Comments covering this IQUA Fieldguide.

Usually IQUA publishes an annual fieldguide to cover its Autumn fieldmeeting. Preventative restrictions emplaced on fieldwork during the foot and mouth outbreaks in the UK meant that IQUA missed a previous fieldtrip and decided, at late notice once restrictions were lifted, to run a meeting in Connemara in 2001.

The associated fieldguide (with some added photographs by PC) is reproduced here as an introduction to IQUA's publications. Further fieldguides, **membership information** and so on can be obtained *via* our web page at:

http://homepage.eircom.net/~iqua/

The Sunday of our excursion was led by a well-known local archaeologist Michael Gibbons. His expertise on all aspects of the Connemara (and Irish) landscape is renowned. He can be contacted at:

walkwest@indigo.ie

or on the www at:

http://www.walkingireland.com/1.htm

Cumann Staidéar Ré Cheathartha na h-Éireann
Irish Quaternary Association

Western Connemara
Iarthar Conamara

Edited by Peter Coxon

With site information from (in alphabetical order)

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(identified by their initials in the text)

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Preface

This guide, which is not a printed publication like many other IQUA guides, is intended to complement a weekend field excursion (Friday 12th October to Sunday 14th October, 2001.) of the Irish Quaternary Association (IQUA).

The handout that we have produced is in place of a formally edited fieldguide because the excursion was organised at late notice due to uncertainties regarding field work in light of this year's (2001) outbreak of foot and mouth disease. It was felt that given the easing of f and m restrictions that IQUA should keep up its record of Autumn fieldmeetings as best it could.

Given the complexity of the Quaternary history of the region this information cannot be regarded as comprehensive. However, it is hoped that it will serve as an adequate introduction to the sites that will be visited and provide a useful guide to information on recent and, in several instances, still on-going research.

Unfortunately due to time constraints we cannot do justice to the Quaternary of the area and much of interest awaits the visitor.

Please note that some of the sites referred to in this handout are private property and permission should be sought before entering.

Material in this guide has been drawn from a number of sources which are attributed in the text.

The area that we will cover during this excursion is on the Ordnance Survey of Ireland's 1:50,000 *Discovery Series* sheets 44 (Saturday) and 37 (Sunday) and some of the sites that we will visit are shown on Figures in this guide.

Outline of the Field Excursion.

<u>Saturday 13th October</u>

1.1 Site 1. Drumlin Section, Ballyconneely Bay L621430
1.2 Site 2. Dog's Bay. L694386
Lunch. Roundstone House Hotel, Roundstone
1.3 Site 3. Loch an Chorcail, Carna. L766335
1.4 Site 4. View over Bertraghboy Bay
1.5 Quarry 1. Bóthar na Scrathóg.L 871397

<u>Sunday 14th October</u>

2.1. Crocknaraw (*Cnoc na Rátha*), near Clifden. L 659 558

Principally archaeological sites and what we find as we move along!

Saturday 13th. Itinerary and guide to site location/distances
Ordnance Survey 1:50,000 sheet 44.

Meet in the car park of the Station House Hotel, Clifden at 0930.

Site Including National grid reference	Distance (miles)	Cumulative distance (approx) (miles)	Comments Follow lead car. Just make sure you wait for the car behind at all turns. Then we can't get lost.
Clifden Station Hotel Car park L662508 (ish)	0	0	Zero mileometer Leave car park by bottom exit, turn right then first left onto the coast road heading south towards Ballyconneelly
	2.0		Veer right over bridge. Stay on coast road
	3.8		Note eroded drumlin in bay
L630456	4.4		View of the white 'coral strands' of Mannin Bay. (The sands are the remains of calcareous algae *Lithothamnion* and *Phymatolithon*)
	5.6		Ballyconneely. Keep going towards Roundstone. Slowly. Turn soon.
Site 1.1. Drumlin. Ballyconneely Bay L621430	**6.1**		Note cross roads sign. Turn right down Small lane. Veer right. Park in field several hund metres down this lane. (follow leader) **Site 1.1. Drumlin. Ballyconneely Bay**
	0	6.5	Back to main road. Zero mileometer at turn. Turn right.
	1.4		Drumin cross section on left hand side.
	1.7		Note drumlins inland too.
	5.3		We have just driven through part of the Clifden fault and now have a lovely view Over Dog's Bay
Site 1.2. Dog's Bay L694386	**5.7**	12.5	Turn right at signposted junction (Dog's Bay) and go down to end car park. **Site 1.2. Dog's Bay. L694386**
	0		Drive back up to main road. Zero mileometer At main road. Turn right.
LUNCH	2	15	Lunch. Roundstone House Hotel. First large White Building on the right in the village.
			Lovely drive around the head of Bertraghboy Bay and down into *Iorras Aithneach*.
	6.2		Go over bridge and turn right beyond the Riverview Bar. Signposted 'Carna 18km' Scenic road but narrow and windy.
	11		Turn right at the T junction Signposted 'Glinsk 6km'. Again scenic but watch the bumps and bends
	12.6		Note beautifully ice-moulded bedrock on left hand side road.

