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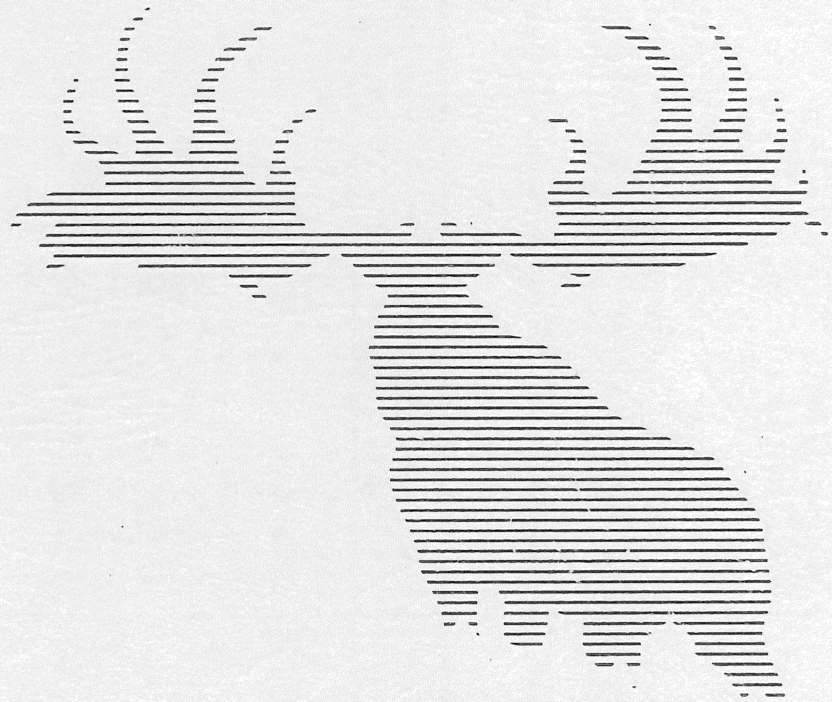

Field Guide to Northwest Iveragh Co. Kerry

Autumn 1983

I Q U A

IRISH ASSOCIATION FOR QUATERNARY STUDIES

AUTUMN EXCURSION, 1983

NORTH-WEST IVERAGH, KERRY

GUIDE BOOK

G.F. Mitchell

P. Coxon

A. Price

CONTENTS

1. INTRODUCTION

For the 1983 IQUA autumn excursion to north-west Iveragh I have tried to arrange a programme (a) that will not involve much motoring - after we have reached Valencia Island -, and (b) will involve looking at a wide range of features, as is, I feel, appropriate for a multi-disciplinary group such as ours. We will therefore not spend overmuch time looking for brachiopods in bogs, or translocations in tills.

But I have to admit that I have introduced a personal geomorphological Will of the wisp. Some landforms in the area are highly untypical of those in Ireland in general, and must, I think, have developed under conditions different both to those of to-day and to those of the Ice Age. I draw attention to these landforms in the hope that experienced geomorphologists (among whom I cannot be counted) will be attracted to study them in detail.

The area to be covered by the excursion lies within Irish Grid Lines V 030 to 070 W/E, and V 060 to 090 S/N. Except where indicated by a grid reference, all place-names used will be found on O.S. ½" (1:126720) Sheets Nos. 20 and 24. In some parts of the maps place-names are scarce, and in some cases the name given to a feature lies slightly awkwardly with regard to that feature. Heights in feet on the maps have usually been transformed into metres.

I have to thank especially our Secretary, Peter Coxon, for assistance in the field, for his pollen study, and for undertaking the production of this Guide. Special thanks also go to Ashley Price for his section on solid geology, to Daphne Pochin Mould for aerial photographs, many taken specifically to assist my work, and to Des and Pat Lavelle for never-failing help and information. I am indebted to the British INQUA Committee for allowing me to draw heavily on their Guidebook to the 1977 A15 Excursion to South-west Ireland, and to my colleagues who contributed to the Guidebook. I trust that the many others who helped me in various ways will feel included in my thanks.

(G.F.Mitchell.)

In addition to the above, Peter Coxon would like to thank the following:

Catherine Coxon for assistance coring the Imlagh site, Richard Bradshaw for his superb Computer drawn (user friendly) pollen diagram and organisational matters, Eileen Russell for typing the fieldguide, Martha Lyons for drawing the diagrams and Stephen O'Connor for duplicating the guides.

2. CLIMATE

The climate can be described as very equable.

The annual value of mean daily air temperature (°C) is 10.8, August 15.4 being highest, and February 6.8 lowest. Frost is registered on 42 days p.a., and snow lies on the ground 1 day p.a.

Rainfall amounts to 1400 mm p.a., December 168 mm being highest, and April 74 mm lowest. There are 190 rain-days.

Prevailing and strongest winds are from the south and south-west. Gales have reached a speed of 88 knots. There are 123 gale-days p.a.

The annual average of daily mean duration of bright sunshine (in hours) is 3.72, May 6.53 being highest, and December 1.31 lowest.

On the whole evaporation rates and relative humidity show typical Irish values, but evaporation is very poor from November to February, and even on a May afternoon relative humidity does not fall below 73%.

Data are taken from Rohan (1975). It should be noted that the station described as Valencia is no longer on the island but is at Cahersiveen.

3 SOLID GEOLOGY (Fig. 1)

Ashley Price

General Stratigraphy

Only rocks of Old Red Sandstone facies outcrop within this part of the Iveragh Peninsula, with neither the base nor the top of the sequence being seen. All were deposited within the Munster Basin. Diagnostic fossils are extremely rare and consequently accurate age correlation is impossible. However, Russell (1978) has demonstrated a maximum age of latest middle or early Upper Devonian for the lower part of the Old Red Sandstone succession found within this area. Graham (1983) has demonstrated that a major fluvial system was present within the Munster Basin, and he was able to subdivide the sediments into four major facies types. The western part of the Iveragh Peninsula is wholly dominated by his fine grained fluvial facies. This facies type is an accumulation of three formations previously recognised by Capewell (1975). These being from oldest to youngest, the Valentia Slate formation, St. Finan's Sandstone formation and the Ballinskelligs Sandstone formation. The latter two formations being correlated as fine grained equivalents of the Chloritic Sandstone formation and the Purple Sandstone formation of the Reeks area.

An area of igneous intrusives is to be found centred on Beginish Island. These rocks have been dated as Devonian. The E-W dyke north of Glanleam (V 403772) on Valentia Island, has been affected by the Hercynian deformation (personal observation) and consequently supports this date.

Lithologies

The sediments occurring within this part of the Iveragh Peninsula are amongst the most common to be found within the Munster Basin. Their main features include a very limited development of large scale cross stratified sandstones and a dominance of siltstones and fine sandstones, which display small scale sedimentary structures. Sediment size rarely exceeds fine sand.

This contrasts with the eastern parts of Iveragh, especially the Reeks, where a coarse-grained fluvial facies predominates, which is best seen in the Chloritic Sandstone formation. This formation is characterised by medium to coarse sandstones and pebbly sandstones generally displaying large-scale cross-stratification.

Capewell's subdivision of the rocks of this area are summarised in the table. Boundaries between formations in the field are almost imperceptible, however, an overall coarsening upwards sequence occurs with scattered conglomerates being found throughout.

Coastal exposure is generally good. However, away from the coast exposure becomes generally poor, due either to the rock having broken down forming a mantle of head or being buried below till and bog. The St. Finan's Sandstone formation notably forms the ridge from Aghatubrid to Knockavahaun and Caunoge.

Structure

The Iveragh Peninsula occurs in the Hercynian fold belt within the zone of cleavage folding of Gill (1962). The western part of the peninsula is dominated by two major anticlinal uplifts and an intervening syncline. These structures are clearly demonstrated from the lithological mapping except in the south, where a series of E-N-E faults occur. Clear axial traces rarely occur, usually a series of small minor folds are encountered.

On the northern limb of the Kilcrohane Anticline a marked anticline (the Cummeragh Anticline) and complementary syncline (the Currane Syncline) occur. These folds are of small magnitude as they fail to expose the Valentia Slates.

A strong cleavage is developed within all the rocks. An excellent slaty cleavage occurs in the fine silts, especially within the Valentia Slate formation. Within the coarser grained rocks a spaced fracture or pressure solution cleavage occurs. Cleavage dip decreases northwards from upwards of 80° to 25° as seen within the Valentia Slate quarries.

Faults within this area cannot often be easily recognised due to the drift. However, in the south a series of E-N-E trending faults occur. These have been interrupted as rotational faults with increasing throw towards the south west. There is a possibility that they may be right lateral wrench faults. The Coomnacronia fault in the north forms the boundary between the upper two formations and is interpreted as a high angle reverse fault (Upthrust) inferred to run along the Ferta Valley and the Valentia River. Within this area the main structural features appear to be broadly parallel, striking E-N-E, however, from a reconnaissance Remote Sensing Study E-S-E trending features may be expected.

Ballinaskelligs Sandstone Formation	Essentially bright purple medium-grained sandstones with minor siltstones. Conglomerates occur at Reencaslagh.
St Finan's Sandstone Formation	Dominated by fine to medium-grained grey and grey siltstones at the base. Chloritic sandstones become important towards the east. Conglomerates notably occur on Doulus Head and Reenadrolaun (Valentia Island).
Valentia	Purple and purplish-grey or greenish siltstones dominate. Subordinate fine-grained purplish-grey sandstones and medium-grained quartzite sandstones occurring high in the sequence. Conglomerates occurring at Coosaganna (Valentia Island).

4. GEOMORPHOLOGY

I have visited the western ends of both sides of Dingle Bay at irregular intervals over a period of fifty years, and have gradually had it forced on me that the topography west of Dingle, and also between Cahersiveen and Waterville is "different" to that in any other part of Ireland. Having in more recent years seen rock-basins and pediments in the western United States and pediments in Brazil, I am driven to the conclusion that much of this "different" scenery can be treated as rock-basins and pediments.

When I ask myself what is the simplest way to imagine an ideal development of these features in this area, I think of a shallow concave oval basin which has a surrounding flat flange, not horizontal but tilting inwards towards the basin at a very shallow angle. This simple picture is not realised in the field, because the flange is not complete, but appears as one or more isolated lobes, each usually surrounded by a semi-circular rock-ridge. But the basin is my 'rock-basin', and the tilted lobes which end upwards against hillslopes are my 'pediments'.

My pediments come within the definition of Young (1972, 204-5). The hillslopes are usually more than 20°, the rock-slope on the pediments is usually less than 6°, but the piedmont zone (between hillslope and pediment) cannot be restricted to "usually less than 50 m long" as there has been heavy periglacial activity since the pediments were formed.

I shall try to restrict myself to description, and avoid venturing into process. But if I envisage rock-basins, then I must consider the removal of loosened debris by wind as a possible explanation of their origin.

In the north-west Iveragh we have an N-like pattern of rock-ridges. The sides of the N run northeast/southwest in accordance with the local Hercynian fold direction. The left side is the ridge that runs from Doulus Head through Knockadober (690 m) to Glenbeigh; the right side is the ridge that runs from Mullaghanattin (820 m) through Coomacallee (660m) to Hog's Head. The cross-bar runs from Drung Hill (640m) to Knockmoyle (630m). Over most of the length of the ridges the height is over 650m.

A lower tract, our study area of "different" topography, lies within the south-west bay of the N (Fig. 2). Only three roads cross the encircling ridges into the tract; at Reencaslagh (120m) on the road from Glenbeigh to Cahercilveen; at Ballaghisheen (300m) on the road from Killorglin to Waterville; at Coomakista (210m) on the road from Sneem to Waterville. In earlier days access was by sea, rather than land.

The valley of the Valencia River, which lies along the Coomnacronia Fault, forms the north-west border of our tract. In cross-section the valley is highly asymmetrical; to the north we have the steep slope of the Knocknadobar ridge, to the south we have gentle pediment slopes. The valley of the River Inny which runs in a syncline in the Ballinaskelligs Sandstone formation forms the south-east border. Again the cross-section is asymmetrical. To the south we have the steep slope of the subsidiary Cocaduff ridge at about 210m, to the north we have gentle pediment slopes. It is not impossible that faulting is also involved in the Inny valley.

The tract has a central rock-ridge with Hercynian trend, but it is lower than the encircling ridges, not rising above 500m. The ridge is broken by a pediment pass at Kilpeacan; north-east of the pass the ridge is in the St. Finan's Sandstone formation; to the south-west the ridge is on the Valentia Slate formation. From the ridge subsidiary ridges run out approximately at right angles to both the ridge and the geological structure; the pediments nestle in the low ground between the subsidiary ridges.

a. The Portmagee Channel (Fig. 2)

In the north-western sector of the tract we have the Portmagee Channel. Guilcher (1966) regards the Channel as a drowned river valley, whose meandering course is still evident; there was modification by capture between Valencia and Doulus Head before submergence. To me the Channel is a partly drowned rock-basin with pediment lobes.

The elongate central part of the Channel is nowhere more than 4m deep. At the northern exit a tidal channel 10m deep is cut between Knightstown and the mainland. At the western end the straight-sided NE/SW bay N of Horse Island is 20m deep; the deep ends abruptly as we turn south-east to Portmagee, and tidal rocks abound in the vicinity of the bridge.

There is no 'drowned valley' here. Though the shallowness of the central part may in part be due to soliflucted drift, rock outcrops are common along its shores.

Reading anti-clockwise, the pediments around the Channel are Portmagee, Gorrane, Ardcost, Laharan, Reenard and - less clearly defined - Valencia. The flat tops of some of the pediments, especially those at Ardcost and Reenard, have bevelled edges as they drop to the modern level of the Channel. The Ardcost Pediment is being dissected by modern streams. Only the Portmagee Pediment will be dealt with in detail here.

