in the mid-1980's. It is based in the Department of Archaeology, University College, Galway and funded by the Office of Public Works. To-date, a listing of the known sites and a set of archaeological constraint maps have been produced and a three volume set of archaeological inventories is now in preparation. This will contain a short description and bibliography of every archaeological monument in the county. The first volume, which will include Connemara and the Aran Islands, will be published in 1989.

Note: Figure and site reference numbers are designated by a prefix: A: archaeology; G: geology and P: palaeoecology.

GEOLOGY

G1 Leenaun (WPW)

The village of Leenaun is sited at the head of Maum valley where it joins Killary Harbour from the south. The orientation of striae and roches moutonnées indicates that this area was glaciated from the south. It is probable that this ice, when at its maximum, passed over Killary Harbour and moved north and northwest over Murrisk in south Mayo. As the ice thinned during deglaciation its passage came increasingly under topographic control and it moved west and northwest along Killary Harbour and northeastward up the Erriff valley, as is indicated by the striae and roches moutonnees on the floors of these valleys.

In Maum valley a series of retreat moraines can be seen spanning the valley floor, illustrating that the final dissolution of the ice sheet here took the form of a receding ice front to the southeast in the Maum valley.

Around the village of Leenaun a series of flat topped surfaces occur at different levels and can be seen to best advantage from the northern shore of Killary Harbour (Fig. G1). These features are best expressed 1 km southeast of Leenaun where a large flat-topped ridge showing two planated surfaces is clearly seen. A small gravel pit at the roadside shows flat lying rippled sand and silt beds and crossbedded sands which pass up into planer bedded sands and gravels which dip slightly west of north the angle of dip increasing southward along the exposed section.

Smaller sections occur along the west side of the ridge along a path running parallel with the small stream which

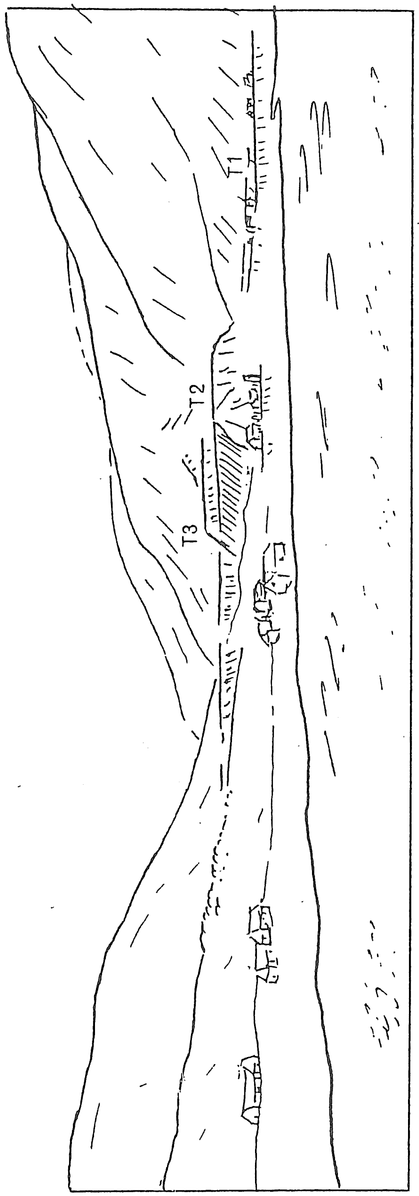

Fig. G1 Delta terraces at Leenaun as seen from the north side of Killary Harbour (T_3 upper level, T_2 lower level, T_1 lowest level).

flows north along the west side of the ridge to join the river that enters Killary Harbour at Leenaun. These sections reveal rhythmic laminated silts which contain large dropstones and are strongly deformed, folded and faulted in places. These pass up into rippled sands with silt/clay drapes. These in turn are overlain by poorly exposed gravels.

The sequence here is best interpreted as representing a prograding delta system extending north from an ice margin immediately to the south.

Whether this formed in an ice marginal lake or the sea is not immediately obvious. The flat surfaces have not yet been instrumentally levelled, but the contours indicate that the upper surface grades to about 80 m OD and the lower surface to about 60 m OD. Other flat-topped terraces at these approximate levels occur in the Erriff valley and in other places in Connemara, such as the upper Kylemore river valley. These may be due to a variety of different processes and are at present under investigation. A lower flat-topped gravel terrace occurs at about 12 - 15 m OD at the village of Leenaun.

It is clear that the delta surfaces at Leenaun relate to an ice margin of the final stages in the dissolution of the Connemara ice sheet. If they were formed at a marine margin, this would indicate considerable isostatic depression, in the order of at least 160 m and this in turn implies a mean ice thickness of at least 480 m assuming no isostatic recovery during the ice retreat from its maximum extent. Ice thick enough to overtop the Beanna Beola mountains (730 m OD) would probably have a mean thickness considerably in excess of this. Thus isostatic depression of the order outlined above would not be unexpected.

G2 Tullywee Bridge, Kylemore (WPW)

A gravel pit immediately south of the main road west of Tullywee Bridge, on the Dawros river, serves a large part of the Connemara area. The main pit, currently active, is in part cut into an esker ridge and in part into a flat apron fronting the ridge (Fig. G2). The following sequence was recorded at the main working face where the apron sediments grade up into the esker sediments.

1. Laminated silts and rippled sand in bedded units about 0.25 m thick alternating with beds of cross-bedded sand 0.3 - 4.0 m thick, all dipping to the southwest. 3 - 4 m exposed. Overlain by:

2. 9 - 10 m steeply dipping foreset beds of gravel, cobbles and boulders. These dip generally to the southwest but northeast dipping beds are also seen. These coarse sediment beds are strongly tectonised in places with folded beds, reverse faults and normal (slump) faults.

The feature here is an esker delta of the type described by Synge (1950). North of the main road two flat-topped terraces are seen. Three small pits here reveal (1) interbedded sand and silt (3 m) overlain by fine-medium planar gravel (2 - 3 m) overlain by 7 - 8 m coarse gravel with interbedded crossbedded fine gravel, sand, some rippled sand beds and laminated sand/silt lenses (all flat lying) in the upper terrace and esker ridge and (2) about 1.5 m topset

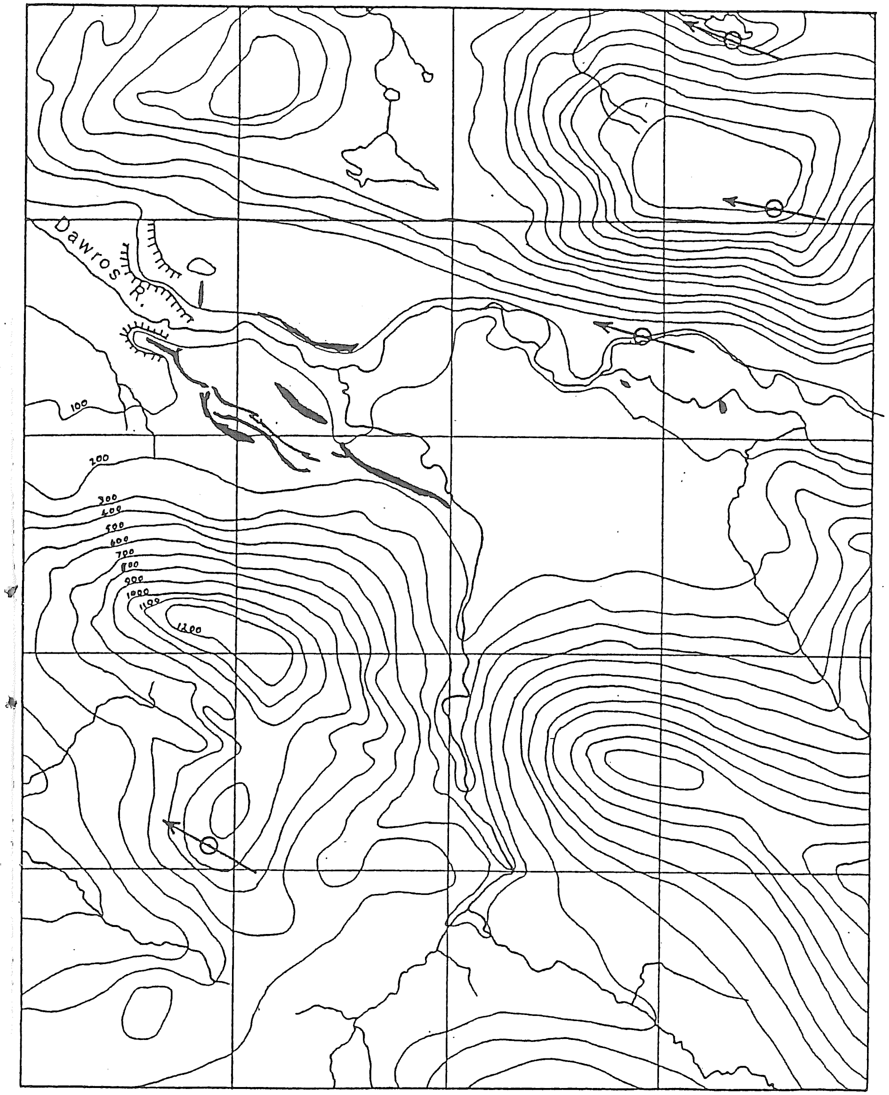

Fig. G2 Eskers at Tullywee Bridge. Heavy black lines represent esker ridges. Fringed lines represent terrace fronts. Arrows represent striated surfaces. The grid is 1km, north is to the top and contour interval is 100ft (30.5m).

gravels and 1 m steeply dipping (foreset) gravels at the top of the lower terrace.

The lower terrace grades to a level slightly below 30 m OD and is the same level as the apron fronting the esker on the south side of the road.

There is not sufficient exposure here to enable a firm conclusion as to the evolution of these deposits. But the following tentative conclusions are suggested:

1. The eskers were deposited into a standing body of water at about 50 m OD.

2. The water level had either previously stood at about 30 m OD or later fell to that level.

3. It is not necessary to invoke a high relative sea level to explain such a standing body of water, as large open bodies of water are common in areas of dead ice during deglaciation.

4. However, as the eskers terminate at this point at the mouth of the Kylemore valley, it is possible that the sediments represent an ice marginal marine delta.

G3 Clifden Drumlins (Ard-oileán section) (WPW)

Drumlins were recognised in Connemara from a very early stage. Those in the area of Clifden were recorded on the Geological Survey field maps as "drift hills" and as drumlins by Kinahan and Close (1872) on their map of Iar-Chonnacht. The pattern of striae, ice moulded surfaces and drumlins indicates an extensive ice sheet moving generally

westward over this part of Connemara as part of a generally radiating pattern that moved northwestward over Inishbofin, Inishturk and Clare Island over the Aran Islands.

A well exposed section, in the drumlin that forms the island of Ard-oileán, 4.5 km southwest of Clifden, is accessible at low tide only (Fig. G3). The drumlin is composed largely of an overconsolidated diamicton containing clasts of local Connemara origin. A number of sedimentary characteristics that are well expressed in this feature point to a basal lodgement process as the chief agent of sediment deposition but also to sedimentation in running water and in quiet or standing water.

The dominant lithofacies is a massive overconsolidated diamicton. It is seen to be fissile along a (north facing) section with clasts and fissility imbricate to the east. The west and southwest facing section does not show the fissility well. At the northern end of the west facing section it shows a massive sandy stony diamicton with some silt lenses (1 - 3 cm thick) and gravel pods (2 cm thick). It passes both laterally and vertically from matrix-rich to matrix-poor facies. Passing from northwest to southeast along the southwest facing flank the diamicton in the upper 5 m becomes cobble- and boulder-rich while in the lower 4 m, it retains its matrix-rich character and silt lenses persist.

At the southern end the silt lenses increase in size and frequency (up to 30 cm thick and 1 m long) and the diamicton is seen to overlie steeply dipping foreset gravels, dipping north.