Carna	19.0		Turn right into Carna village and go through.
Site 1.3. Loch an Chorcail, Carna. L766335	21.0	34	**Site 1.3. Loch an Chorcail, Carna. L766335**
	0		**Drive back in to Carna.** Zero mileometers at church opposite 'Nearbuy' Supermarket in Carna. (ti mhic Oíreachtaigh)
Site 1.4. View. Tertiary Planation (?) L793384	4.6	41	**Site 1.4. View over Bertraghboy Bay** Little space to park. Be careful. Pull Well in.
	8.1		Note sign for right hand junction
	8.2		Turn right onto unposted road
			Very good views of scenery. Especially to North.
	9.1		As crossing small bridge note lovely Ice-moulded bedrock all around.
Site 1.5. Quarry 1. Bóthar na Scrathóg L871397	12.0	48	**Site 1.5. Quarry 1. Bóthar na Scrathóg.L 871397** We may go onto a second quarry. Time Dependant.
	0		Zero mileometers
	3.8		Turn right and keep going back to main Galway-Clifden road.
	ca. 7	59	Turn left to clifden. It is about 10 miles.

Sunday 14th. Itinerary and guide to site location/distances
Ordnance Survey 1:50,000 sheet 44.

Meet in the car park of the Station House Hotel, Clifden at 0930.

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Co. Galway, Ireland
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In Ireland: 1-850-CONNEMARA (1850-266-636)
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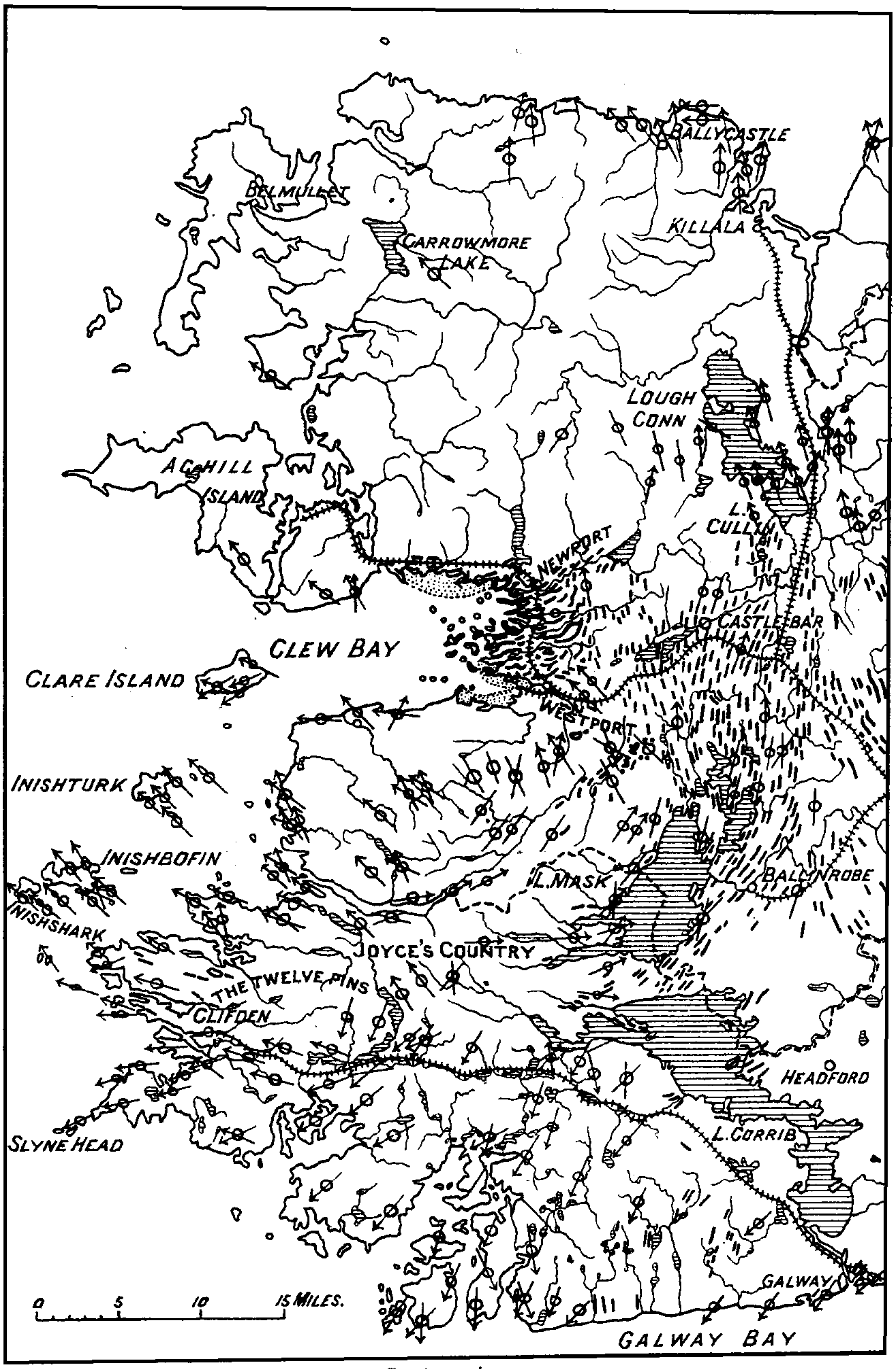


Explanation.