North of Cahersiveen, and apparently north of the Coomacronia Fault, there is some low ground around Ballycarbery. North of Ballycarbery Castle (V 446797) there is very broken rocky ground, and this I could not regard as a pediment. There is some suggestion that a fault runs through from the inlet west of the castle to the west side of Coonanna Harbour.

Smerwick Harbour, in the Dingle Peninsula, is another sea-invaded rock-basin. Here there is one well-marked pediment lobe, that around Emlagh to the south, and a smaller one at Kilquane to the east. At Imlagh, in the north-west corner of Valencia Island, we have a small rock-basin without pediments, and this will be described here.

In our "different" tract we have, south of the central rock-ridge, the sea-invaded Ballinskelligs Basin, with pediments on its north flanks at Ballinskelligs itself, Emlaghmore, and Muingadowda. By the cutting-back of their hillslopes, the Muingadowda Pediment on the south and that at Ardcost to the north have cut through the rock-ridge and become united via a pediment pass west of Kilpeacan. A rock gorge, possibly cut by glacial meltwater, has cut into the floor of the pass, and enabled the Derreen River, which flows north to the Portmagee Channel, to capture

some of the drainage on the Muingadowda side.

At Kilpeacan, the pediments have met at the same level in the pass. In the Dingle Peninsula the small pediment at Kilquane has already been mentioned. There the valley of the Milltown River occupies a pediment lobe attached to the Dingle Harbour rock-basin. These two pediments meet in a narrow pediment pass, but there is a marked scarp, as the Kilquane Pediment is at a lower level than the Milltown one. A small lake lies at the foot of the scarp.

East of the Ballinskelligs Basin we have, as we proceed up the north side of the Inny valley, the Mauinahow, Foildrenagh and Kealafreaghane Pediments. The Kealafreaghane Pediment on the south and that at Ferta to the north have very much narrowed the rock-ridge between them; the col at Knockanedan is at 160m.

Having thus given an outline of my position, I shall now describe the Imlagh rock-basin, and the Portmagee Pediment.

b. The Imlagh Rock-basin (Fig. 3)

Here we have a very shallow concave oval rock-basin, which has no flanging pediments; its rim is cliffed by the sea along much of its northern and western margins. The 6" map carries a central name Imlagh, and I call it the Imlagh Rock-basin; the name doubtless refers to the wet fen which before drainage occupied the lowest part of the basin; it is shown on the 1855 edition of the GSI 1" geological map (Sheet 182). The basin is 4km long, and its surviving breadth is 2km. Its south-east rim rises to 180m; the same height is attained to the south-west between Bray Head and Beenaniller Head; it is no longer possible to say to what height the north-west rim rose, but everywhere the slope is downwards from the cliff into the basin; the north-eastern end is less clearly defined.

Its floor is not perfectly smoothly rounded, because here and there knobs and ridges of rock (parallel with the cleavage) stand up. Towards the west, at V 348745, there is a prominent rock which almost merits the name inselberg, rather than tor. It is 50m long, 8m wide, and 5m high, and crowns a ridge, which is presumably of rock.

Except for two areas, there is little glacial deposit in the basin. At the western end, drift is banked against the east rock-slope of Bray Head; it slopes smoothly eastwards at 5°. It extends to the west for a short distance as a ridge below the northern face of the rock-slope; a pit shows 5m of festooned drift, not buried by head.

Here the rock-slope has a free face, and a slope of about 20° to the north. It ends abruptly downwards against sloping head, which dips north-east at 6°; the head which is cryoturbated has carried some large blocks of rock from the slope along with it. In this higher western end of the basin the head forms a continuous sheet, and masks much of the underlying rock; in the cove immediately east of Beenaniller Head a section shows 2m of fine cryoturbated head resting on a pocket of drift with rock below.

On the north-west margin, at Beenderyraka Head, an area of drift about 6m thick forms a low knoll, and there is a further deposit a short distance to the west. At the Head, the underlying rock dips inwards.

Before drainage the lowest part of the basin held a fen. The rest of the basin was buried by blanket-bog, of which a small amount remains uncut. The peat must have continued to form until comparatively recently, because a monastic site is buried by more than 1m of peat, (see Henry, 1957) and numerous old field-walls have been exposed by peat-cutting.

Because of the peat-cover, rainfall run-off is slow, and there is only a trifling stream. As the stream approaches the sea it follows the artificial cut (largely in rock) by which the fen was drained; it escapes through a rim-breach, ramifies over some flat slabs of rock, and drops about 5m into the sea.

To what process of erosion are we to ascribe the formation of the basin ? Surrounded by an enclosing rim, it is unlikely to have been created by river action in temperate conditions. It shows no forms pointing to a glacial origin, though ice moved over it probably more than once, and from varying directions. If we cannot say that it was created under temperate or arctic conditions, then we must look further, perhaps to tropical semi-arid, with wind removing the products of rock-weathering and so producing a basin.

c. <u>The Portnagen Pediment</u> (Fig. 4)

Before considering the rock form of the pediment itself, it is necessary to realise that the pediment has had a chequered post-formational history.

We do not know how many times ice swept across it, but there remains a thin (i.e. measured in metres rather than in tens of metres) unevenly distributed glacial deposit, occasionally undisturbed in its lower layers, but generally deeply cryoturbated. To-day its surface is relatively even; when deposited the surface may have been highly irregular.

The pediment was probably subjected to periods of temperate interglacial weathering.

At the close of the last cold stage (and probably on other earlier occasions also) the hillslope was subjected to freeze-thaw activity. Fragments of rock were prised off and flowed downslope leaving valley-side tors exposed. A sheet of fine head extended out from the base of the hillslope. Nor was this the end as the upper layers of the sheet of head themselves show evidence of post-depositional cryoturbation.

In early postglacial time soil developed on the varied deposits, and the area became clad with pine trees, and probably oak as well. Later, as throughout western Ireland, the area was buried by blanket-bog, a substantial amount of which has now been cut away by man. There have been frequent debris-slides, usually of peat.

These Quaternary events will reappear in later sections of this Guide.

To return to rock topography; and to take the pediment first. The arrangement of the contour-lines and the dendritic pattern of the streams show clearly that we are dealing with a gentle even slope. That this is fundamentally a rock-slope and not merely a slope on the superjacent deposits is shown by the very ~~by the very~~ numerous exposures of fresh unweathered rock. If from Point J on Fig. 4 we follow the bed of the stream until it reaches the sea at F, for two-thirds of that distance our feet will have been on rock; throughout this distance the slope averages 3°. Rock makes frequent appearances along the courses of the other streams, as is shown on Section E/F on Fig. 4.

The hill-slope can be taken in three units, G, H and I as shown on Fig. 4. Sector H is the simplest; here we have a straight rock-slope, only thinly mantled by a mat of peat, which often breaks away downslope leaving rock exposed; the slope is about 20° to the north. The piedmont zone is narrow here, and there is a prominent spring-line.

In Sector G the hillslope becomes a concave arc, and the inclination steepens upwards to 30°, with hill-slope tors near the slope summit. Here the hen and egg argument comes into play. Was the rock-slope already concave in pre-Quaternary time, and did the concavity act as a trap for snow, which dug further back into the slope, and spread the excavated debris out in front of the concavity as a sheet of head, with a slope of about 5°? Or was the rock-slope straight, as in Sector H, and did the higher ground behind the slope at this point cause an accumulation of snow on its north-east side, and thus initiate the concave excavation?

In Sector I we have again a concavity in the rock-slope, and some accumulation of head below the break in slope to the pediment. But here two steep-sided gullies, one simple, the other V-shaped, have been cut into the rock-slope. From their 'fresh' appearance, it is tempting to regard these as cut by lodged snow in late Quaternary time, but there is no suggestion of any 'fresh' moraine or pro-talus rampart.

But although the hill-slope shows some variation along its length, the fundamental rock-form is clear, a gently sloping pediment at the foot of a horse-shoe shaped hill-slope. Neither temperate fluvial or glacial action could have created this landform, and I am forced again to think of some other climatic regime.

There remains the Ballynahow river valley, another enigma. Why should we find only a solitary "typical" V-shaped river valley, in an area where pediments are well developed? The valley is like a rogue wedge in a pedimented cake. The river rises at the highest point (395m) on the western end of the central rock-ridge, and at first its valley is broad and open. At about 300m the valley makes an S-bend, drops and narrows, as though there had been some rejuvenation. But the general direction of flow continues to the south-west, in accordance with the strike. The stream then meets a north/south gully on the north side of the valley (presumably fault-controlled), and turns south for a short distance. It then emerges onto the Keel Pediment, and resumes the strike direction. This pediment ends abruptly to the north-east, where it meets the scarp of another north/south fault.

5. GLACIAL GEOLOGY

As far as later glacial events in Kerry are concerned, W.B. Wright (1927) laid down the foundations of our understanding, by demonstrating the former existence of a great ice centre in the upper part of Kenmare Bay. Later work (Warren, 1977) has added superstructure to the Wright base. Slender lobes of ice pushed westwards through the mountains to reach the headwaters of the Inny River (Fig. 5), and a more massive ice-flow over-topped the ridge north-east of Waterville and created a series of lakes of which Lough Currane is the largest (Fig. 10; Bryant, 1977). This advance failed to overtop the Coomduff rock-ridge.

Corries were ice-filled on the Knocknadober ridge (Fig. 6) and on the Coomcarra ridge at heights of over 300m. Within the tract studied in detail in the previous section this height is only attained at Foilclough on the central rock-ridge; here there is a shallow corrie with a lake-holding pro-talus rampart at its foot. Is it legitimate to make deductions as to the height of the Late Midlandian snow-line?

My personal hunch is - and I put it no higher than that - that there was in Munsterian times a Greater Cork/Kerry Glaciation, in the sense of Farrington (1947), and that the general movement of ice within our area was from east to west. The movement of the lower layers of the ice was strongly influenced by the underlying rock topography, with corresponding effect on the distribution of drift and the pattern of the striae.

How far west did the older ice extend? Like the Grand Old Duke of York ice can march erratics to the top of a hill, but subsequent solifluction can be very effective in marching them down again.

Farrington (1947) and Quinn (1977) thought that the top of Knocknadober (690m) was never overtopped by ice. Guilcher (1966) thought that the higher parts of the offshore islands had not been covered. Puffin Island has erratics. Unlike the mainland both the Great and the Little Skellig show indurated head all around their flanks. The Tearaght shows the same feature still more dramatically. In my opinion the older ice-sheet failed to reach these rocks. There is some confusion regarding glacial striae (Lewis, 1971, Synge, 1979 and Warren 1980).

6. CLIFFS AND BATHYMETRY

Guilcher (1966) has discussed the cliffs and 'megacliffs' (more than 500m in height) in western Ireland, including those in our area; he notes especially those on Valencia Island (those at Fogher, 180m, and at Bray Head, 232m, which cut the headland in half, the hillslope to the south-east being replaced by a slope of 60° to the north-west) and at Dromgour, south-west of Portmagee. He further notes that at Dromgour the cliffs have carried off the western flank of a hog's back, in the same way as happens on the seaward side of Smerwick Harbour in

the Dingle Peninsula. At Dromgour itself the cliff falls away from a height of 250m in great sub-vertical blocks at an angle of 40 to 45°.

Guilcher considered that wave force alone operating on hard rock could not create such cliffs. He noted that though the most frequent wind direction at Shannon airport was 40°S, most of the high cliffs faced north-west, the direction parallel with folding and cleavage. Frost action had further opened up weaknesses in the rocks. He pictured the waves attacking the face of shattered rocks; when a notch had been cut, more rock collapsed downwards, only to be removed in turn. Thus the cliffs grew steadily upwards.

The rock-fall we see on Puffin Island exhibits this process in action.

Off the cliffs, steep slopes continue seawards (Admiralty Chart, 2125, Valencia Island). The -50m contour runs from Puffin Island to Bray Head, hugs the cliffs at the west end of Valencia Island, and strikes across to Doulus Head.

The -20m contour pushes into the west end of the Portmagee Channel, and runs across outer Valencia Harbour along the line of the igneous intrusion that runs from Fort Point across Beginish and minor islands to the mainland shore. The inner harbour has no depth greater than -17.5m.

7. BEACHES

Wright and Muff (1904) described a 'pre-glacial' beach with some non-local stones below glacial deposits at many localities along the coast of southern Ireland. Bryant (1966) records a similar beach in the Dingle Peninsula, and Warren (1977) notes an occurrence at Ross Behy (V 644909) just east of the area of the field trip. Unfortunately the beach has never yielded any fossils, and its age is problematical.

The tombolo at Ballinskelligs, which is not covered by any glacial deposit, and is probably largely post-glacial in its present form, also contains non-local stones. A short distance south of the tombolo a boulder of granite, $1m^3$, lies at the base of a drift cliff, from which it has probably been eroded. The granite, together with several of the other non-local stones in the tombolo, is almost certainly from Connemara. A similar suite of rocks also appears in the beach at Fanamore, north of Castlegregory, in the Dingle Peninsula. Another group, chalk, flint and basalt, will be from the sea-floor west of the present coast. There are also limestones, probably from north Kerry. Transport from north to south by some agency is clearly signalled. But by what agency, and when?

Longshore currents could not have transported boulders $1m^3$. Floating ice could have been the agent, but with sea-level presumably low, the boulders would then have been trundled upslope by the waves of a sea which was rising in level. Ice could easily have transported them; but when? In the lower Shannon estuary, west of the usually accepted limit of Midlandian ice, many striae run east/west, a direction at right angles to that necessary for transport from Connemara to Kerry.