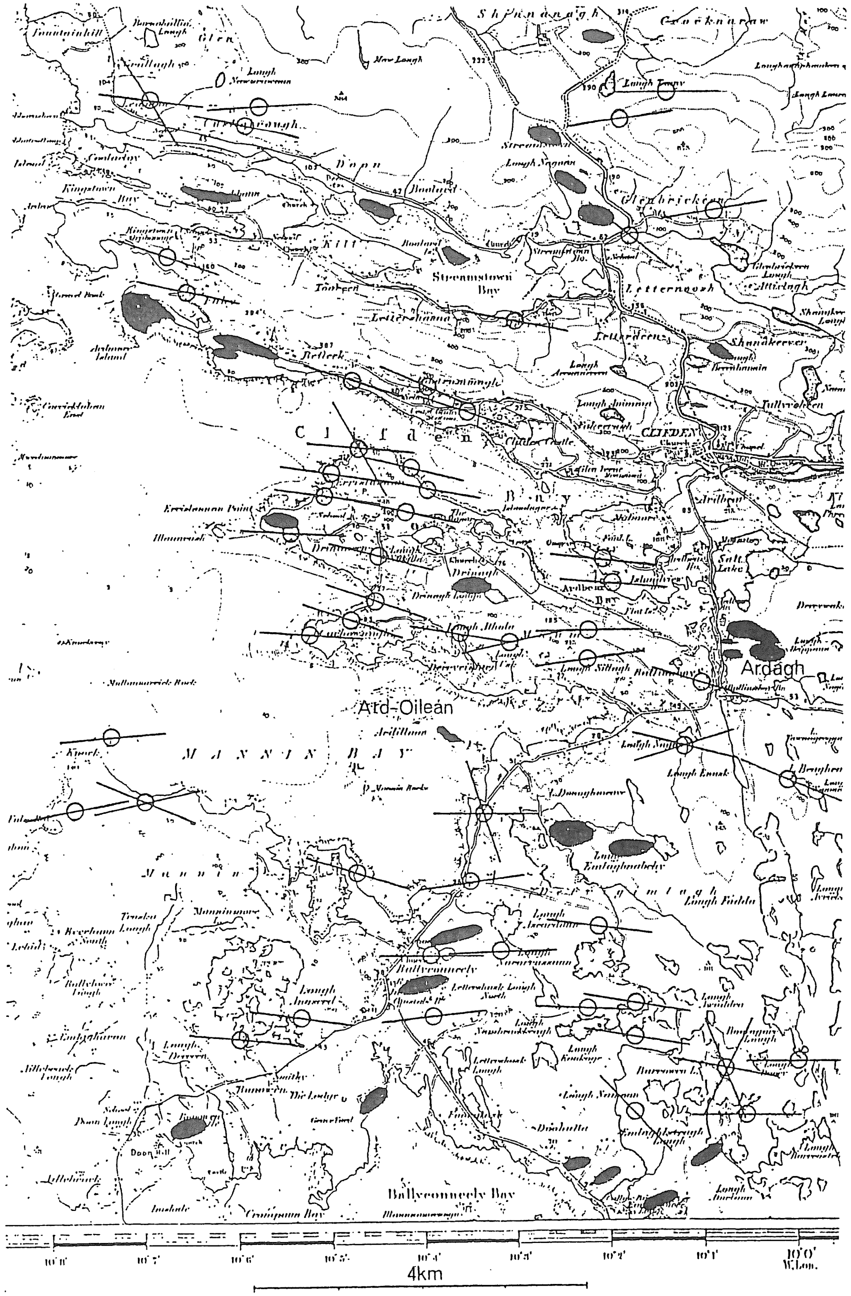

Fig. G3 Drumlins (heavy black) and striae (line through circle) illustrate the dominant ice flow pattern in the Clifden area.

These sediments are interpreted as subglacial deposits which formed in conditions of considerable basal melt, where both ponded and flowing water occurred in small subglacial cavities and their associated sediments were reworked as the ice passed over them, probably rapidly dewatering them and accreting through basal lodgement. Alternatively, the process of deforming beds as proposed by Boulton (1987) could have been largely responsible for these sediments.

It is likely that the other drumlins in the Clifden area are composed of similar sediments. Those at Indreabhan (see stop G5 below) and at the head of Galway Bay contain similar sediments and given the close association between drumlin, striae and roche moutonnee orientation, it is likely that they were formed during the same general glacial event.

G4 Geological evidence for late-glacial earthquake activity in Iar Connacht (PM)

Late-glacial (c. 10,000 years ago) seismicity in western Scotland has recently been identified from surface morphology, soft-sediment deformation and coeval landslides. These features are associated with areas of rapid post-glacial uplift. Estimated seismic magnitudes range up to 6.5 - 7.0. (Davenport and Ringrose, 1987; Davenport et al., 1988; Ringrose, 1988). In Iar Connacht, late-Glacial reactivations along an orthogonal set of Caledonian fault zones are recognised from morphologic offsets (Mohr, 1986). NW-NNW-trending faults are upthrown as much as 7 m SW and ENE-trending faults are upthrown S. A late-glacial age is posited where sectors of the morphologic trace of a fault has been obliterated by ice of melt-water flow. Fault movements have been of normal sense cf. the strike-slip movements posited for Scottish faults. While the faulting and associated palaeo-seismicity of Iar Connacht was probably related to isostatic rebound following retreat of the glaciers, the possibility remains that the ?late-Tertiary uplift of the Iar Connacht plateau, due to mantle perturbation, is still continuing. The present aseismicity of Iar Connacht contrasts with the active microseismicity of western Scotland and renders the author's observations open to debate.

G5 An Cnoc, Indreabhán (drumlin) (WPW)

About 4 km west of Spiddal a number of small elongate drumlins are oriented north-south. One of those in the townland of Cnoc Theas is exposed both in a coastal section and a small pit on the western side of the coast (Fig. G5). The drumlin is 1000 m long and 100 m wide. The pit exposes a strike section in which a compact fissile diamicton is the dominant lithofacies. This diamicton contains within it lenses of gravel and sand, some crossbedded. It also contains large granite clasts which are faceted and striated. These are usually moulded, faceted and striated on the upper surface while the underside remains rough. Some of the moulded and striated boulders occur as dispersed boulder pavement.

The diamicton is exposed along most of the coastal section. However, 23 m from the eastern end of the exposure massive diamicton gives way abruptly to coarse gravel with cobble size diamicton clasts. This is interbedded with thin

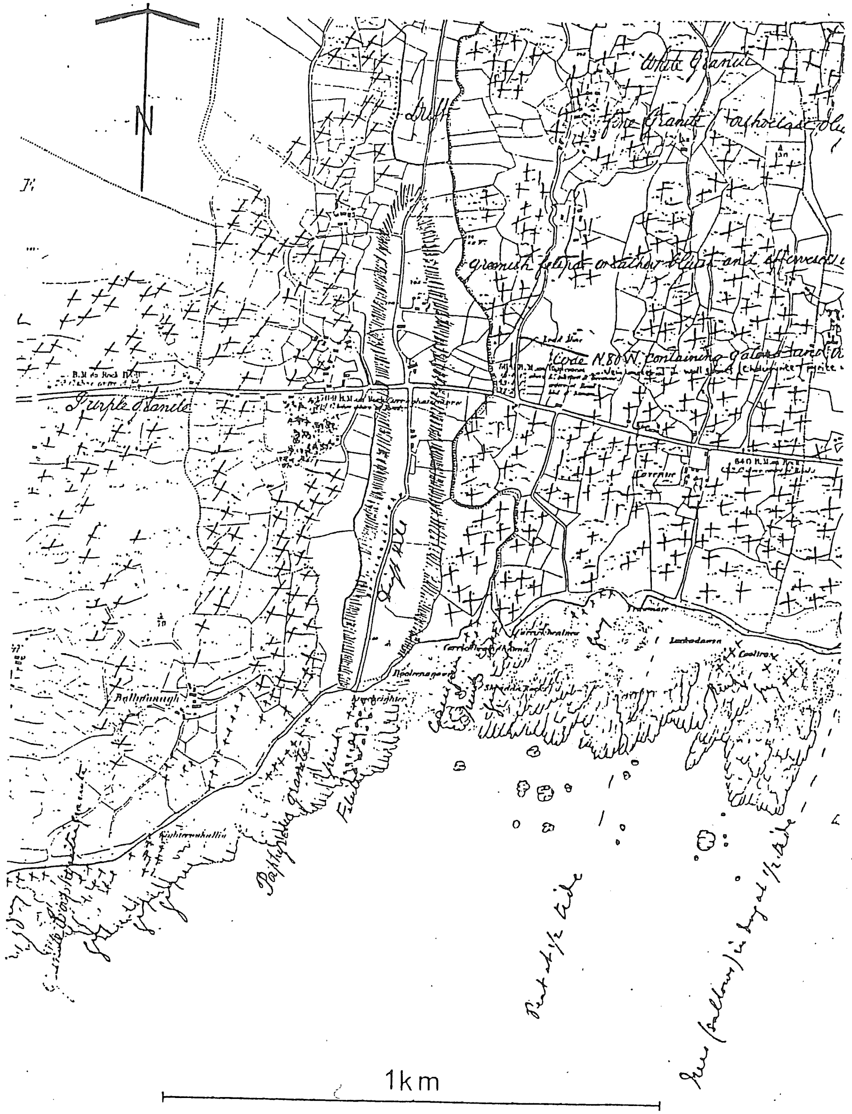

Fig. G5 . Elongate drumlin at An Cnoc, Indreabhán, as recorded on Geological Survey manuscript map.

diamicton beds and passes up to massive diamicton. Some channel fill features are seen in this sequence and water escape structures are evident. At the eastern end of the exposure folded gravel beds and strong mechanical gravel/diamicton contacts are seen.

Overall, these sediments, like those at Ard-oileán, suggest a combination of subglacial lodgement and meltout, probably reflecting the opening and closing of a subglacial cavity, at times allowing the passage of meltwater or collection of standing water and at times compressing the sediment and depositing till by lodgement.

The petrographic composition of the sediments reflects the local geology, dominantly local granite with some quartz porphry (fel stone and elvanite of the old maps).

The absence of limestone suggests a northern rather that southern derivation and this is confirmed by the roches moutonnées in the general area.

G6 Gort Gearr drumlin (WPW)

A small drumlin swarm occurs on the high ground between Moycullen and Spiddal (Fig. G6). Limestone fragments were noted in some of these by Geological Survey geologists in the last century (Kinahan, 1869). A reconnaissance visit in 1987 confirmed this and although the drumlin sediments are poorly exposed, a sample was taken from the Gort Gearr drumlin in the townland of Knockarassen. The sample was taken from a stony diamicton with a grey/brown silt/clay calcareous matrix. Analysis of the phenoclasts in the 5.1 - 11.2 mm size range revealed the following petrographic

Fig. G6 Drumlins (heavy black) between Moycullen and Spiddal. Grid is 10km.

composition:

Granitoid: 59%; Limestone and chert: 33%; Metamorphic: 8%

Clearly the ice movement here was from north to south as the metamorphic rocks must be of northern provenance. The low number of metamorphic phenoclasts suggests that the source was somewhat east of north.

G7 Brownville (WPW)

About 5 km southeast of Moycullen on the Galway road, at Brownville, a recent cutting shows a limestone dominated till overlain by a granite dominated till. Each unit is composed almost exclusively of its dominant lithology.

As this site lies just on the limestone/granite junction, it is unlikely that southerly or southwesterly moving ice could have deposited the upper unit. Assuming the upper unit to be on in situ till, it would seem that an ice movement to the south or southwest was followed by one moving generally to the east. The occurrence of granite and metamorphic erratics on the ground between the Galway-Oughterard road and Lough Corrib, and their occurrence, in decreasing numbers to the east in the gravels of the Rosscahill esker, confirms this.