Glacial Striæ, the arrow marking the direction of ice flow. // Drumlins.

Map showing direction of ice-movements and orientation of drumlins in West Connaught, including the observations of Messrs. Kinahan and Close, and of the Geological Survey.

[Reproduced, by permission of the Controller of H.M. Stationery Office, from the Geol. Survey Memoir: "The Geology of Clare Island, Co. Mayo."]

from: Hallissy,T. 1914. Clare Island Survey, Part 7. Geology. *Proceedings of the Royal Irish Academy,* **31**, section 1: part 7, 22pp with plates and figures.

Site 1.1. Drumlin. Ballyconneely Bay. L621430. PC

- **Do not stand in close to this section**

The drumlins of this part of Connemara are sparse and spread across the knock and loughan scenery of western Connemara. The glacigenic sediments appear to have been concentrated into drumlins leaving widespread bare rock surfaces in the inter drumlin areas.

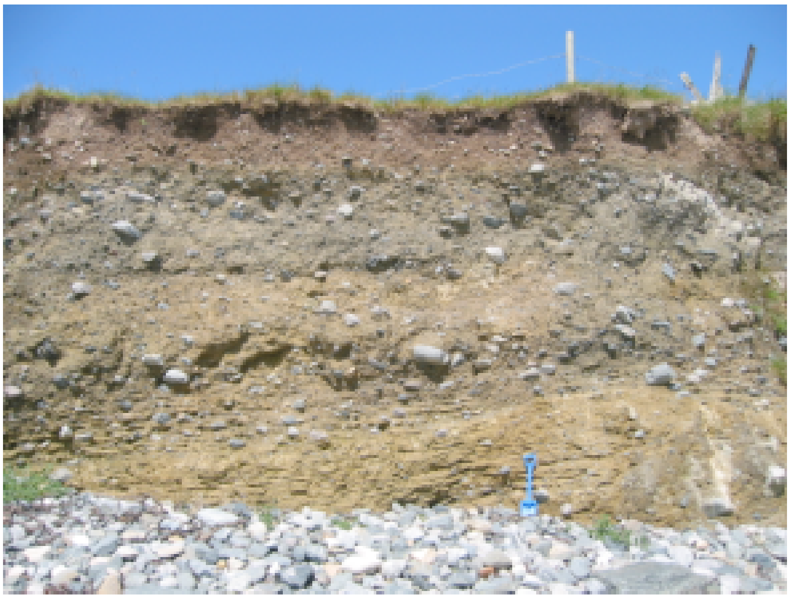
This drumlin is beautifully exposed in long section (slightly oblique, see picture above) over a distance of several hundred metres. The core of the drumlin is a massive lodgement till showing a very strong fabric and extensive shear planes (the large clast in the picture below is c. 40cm in length).

Most impressive is the lee-side stratified fill to the western end of the section. Such stratified fills have been widely described from the lee-side flanks of Irish drumlins (Dardis *et al. 1984;* McCabe 1993) and the one seen here is particularly well exposed. The existence of such lee-side fills suggests a high volume of water was present, flowing and transporting sediment at a late stage in the drumlin's growth. It has been suggested that it is the build up of subglacial water pressure that leads to the glacier uncoupling from the underlying substrate and hence producing rapid flow and streamlining of the entrained debris to produce the drumlin form. Rapid glacier downdraw during deglaciation may explain the form, symmetry and distribution of drumlin fields in Ireland and the UK.

This image shows the boundary between the lodgement core and the stratified lee.

The waterlain, stratified, lee-side deposit.

View of stratified lee-side deposit



Laminated muds below stratified lee-side. (to the left of this section there is a Holocene midden overlying the lee-side sediments too!)

The age of this particular drumlin is unknown but McCabe (1996) and McCabe and Clark (1998) have shown that drumlins around Ireland were actively forming as part of an intense deglacial episode between 19,000 and 14,500 years ago leading to Heinrich Event 1 (H1) of the North Atlantic (Drumlin Event of the Glenavy Stadial, see Table 1)

Dardis, G.F., McCabe, A.M. and Mitchell, W.I. 1984. Characteristics and origins of lee-side stratification sequences in late Pleistocene drumlins, Northern Ireland. *Earth Surface Processes and Landforms*, **9**, 409-424.