There is another problem. If the time of transport was a long time ago, how have such easily dissolved rocks as limestone and chalk managed to survive? Had they remained in the glacial deposit, they would have been destroyed by leaching long before waves had an opportunity to erode them, though the more durable granite did survive. If transported by ice, they must have been rescued from leaching a long time ago.

High storm beaches, both active and sub-fossil, give evidence of the power of modern waves. On Puffin Island at one point on the north-west cliffs at a height of 30m there are three short beach-ridges one behind the other. They hold slabs up to $1m^3$, presumably torn from the cliff-face as the waves rushed up. At Beennakryaka Head on Valencia Island where the cliff is topped by a layer of drift, stones from the drift have been deposited at heights up to 35m. On December 27, 1955, glass in the lighthouse on the Great Skellig, 53m above sea-level, was broken by wave action.

Submerged peat can be seen in the inner reach of the estuary of the Valencia River, off Ardcost in the Portmagee Channel, and on the shore at the abbey in Ballinskelligs Bay.

5. SOILS AND VEGETATION

Though the parent materials of the area are siliceous and deficient in nutrient, nonetheless there was early post-glacial forest growth, and this suggests that the early soils may have been forest brown earths. But as time progressed there was a development towards podsolisation, although the factors underlying this development are not understood (see discussion in Lynch, 1981, 55-58). Gradually blanket-bog smothered the whole area - except where slopes were very steep. Cutting away of peat exposed peaty podsols, or in more limited areas, such as Valencia Island, brown podsolics.

No interglacial deposits are known in the area, and the first organic deposit is of Woodgrange interstadial age (Mitchell, 1976) in the Finglas River valley, near Waterville (Bryant, 1974). The mud, dated between 12,000 and 11,200 BP, showed a meadow-like countryside, with scattered birch, willow and juniper.

Jessen (1949, pp 188-190) studied a blanket-bog at Emlaghlea (V 471697) in the Muingadowda Pediment. Peat formation started early when _Betula_ was dominant; when _Corylus_ came in about 9,000 BP conditions got wetter and swamp woodland formed. When _Alnus_ arrived about 6,000 BP conditions were still wetter, and trees disappeared from the _Phragmites_-swamp. Trees re-invaded the swamp, and _Betula_, _Pinus_ and _Quercus_ were growing freely in the vicinity. A Middle Bronze Age axe was said to have been found in the peat at this level.

Bog-growth then changed completely, and blanket-bog-peat rich in _Molinia_ replaced the swamp-wood-peat. Near the base of this peat _Quercus_-pollen rises to a maximum as _Pinus_ falls away. If this feature is of the same age as the similar feature to be seen in the Cashelkeelty I diagram (Lynch, 1981, opp. p. 134), we may place the Emlaghlea _Quercus_-maximum at about 4,000 BP (2,000 BC). The axe (_c._ 1200 BC) must have been buried or sunk slightly in the peat. Cashelkeelty (V 075852) is a blanket-bog at 110m 22km ESE of Emlaghlea.

At Emlaghlea the change to blanket-bog-peat is older than 4,000 BP. At Cashelkeelty I the change was dated to 3,000 BP. At both these sites the change took place in already established bog. Lynch (1981, p. 59) dated the initiation of blanket-bog formation at six profiles, and these ranged from 3265 to 800 BP; dates in the north of Ireland range from 4205 to 1485 BP (Lynch, 1981, p. 60). The conclusion can be safely drawn that the base of blanket-bog peat in Ireland is a highly diachronous surface. But considerable parts of the area must still have been free of peat when the wedge-tomb builders arrived about 2,000 BC. Peat continued to grow after Early Christian times. When the Normans appeared about 1300 AD, bog must have had its widest extent.

An almost universal pall of bog except on steep siliceous slopes has left little scope for the type of plant the modern botanist hunts for. Nor has the cutting away of bog to expose peaty podsols improved matters. But there are some stars. _Pinguiclula grandiflora_ on uncut bogs, _Euphorbia hiberna_ in ditches and field margins, _Saxifraga spathularis_ and _S. geum_ on wet rocks; _Arbutus unedo_ still lingers round Lough Currane, near Waterville. Some introductions flourish; _Rhododendron ponticum_ is common, _Fuchsia gracilis_ forms hedges, _Phormium tenax_, introduced as a fibre-plant in the 1914-18 war, and for shelter-belts, grows widely.

The gardens at Glanleam on Valencia Island demonstrate the mildness of the climate. New Zealand tree-ferns (_Dicksonia antarctica_) run riot, and many forms from South America and Australasia are thoroughly at home.

Peat

a. A peat profile at Imlagh, Valencia Island (P. Coxon)

The Imlagh rock basin is described on pages 8 and 9 of this guide by G.F. Mitchell. Near the stone crosses in the Imlagh basin (Figure 3) there are recent turf cuttings and these provide sections in the local peat deposits. Samples were taken from beside the cuttings to gauge the depth of the peat and to provide further samples for analysis. The site is of particular interest because one of the stone crosses rests upon a stone platform which has been buried by peat growth. Only the top of the cross is currently visible. The stone platform can be seen in adjacent peat cuttings.

I. Peat deposits. Description and discussion.

The sections (0-141cm) and the core (141-290cm) proved the following :

0-3cm	Surface vegetation and roots
3-69cm	Fibrous, herbaceous peat composed of rootlets and coarse and fine plant detritus.
69-86cm	As above with increasing component of finer plant detritus.
86-95cm	Layer of flat, angular cobbles and boulders lying in a distinct horizon. Associated in places with wood fragments.
95-215cm	Coarse and fine plant detritus containing roots including cf. *Phragmites*.
215-252cm	Coarse and fine plant detritus with woody detritus and larger fragments of wood.
252-277cm	Coarse and fine plant detritus with roots (cf. *Phragmites*)
277-283cm	Light blue-grey silt with angular rock fragments.
283-290cm	Angular rock fragments.

The depositional sequence appears to show the following main characteristics :

1. Shattered bedrock surface (283-290cm) .
2. Possible B horizon of a gleyed soil developed upon the underlying bedrock (277-283cm)
3. Accumulation of fen peat in wet conditions within the basin (95-283cm)

   Trees growing on the peat at some levels (215-252cm).
4. Platform of angular flat rock laid by man upon surface of the fen peat (86-95cm)
5. Reversion to wet conditions producing fen peat (69-86cm)
6. Gradual coarsening of detritus and production of herbaceous peat due to growth of peat above the local water table or drainage (69-3cm).

II. Pollen analysis of the peat.

50 samples were taken for pollen analysis and the results of 30 of the these samples are shown on Figure 11 at the back of the guidebook.

The pollen diagram does not show all of the taxa recorded. Some of the counts (especially those for the herbaceous peat) were low (ca. 50 grains per level) although most of the counts were between 250-500 pollen grains per level.

Samples from the blue-grey silt (277-283cm) contained very little pollen and they have not been included on Figure 11 . These samples contained *Quercus* (oak) and *Pinus* (pine) pollen.

A brief description and discussion of the pollen diagram brings out the following general points. (Following normal practise the diagram has been divided into local pollen assemblage biozones, in this case 7 zones).

Zone a. At the base of the core (270-277cm) the values for *Quercus* are high at 30% of the total pollen (P). *Taxus* (yew) and *Corylus* (hazel) are also present at levels of 10 and 20% respectively. These taxa were clearly growing on the basal peat deposit directly upon the gleyed B horizon (277-283cm).

Zone b. Following the lowest zone the % of *Quercus* pollen drops markedly as does that of *Taxus* and *Corylus*. The pollen of *Salix* (willow), gramineae (grasses), Rosaceae and Umbelliferae become more important in the diagram (245-270cm). This change probably reflects wetter conditions in the area producing a fen with *Salix*, herbs and grasses dominant. *Alnus* (alder) is also present.

Zone c. The zone between 180-245cm shows *Pinus* rising to between 5 and 10% P and *Betula* (birch) with values of 3-5% P. *Alnus*, *Quercus* and *Corylus* are all represented in this zone. The pollen of gramineae is abundant reaching 65-70% P. *Calluna* also begins to be important in the pollen sum. The pollen of *Sparganium*-type and *Sphagnum* spores are also represented.

This zone reflects a mostly open, wet area with occasional trees and shrubs (growing locally as shown by the wood in the peat between 215-252cm). The influence of the proximity of the ocean is probably strong.

Zone d. Between 140-180cm *Pinus* pollen values drop markedly. *Betula*, *Alnus*, *Quercus*, *Corylus* and Gramineae pollen % also fall.

The pollen % of *Calluna* and *Plantago* rise markedly and the diversity of herb taxa increases.

This zone is one where disturbance has occurred and the trees and shrubs have been cleared to the profit of *Calluna* and herbaceous taxa.

Zone e. This zone (100-140cm) shows a slight increase in the % representation of Betula, Alnus, Quercus and Corylus. Ericales (heaths) also increase during this zone.

The changes in the pollen assemblages of this zone may represent a partial recovery of the tree and shrub vegetation as the diversity and % representation of the herbaceous taxa fall. Such a recovery indicates less disturbance.

Zone f. This zone (85-100cm) shows rises in the % pollen of Pinus, Taxus, Betula, Myrica (bog myrtle), Corylus, Cyperaceae, Calluna and Rumex (dock).

This disturbed horizon (with its stone layer) is clearly complex with sharp variations in the % representation of various taxa. The stone platform was probably placed onto this horizon and pushed into the peat, thus the pollen in these levels is not necessarily contemporaneous with the building of the platform. Possibly the rise in % Corylus pollen which had begun in the zone below (e) showed another recovery from clearance. This recovery was abruptly disturbed by man on laying the stone platform.

Zone g. The zone between 4-85cm represents changes since the building of the platform to the present day. Betula, Alnus and Quercus all disappear from the pollen record whilst Gramineae, Calluna and Ericales all increase in % P.

The sharp peak of Plantago pollen and the rise in diversity of the herbaceous taxa at the beginning of the zone probably represents the disturbance caused by building the platform.

The above description is brief and further analysis and description may provide more information.

III Discussion.

The changes reflected in the pollen diagram and in the sediment show a complex set of interactions between man, the oceanic climate, the local water table and the vegetation. It is very difficult to disentangle these interrelationships and make sense of the variation in pollen assemblages. The above description and discussion is an attempt to highlight the more obvious changes and a closer inspection of the diagram shows even more detail.

This detail shows the response of the vegetation to changing water table conditions and also to what are probably local clearances and subsequent recoveries. The diagram shows for instance that clearance had probably occurred at least once before the building of the platform and erection of the stone cross. (The stone cross, partially buried in peat, appears to lie upon the stone platform seen in the section. This was tested by a series of probes).

Comparison of the Imlagh pollen diagram with others is difficult partly because of the strong oceanic influence at Imlagh and also because there are few other diagrams. Jessen (1949) published a diagram from Emlaghlea (11km to the south east) but I found a comparison difficult.

Lynch (1981) has published radiocarbon dated pollen diagrams from Cashelkeelty (40km to the east south east) Dromatouk (60km to the east) and Dromteewakeen (48km to the east north east) amongst others. Again detailed comparisons would be hard to make because of the different environmental and ecological controls affecting these sites and the one at Imlagh. It appears possible that the more characteristic changes in the woodland assemblages that occurred before widespread clearances are missing from the Imlagh site. With only a disturbed vegetational record it is hard to compare vegetational sequences as sites vary so greatly.

Lynch's Cashelkeelty I pollen diagram shows Pinus finally disappearing at around 3000 bp. This date for the disappearance of pine from the pollen diagram is by no means going to be applicable to other sites but it may allow a tentative dating of the upper part of Imlagh zone c to about 3000 bp. The subsequent recovery of some shrubs and trees at Imlagh and their clearance during and after zone f points to this zone (f) representing Early Christian times.

Other similarities between Cashelkeelty and Imlagh exist but without radiocarbon dates at the latter it is probably best to avoid too much speculation.

9. ANIMALS

The chief feature of the area is its summer sea-birds, most notably on the Little Skellig, Great Skellig and Puffin Island (now the property of the Irish Wild Bird Conservancy). But they will have departed by October, and also the Corncrake, which still lingers on Valencia Island. But the Eagle is gone, though it still gives its name to a headland, Beenaniller (Binn an Fhiolar) on the island.

On the whole the dullness of the local botany is reflected in the animal life. But the Lusitanian Spotted Slug (Geomalacus maculosus) is on the mainland, and the Natterjack Toad (Bufo calamita) is not far away on the sandhills around Glenbeigh.

The fauna (and flora) of Valencia Harbour are recorded by Browne et al. (1899), following on two summers' work.

Praeger (1947) reports that the Great Skellig has thirteen molluscs (9 snails, 4 slugs) which on the mainland affect native habitats, and are not associated with man. How they reached the rock is a matter for speculation.

10. PEOPLE

Little is known of any occupation of the area before the Bronze Age (2000 BC). Nothing Mesolithic is known though recent discoveries at Ballyferriter in the Dingle Peninsula, suggest that Mesolithic people may have reached that area.

Ann Lynch (1981, p.117) records forest disturbance near Kenmare dated to between 4,000 and 3,000 BC which was probably due to the activities of Neolithic farmers, but no Neolithic objects are known from the area.

Around 2,000 BC Bronze Age people, perhaps initially seeking supplies of copper and tin, came into the area from Brittany. Presumably they also farmed, and they buried their dead in wedge-shaped megalithic tombs, of which there are no fewer than five in the area; we shall see two of these. Though there are local copper-bearing deposits (but no tin), finds of copper or bronze objects are remarkably few.