P1.0 Derryinver Hill, Rinvyle – reconstruction of the palaeoenvironment. (KM and M OC)

P1.1 Introduction.

Derryinver Hill or Tullach (grid ref. L695 615) is a relatively low-lying glacial ridge (c. 100 m O.D.) lying at the eastern side of Tully Mountain (357 m). Archaeologically, the area is of considerable interest having a rich variety of field monuments and, moreover, in the Rinvyle Peninsula, megalithic tombs, representative of all except the passage tomb-type have been recorded (de Valera and Ó Nualláin, 1972; Gibbons and Higgins, 1988; see A1).

The area offers considerable possibilities for palaeoecological reconstruction. The ridge itself is peat covered, so that the underlying soils and basal peats can be expected to contain a record of events and processes which took place immediately prior to and after peat formation (DYRII, below). It should also be possible to date the pre-peat stone wall system and hence provide a chronology for an important phase of land-use in the area. The mineral soil beneath the stone walls (DYRI and DYRIII) can, in turn, be expected to contain a record of land-use and pedogenesis prior to stone wall reconstruction which may considerably pre-date peat formation.

P1.2 Investigations

Three sites were selected on the ridge. In each case, a monolith was removed from a freshly exposed trench face. Sites DYRI and DYRII lie on the ridge slope to the SE of the stone alignment and within c. 20 m of it. At DYRI, the stone wall (referred to here as the main wall), which continued over the top of the ridge, passing at more or less right angles through the stone alignment, was sectioned. The exact relationship of the wall to the alignment at the point of intersection could not be determined without excavation. It appears reasonable to assume, however, from the general context that the wall construction is, at earliest, contemporaneous with or post-dates the alignment.

DYRII lies 7.5 m S.W. of DYRI, where peat cutters have left a low bank of peat (44 cm), so that there was no risk of contamination of the basal peat layers by the poaching cattle or sheep.

DYRIII lies diagonally opposite to the sites DYRI and DYRII, on the NW lower slopes of the ridge where a curving stone wall can be traced for a considerable distance. The sampling site was in a cross section through this wall.

The basin to the east of Derryinver Hill contains an extensive area of much cutaway bog. At the edge of the bog, within 30 m of the mineral soils of the lower hill slope, an area of peat 5 m deep was located. A profile from here (DYRV), which has been pollen analytically investigated, spans the post-glacial. Since ^{14}C dates are not available at the time of writing and since, in this particular diagram, the pollen assemblages provide no reliable time markers, especially in the prehistoric period, the profile is not discussed.

P1.3 Results

P1.3.1 Soils (Fig. P1)

In the three sections examined, the silty loam soils were highly podzolized, but showed no evidence of iron pan formation. The profiles from beneath the stone walls had distinctive horizons, but differed substantially. At DYRI, the uppermost mineral horizon (A_o/A_1), 5.5 cm deep, was organic rich (incl. charcoal) and relatively compacted. Between this and the C horizon at 25 cm, an indistinct A_2, a fairly well defined B_2 and a transitional B/C horizon were recorded. At DYRIII, on the other hand, the uppermost horizon (A_o) consisted of a layer of charcoal, c. 5 mm thick. An A_2 horizon, 6.5 cm thick and with low organic content, followed. The B_2 horizon, with a higher organic content and freckled with charcoal, especially in the uppermost 3 cm, extended to 30 cm. Mottling was evident in the lowermost 11 cm.

At DYRII, the overlying peat showed the following features: the present day rooting zone commences at -22 cm (i.e. 22 cm above mineral soil/peat interface). At -20 cm a diffuse charcoal band was recorded. From -11 to 0 cm, the peat was dark because of the high levels of charcoal present. The transition to the mineral soil was very diffuse. At the top of mineral zone, the organic content rapidly declined, yielding to a poorly defined A_2 horizon (5 - 11 cm), a B_2 horizon and a C horizon commencing at 21 cm.

At DYRIII, i.e. the section through the curving wall, positive and negative lynchets were noted on the up and down slope side, respectively, of the wall. This indicates

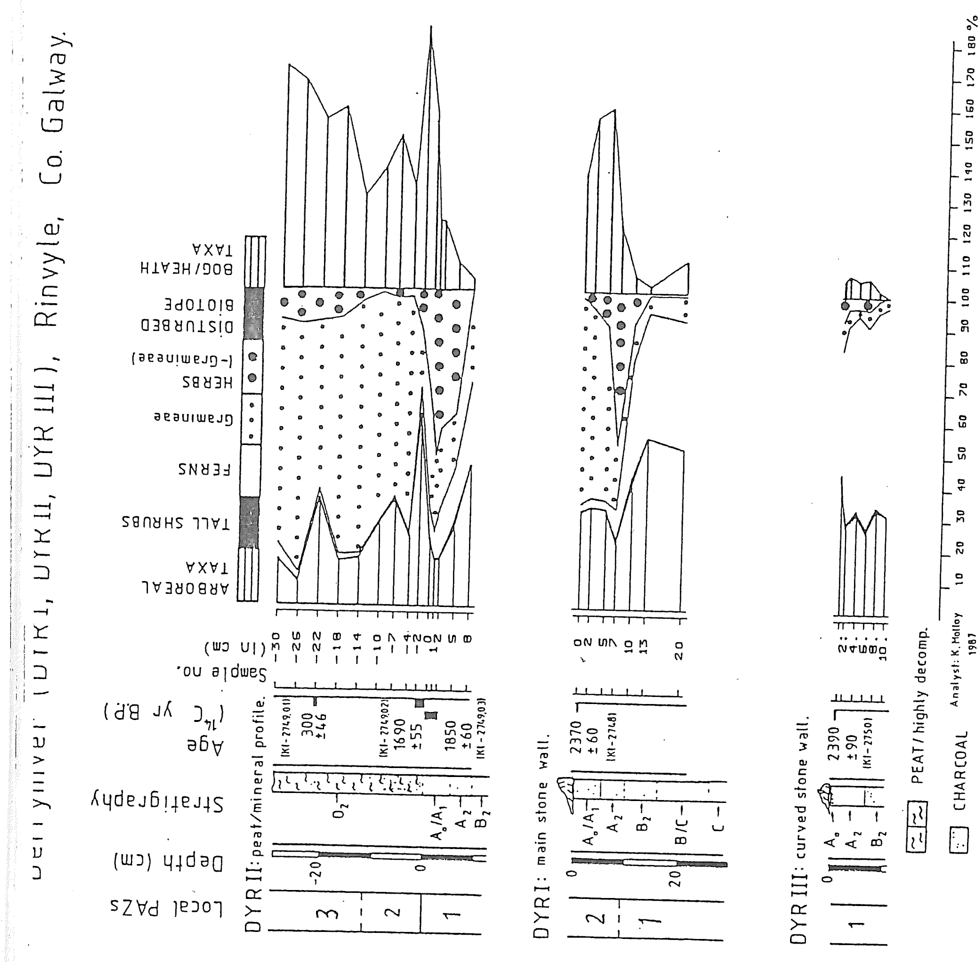

Fig. P1.1 Summary percentage pollen diagrams from soil and soil/peat monoliths, Derryinver, Rinvyle.

substantial soil movement between wall construction and peat growth.

P1.3.2 Pollen analysis and radiocarbon dating (Fig. P1).

DYRI - profile from beneath the main wall system.

Pollen was preserved in reasonable quantities at deeper levels here than elsewhere (20 cm; B/C horizon); however, the low pollen concentration at 20 cm, suggests that corrosion is here a serious problem, so that too much reliance should not be placed on this spectrum alone. It suggests hazel-dominated scrub with the possible presence of oak as a tall canopy tree. This gives way to a hazel-dominated scrub vegetation (13 cm) which becomes open (10 cm), as pasture expands (cf. _P. lanceolata_).

The uppermost four spectra (DYRI-2) record the transition from scrub to heathland. At 7 cm, exceedingly high levels of _P. lanceolata_ (41%) are recorded. Liguliflorae (dandelion) and _Cerastium_-type (chickweek) also peak. These features, taken in conjunction with the decline in _Corylus_, indicate clearance of scrub and its replacement by grassland which was probably intensively grazed. Cereal-type pollen suggest that there was also arable farming.

In spectra 5 to 0 cm, exceptionally high Gramineae and _Calluna_ representation are recorded while _P. lanceolata_ levels decline substantially. This indicates a vegetation dominated by grass and ling. It is assumed that soil pH and the chemical characteristics of the litter led to a progressive increase in the organic matter content of the soil (A_o/A_1 horizon) so that, at the time of wall construction (2370 +/- 60 B.P.), soil degradation was already at a fairly advanced stage.

DYRIII - profile from beneath curving wall.

The DYRIII profile contrasts strongly with that from beneath the main wall (DYRI). The six available spectra constitute a uniform pollen assemblage in which ferns (but no *Pteridium*) and *Corylus* dominate. On the other hand, Gramineae, *P. lanceolata* and *Calluna* have poor representation. This provides a clear picture of the pre-wall environment in the area. Hazel scrub with a rich fern layer dominated. The low but more or less continuous record for *P. lanceolata*, *Succisa* and *Calluna* indicates that open areas of grass and heathlands were also present in the region and possibly in that vicinity for a considerable period prior to wall construction. It is noteworthy, however, that there was no prolonged local clearance of hazel, at least in the period represented by the pollen spectra. The charcoal layer immediately beneath the stone wall suggests clearance by fire immediately prior to wall construction. This charcoal layer is dated to 2390 +/- 90 B.P. It is statistically inseparable from that at DYRI.

DYRII - peat/soil profile.

As indicated above, it was initially assumed that the vegetational changes recorded here would post-date those represented in DYRI. This assumption is borne out by the ^{14}C dates which indicate a probable minimum of 600 calendar years between wall construction (shortly after 2400 B.P.) and initiation of peat growth (c. 1700 B.P.)

The pollen from the basal level (8 cm), though affected by corrosion, reflects the hazel-dominated scrub phase recorded in DYRIII and the deeper spectra of DYRI. The next four spectra (5 to 0 cm) suggest primarily pasture-dominated

farming (cf. exceptionally high *P. lanceolata* percentages, also Liguliflorae (dandelion), *Ranunculus* (buttercup) and *Trifolium repens* (white clover)). Cereal-type pollen is well represented suggesting that arable farming was also pursued on Derryinver. The increasing representation of *Calluna* and also *Succisa* suggest progressive acidification, culminating in the presence of *Sphagnum* as the uppermost spectrum (0 cm) is forming. This is not surprising since ling was locally important here at c. 2400 B.P. (DYRI). Indeed, it appears that land-use practices halted or even reversed soil degradation and facilitated productive use of the land for a number of centuries.

At -2 cm, an exceptionally high *Calluna* value (74%) is recorded, while other curves suggest regeneration especially of hazel and to a lesser extent of alder and birch. It appears that, at the sampling site, ling dominated (high pollen productivity, but relatively poor dispersal), while elsewhere a decline in human activity facilitated strong regeneration of hazel. The ^{14}C date of 1690 +/- 55 B.P., relating to -2 to 0 cm, places this between c. 250 and 360 cal. A.D. Above this, the *Corylus* and, to a lesser extent, the *Betula* and *Alnus* percentage curves are depressed but this may be due, in large measure, to the high Gramineae values arising from a grassy heathy vegetation at the sampling site. In the uppermost spectra (DYRII-3), the bog surface appears to have become wetter (cf. Cyperaceae) and peat accumulation rates increase. Scrub vegetation is greatly reduced and, on the basis of the NAP curves, a sustained rise in farming activity may be postulated. The uppermost spectrum analysed may date to as late as the eighteenth century.

P1.4 Conclusions.

1) A hazel-dominated scrubland was the final woodland-type community present prior to wall construction. It is assumed to be secondary. The evidence for the composition of the earlier tall canopy woodland is meagre. Neither is there evidence for a clearance phase which is assumed to have taken place between that of tall canopy woodland and hazel-dominated scrub.