McCabe,A.M. 1993. The 1992 Farrington Lecture: Drumlin bedforms and related marginal depositional systems in Ireland. *Irish Geography*, **26(1)**, 22-44.

McCabe, A.M. 1996. Dating and rhythmicity from the last deglacial cycle in the British Isles. *Journal of the Geological Society,* **153**, 499-502.

McCabe, A.M. and Clark, P.U. 1998. Ice-sheet variability around the North Atlantic Ocean during the last deglaciation. *Nature*, **392**, 373-377.

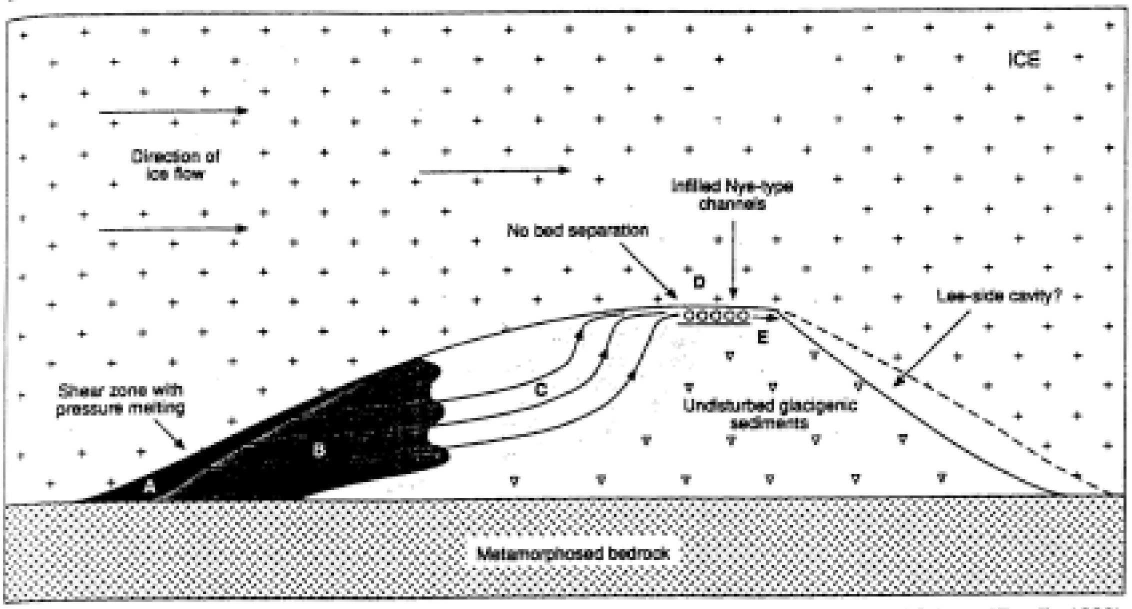


Figure 22: Depositional model, Kanrawer drumlin (McCabe and Dardis, 1993)
Zone A - shearing and deposition of breccia.
Zone B - well-defined water transfer structures/chaotic gravel honeycomb.
Zone C - water escape structures

(McCabe and Dardis, 1983)

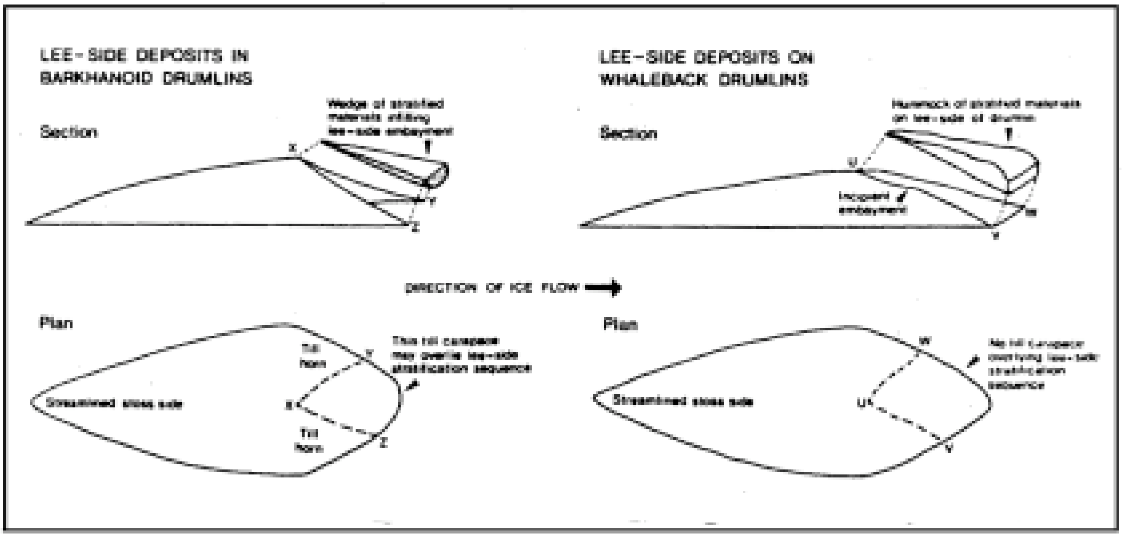


Figure 23: Stratigraphic position of lee-side stratification sequences in barkhanoid and whaleback drumlins
(Dardis, McCabe and Mitchell, 1984)

Site 1.2. Dogs Bay beach, Roundstone. L694386, (LH).