Though the Iron Age (500 BC - 450 AD) is a shadowy period in Ireland, the massive stone fort at Staigue, 11km east of Waterville, shows that there must have been a population at this time.

In the early centuries of the Christian Era small round sites surrounded by a bank of earth (rath) or of stone (cashel) were apparently the farmhouses of the day. There are several raths at Foilmore, north-east of Cahersiveen. Professor O'Kelly excavated a cashel at Leachanbuaile, north-west of Cahersiveen, and also a site on Beginish in Valencia Harbour (see Pochin Mould, 1978). The latter was a group of huts, surrounded by

old fields. A stone with a Runic inscription suggested a date about 1050 AD. There is a similar site on the south slopes of Bray Head on Valencia Island. Cashels were sometimes used as burial grounds, and we shall see one at Kildrenagh, where as well as numerous small grave-markers, there is a standing-stone with both a cross and an Ogham inscription.

Near Beginish is Church Island, a small rock with graves, houses, and oratory, and also a standing-stone with both cross and Ogham. We shall see a much more elaborate site on the Great Skellig, and a more simple one on Puffin Island. Such sites are very common in the area, and imply a considerable monastic population (see Barrington, 1976).

The Vikings passed by, and the Normans put in a brief appearance, but history, and castles, really begin with the late sixteenth century Tudor re-conquest. But the poverty of the land is reflected in the very small number of buildings (or ruins) of any pretensions.

The disastrous effect of the potato on the well-being of the people is illustrated to the full in Kerry. A population of 216,000 in 1821 had jumped to 294,000 by 1841. Twenty years later in 1861 famine and emigration had cut away one-third, bringing the population down to 202,000. A slower haemorrhage followed until in 1971 it had dropped to 113,000. Valencia Island confirms the story; 2,900 in 1841, 700 today.

Everywhere we can see mute signs — chiefly abandoned 'ridges' or 'lazy-beds' that the population was formerly much greater than it is today.

DAY 4 IQUA 1983 Farranfore - Knightstown

At 13.30 h we depart from Ulick's Bar, Farranfore, and drive south on the Killarney Road. We halt at Barry's Glyn (V 953978), opposite Glengrange Farm. The outwash channel here is part of a complex of ice marginal drainage features associated with the Kilcummin moraine system of Midlandian age. The channels initially drained into an ice-dammed lake, which in turn drained to the north through the Gowlane channel (Q 925008). As the ice withdrew the proglacial lake found its exit ice-marginally at Ballybrack (V 914987) at progressively lower levels; it was during this time that Barry's Glyn was cut (Warren, 1977, 43).

We cross the stream (stepping-stones) to see the famous Ballydeenlea outlier of Cretaceous chalk. A solution-pipe in the local Namurian shale, perhaps 50m in diameter, contains typical chalk with flint, through which angular fragments of shale are scattered (Walsh, 1966).

We return to Farranfore, and take the road to Killorglin. 9km beyond Killorglin, on the Cahersiveen road, we turn left at V 731945 down a land towards Muingaphuca which soon brings us to pits in a moraine belonging to the Kilcummin system. The pit on the left is a site for dumping toxic waste: we visit the pit on the right. The pit shows till, fluvioglacial gravels and sands, ice-contact features, and ice-wedge casts. The moraine lies amid blanket-bog, and there is a good view of the mountains to the south.

We continue through Glenbeigh, and climb up out of the Behy valley with its fine glacial features (Lewis, 1967) to the coast at Kilkeehagh (V 590880). Here from a lay-by, we see remnants of terraces of head below us, we see the spits in the inner part of Dingle Bay to our right, while straight ahead we have the mountains of the Dingle peninsula.

We continue on, and the road climbs to Kells Post Office. A little farther we cross a col, and come into the head of the long valley, controlled by the Coomnacronia Fault, that runs west-south-west to Cahersiveen and Valencia Island. We halt at V 535840 for a view of the local topography. To the north, across the fault, we have the Knocknadober Ridge, which runs south-west to Killelan Mountain. To the south we are looking at the pediment in the upper Ferta valley. We see a flat-floored basin separated from a surrounding horse-shoe shaped ridge of higher ground by an abrupt break in slope. To the south-west we see a limited area of higher ground in the floor of the valley around Foilmore.

We move on to Foilmore (Fig. 6) and see moundy ground dissected by migrating meanders of the Ferta River and its tributaries. At Foilmore Bridge a surviving block 15m high and 50m long stands between two meander scarps. The section is at the far side of the river, and access is by wading - if possible. Reading upwards towards the left from the bottom right-hand corner we see

(a) Rounded rock (which ought to carry striae)

(b) Sand and silt, varved in places, but much disturbed, perhaps by load-casting

(c) Bedded gravel and sand (with till units?) dipping apparently to the left; old cracks have sheets of translocated clay

(d) Cryoturbated surface layer with festoons to at least 2m.

It seems there must have been ice-ponded water nearby. It is not easy to say whether the uneven topography is due to primary deposition or to subsequent dissection.

As we leave the site, we see that two of the neighbouring mounds carry raths on top. As we continue to Cahersiveen, we get glimpses of the Carhan Pediment to the south; we see it also has a tilted flat floor and a surrounding ridge of high ground.

We pass through Cahersiveen, and take the Waterville road as far as the river at Oghermong, where we turn right towards Portmagee. At Portmagee we cross the bridge onto Valencia Island, and turn right for Knightstown.

DAY 5 I IQUA 1983 Puffin Island (Fig. 7)

Puffin Island (166m) is the detached tip of a promontory that runs south-west from Height 314m (V 360696) 4km south of Portmagee. Puffin Sound is narrow, with a strong tidal race.

When we look at the island, we see it almost severed into an eastern and a western half by a deep but interrupted fault-controlled cleft that runs north/sout from Cormorant's Rock to Poulacocka Cove. The eastern half (which has a general eastwards tilt) is divided into a relatively flat northern third, lying between 17 and 50m OD, and a more hilly southern part which rises to 90m OD; the dividing line is a marked change in slope.

The western half, best seen from the seaward side, is a high broken-backed ridge, cut into three units by two fault zones which run almost east/west. The ridge has been created by a sea-cliff (sloping west at an angle of about 40°) cutting back a land-surface which slopes eastwards at about 25°. This feature is well seen in the northern unit, which runs NNE/SSW, and slopes down from a high point of 166m OD till interrupted by the north/south cleft.

Only a fragment of the old eastward sloping surface survives on the central unit, which is cut into by steeply sloping sea-cliffs on both west and east. Relative to the northern unit, this unit appears - along the line of the Birds' Cove fault-zone - to have been re-aligned NE/SW, to have been rotated slightly so that western slopes are lessened and eastern slopes steepened, and to have been lowered, so that the high point in this unit is 144m OD.

If the dramatic change in topography to the north and south of the Birds' Cove chasm is the result of such faulting, then the movement on the fault must have taken place after the topography had been blocked out. Detailed study of the two rock-walls of the chasm might demonstrate the extent of the movement.

An abrupt drop in the level separates the third, south-western, unit which runs out to Canduff, the tip of the island, from the central unit. Another fault-zone, here called the Canduff zone, is probably responsible. No portion of the old land surface survives in this unit, where the west and the east cliffs meet in an arrête.

We land immediately south of Oats Island, and make an anti-clockwise tour.

We quickly come to a blow-hole (marked with a circle on Fig. 7), whose walls show a 4m section in head built up of rock and drift with erratics, resting on rotted and crushed rock. There are involutions in the upper part of the head.

We continue on across a low-level area of almost bare rock with jagged spikes. Salt spray may restrain plant growth here.

On the north-west side of the flatter part, where, between Carrignarone and Cormorants' Rock, the cliffs are quite unprotected, there are, at the head of one gully, at a height of about 35m OD, three storm beaches, one behind the other. The outermost, youngest beach lies about 10m back from the cliff-edge; it is about 3m wide and 2m high, and is built up of imbricated slabs, up to 1m square and 20cm thick; there are no lichens on the slabs, which were probably torn from the cliff-face as the waves surged upwards. The second beach, 15m behind, is rather smaller; its slabs carry small lichen growths. On the third beach, some 12m further back, there are larger lichen-growths and some development of soil.

We move on to the deep cleft south of Cormorants' Rock, where a massive rock-fall is slowly proceeding. Along the east side of the cleft, over a length of about 150m and a breadth of 10m, the rock wall is foundering. Great slabs have been dropped by about 2m, and blocky talus at the angle of rest runs down into the cleft below. According to the local fishermen who used to place lobster-pots in the cleft, the movement began six to seven years ago. The aerial photographs taken for the Geological Survey in 1973 show no sign of the movement.

As we turn up the steeper slope to the summit, at about 100m OD, we can still find erratics, but I have not seen them above this level.

We move back downhill to Birds' Cove, a striking fault-chasm. In places strings of quartz and crush-breccias can be seen in the rocks.

We do not visit the south end of the island, where the slopes are steep and treacherous, but proceed back to the landing-point, passing the remnants of former blanket-bog. The peat is up to 60cm thick, but

it has been so burrowed into by rabbits, puffins and shearwaters that it is no longer in active growth.

Close to the landing-point there is a small anchoritic enclosure (Fig. 8), about 50m square, bounded by the remains of walls and banks (marked on Fig. 7 by a +). It contains a ruined beehive hut, a circular area with burned stones, an erect slab, and an area with scattered pieces of quartz. There are some traces of old fields nearby. The site is not listed in Henry, 1957.

We embark again and return to Portmagee.

<u>DAY 8 II</u> IQUA 1983 <u>Valencia Island</u> (Fig. 3)

The starting-point is the north end of the approach road to the bridge to Portmagee; we head west. At the first bend to the right we see a promontory fort, named on the map <u>Cromwell's Fort</u>. The site has nothing to do with Cromwell, as it appears on maps which predate him. It is probably a corruption of Cromchoill, a twisted or wind-trimmed wood. We pass the ruined Anglo-American Cable House, where the first successful cable came ashore in 1865, and stop round the bend to the left. Here in a quarry we see a 2m section in shattered slate, strongly festooned to the base of the section.

We turn to the right, and continue to the next turn to the left, passing cottages with shelter-belts of <u>Phormium</u>; here we leave the cars. We are standing on drift banked against the eastern rock-slope of Bray Head; a tongue of drift runs round the side of the slope, where we shall see a 5m section. The drift quickly peters out to the east, and we see a torn or inselberg of rock rising out of the blanket-bog.

We walk west to see the contrast between the rock-slope above and the head-slope (or solifluction-slope) below; it is clear that great blocks of rock have been 'floated along' in the head (see French, 1976, p.139). We continue to the cliff-edge between Bray Head and Beenanillier Head, where we have a fine view of the cliffs. We are walking on head from now-vanished slopes to the west; the eastward slope on the head is about 2°.

We follow the cliff-edge east, and see examples of cliff-falls, both old and new. The sea is re-excavating a cove east of Beenanillier Head, and we see a section through 2m of head resting on drift. The 'pre-glacial' cove was larger than the present one. As we round the cove we see an old field-wall running for 100m from cliff-edge to bog.

We then come to an area with a considerable amount of drift, which like the cliff-edge, is being eroded by the waves. The waves tear cobbles up to 30cm long out of the drift and hurl them onto the top above. A mound of beach formerly carried a bench-mark at 114 ft OD (35m), but this has been largely carted away. A beach-ridge 40m long and 1m high largely covered by vegetation at about 100 ft (30m) still survives. There are slab-beaches at about the same height on Puffin Island.

Bennakryraka Head has a cap of drift, seen in section in two chasms. A 10m section in a chasm wall shows alternate layers of drift and head, the upper part being heavily cryoturbated. As the waves are stripping away drift and revealing rock below, it is hoped that members of the party will make a determined hunt for striae. There are more old field-walls here.

We move on across the bog to the site marked Stone Crosses. When first erected the crosses must have stood in a monastic settlement on rock surrounded by blanket-bog; after the site was abandoned peat continued to form, and the crosses are now partly buried by peat.

We walk on to a triangulation point at 101 ft (30m) (V 352762), and look southwards down into the basin, with higher cliffs behind us. To the east the inward slope of the cliff is littered with relatively large blocks of local rock; these are probably thrown up by storms, in the way the pebble beaches we have already seen were thrown up.

We walk a short distance east to see the exit of the stream that drains the basin. The water ramifies across a flat sheet of rock before dropping down a short cliff into the sea. We cross the stream and walk a short distance upslope to see more alignments of boulders, old field boundaries, part exposed, part still buried below peat. We return to the cars.

We take the inland road towards Knightstown. We stop at Kildrenagh (V 377757) to see a circular enclosure, which contains very many small grave-markers and an oghum-stone, which has also an incised cross. The stone reads LOGITTI MAQI ERPEN (Logitt, son of Erp). Such crowded graveyards are often called killeens, used for the burial of unbaptised children, but I regard them as deriving from overpopulation and poverty in pre-Famine times. A short distance upslope we see another wedge-tomb, similar to that at Coom. Here in Cool East Td. (V 376758) there is a short, broad chamber, a heavy roofslab, and sides of single slabs; there is no portico (de Valera & O Nualláin, 1982, p. 61).

Here we get a splendid view of the Portmagee Channel or Rock-basin. The channel drowns the floor of the basin, and on the far side we see the narrow pediment slope at Laharan, the dissected Ardcost Pediment, and the smaller pediments at Garrane and Portmagee.

We continued on, and again meet the Coomnacronia fault-scarp on the north face of Kilbeg Mountain; we pass along the steep slope. If time permits we will drop down to sea-level at Glenleam (V 403772) to see the famous gardens with many trees and bushes from South America and Australia which flourish in the sheltered, almost frost-free conditions here. Australian tree-ferns (Dicksonia antarctica) are especially common.