2) Wall construction is securely placed in the Iron Age (shortly after 2400 B.P.). Unfortunately, the ^{14}C calibration curve is particularly "flat" in the interval 2500 - 2400 B.P., so that the calibrated ^{14}C dates may lie within the wide range of c. 800 and 400 B.C. A pointer towards the latter end of this range is provided by the L. Sheeauns (SHEIII) profile. A distinct increase in farming activity centering on 2340 B.P. is recorded in that profile (see P2.3).

3) The megalithic structures on the hill top must considerably pre-date the wall construction, if the conventional dating ([late Neolithic], mid to late Bronze Age) for such structures is accepted (Lynch, 1981b; O Nuallain, 1984; Pilcher, 1969). It seems justified to assume that they were put in place when the hilltop was more or less devoid of woody vegetation. The soil profiles contain no record of this. The record has probably been lost through subsequent pollen rejuvenation in the soil (cf. O'Connell, 1986).

4) The results urge caution when inferring age of structures which are overlain by peat; great antiquity cannot be automatically assumed.

5) As in many peat covered areas in Connemara, iron pan is not present and, hence, cannot be implicated in blanket bog formation.

6) Finally, the evidence suggests that land management rather than climatic change is the crucial factor affecting spread of blanket bog during the post-glacial.

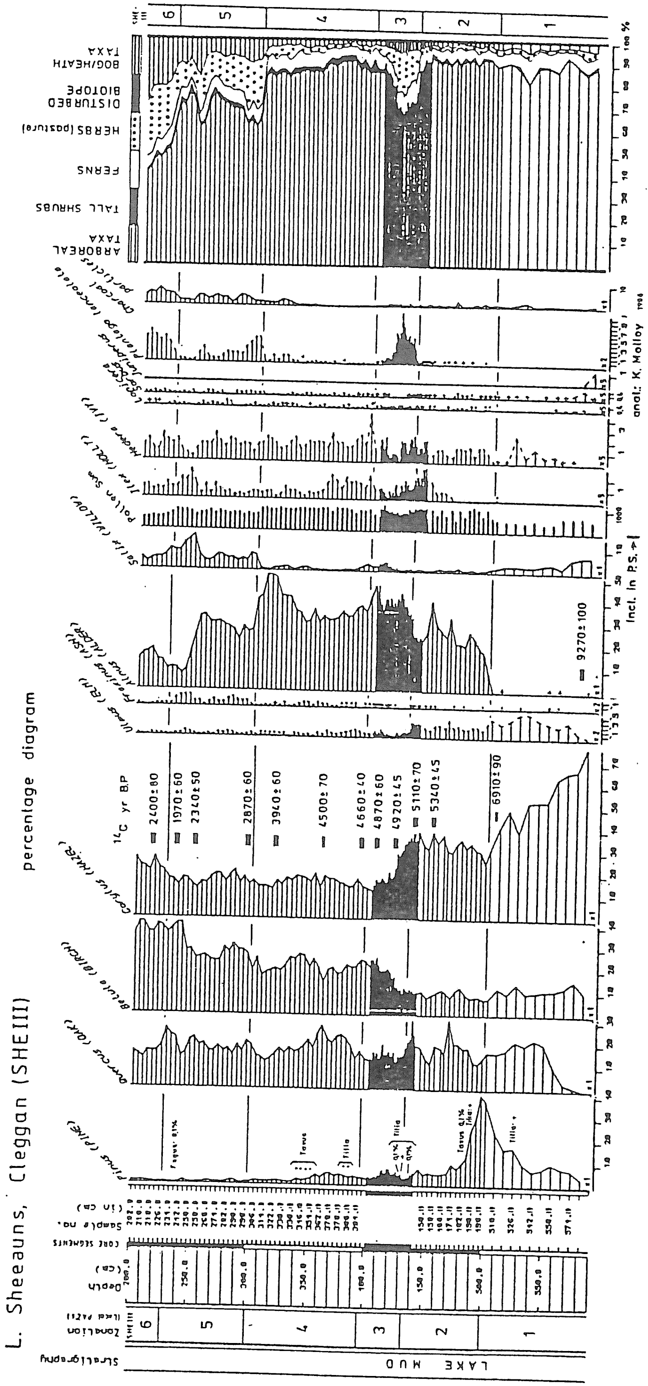

Fig. P2.1 Summary percentage pollen diagram from Lough Sheeauns, Cleggan (SHEIII).

P2.0 Lough Sheeauns, Cleggan - post-glacial woodland history and prehistoric land-use. (KM and MO'C)

P2.1. Introduction

Lough Sheeauns lies within what is probably the most dense concentration of prehistoric field monuments in Connemara (see Fig. 2; grid ref. L625 582). This made it an obvious choice for the study of prehistoric impact in the region. The basin has two features in particular which suggest that it might hold a good record of land-use within the catchment:

a) small basin size (c. 120 m greatest diameter).

Basin size largely governs the ratio of local to regional pollen in the fossil pollen assemblages. The regional pollen, originating from up to 30 km or more will reflect the general trends in vegetation development, e.g. regional expansion or extinction of a tree species. Events, such as local woodland clearance or arable farming, will be poorly reflected, if at all, in the regional pollen. On the other hand, such events will register best in the local pollen which is well represented in small basins.

b) closed basin and sheltered location.

It is established that the pollen input to basins with inflowing/outflowing streams often reflects the waterborne rather than the aerial pollen component, and that there may also be loss of pollen through outflow streams. Resuspension of sediment at margins and in the deeper parts is also a factor which may be of considerable significance in exposed lakes (see Birks and Birks, 1980). L. Sheeauns,

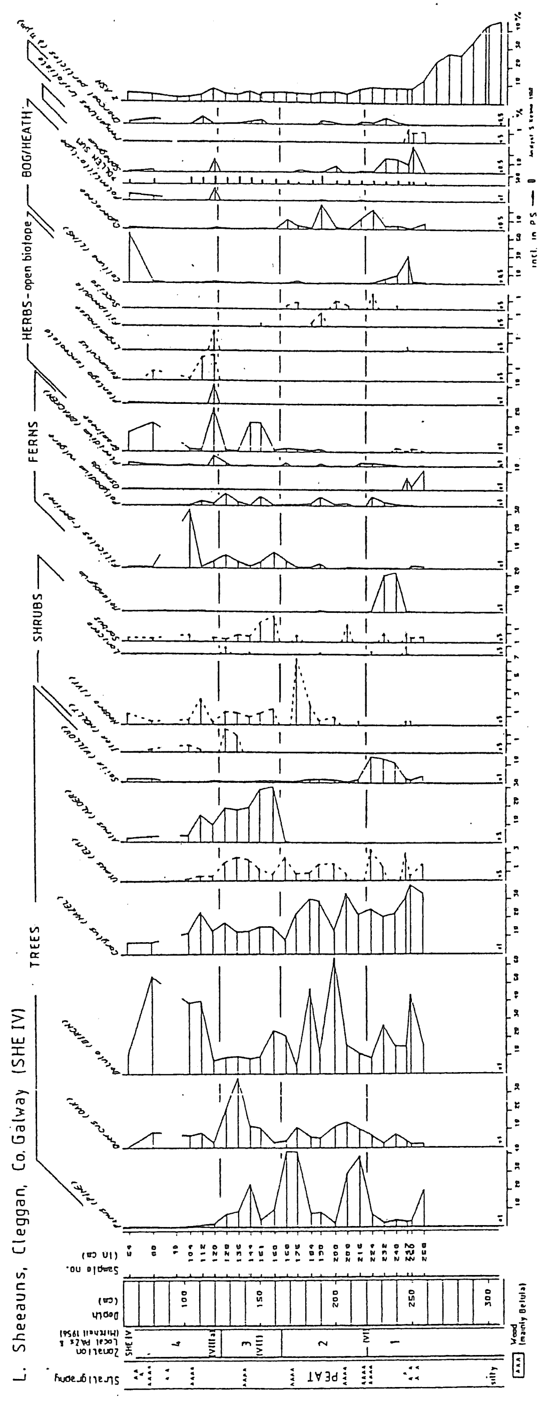

Fig. P2.2 Percentage pollen diagram from a peat core at Lough Sheeauns, Cleggan (SHEIV).

being a closed basin and protected by hillocks from the prevailing westerlies, should not be unduly affected by the complicating factors referred to above.

P2.2 Investigations.

Pollen and chemical analyses has been carried out on a core taken from the centre of the lake (profile SHEIII, Fig. P2.1; Molloy, in prep.). Pollen analysis was also carried out on a 3 m peat core from the valley floor c. 33 m to the east of the lake (profile SHEIV; Keane, 1988 (Fig. Fig. P2.2). This investigation was carried out with a view to clarifying certain aspects of the main SHEIII profile. It showed, for instance, the pollen input as reflected in SHEIII, is, as was assumed in Molloy and O'Connell (1987), quite local in character. Thus, Calluna and Melampyrum peaks recorded at the base of SHEIV do not register at all in SHEIII.

P2.3 Results and Conclusions.

Boreal and Atlantic woodlands (SHEIII-1; SHEIV-1, 2 and 3)

Both diagrams open at or shortly after the Corylus maximum in the early post-glacial (9300 B.P.). Apart from hazel, willow and Sorbus - most probably rowan or mountain ash - were also important in the early stages of woodland development. Pine is established before oak and elm, but oak becomes the dominant tree in the early phase of tall canopy woodland.

The Boreal/Atlantic transition in SHEIII (PAZ 1/2 boundary; 6900 B.P.) is marked by a peak in Pinus which is followed by a sharp rise in Alnus and a fall in Corylus to low but steady values. In the chemical profile, there is an increase in Ca, Mg, Na and K, and a decline in loss on ignition which indicates increased erosion. A decline in aquatic pollen representation suggests that a change in lake levels may also have taken place. Obviously, a number of important changes are taking place in the environment, but a question remains as to what degree the changes in the pollen curves reflect changes in species composition in the immediate vicinity of the lake including the wet valley floor (cf. SHEIV) as against the woodland on the drier valley sides (see O'Connell _et al._, 1988).

A feature of the later Atlantic period (top of SHEIII-2; c. 5400 B.P.; also SHEIV-3) is the expansion of the _Ilex_ curve and the presence, in low levels, of _P. lanceolata_. A similar late expansion has now been noted at several lake sites in Ireland, and suggests an opening up of the woodland structure which would have favoured not only the establishment of holly, but also an increase in pollen production and dispersal by that species. Pennington (1979) has shown that _Ilex_ pollen may be brought into lake sediment through erosion of woodland mor humus in which the resistent _Ilex_ pollen tends to accumulate (see Mitchell, 1988). Such a process does not appear to be operating here since a similar expansion of _Ilex_ is also recorded in SHEIV, where the possibility of erosional inwash is highly unlikely. The changes are hence interpreted as representing a real expansion of _Ilex_, favoured by a perturbation in the woodland ecosystem.

The elm decline and Neolithic Landnam (SHEIII-3 and SHEIV-4)

Detailed consideration of the vegetational changes and land-use history at and about the elm decline (5000 B.P.) has been presented by Molloy and O'Connell (1987; 1988). The main conclusions are as follows:

1. In the century prior to the elm decline, Neolithic farming commenced. The main evidence is the presence of _Triticum_-type (wheat) pollen. The NAP component, including _P. lanceolata_, expands indicating opening-up of the woodland canopy. However, no large scale woodland clearance took place.

2. The elm decline (_Ulmus_ representation drops from 2.8 to 1.2% (TTP) across the zone boundary in SHEIII) is recorded as an event distinct from the following Landnam episode. An anthropogenic explanation for this event is considered to be no longer sustainable, at least at this site. Disease appears to be the most likely cause of this decline in _Ulmus_ pollen representation.