Dog's Bay is a beautiful embayment on the west side of the Dog's Bay/Gorteen Bay **tombolo** [a narrow sand or shingle bar linking a small island with another island or the mainland]. The tombolo is composed of 150 Ha of dune grassland (termed machair) underlain by granite bedrock and is famed for its foraminiferid-rich sand. Five points of interest are highlighted herein:

1) The machair dune system and its formation
2) The sand composition and source of foraminifera
3) The stratigraphy of the tombolo and associated erosion history
4) The archaeological excavation
5) The unusual flora supported by machair

Machair: its development and significance

Machair has been designated an EU priority habitat and is only found in the West of Ireland and the NW of Scotland. The term **machair** is an old Gaelic word for areas of level, stable, dune grassland over calcareous soils. The land comprising the tombolo is classic machair and a stroll in through the gate of the commonage from the car park at Dog's Bay affords one opportunity to examine the machair habitat in closer detail. According to Ritchie (1976), there are five features commonly associated with Scottish machair dune development, which can also be observed in Irish machair (Bassett and Curtis 1985):

- ❖ Mature coastal sand dune phase with more or less level surface;
- ❖ Shell-rich sand producing alkaline soil;
- ❖ Grassland vegetation with low frequency of sand-binding species;
- ❖ Grazing animals; and a
- ❖ Moist, cool, windy oceanic climate.

All of these characteristics are found in this location, however, grazing has been limited to the central part of the tombolo since 1991 for conservation reasons.

Machair development is related to **deflation** of a previous dune formation. Deflation surfaces develop where unconsolidated material on a gently inclined surface is exposed to aeolian processes that remove the finer material and leave an immobile coarser residue behind (Carter *et al*. 1990). The exact age of machair development at this location is not known, but is possibly related to the introduction of grazing animals to the area, and is likely to be pre-2000 AD (Erin Gibbons, pers. comm. 1992).

The current **working model for machair development** in Ireland and Scotland is one of a dune system consisting initially of ridges, but which, through severe exposure to frequent strong winds, coupled with heavy grazing, is eroded down to the water table to produce a level surface. With almost continuous wind, there is a constant input of sand into and throughout the system, although further dune building is inhibited though the action of grazing animals. There is thus a dynamic equilibrium between these elements, which ensures the maintenance of the sand-plain topography.

Sand composition and source of foraminifera

The tombolo is composed of a skeletal carbonate sand comprising foraminifera, echinoderm fragments, bryozoan fragments, ostracodes, sponge spicules and gastropods, all of which are believed to live in the area of the sand blanket around the coast at Dogs Bay (Lees *et al*. 1969). On the Dog's Bay side of the tombolo, the sand comprises an unusually high percentage of foraminifera and is thus a wonderful location for the study of these beautiful shells.

Foraminifera, (informally termed forams), are almost exclusively marine, single-celled organisms (protozoa) that resemble amoeba in tiny, exquisite, multi-chambered shells of considerable and intricate architectural variation. They live in immense numbers in the sea, either floating or attached to seaweed or stones on the bottom, feeding on diatoms and other tiny particles.

They mostly have short lives, ranging from a few weeks to a few months, and when they die their shells accumulate on the sea floor. From there the shells can sometimes be washed onto the lower shores. However, in practise this is not a common occurrence. If present on the beach, foraminifera are usually quite a sparse component of the sand. There are a few beaches world-wide, however, where the sand is dominated by foraminifera. Dog's Bay is one such beach. In fact, Dogs Bay sand has long been renown for the abundance of forams not only on the lower shores, but in the sand dunes also as evidenced by the following excerpt from the Manchester Microscopical and Natural History Society transactions for 1900 (p. 71-75).

> *'Dog's Bay, Galway, Eire, has long been known for the immense quantities of Foraminifera it yields, the surface of the strand at times being entirely composed of their tests with, in patches, some tiny mollusca. So plentiful are they that the blown sand-hills there are practically all Foraminifera. It is a sight never to be forgotten by the microscopist, and especially one who has perhaps only obtained small quantities by exchange, or collected them laboriously on some silicious strand, to see on a hot breezy day, when the tide is out, this fine foraminiferous surface of the strand, moving steadily inland, till it covers both the remnants of the grassy sward and old kitchen middens with a white fall like driven snow, filling up hollows and cattle tracks level with the general surface.*

In 1900, Wright described the foraminifera from Dog's Bay. He found 124 species and varieties, all known to live around British coasts at the time. Loeblich and Tappan, (1989), created an entirely new genus *Connemarella* on the basis of Wright's find of type-species *Gaudryina rudis*. Using a X10 hand lens or a table-top microscope one can study the diversity and beauty of the foraminifera in the sand.