We return to Knightstown.

We drive from Knightstown to Portmagee, and take the Ballinskelligs road. After a short distance we turn right down a minor lane, to reach the shore at Reencaheragh (V 356728), where drift rests on rock. North of the lane we see

5m Festooned 'drift' with 'brodels'; many of the stones stand erect; there are large striated erratics; there are some ice-wedge-casts at the top

3m Festooned shattered rock with occasional erratics

Rock

South of the lane we see

4m Festooned 'drift'

2m Laminated 'till'

Modern beach

We return almost to Portmagee, turn right up a minor road, and stop at a pit at Doory (V 367723). Here we see a 6m section in cryoturbated sands and gravels with some ice contact features and also ice-wedge-casts.

We return to the Ballinskelligs road, and proceed up hill to the point (V 362704) where a lane with a nearby abandoned cottage leads east across the head of the pediment. Here we leave the cars (Fig. 4).

The rock-slope is about 20° east, and we see the remains of a debris-slide that took place some years ago. The thin mantle of vegetation slid down, carrying some stone with it, surrounded the cottage and blocked the lane.

We continue up the road and reach some excavations in head, where we are at about 170m (550'). There do not appear to be any erratics at this level. The dip on the head fragments is about 30° to the north-east, and the slope below the road is about 26° in the same direction. If we look back uphill above us we can see hillslope tors.

We reach the top of the ridge, and turn east along the track that leads to the television mast. We are on rock, covered by a thin skin of blanket-bog.

We walk along the track for about 1.5km, and turn south-east downslope on the northern flank of the Ballynahow valley to get an impression of its form. It is the only significant river valley of the area, which is extensively dissected by pediments. From a vantage-point at about V 385702 we can see the upper open section, a lower incised section, both following the strike direction of the rock-cleavage, the fault-controlled change of direction, and the resumption of strike direction when it emerges on the remnants of the Keel Pediment, into which it is incised.

We return to the track, cross it, and turn downslope towards Lateeve. Here we are on a rock slope, dipping 20° to the north-west (Sector H). There is a thin skin of vegetation and peat, and there is abundant evidence of debris slides, both recent and more ancient.

South of Lateeve, two steep-sided gullies are nicked into the concave rock-slope (Sector G). The gully-floors dip north-west at about 7°.

Abruptly we reach the floor of the pediment, and the slope flattens out, though the flattening is exaggerated by the drift mantle on the rock. For a short distance the stream has cut a trench 5m deep through the drift down to rock. The slope on the drift surface is 2° to the north-west, and the section is 2m cryoturbated head with erratics, 3m glacial gravel, rock.

If we stand on the bridge at Lateeve, and look downstream to the north-west, there is a steady slope at about 3° all the way to the exit of the stream into the sea, east of Portmagee. Were we to walk along the stream-bed, our feet would be on rock for two-thirds of the distance. The channel which has been cut by flash-floods broadens and narrows irregularly, and the height of the drift walls varies within narrow limits, say 2 to 5m.

We turn back west along the lane, to return to the cars. The lane first runs south-west, and rises gently up the slope of the pediment (Sector H). At Lomanagh (V 376707) we have reached 80m (260'), and are near the break in slope; there is a prominent spring-line north of the lane, while south of the lane the stream is cutting a narrow gorge back into the rock-slope.

To this point we have been below the straight rock-slope we descended on our outward walk, but now the slope changes and becomes concave (Section I). This change was also noted by earlier inhabitants of the area, as the townland name is <u>Coomanaspig</u>, the Bishop's Coom. We have already seen head deposits higher up the slope; they spread out across the floor of the coomb.

At V 370706, below a partly washed-away bridge, the stream has cut a deep section

1.5m	Blanket-bog
2.0m	Fine grey head, with faint cryoturbation in its upper levels
2.0m	Cryoturbated glacial gravel
	Stream

If we walk a short distance upstream we quickly come to rock. Upslope from the bridge the slope is about 6°; downslope it flattens out to 3°.

We continue up the lane to rejoin the road and the cars, having first struggled across the remains of the debris-slide already referred to.

<u>DAY 6 II</u> IQUA 1983 <u>Coomanaspig to Ballinskelligs</u>

From Coomanaspig we drop down a zig-zag hill into the valley of the Ballymaher River, and cross the stream almost at the point where it abandons a fault-controlled direction to resume a course parallel with

We stop at Keel to look north-east up the valley to the fault-scarp that truncates it. The floor of the valley south-east of the river displays a great deal of rock exposure.

At Killonecaha we visit a roadside pit which shows 5m of head resting on 6m of 'till'.

As we cross over the ridge to reach Ballinskelligs Bay, the road cuts through a narrow gorge. The gorge probably arises from erosion along a structural feature rather than from cutting by glacial meltwater.

Descending the hill, we make a short detour to the right to visit the megalithic tomb at Coom (V 405659), excavated by Professor Herity some years ago. It is a wedge-tomb of the Early Bronze Age (say 2,000 BC); these tombs typically consist of a portico and a chamber, the two being separated by a vertical slab; this type of tomb derives from Brittany. The tomb was discovered in 1882, when the slope was still covered by blanket-bog, through which only a few stones protruded (de Valera, R. & Ó Nuallain, S., 1982, p. 65).

Reaching Ballinskelligs, we turn south to the point where the road ends at a jetty. We walk about 100m along the beach, and see at the base of the drift cliff a granite boulder, almost 1m in diameter.

This piece of granite was apparently first noted on July 18, 1964, when the beach was visited by Excursion 30a of the International Geographical Congress, and was recorded by Francis Synge. Synge noted that the boulder was striated, that it was about 3m from the base of the cliff, that the cliff was of rubble drift of local origin, the upper part being disturbed by frost-heaving, and that the drift rested on rock, in places striated SSE-NNW.

On later visits I noted the cliff section as 2m cryoturbated till, 2m till, 2m laminated till, rock. I also found among the beach cobbles a further piece of granite and a piece of rhyolite, each more than 30cm in diameter. I also saw in the beach in Boolakeel Bay (1km to the south-west) a granite boulder which was too heavy for me to lift.

We turn back to the ruins of Ballinskelligs Abbey, a medieval priory of Canons Regular of St. Augustine, to which the monks of the Great Skellig are said to have moved when they abandoned the island. Here - if the tide level is right - we see a fine boulder of metabasite, probably from Connemara, and also submerged peat.

We walk along the storm beach or tombolo (c. 6m OD, and 1km long) which has the ruins of a MacCarthy castle at its tip. From the beach or the foreshore I collected (or noted) in 1982 30 erratics, and in May, 1983, Peter Coxon and I collected 30 more during a visit lasting one hour (for details see Table and attached note). Members of the excursion are expected to collect at least two erratics each, so that the total number found can be brought to 100.

Below the castle we see rock moulded into roches moutonnees, with striae running 255° Mn., SSW-NNE. If we can reach the rocks on which the ruined pier stands, these features are still better seen, together with disturbed drift.

We return to the cars.

Table PROVISIONAL IDENTIFICATIONS OF NON-LOCAL ROCKS COLLECTED FROM MODERN BEACH AND SUB-FOSSIL TOMBOLO AT BALLINSKELLIGS, Co. KERRY

	1982	May, 1983	October 1983
IGNEOUS			
PLUTONIC			
GRANITE	1	1	
S. GALWAY GRANITE (Trebane facies)	-	1	
DRUSY GRANITE	1	1	
VOLCANIC			
RHYOLITE	-	1	
VESICULAR LEUCITE-BASALT	1	-	
-LAVA	-	1	
PUMICE	1	-	
METAMORPHIC			
MIGMATITE	6	7	
METABASITE	1	1	
HORNFELS	-	2	
SEDIMENTARY			
CALCAREOUS			
CARBONIFEROUS MUDSTONE	10	9	
LIMESTONE	1	-	
OOLITE	1	-	
CRETACEOUS CHALK	1	-	
RECENT TUFA	1	-	
SILICEOUS			
SANDSTONE	1	1	
GREYWACKE	-	1	
FLINT	2	3	
CHERT	-	1	
	30	30	

Note When we look at the list, we see that Carboniferous mundstones are the most numerous: these are most likely to come from north Kerry or from seaward extensions of the same rocks. Second most common, the migmatities, are almost certainly from Connemara, as the Rosslare, Co. Wexford area is much less likely. The granites, especially the specimen of Trabawn facies, are probably from Galway. The chalk and flint come from undersea outcrops, as does the vesicular leucite-basalt, which may be of Tertiary age. The rhyolite could come either from Killarney or from Mayo; at one stage there was an ice-movement from east to west in the lower Shannon estuary.

Taken as a whole, a movement from north to south is indicated. Longshore drift alone could not have moved boulders 1m in diameter; floating ice could have moved such boulders; an ice-stream would have been effective. Was some of the material first deposited west of the present coast-line when sea-level was lower, and was it then trundled eastwards upslope as sea-level rose again ?

What is the age of the sub-fossil tombolo? It seems to me not unfair to regard it as a mini-Chesil Bank, which also contains far-travelled stones of uncertain origin.

Lemon Rock (20m), Little Skellig (130m), Great Skellig (214m), and Washerwoman Rock (2m) are the unsubmerged peaks of a promontory that runs west from Bolus Head; the general level of the promontory lies between 50 and 60m below sea-level.

As we pass Puffin Island, we see the rock-fall, and the broken-backed profile of the island, caused by east/west faults.

Passing the Little Skellig, though the general impression is one of bare rock, closer inspection shows that there are considerable quantities of indurated head tucked away in fissures and gaps.

Arriving at the Great Skellig, we land at Blind Man's Cove, and see immediately above us surviving patches of indurated head, with some boulders of considerable size.

From the Cove we take lighthouse road, 1000m long, which was cut into the rock when the lighthouses were being built between 1820 and 1826. The stone in the inner face has thus been exposed to attack by the atmosphere and by seaspray for more than 150 years, and etching is revealing many small scale sedimentary structures.

As we approach Cross Cove, if we look down over the low wall, we will see head in narrow crevices, which suggests that considerable rock-fracting had taken place before movement of head.

The axis of Cross Cove, like that of Blind Cove, lies parallel with the main direction of rock cleavage, and the coves have probably developed because of enhanced wave attack. As gullies, their axes can be traced southwestwards across the island, to reappear in the south and north arms of Seal Cove (Fig. 9).

Rock falls happen in Cross Cove, and the road round the cove is roofed. This means that light is poor, but some crush breccias can be seen. Fault movement parallel with the cleavage may have further weakened the rock here.

As we continue on, shortly after we have passed Blue Man's Rock we see a big fault cutting upwards to the right. In my opinion this fault runs right through the island, and is partly responsible for the shape of Blue Cove, to the north.

We pass round the active lighthouse (rebuilt in 1966), and reach Seal Cove, where a considerable quantity of indurated head still survives. Many of the elongated blocks lie at an angle of about 15°, and abut against a rock-slope at about 55°. If 15° is the angle of rest for the head, it is clear that its volume must formerly have been very much greater. If sea-level fell by 50m at the peak of the last cold stage, then the base of both the Great and the Little Skellig will have been exposed, and the Head will have descended to the platform surrounding them. Wave attack, both during rising sea-level and in modern storms, and atmospheric weathering have since removed the bulk of the head.

We continue on round the cove to the old lighthouse, where we note the fitted cut blocks of granite, the imported slabs of the wall-coping, and the cast iron fittings of the light-keeper's house. We re-trace our steps noting a drystone wall in a gully high up to the left. The island is full of short lengths of drystone walling; these may be of monastic age, or may have been built by the lighthouse men to keep in their goats.

We continue back past the lighthouse to a point just short of Cross Cove where we meet the bottom of the Southern Steps, part ancient, part modern, and begin the ascent.

We break off at a short distance to visit the "Wailing Woman", a slender slope-tor, almost 3m high. There are other much more impressive slope-tors on the north point of the island. It is not easy to see how such a slender pillar could have remained standing while masses of head sludged down past it.

Continuing up the steps, we reach Christ's Saddle, at about 125m, and see Blue Cove below us. The east wall continues the fault we have already seen below, and a second fault forms the north-west wall. The intervening block has disappeared, like a slice out of a cake. Another path and steps (now broken in places) leads down to Blue Cove - though there the sea is rarely calm enough for landings. If we descend for a short distance, we can look back into the inner part of the cove, and see more indurated head. BUT PLEASE NOTE that the descent is steep, and that the vegetation, if wet, can be extremely slippery.

We return to Christ's Saddle and see that on the south-east, to the west of the steps, there is a drystone revetting wall. There may be some depth of soil in the Saddle, and a limited amount of cultivation could have been carried out here.

We continue the ascent and reach the monastery (see Lavelle, 1977). Here in walled enclosures are six stone huts, an oratory, a church and numerous gravestones and cross-slabs, at almost 200m above sea-level. The site must have been an early foundation (dedicated to St. Michael), because it was raided by the Vikings in 823. The monks are said to have abandoned the site and withdrawn to Ballinskelligs in the 12th century.

We return to Blind Man's Cove and the boat. We cruise round the island to get a better view of some features, and return to base.

We drive to Portmagee, and turn east on the Cahersiveen road. We halt at V 412735 to see the Garrane pediment, and again at V 441737 to see the Ardcost pediment. This large pediment is now being divided by three streams flowing north-north-west. We look south-east past Kilpeacan to the gap in the hill-ridge where the Ardcost Pediment flows through to join the Mulngydowda Pediment.