3. The elm decline is followed by a Landnam phase during which there was widespread woodland clearance. The high Gramineae, _P. lanceolata_ and Liguliflorae (dandelion) representation and the overall high diversity of NAP taxa, most of which are common today in grasslands and especially closely grazed pastures, suggest that the Neolithic economy was pastoral based. In the later part of the Landnam phase, as the NAP begin to decline, the pollen of weeds of disturbed habitats which includes those of cultivated land are recorded. This, together with evidence for soil erosion in the chemical record, suggests that a shift towards arable

farming may have taken place as the intensity of agricultural activity declined and the woodlands began to regenerate.

4. This major Landnam phase lasted from c. 5000 to 4800 B.P. For the remainder of the Neolithic, the palynological record, as far as human activity is concerned, is largely silent. From 4500 B.P. onwards, however, small changes in the NAP and more substantial movement in the AP curves indicate that changes are taking place in the woodland environment. It is possible that events of a regional rather than a local character are reflected here.

In the original publication, Molloy and O'Connell (1987) regarded decline in soil fertility as an unlikely cause of the abandonment of farming at the end of the Landnam phase. The small increase in representation of bog/heath taxa recorded during the Landnam phase in SHEIII need not necessarily indicate an expansion of bog or heathland. The increased input of these taxa may be more apparent than real, being the result of the percentage method of calculation though the increase in concentration levels suggest that the latter may be the case. This, of course, may be due to the increased probability of pollen reaching the basin as a result of the more open landscape rather than an actual increase in heathland. When the Landnam phase reaches its maximum, the Betula curve begins a sustained rise and Corylus remains low. This could be interpreted as birch replacing hazel in the regenerating woodlands due to soil deterioration. However, the evidence from SHEIV-4 and from coring in the valley floor shows that there was widespread development of birch on peat at this time and it is likely that this, rather than a change in the woodland shrub layer, is reflected in the main diagram

(SHEIII-3). Soil impoverishment seems unlikely to have been the cause of cessation of farming activity in the area.

Land-use in the post-Neolithic (SHEIII-4, 5 and 6)

At c. 4000 B.P. (326 cm and above), the NAP begin to rise and cereal-type pollen is recorded and the NAP curves, especially Ulmus and Fraxinus, decline to low levels. The level of human impact remains modest, however, until 2900 B.P. (SHEIII-5) when a suite of indicators (high Gramineae, P. lanceolata, Pteridium, etc.; initiation of a cereal curve and low A.P. values) suggests intense agricultural activity. This corresponds to the late Bronze Age when there appears to have been widespread and substantial human activity in N.W. Connemara (Molloy, in prep.).

The changes seen at the base of SHEIII-5 may be reflecting those of a regional rather than a purely local character. At this time, in the Connemara National Park, blanket bog expansion takes place most likely in the context of prolonged intense human activity (O'Connell, in press). In SHEIII, too, an expansion of bog/heath taxa takes place and Fe levels increase suggesting reducing conditions in the catchment favourable to bog/heath expansion.

This late Bronze Age activity continued, though somewhat reduced, into the Iron Age. At c. 2300 B.P., human activity again increased before falling to minimal levels at the end of the Iron Age (2000 B.P.; top of SHEIII-5). The uppermost PAZ records the upsurge of activity which is associated with the beginning of the Christian period in many parts of Ireland, including Connemara. Here; as at L. Namackanbeg, Spiddal (see P4), soil erosion was of such a magnitude as to cause reversal in ^{14}C dates.

P3.0 Streamstown Bay - partially submerged peat as evidence for later post-glacial sea-level change (M.O'C)

Partially submerged peats are a common feature along much of the Connemara coastline. To the west of Galway city, at Salthill, Barna and Spiddal, thin layers of peat with pine stumps (usually small) are common on shingle shores at about mean sea level. From Spiddal, Mitchell (1976, p. 133) gives a date of 3730 B.P. for such a peat layer. This corresponds well with other dates from similar contexts on the western coastline, e.g. 3935 +/- 80 (UB - 2094) and 4185 +/- 50 B.P. (UB - 2093) from wood peat and oak, respectively, on foreshore between tide marks at Rinvella Bay, Carrigaholt, Co. Clare (Pearson, 1979). These foreshore peats suggest low sea levels at c. 4000 B.P. during which freshwater terrestrial organics accumulated where at present saline conditions prevail.

A feature of the south-western and western Connemara coastline consists of eroding hags of freshwater peat frequently bearing saltmarsh vegetation in bays and sheltered inlets, e.g. in Cashla Bay, in Bertraghboy Bay on the sides of both the Carna and Roundstone peninsulae, and in inlets south of Clifden (cf. Roundstone I; Jessen, 1949). Occasionally, extensive unbroken tracts of freshwater peat occur, often capped by saltmarsh, i.e. the peat surface lies below the high water mark at spring tide (HWMSpr). Good examples are to be found at Mweenish Bay, Carna and in Co. Mayo at Bellacragher Bay, N. of Mallaranny and also at Tullaghan Bay (see Jessen, 1949, p. 171).

At the head of Streamstown Bay (grid ref. L63 65)

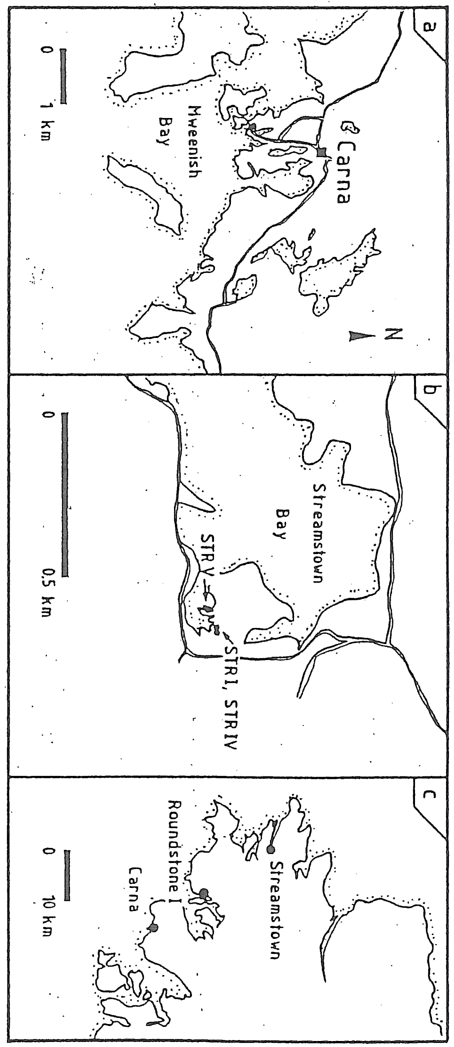

Fig. P3.1 Site maps (a) and (b) show location of sampling points in Mweenish Bay, Carna, and Streamstown. The latter map is based on the O.S. 6" sheets (surveyed 1898) and does not show channels formed by peat erosion which has taken place in the intervening period. Roundstone I is Jessen's (1949) site.

extensive but eroding and probably much cutover freshwater peat deposits occur, protected to some extent from erosion by wave action by a glacial gravel ridge. Trial borings revealed a considerable depth of peat (Fig. P3.1 and P3.2). On a trackway, which lies above the HWMSpr, 3.4 m of freshwater peat were recorded (STRI). On a large peat island to the seaward side of the track at a lower elevation, a 3 m deposit was recorded (STRV).

Jessen's (1949) investigations at Roundstone I, where the potentially complicating factor of a fiord-like bay is not present as at Streamstown, showed freshwater deposits forming in the late-glacial (zone II), at over 5 m below present-day high tide level. Peat formation continued until late in the post-glacial (end of late Bronze Age or later; Jessen, 1949), when a marine transgression took place. It should be noted that a carr, including pine, became established on <u>Phragmites</u> peat at a level which, on the basis of our present knowledge of the chronology of vegetational development in the region, dates to c. 4000 B.P. (as postulated also by Jessen). This indicates a drying out of the peat surface which would hardly have occurred in the context of a marine transgression. Patterns of sea level change are therefore very different from those observed more or less directly opposite on the east coast, where the maximum post-glacial marine transgression is considered to date to about this time (Synge, 1985).

A simplified pollen diagram from a partially submerged freshwater peat in Mweenish Bay, Carna (grid ref. L7830) is reproduced in Fig. P3.3 (Joyce, 1976). At the sampling point, 235 cm of peat were present but, according to local sources, depths of up to 6 m are present in the area. At the sampling point, peat accumulation began in mid post-

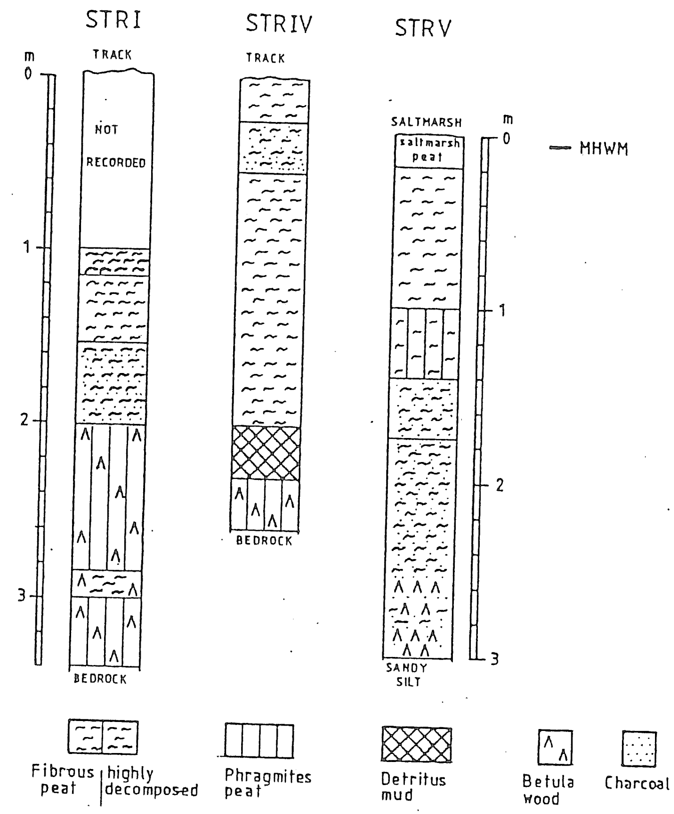

Fig. P3.2 Peat stratigraphy at 3 locations in the partially submerged peat at the head of Streamstown Bay. The relative heights above sea level of the surface at the sampling points were not instrumentally measured; they are only approximate.