There are textural and species diversity differences along the beach from the north-eastern to the south-western end that may reflect sorting of the sand particles by wind and waves. There is also a variation in species diversity and grain size within the dune stratigraphy, which may related to temperature and salinity variations in the past as well as being climatic indicators, but more of that in the next section.

Formation and stratigraphy of the tombolo and associated erosion history

Formation of the tombolo is the result of accumulation of sand in the area north of what would have been the rocky island. This tendency for deposition behind islands is due to the refraction of the waves, which causes their energy to be dissipated over a wide area in the lee of an island. In the case of Dog's Bay, the prevailing wind direction today is from the SW, and it may be no coincidence that the tombolo formed to the NE of the rocky former island.

The Gurteen Bay side.

Tombolos are usually initiated by the meeting of the waves from both directions refracted about the island. On meeting, their energy is reduced and their oscillatory movement on the bottom tends to cancel out, leading to a slight movement towards the shallower water, where deposition would result. The growing accumulation of material with shallowing water will cause further loss of wave energy and hence further deposition, until the sediment builds up above sea-level. Its height can then be increased by wind-blown deposition and the binding of vegetation.

The formation of the tombolo, presumably post-dates deglaciation in this area, however, the exact date of its initiation is difficult to ascertain. Carter and Wilson (1990) believe that the fall of sea-level in the north of Ireland after 6000 years before present (BP) facilitated the onshore transport and accumulation of coastal sands and ultimately the initiation and growth of Irish dune systems. Organic layers in the dunes, discussed in detail below, were radiocarbon dated to 2000 years BP (E. Gibbons, pers. comm. 1992) indicating that sedimentation had already begun by that time.

Attempts at reconstructing the history of the tombolo can be made by studying the different strata comprising the tombolo sand hills. These would have been laid down on top of one another and should represent a chronological succession from bottom to top, however, intermittent erosion events may have removed layers before the accumulation of sediment continued. From the information stored in these layers we can begin to investigate the history of the formation and evolution of this tombolo.

In some of the sand hills, especially near either end of the beach, very distinct 10 – 20 cm thick, dark-brown beds are apparent. These are organic rich, often containing shell and stone fragments and even animal remains such as bones or teeth. These may represent the stabilisation of the sand hills at times in the past and the development of a soil with grassland vegetation similar to what is seen on top of the tombolo today. Their association with shell middens, animal remains and other finds of archaeological significance discussed below suggest these strata coincide with times of settlement by man who subsequently littered them with his rubbish and fire remains.

These organic-rich layers are useful in investigating the erosion history of the tombolo also, a factor that was in the forefront of locals ten years ago when the tombolo was suffering considerable erosion. At this time, there was concern that the sea would break through the tombolo destroying the wonderful beach and commonage amenities. The organic rich layers are preserved clearly at either end of the beach, however, they are missing from some of the more central sand hills on Dog's Bay. From this observation two conclusions can be made:

1) That the organic rich layers never formed in the central part of the tombolo, i.e. that it was never stabilised by vegetation; or
2) That the central part of the tombolo has suffered considerable erosion in the past, from which it has recovered, as evidenced by the formation of what appear to be more recent, foraminifer-rich dunes, lacking in these organic layers.

Close inspection of the dune faces in some areas may reveal intricate sedimentary structures characteristic of wind-blown sediment, such as trough-cross bedding.

Archaeological excavation

Excavations from a site at the southwest end of the dunes on Dogs Bay beach unearthed evidence of a settlement, comprising old walls, a corn-drying kiln and a children's burial ground as well as other artefacts such as man-made tools. In 1991, a stone pit and a limpet shell midden were being uncovered by the natural erosion of the dunes in this area. A summary of these findings has been published by Gibbons (1991).

Dune palaeosol containing midden material. Dog's Bay.


Burnt stone and shell. Midden in palaeosol, Dog's Bay

Unusual flora supported by machair
Part of the reason for the EU priority habitat designation for machair environments are the unusual flora supported by the alkaline soils and wild, oceanic climate. The tombolo flora has been studied extensively by Dr. Steve Waldren (Trinity College Botanical Gardens) and his students. He suggested that at this time of year (October) it may be possible to see last few *Spiranthes spiralis* (Autumn Ladies Tresses- a small, white flowered orchid); likewise one might also catch *Gentianella campestris* (Field Gentian), which is also a late flowerer, and is very local in Ireland. In particular from the Dog's Bay peninsula, Waldren studied a dwarf form of Ox-eye Daisy (*Leucanthemum vulgare*), which seems to occur on machair sites around Connemara.