At Aghnagar Bridge we turn south to follow the Derreen River through the gap as it has captured streams in the north-east part of the Mulngydowda basin. In the gap the river is in a deep channel; has this been cut by river action or by glacial meltwater? We proceed to Aghatubrid Bridge, where we view both the river capture and the Mulngydowda Pediment.

We proceed to the River Inny at Scariff. In its straight north-east/south-west course from Dercos Bridge to the sea, the river divides pediment slopes on the north flank from a steep hill-ridge on the south. This is the mirror-image of what we have seen on the north side of the central hill-ridge. The valley from Foilmore to Glanleam is controlled by the Coomacronia fault; I consider that the Inny valley is similarly fault-controlled.

We continue on and having crossed the tip of the hill-ridge we turn north-east to the Cummeragh valley. We have a splendid view of Lough Currane.

The Cummeragh Valley moraines (Fig. 10)

In the Cummeragh valley a series of well-defined arcuate terminal moraine ridges mark the limit of Late-Midlandian glaciation in the area. There are four distinct moraine systems, formed by the Waterville, Cloonaghlin, Derriana, and Coomavoher glaciers. In addition, moraine ridges of similar age are also visible in the upper part of the Inny valley. Each of these moraine systems can be related to glacial trimlines and breaches in the South Iveragh mountains. The Waterville system is the largest, damming Lough Currane and affording a site for Waterville itself. The village is built within a small area of hummocky moraine, but elsewhere the end-moraine takes the form of either two or three parallel ridges on the valley floor, or a steep-flanked ledge against the hillside. The moraine is broken in a number of places by meltwater channels, of which the marginal channel at Termon's Lake is among the more prominent.

The Cloonaghlin and Derriana systems are much smaller in areal extent, but their lateral moraines are traceable to considerable elevations on the flanks of their respective glacial troughs. Both these former glaciers appear to have possessed steep surface gradients and a high regimen. The southern lateral moraine of the Derriana system is extremely massive and has dammed a small lake (Lough

Ballinane) between the outer slope of the moraine and the side of the mountain. The Coomavoher moraine lies at the mouth of a steep-sided glacial trough which leads by a series of glacial steps up to a small plateau at an elevation of c.600m. Here, ice movement indicators suggest that the plateau was an independent centre of ice dispersal during the latter stages of the Last Glaciation.

We return to Waterville to examine coastal sections near the village. Here the drift appears to be older than the Late Midlandian Cummeragh moraines, and may be of the same age as that around Ballinskelligs. North of Waterville, sea-cliffs between the village and the mouth of the Inny River are composed of local stony till of purplish hue deposited in the Ballinskelligs glaciation. Sand and gravel lenses within the till display disturbances of two types: deformation by glacier ice, and periglacial involutions. The involutions are worthy of further comment. Where they occur in sections, they are invariably found within two metres of the ground surface, and intraformational cryoturbation has not so far been recorded. Their distribution is significant in that they are not found within the Cummeragh Stage moraine systems, but are widely distributed outside them. Some weakly developed examples have been observed in exposures in the outermost moraine ridges. It would seem that the involutions are broadly contemporaneous with the Cummeragh glaciation, and more specifically with the time when glacier ice stood at the inner moraine ridges.

At Waterville itself, the sea-cliffs cut through a number of mounds which appear to be morphologically similar to other nearby hummocky moraine features in the Waterville moraine systems. The exposures show chaotic assemblages of large boulders, probably deposited as ablation till, but surprisingly little fluvioglacial material. Petrologically this till appears to be little different from Ballinskelligs till, and nowhere is it possible to describe with certainty Cummeragh glacial till resting on Ballinskelligs drift.

South of Waterville, at Fouleragh, exposures in Ballinskelligs material reach heights of 40m. At the base of the cliffs there exists 2/3m of undisturbed horizontally-bedded sands, but much of the rest of the cliff is characterised by large glacial tectonic structures displaying complex folding and overthrusting of individual till or fluvioglacial members. In general character, these structures are still recognisable as those first described at this site by Carvill Lewis in 1894.

If this trip takes place, and if it takes place on the final day, then the excursion will disperse from Waterville.

If the trip takes place on a day other than the final day, then the trip will be extended up the Inny valley to see the moraines around Awroe Bridge.

We return to Dromaragh where west of the rock-knoll the stream has cut sections up to 12m deep in drift. The sections are rather inaccessible, but below the bridge we can see 3m of contorted drift, which has a stone concentration and involutions below its surface; blanket-bog buries the drift.

If time allows we will walk to the top of the knoll to see a remarkable concentration of old stone field-walls and other structures.

We return to Portmagee and Knightstown.

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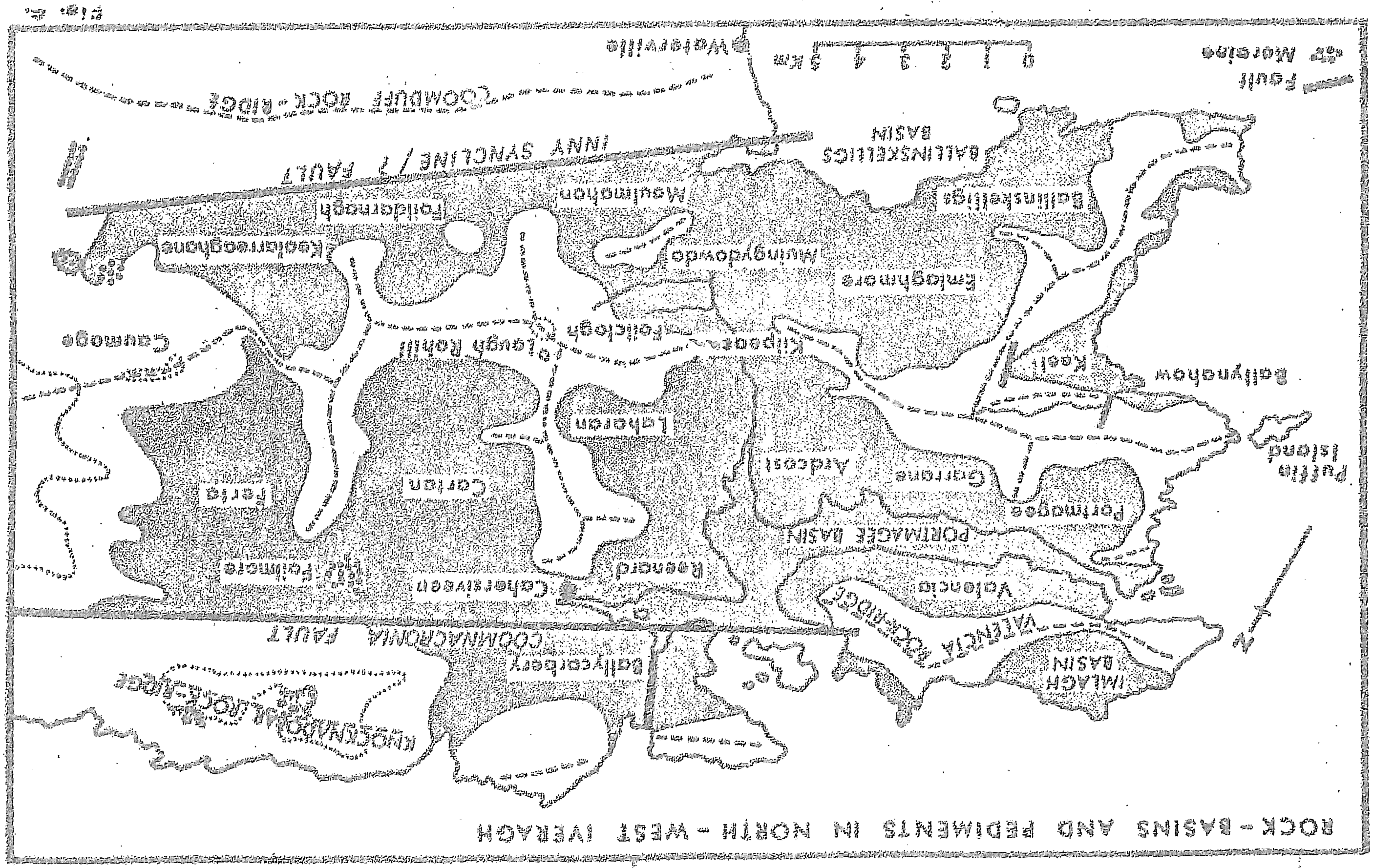
Fig. 2.


ROCK-BASINS AND PEDIMENTS IN NORTH-WEST IVERAGH
KNOCKNADOBAR ROCK-RIDGE
COOMNACRONIA FAULT
Ballycarbery
Cahersiveen
Foilmore
Ferta
Carhan
Reenard
Laharan
Lough Rohill
Foilclogh
Kilpoac
Caumoge
Koolarreaghane
Foildarragh
Moulmahon
Muingydowda
Emlaghmore
Ballinskelligs
BALLINSKELLIGS BASIN
INNY SYNCLINE / ? FAULT
COOMDUFF ROCK-RIDGE
Waterville
0 1 2 3 4 5 Km
IMLAGH BASIN
VALENCIA ROCK-RIDGE
Valencia
PORTMAGEE BASIN
Portmagee
Garrone
Ardcost
Keel
Ballynahow
Puffin Island
N
Fault
Moraine

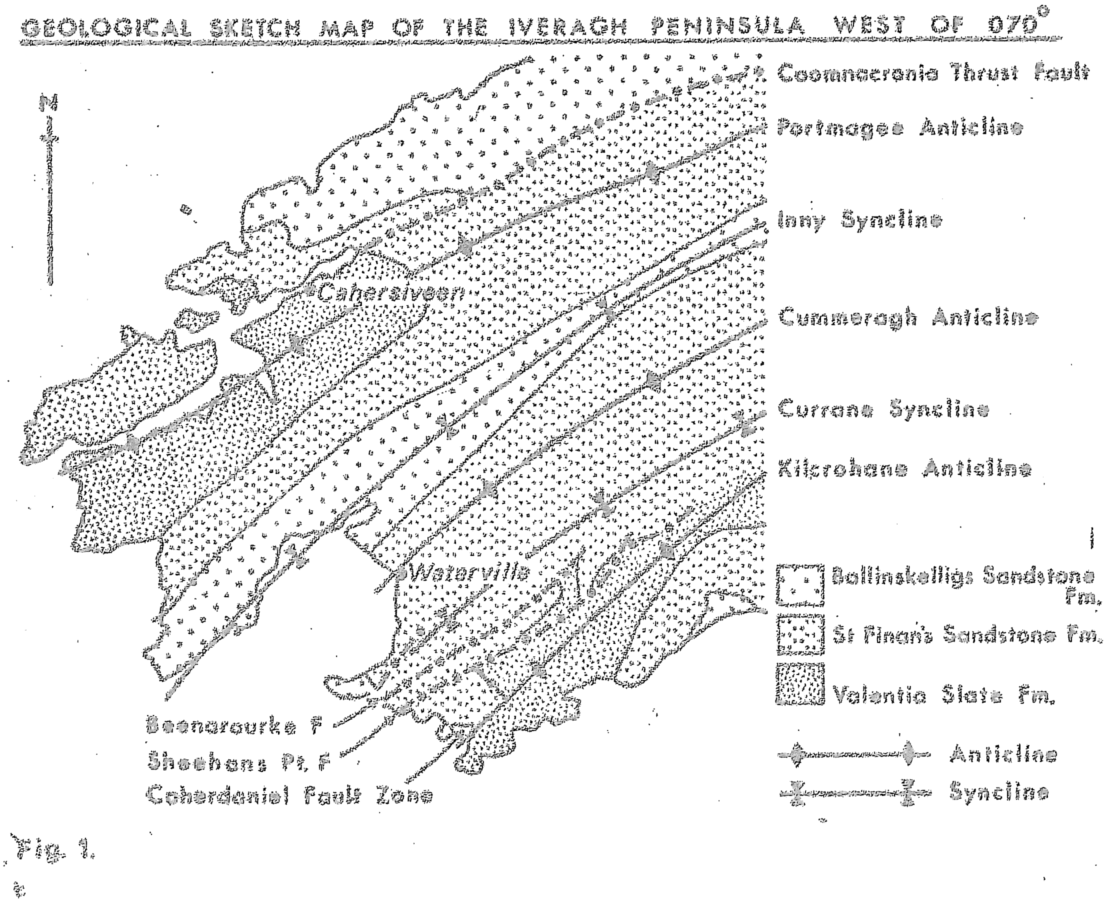

GEOLOGICAL SKETCH MAP OF THE IVERAGH PENINSULA WEST OF 070°
N
Coomnacronia Thrust Fault
Portmagee Anticline
Inny Syncline
Cummeragh Anticline
Currane Syncline
Kilcrohane Anticline
Cahersiveen
Waterville
Ballinskelligs Sandstone Fm.
St Finan's Sandstone Fm.
Valentia Slate Fm.
Anticline
Syncline
Beenarourke F
Sheehans Pt. F
Caherdaniel Fault Zone

Fig. 1.