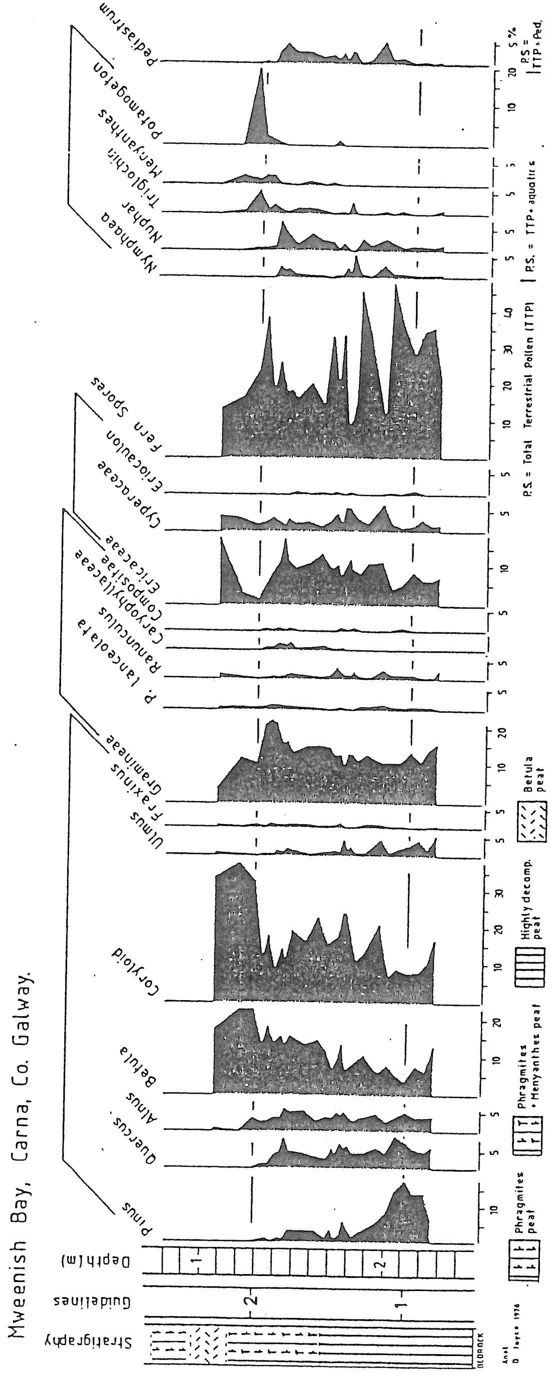

Fig. P3.3 Pollen diagram showing the curves for selected taxa from partially submerged peat in Mweenish Bay, Carna, Co. Galway (after Joyce, 1976).

glacial time. The <u>Pinus</u> peak at the base of the diagram (Guideline 1 in Fig. P3.3) most likely corresponds to that dating to 4000 B.P. as recorded elsewhere in western Connemara. The <u>Pinus</u> curve ceases at 128 cm (Guideline 2 in Fig. P3.3). This level probably corresponds to the centuries at/before 0 A.D. when the pollen record of pine ceases in Connemara (O'Connell <u>et al</u>., 1988). It is noteworthy that carr is recorded above this level and that at no time in the record are Chenopodiaceae or substantial values for Compositae recorded. For most of the post-glacial, therefore, saline or brackish conditions are not present near the site, the surface of which today is inundated at HWMSpr. The post-glacial marine transgression in this part of the country may, therefore, be considerably later than postulated by Jessen.

P4.0 Lough Namackanbeg, Spiddal - post-glacial woodland history and prehistoric land-use. (MO'C)

Lough Namackanbeg (90 m O.D.; grid ref. M132 269), a small lake 4.6 km north of Spiddal was selected to obtain a record of vegetation and landscape development in a granite area where no megaliths have been recorded and other archaeological evidence of prehistoric human presence is meagre (see Introduction and A5). The available pollen and chemical records reflect the course of vegetation and soil development from the early post-glacial (9000+ B.P.) to probably the end of the last century (O'Connell et al., 1988). A summary pollen diagram of the complete profile and a diagram which includes the more important anthropogenic indicator curves from the upper part of the profile are presented in Figs P4.1 and P4.2, respectively.

The main features in the pollen record are as follows:

1. At the base of the diagram (NMKI-1, 2 and 3), Betula, Corylus and Pinus peaks follow in quick succession reflecting migration and expansion of these shrubs/trees. Oak and elm then become important, but pine continued as the dominant canopy species until well into the Atlantic period (post 7000 B.P.).

2. The expansion of alder begins at 7100 B.P. (NMKI-4). When the Alnus curve achieves full expansion (6700 B.P.), the Pinus curve drops to c. 8% AP (or 7% total terrestrial pollen (TTP)) and the Quercus curve expands. There may be a displacement of pine by alder in the wetter habitats, but it is also probable that the tall canopy woodlands of drier areas experienced a distinct shift in species composition in favour of oak at the expense of pine. The decline in

Pteridium and Calluna indicates that this resulted in a more closed woodland structure.

3. A distinct recovery is shown by the Ulmus curve after the elm decline (NMKI-5). As more or less full recovery is approached, yew expands dramatically, its curve attaining 25.6% of TTP or 27.4% of AP (Fig. P4.1). It is not clear if this shift in woodland composition is brought about by natural or anthropogenically-induced perturbations in the ecosystem; it is possible that there is a combination of factors involved.

4. The decline of Taxus (4100 B.P.; NMKI-6) is accompanied by an expansion of Calluna and the initiation of a Narthecium (bog asphodel) curve. This signals the initiation of blanket bog. Later, at 3400 B.P., a major rise in the curves of several bog taxa is recorded (base of NMKI-7), signifying an expansion of blanket bog. Earlier (308 cm), a more or less continuous cereal curve is initiated and, at the top of NMKI-6, the charcoal curve expands dramatically. In the chemical profile, the erosional indicators, i.e. Mg, Na and K, also expand. These features point to substantial human impact, with fire playing an increasingly important role in the farming economy and, ultimately, in determining the environment.

5. Apart from the uppermost spectra of NMKI-7, NAP values are high and the cereal-type curve is more or less continuous in this PAZ, suggesting that the farming activity, which commenced in the previous zone (early Bronze Age), was maintained and possibly intensified especially in the late Bronze Age (c. 3000 B.P.). The late Iron Age (c. 0 A.D.) is represented at the top of NMKI-7 where a lull in farming is recorded.

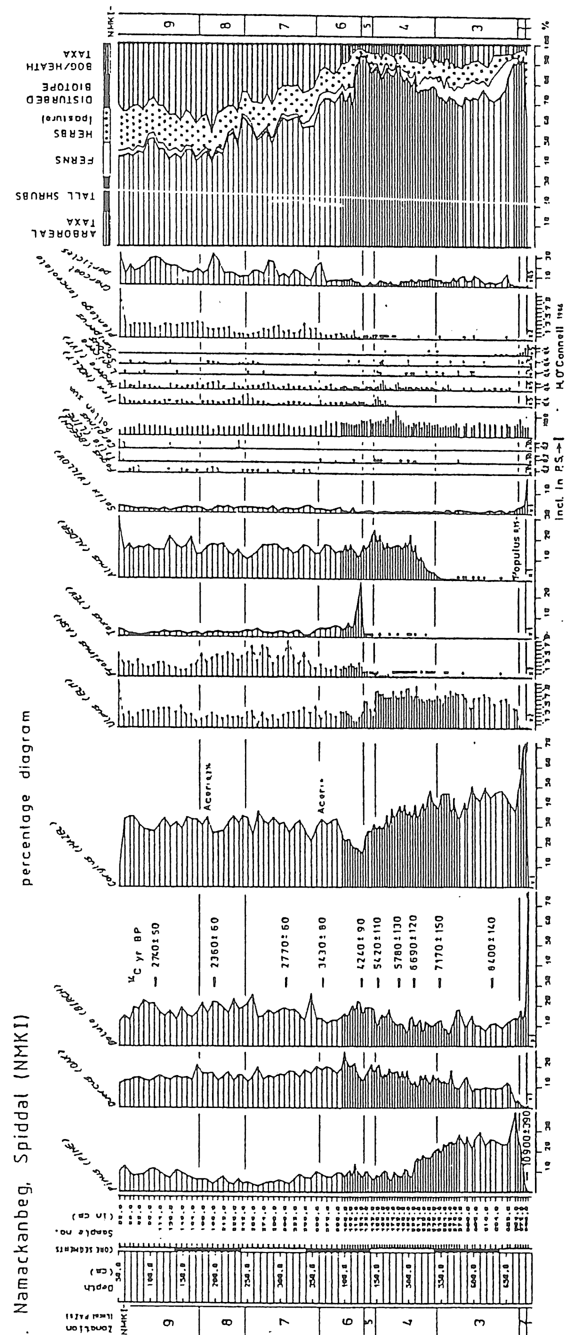

Fig. P4.1 Summary percentage pollen diagram from Lough Namackanbeg, Spiddal (NMKI).

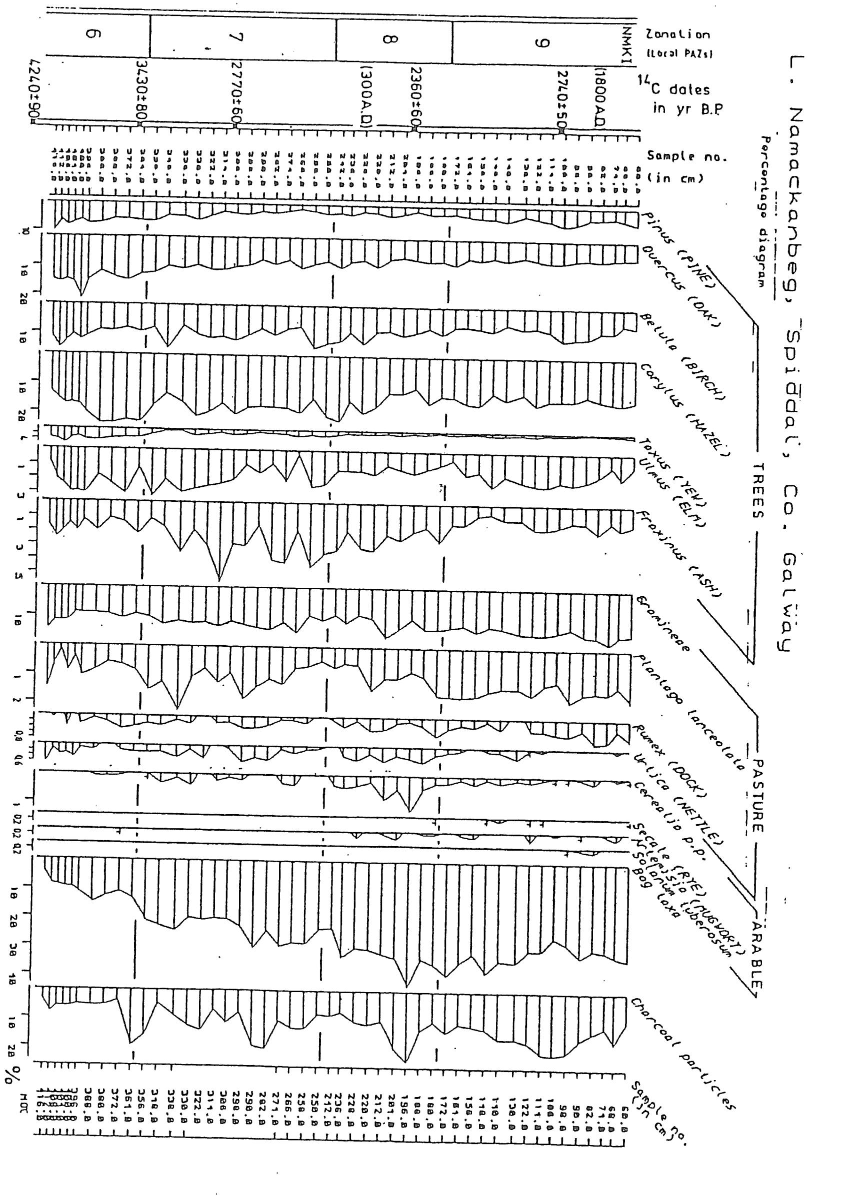

Fig. P4.2 Selected arboreal and non-arboreal percentage pollen curves from the upper part of profile NMKI, L. Namackanbeg, Spiddal.

6. In NMKI-8, many of the anthropogenic indicators, including the cereal-type curve (maximum 1.2% TTP), are at their highest. Farming activity was such in the catchment that peat erosion took place resulting in input of older secondary pollen (cf. especially Pinus - now probably extinct - and Taxus) and giving a ^{14}C date which is too old. The lower part of NMKI-8 most likely dates to c. 300 A.D.

7. The Pinus and Taxus values recorded in NMKI-9 are also interpreted as largely due to inwash of peat containing substantial quantities of these pollen as well as of pollen taxa representative of bog. The inwash is also responsible for the reversal in the uppermost ^{14}C date as well as the records of Solanum tuberosum (potato), a pollen which normally does not appear in the fossil record because of poor dispersal capacity.