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Iorras Aintheach ('windy peninsula' –Robinson 1990).

Site 1.3. Loch an Chorcail, Carna. L766335. M.O'C.

Loch an Chorcail is a small lake, the surface of which is now covered by a scraw. It lies at c. 28 m O.D., on the Carna peninsula, 1.8 km west of the village of Carna, Co. Galway. (grid ref. L 766 335). The lake basin is ca. 140 x 100 m. An attempt was made to drain the site in the mid 1900s which resulted in a drain channel from near the centre of the basin to the NNW margin. The underlying bedrock is Galway granite which in not infrequently covered by a thin layer of stony drift. The site is surrounded by bog, rough pasture and occasionally fields with good quality pasture, the result of careful management. A turf bank at the southern side of the lake indicates the former present of a thin covering of blanket bog.
The presence of *Juncus planifolius* is noteworthy (Lockhart *et al.* 1989). The species was first recorded in Ireland by Scannell (1973), who found it to be well established in the Cashel/Carna area and unknown elsewhere. Previous to its identification at this site its eastern limit was known to lie 5 km east of Carna (Webb and Scannell 1983). *Juncus planifolius* occupies lake margins, stream sides and wet bog habitats in the Cashel/Carna area. It is native to Australia, New Zealand and temperate South America but the manner of its introduction to Ireland is unknown.

In the late 1980s, the stratigraphy of the basin was investigated by a series of coring and a more or less full Holocene pollen diagram was constructed in the context of a BSc (Hons) undergraduate project (McDonnell 1988). Subsequently, ^{14}C dates were obtained for the profile. The results of these investigations, which have not been published, will be presented in the course of the field excursion.

References

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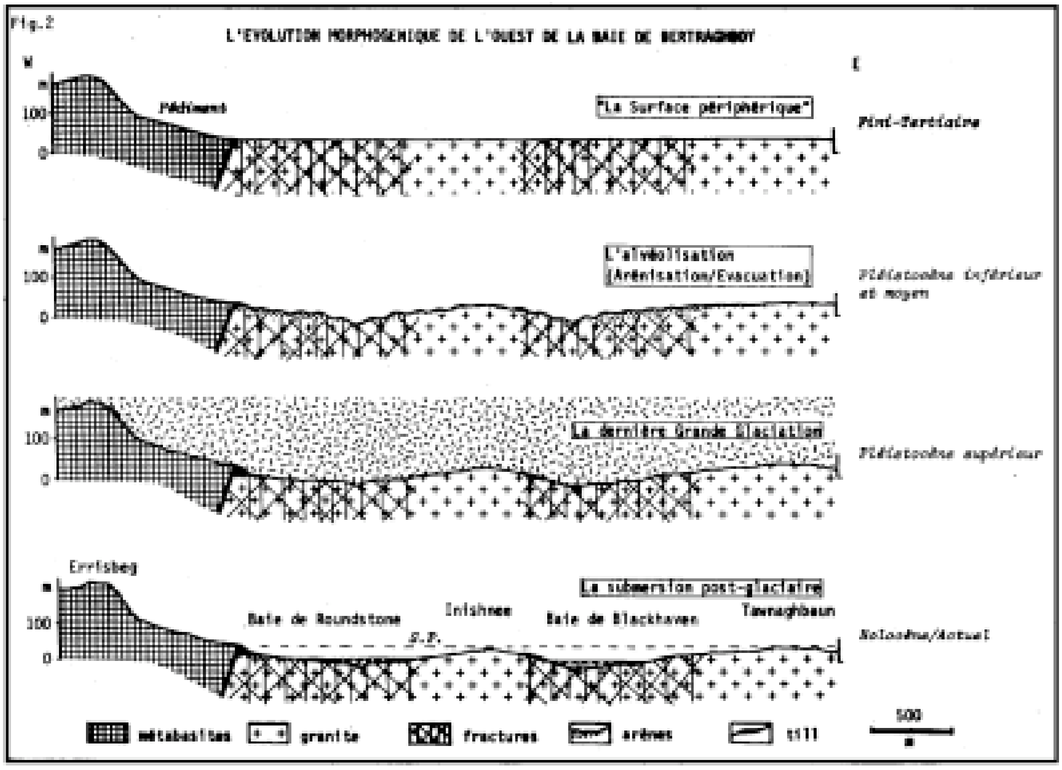
McDonnell, K. 1988. *Studies towards the post-glacial vegetation history of Lough Corcal, Carna, Co. Galway.* B.Sc. (Hons) thesis, Department of Botany, University College Galway,

Scannell, M.J.P. 1975. The known distribution of *Juncus planifolius* R.Br. in Ireland. *Watsonia,* **10,** 418-419.