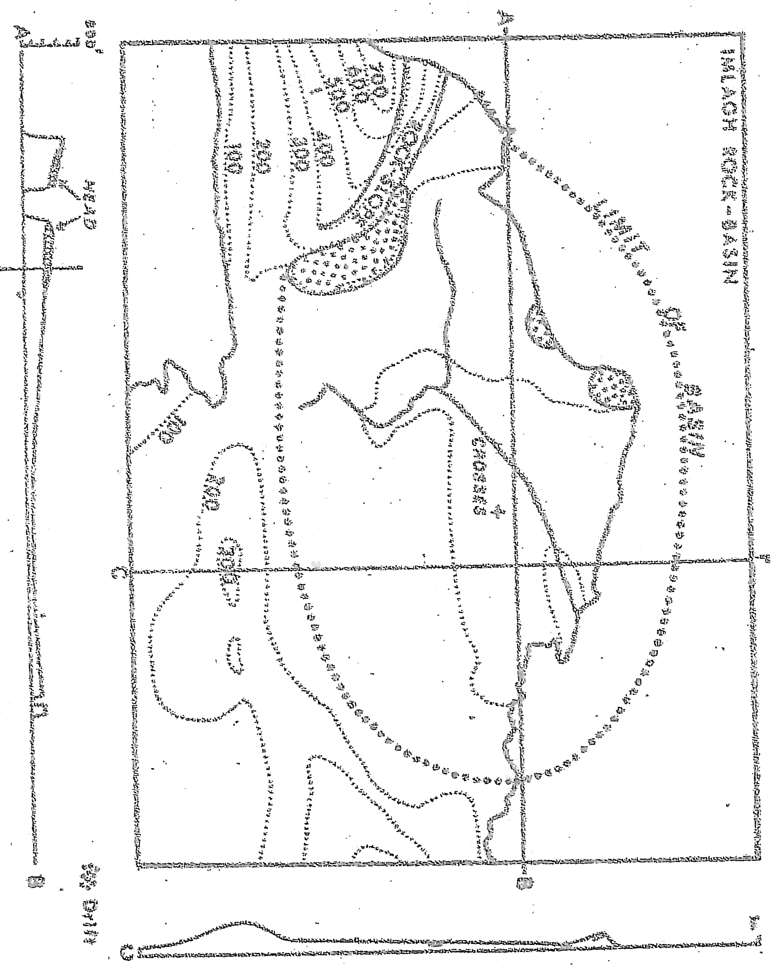

IMLACH ROCK-BASIN
LIMIT OF BASIN
ROCK-SLOPE
0
1000
2000
3000
4000 ft.

Fig. 3

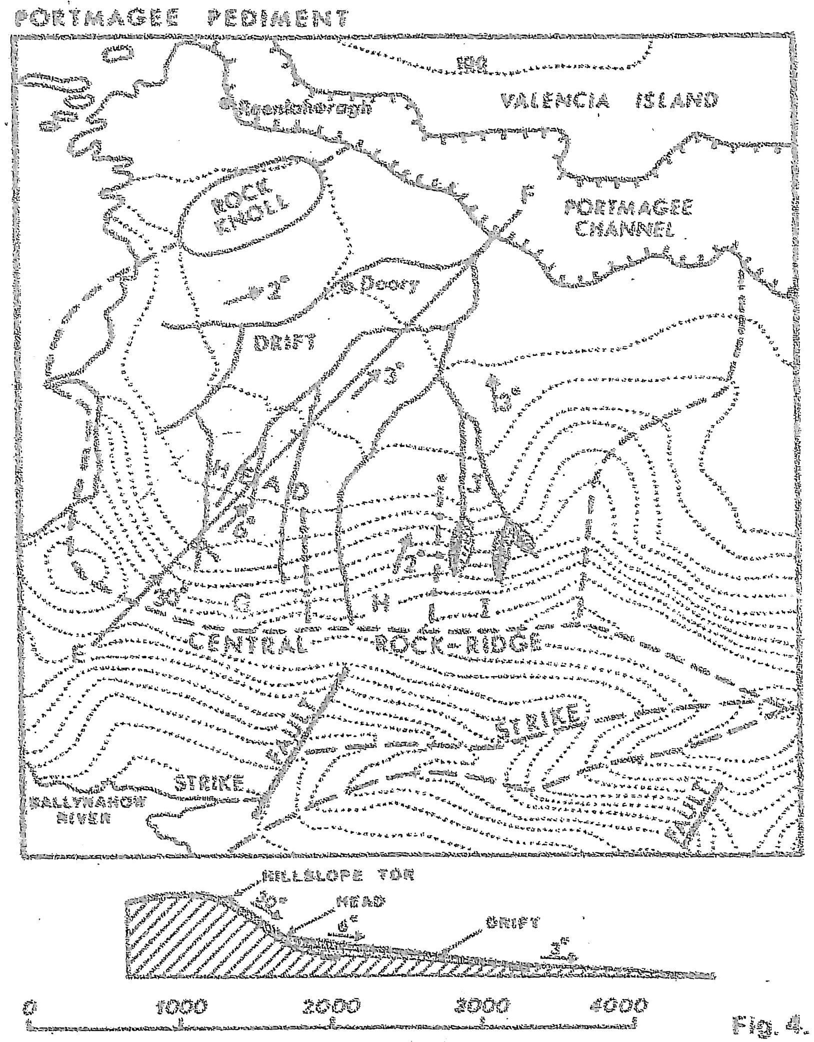

PORTMAGEE PEDIMENT
VALENCIA ISLAND
PORTMAGEE CHANNEL
ROCK KNOLL
Doory
DRIFT
CENTRAL ROCK-RIDGE
STRIKE
FAULT
STRIKE
FAULT
BALLYNAHOW RIVER
HILLSLOPE TOR
HEAD
DRIFT
0
1000
2000
3000
4000

Fig. 4.

Map of glacial features associated with the north flank of the Kenmare ice-mass. (after Warren, 1977)

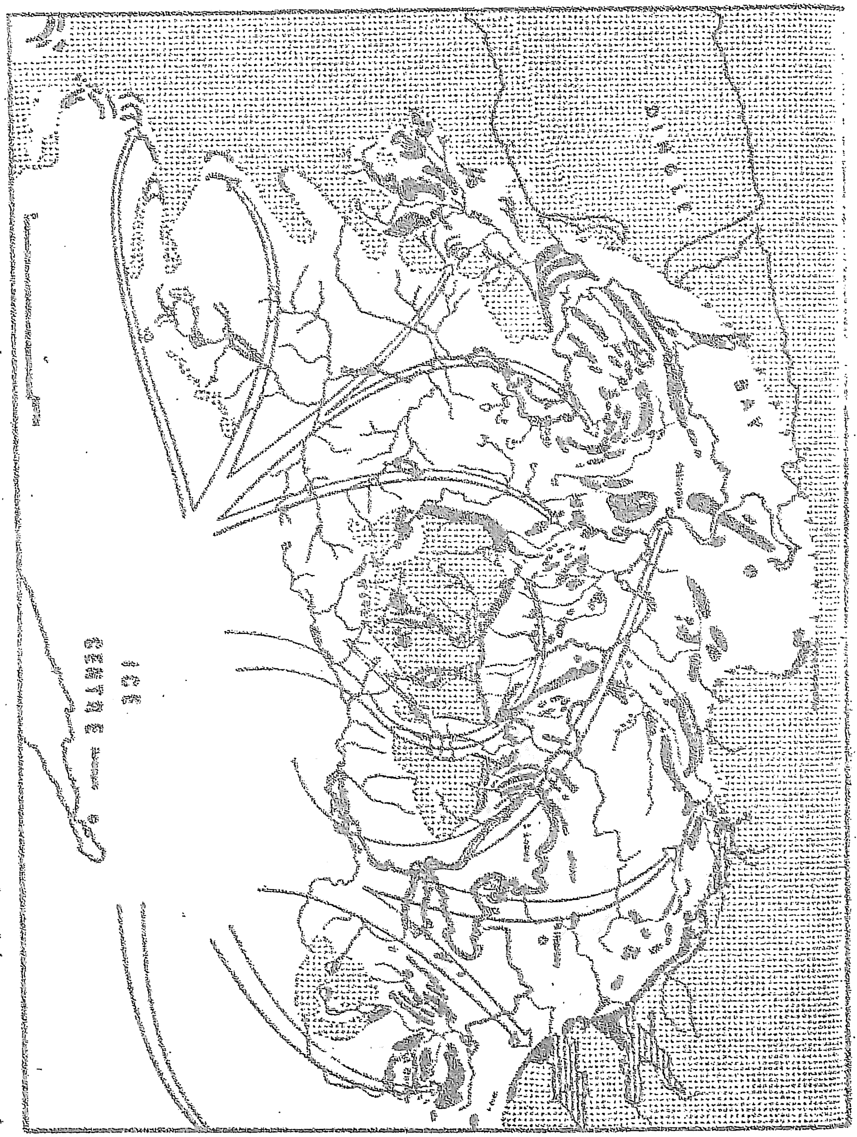


Fig. 5 Key: black areas are moraines; horizontally shaded areas were pro-glacial lakes; black [illegible] indicate melt water channels; [illegible]

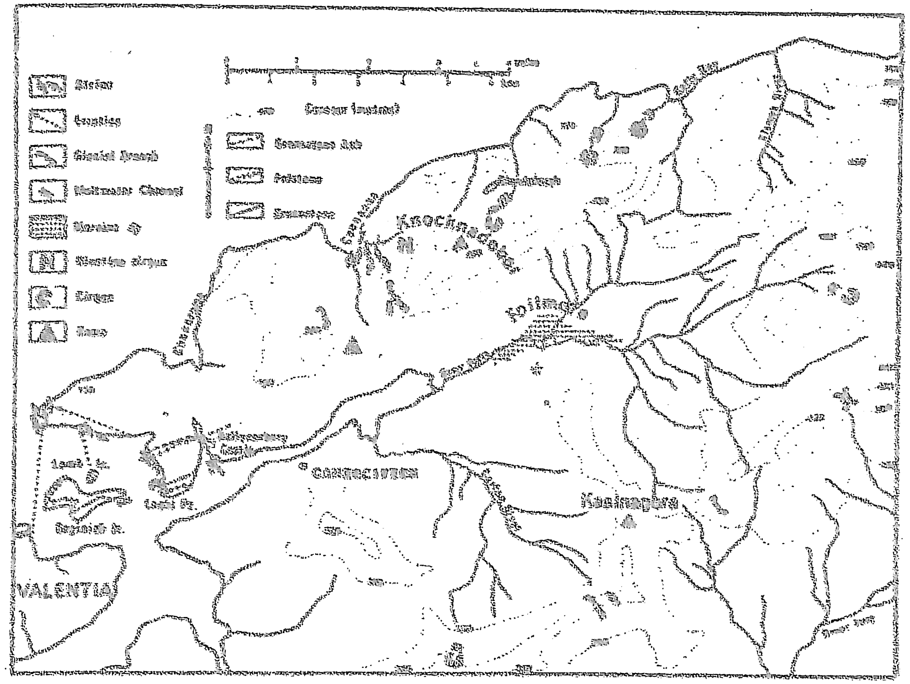


Fig. 6 Glacial features around Cahersiveen

(after Quinn, 1977)

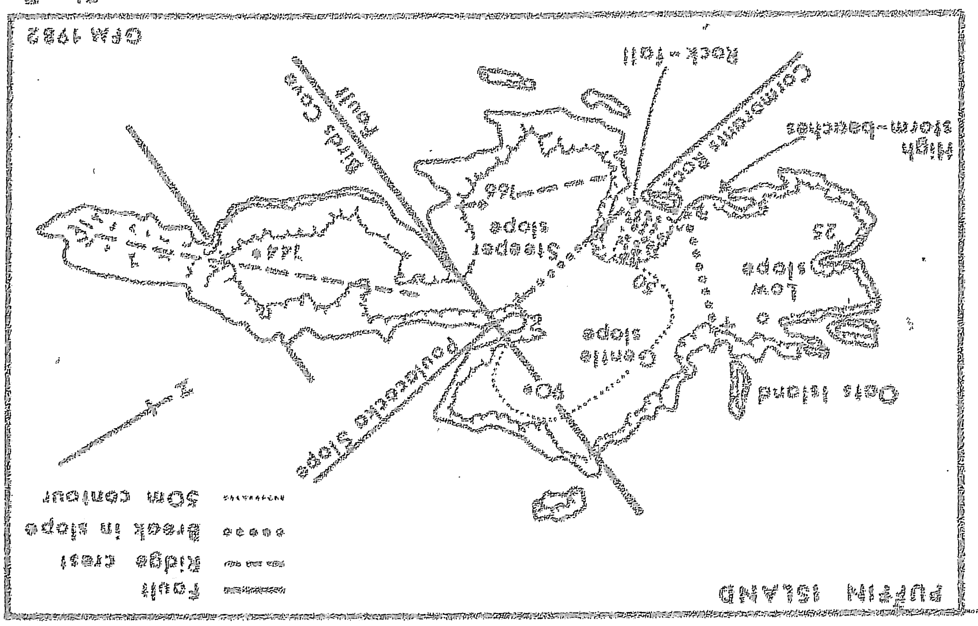


Fig. 7

CRUDE PLAN OF ANCHORITIC SITE, PUFFIN ISLAND, COUNTY KERRY.

A. Damaged beehive cell.

B. Circular area with burned stones.

C. Area with much quartz including rounded cobbles.

D. Erect slab.

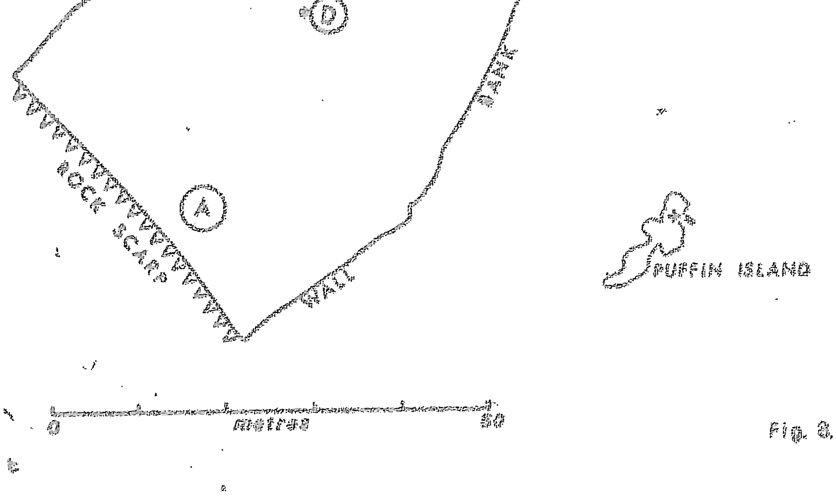


Fig. 8.