ARCHAEOLOGY

A1 Derryinver, Rinvyle (MAG and JH)

The Derryinver complex of sites straddle a low lying bog covered glacial ridge at the eastern side of Tully mountain and overlooking Tully Lough. The surrounding area has a rich assortment of monuments dating from the Neolithic through to the Early Christian period. The Rinvyle group of tombs, consisting of two portals, one court and one small simple megalith, amply documents an extensive Neolithic settlement.

The Derryinver complex is overlooked by two hilltop cairns on Tully mountain and the complex, in turn, overlooks a small cist burial a short distance away to the N.E. These can tentatively be assigned to the Early Bronze Age. Further evidence of Bronze Age activity in the area is a steatite mould for the production of bronze axes and spearheads from Culfin (see Raftery, 1973). For the later Bronze Age, Iron Age and early Christian Period there is little surviving settlement evidence in the immediate environs of the site, with the possible exception of a fulacht fiadh and promontory fort from Rinvyle and an island cashel from Tully Lough.

The monuments on the hillside suggest a complex pattern of settlement, burial and ritual activity spanning several millenia (Figs. A1.1 and A1.2).

The main structures on the hillside are as follows:

Structures 1 and 3 (Fig. A1.1): low pre-bog walls consisting of a curving wall which partly encloses the hillside on the north side and another which runs across

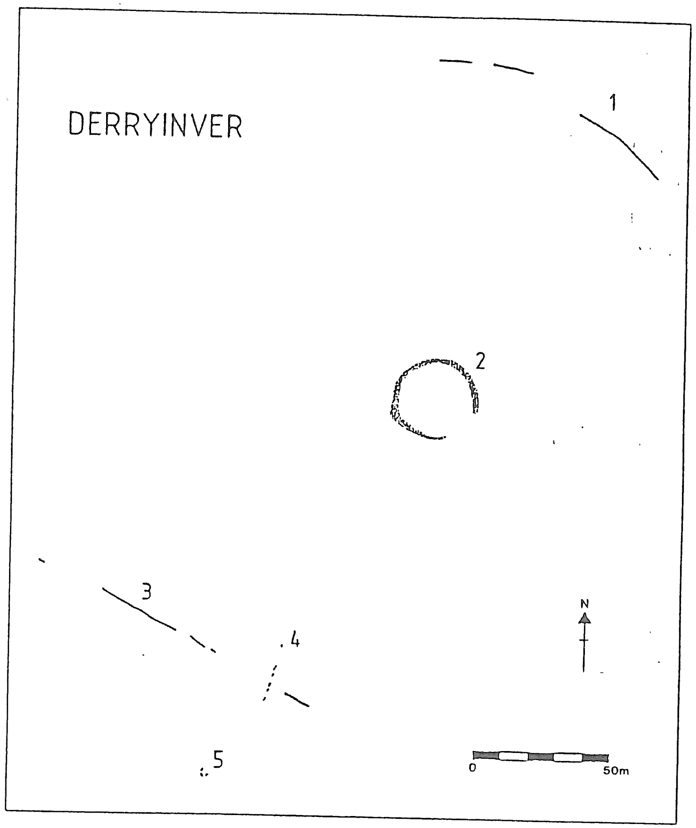

Fig. A1.1 Site map showing main archaeological features on Derryinver Hill. 1 + 3: curved and main pre-bog walls, respectively; 2: ring structure; 4: stone alignment; 5: megalith (Figs A1 to A4 drawn by Noel Dunne and Ailbhe Ní Ríain).

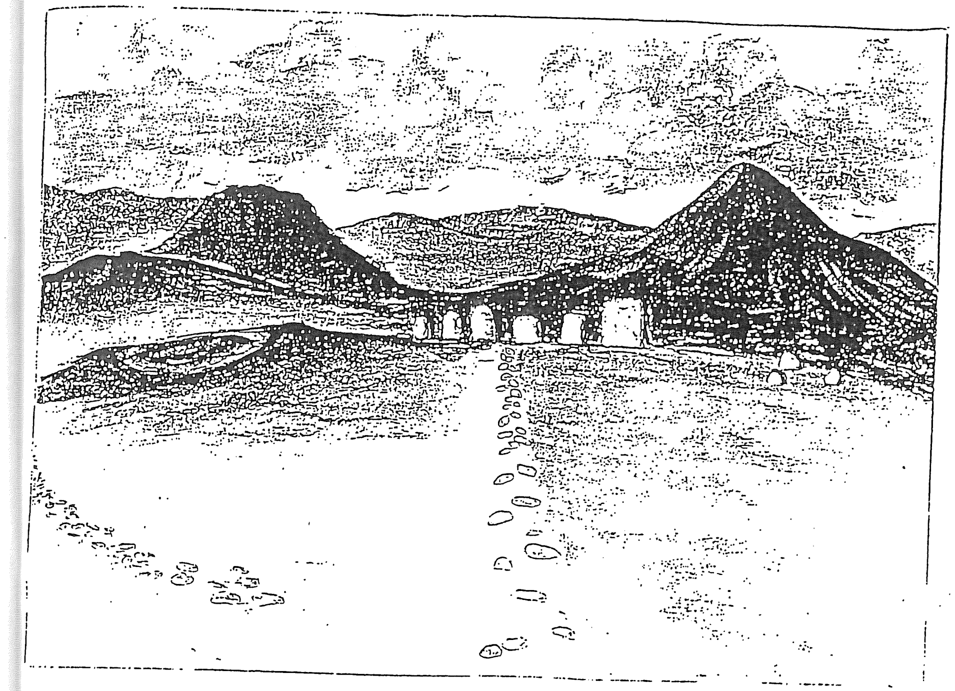

Fig. A1.2 Artists impression of Derryinver looking eastwards with Garraun and Doughruagh Mountains in the background.

the hillside cutting through the line of the stone alignment. These have now been firmly dated to the Iron Age (see P1). The presence of both positive and negative lynchets on either side of the curved wall indicates that, in addition to stock, cultivation of crops over a considerable period of time must have taken place on the hillside.

Structure 4, the most prominent feature on the hillside, is a spectacular six stone graded alignment together with what appears as a rather simple megalithic structure which does not readily fit into any of the recognised megalith types (Structure 5). This simple megalithic structure is arguably the earliest monument on the hillside and it was first proposed by Killanin (1954) that it was the remains of a megalithic tomb. We tend to agree with Killanin's suggestion as there are many simple megalithic tombs now recorded in Connemara. Stones were probably robbed to build the southern part of the stone alignment.

It has been also suggested (Ó Nualláin, pers. comm.) that this megalith represents the remains of a five-stone stone circle and is part of the same cultural assemblage as the stone alignment. Both stone rows and stone circles are seen by Ó Nualláin (1984) as of late Neolithic/Early Bronze Age context and he argues against Lynch's (1981b) dating of these monuments to mid to late Bronze Age, c. 1400 - 700 B.C.

The Derryinver stone alignment is one of at least five and possibly as many as eight such sites in Connemara. It consists of two sets of three stones aligned on an NE - SW axis. The southern group are large rectangular slabs of

stone perhaps robbed from a pre-existing megalith. The northern ones are of rounded granite boulders and, though smaller, duplicate the spacing and scale of the southern set. Both sets decrease in height from south to north. An isolated stone lies further to the north, possibly an outlier.

The overall impression is one of a two phase monument. Interestingly, the pre-bog field wall which runs through the site seems to respect it. The Connemara group of sites is important being the third largest grouping of such sites in the country, the other major concentrations occurring in central Ulster and west Cork/Kerry.

The function of both alignments and stone circles is still far from certain. It is clear that some at least were used for burials and Lynch (1981a) was able to show that a high proportion of the alignments have significant astronomical orientations, particularly on the summer and winter solstices.

Structure 2 consists of a circular area defined by an inner ditch and substantial outer earthen bank with a gap in the east. The overall diameter is c. 30 m. The site is without parallel in Connemara. If the existing gap in the bank is indeed a causeway, it may represent the enclosing elements around a late Bronze Age circular house site. It could possibly be a large Iron Age ring barrow similar to Raftery's (1981) site No. 10 on Carbury Hill, Co. Kildare which contained cremations or, alternatively, it may represent some form of ritual enclosure or henge monument associated with the stone alignment.

A2 Lough Sheeauns area (MAG and JH)

The area referred to has fairly natural boundaries consisting of L. Anillaun to the west, Ballynakill Lough to the east, Dundoughlas Bay to the north and a lowlying ridge forming the southern boundary. It contains a great concentration and diversity of archaeological sites indicating major phases of pre- and early historic activity in the area (Fig. A2).

To the Neolithic can be ascribed three court and one portal tomb as well as a simple megalith which, indeed, may be the earliest of the tombs. The pollen record (see P2) shows a single very intense phase of activity in the earlier Neolithic in the vicinity of L. Sheeauns. This in turn suggests that at least those tomb types sited in close vicinity to the lake, namely, the portal and court tombs, were constructed in this period of major human impact, i.e. from c. 5000 to 4800 B.P. The pollen record also suggests no break or diminution in human activity in the period of intense activity, which may imply cultural continuity over the period in question.

Pre-bog field walls occur in the area but are rather fragmentary. A single clearance cairn has also been recorded which might suggest arable farming. These have not been dated, so it is not known if they date to the Neolithic. It is clear, however, that the pastoral-based economy reflected in the pollen evidence did not entail laying out an extensive stone wall field system as in N. Mayo (Caulfield, 1978; 1983).

During the middle and later Neolithic it appears that settlement was non-existent or sparse. Certainly, its

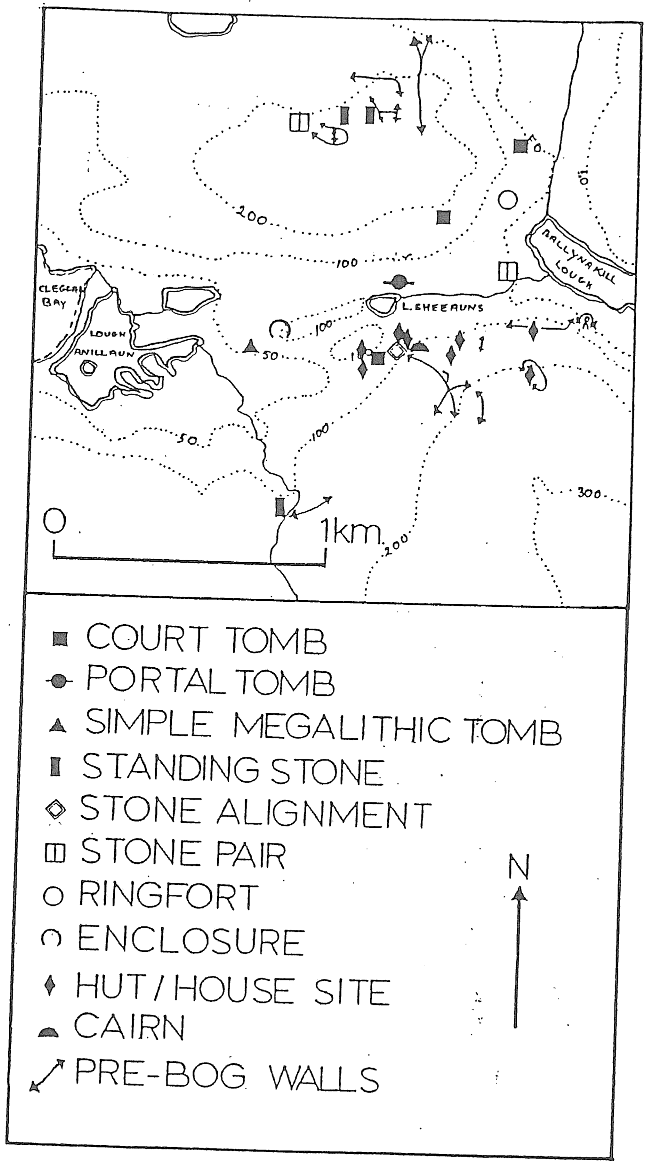

Fig. A2 Map of the L. Sheeaun's area showing the distribution of archaeological field structures. (Contours are given in feet).

impact, if there was settlement at all, was slight, it leaving little or no trace in either the archaeological (though dates ascribed above to megaliths can only be regarded as tentative) or pollen record. The palaeoecological evidence (see P2) contains no evidence for soil deterioration and it appears doubtful if deterioration in climate could have been such, as to cause a major decline in human activity. Since the area is one of the more fertile in Connemara today, there would appear to have been no incentive to migrate. Obviously, a better knowledge of the prehistory of adjoining areas is required before a satisfactory explanation for this apparent void in settlement evidence can be proffered.