GEOLOGICAL INFLUENCES CONTROLLING THE SHAPE OF THE GREAT SKELLIG

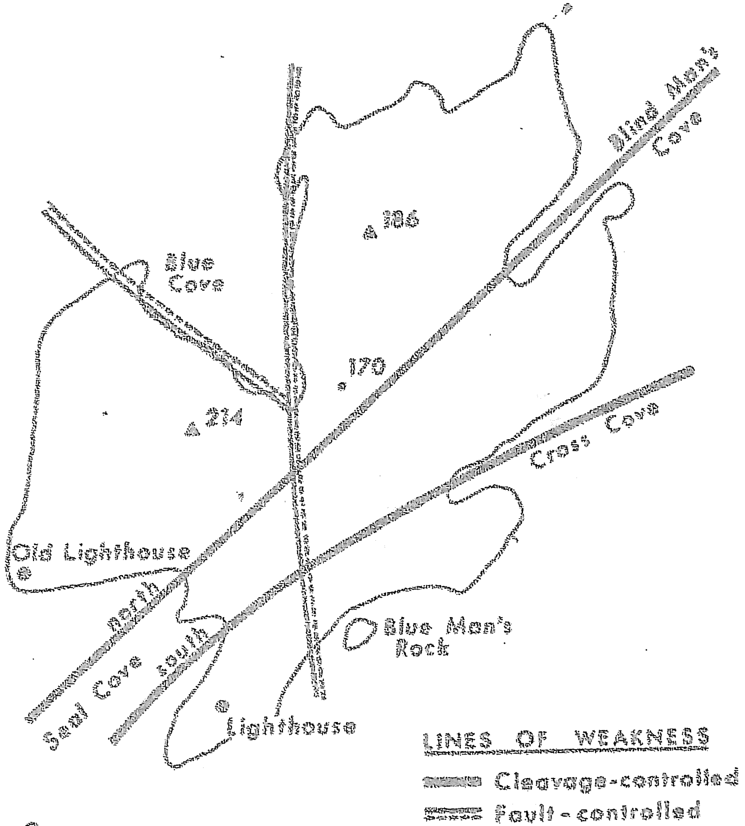
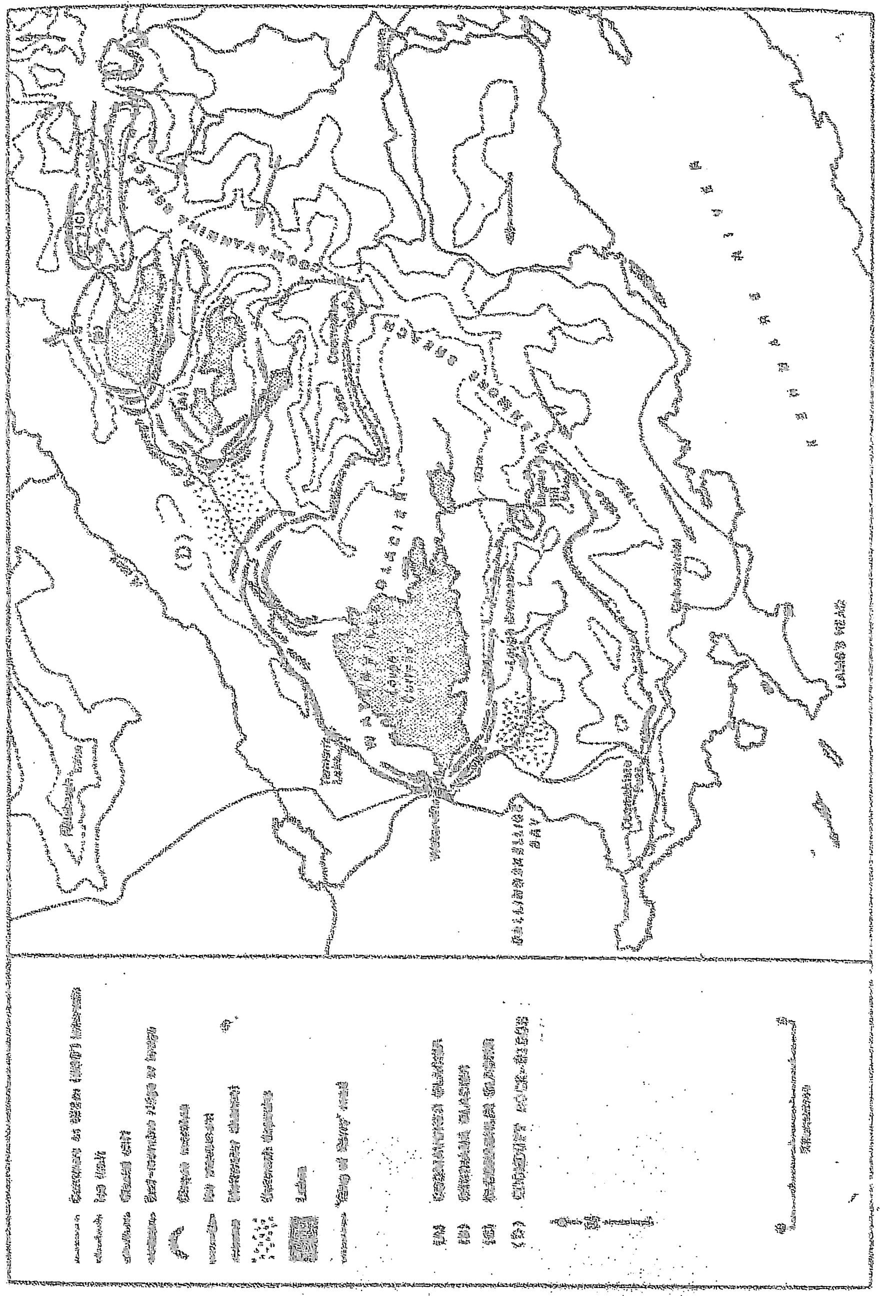


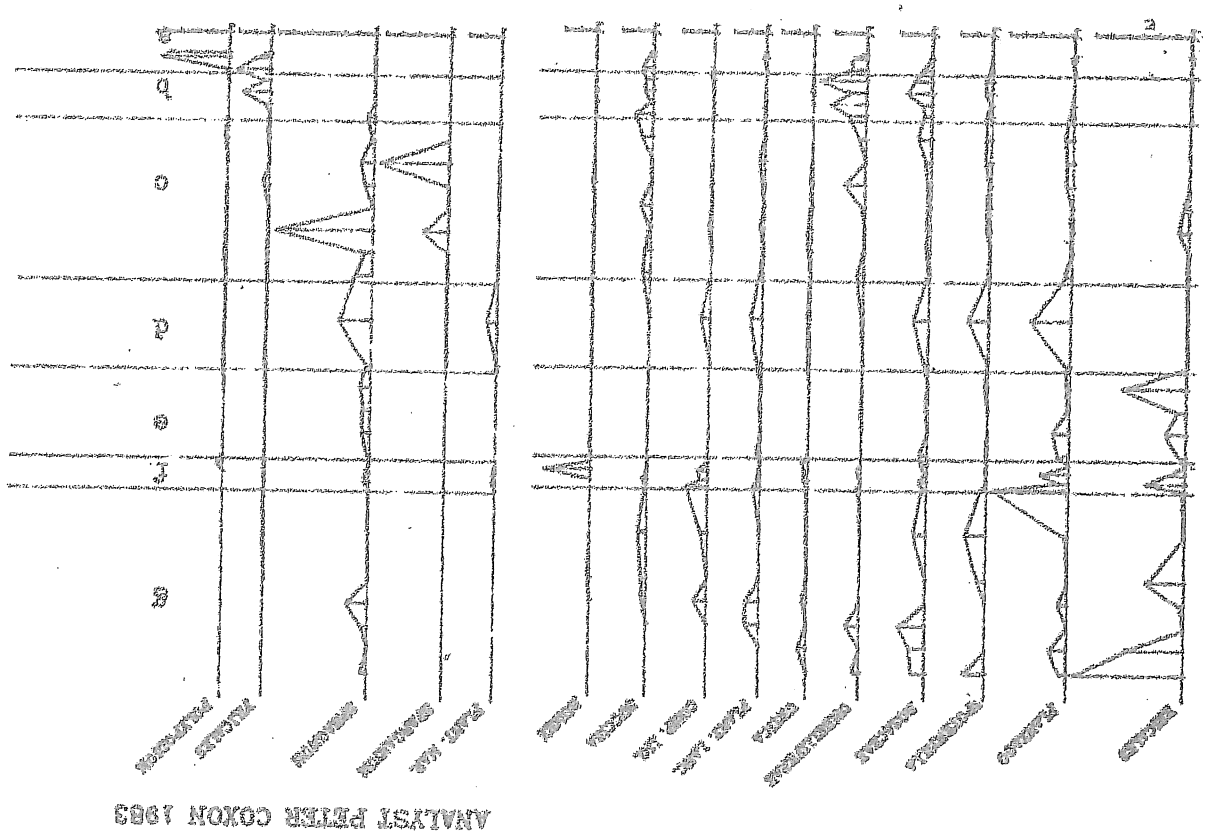
Fig 9.



Map of glacial features associated with the west flank of the Kenmare ice-mass.

(after Bryant, 1977)

Fig. 10



IMLAGH, VALENTIA

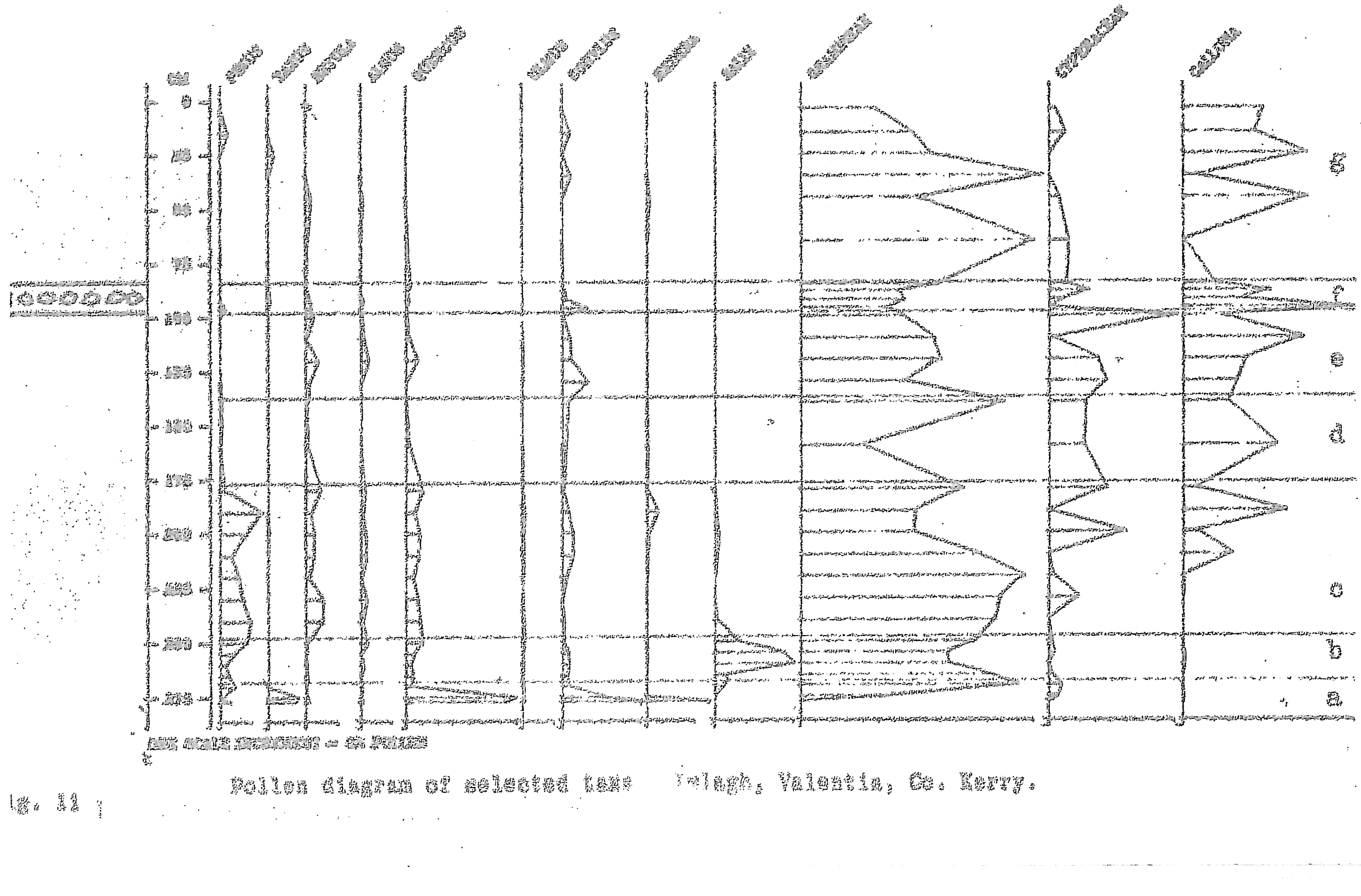


Fig. 11 Pollen diagram of selected taxa Imlagh, Valentia, Co. Kerry.