Settlement dating to the Bronze Age is suggested by stone pairs, single standing stones and a fine stone row. From the prominent hilltop enclosure to the west of L. Sheeauns, two saddle querns have been recorded. Not yet referred to are eight house/hut sites. These are very difficult to date, but as most of them are partially enveloped in peat, a prehistoric date is assumed. They vary considerably in size and form (and probably also in age), but one at least, bears a close resemblance to the circular Bronze Age house site at Belderg, Co. Mayo. Excavation is required to enable correlations to be established between these various archaeological structures and the pollen analytical evidence which shows a substantial rise in human activity at the end of the Bronze Age (2900 B.P.).

Finally, in the later Iron Age/Early Christian period a very fine ringfort and a denuded island cashel in Ballynakill Lough testify to human settlement in the area.

A3 Streamstown Bay area (MAG and JH)

This is the third area showing evidence for intensive prehistoric and early historic settlement in west Connemara (Fig. A3). Here, as elsewhere, there is a distinct tendency of sites to be located in or adjacent to pockets of present day agriculturally productive land. The Neolithic is represented by at least three separate tomb types ranging from two small but quite distinctive megaliths to the largest court tomb in Connemara (over 12 m in length).

From the Bronze Age there is one possible stone circle, a long cist set in a low cairn and a number of standing stones and stone settings. House/hut sites are almost totally absent except for a small pre-bog site with field walls on the south shore of the bay. Pre-bog walls are less well represented than might be expected, though some five examples are found between Lough Auna and Shanakeever Lough.

The paucity of direct settlement evidence may be due to intensive nineteenth century settlement on the northern side of Streamstown Bay. The rediscovery of sites like Dun Moyle, Dun Dearg and Dun Gibbon, first mentioned by Petrie (1972) gives us an important tight-knit group of small defensively sited hilltop enclosures. These, together with the church site at Templedearg, suggest considerable Iron Age and early Christian activity around the inner reaches of the Bay.

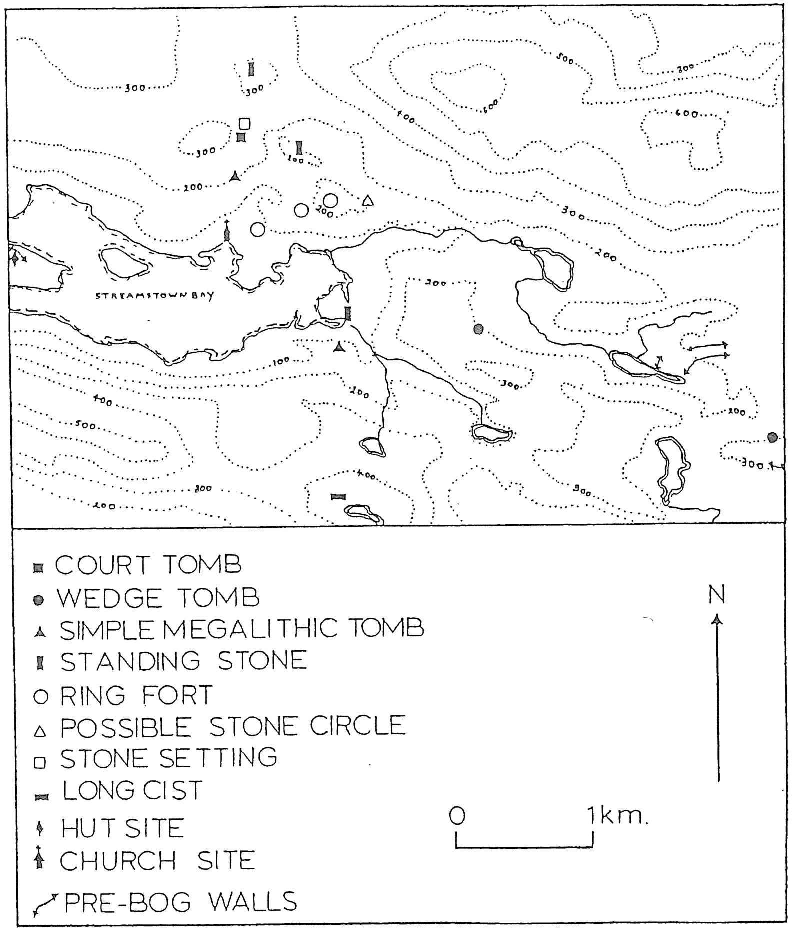

Fig. A3 Map of the Streamstown area showing the distribution of archaeological field structures. (Contours are given in feet).

A4 Truska midden sites (MAG, JH and FMcC)

The known middens in the Truska area extend for a distance of c. 2 km in a line parallel to, and at some distance inland from the present coastline (Fig. A4). It seems certain that there are other unrecorded middens present which are still protected by sand and turf cover. The visible middens consist of three types in terms of their present states of preservation.

About 75% of the presently visible sites consist of destroyed middens. They survive as a spread of shells, stones and to a lesser extent, bones lying on the present surface of the sand, but not extending into it. These represent the heavier contents of middens which were preserved in upper strata, the original archaeological contexts of which have been removed by wind and possibly other erosional forces. These may represent either a destroyed single midden or several middens that were stratified on top of each other. Because they potentially consist of a mixture of different middens of various dates, they are of limited archaeological value.

The second type of midden consists of those that are still covered by a sand of varying depth and are visible in the sections of sandbanks. These constitute about 15% of the sites. In most cases, only one archaeological horizon is visible but in a few, accumulations of sterile sand separate a number of horizons. These sites are to a certain extent protected by an overburden of sterile sand sometimes capped with an intact sod line but there is invariably some destruction at their edges which accounts for the visibility of the sites.

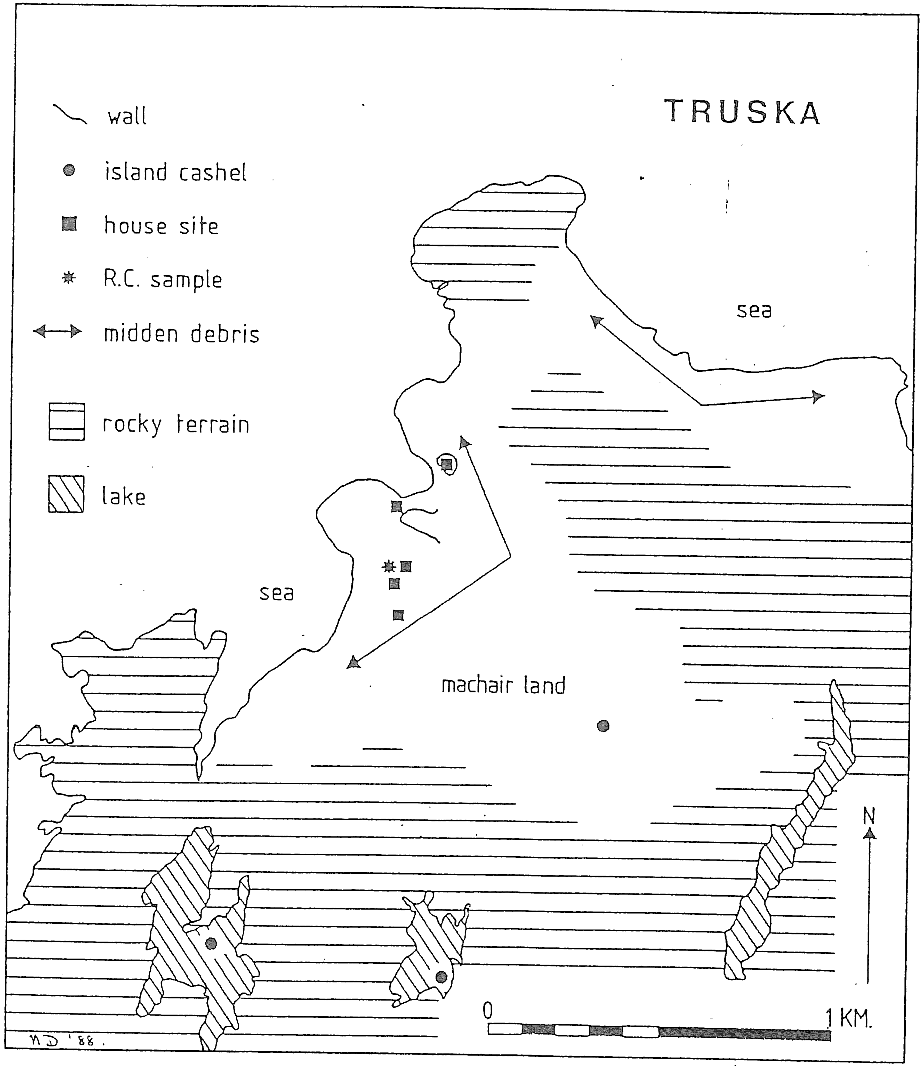

Fig. A4 Site map showing distribution of main features at the midden sites at Truska, Ballyconneely.

The third type, accounting for, at most, about 10% of the sites, consists of middens in which the over burden of sand has been removed and the surface now visible is the actual archaeological surface. Invariably, the edge of these middens has been destroyed to some extent and rendered into the form of the first type mentioned above. All are in the process of rapid destruction by rain, wind and especially by sheep and cattle grazing in the area.

Numerous hearth sites, subcircular, hut sites with and without adjoining enclosures and large sections of walling have also been noted (Fig. A4). Numerous stray finds including a chert arrowhead, stone axes, hammer stones and a large assortment of early Christian and Mediaeval bronze artifacts have been recorded. The broad range of artifactual evidence demonstrates the extensive time period during which these and other middens were used, however sporadically.

The circular house sites from the Truska area may well date to the period of intense activity on the sites during the early Christian Period. It would appear that during this time a great expansion of settlement took place on these relatively fertile dunes. The presence of scrap bronze suggest metal working was taking place and points to settlement of a semi-permanent nature. The dunes were attractive to people due to the broad range of additional economic resources in the vicinity, not least the fertile machair which probably provided good grazing. Results are not yet available from material submitted for radiocarbon dating. However, a shell deposit from a midden site at Seaweed Point near Barna has produced a date of 2560 +/- 110 B.P. (Keary and Dunne, 1973). By contrast, O'Rourke's

(1945) excavation of midden sites at Dog's Bay, produced an almost entirely Mediaeval assemblage.

A5 A possible togher at Boliska Oughter, Spiddal, Co. Galway (PG)

A dense layer of brushwood was uncovered during turf-cutting in 1984 - 1985, c. 1 km north of Boliska Lough (O.S. 6" sheet 80, Co. Galway).

The brushwood layer, consisting of branches of birch and hazel (average diameter 30 - 50 mm), lay at a depth of approximately 1 m below the surface of the bog. Probing revealed a further 1.5 m of bog below the brushwood. A number of pointed stakes, ranging in diameter from 31 to 85 mm, were also recovered, their points having been formed either by diagonal saw-cuts or rough shaping with an axe.

As the discovered was not reported until late 1986, it was not possible to carry out further investigation to enable conclusions to be drawn regarding the dimensions, construction, orientation or date of the brushwood layer. The most likely interpretation, however, would be that it was a brushwood path retained by stakes. Its position in the bog may also suggest that it is most probably post Early Christian in age.

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