Webb, D.A. and Scannell, M.J.P. 1983. *Flora of Connemara and the Burren.* Royal Dublin Society and Cambridge University Press, Dublin and Cambridge.

Site 1.4. View. Tertiary Planation (?) L793384. PC

View across Bertraghboy Bay from Glinsk



from: Coudé, A. 1985 L'alvéole granitique de la Baie de Bertraghboy, Connemara (Irlande). *Physio-Géo.* **13**, 11–18.

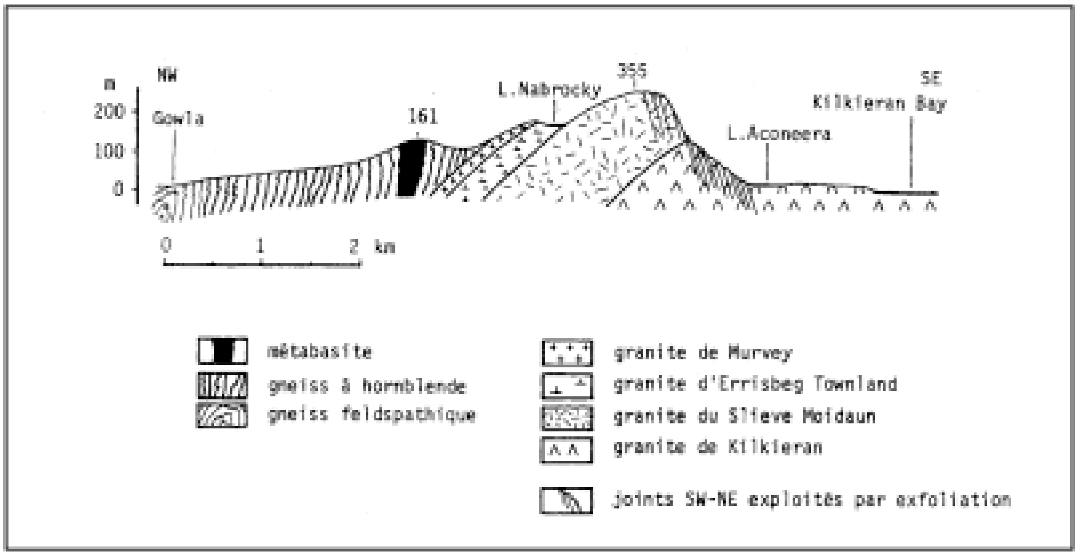


FIG. 4. — Le Slieve Moidaun, Connemara, Irlande occidentale : un relief monoclinal granitique.

FIG. 4. — *The Slieve Moidaun, Connemara, Western Ireland : a granitic monoclinal-controlled landform.*

from: Coudé 1983

Planation edge (?) on an island in Bertraghboy Bay

Site 1.5. Quarry 1. Bóthar na Scrathóg.L 871397. PC

In part from: Coxon,P. 2001. Understanding Irish landscape evolution: Pollen assemblages from Neogene and Pleistocene palaeosurfaces in western Ireland. *Proceedings of the Royal Irish Academy,* **101B** (1–2), 85–97. (note this paper is available as a reprint from the author. E-mail : pcoxon@tcd.ie)

Introduction and sections

The granite upland of Cnoc Mordáin, to the northwest of the head of Kilkieran Bay in County Galway, rises to just over 350m in a markedly asymmetric northeast-southwest running ridge (steep on the southeast facing edge and shallow dipping on the northwest side). The ridge is composed of several granite masses which form high ground to the south of the extensively eroded basic and ultrabasic rocks and quartz diorite gneisses which in turn lie to the south of the quartzite peaks of the Twelve Bens and Maumturk mountains.

The northern slopes of Cnoc Mordáin stretch gently from granite out onto the ultrabasic rocks and gneiss and the slope is impressively mantled by debris for much of its length and extending as low as the 80m contour. Occasional stream sections show extensive soliflucted diamictons draping the underlying bedrock. A small road (Bóthar na Scrathóg, Robinson 1990) running from Lehanagh South (L 817417) to Derryrush (L 898391) cuts across a distinct break in slope at the foot of Cnoc Mordáin in the Gowlan East townland. This break of slope appears to be the toe of the extensive debris mantle covering the north facing slope of the upland, and fortuitously, several small quarries excavated into a marked spur of rock have cut back into the debris mantle and exposed the bedrock and its immediate cover.

At quarry 1 (L 871397) excavations in the debris have, after cleaning, provided excellent sections.

At quarry 2 (L 875395) a large *in situ* granite tor can be seen lying surrounded by a cover of weathered granite and soliflucted debris. The tor has been buried by this material and has only been exposed by quarrying activity although the top of the tor had probably been partially exhumed naturally.

Table 1. Section at quarry 1

Unit	Description	Approximate thickness (m)
8	Modern soil	0.40
7	Diamicton containing occasional large clasts (cobbles and boulders)	1.00
6	Bouldery diamicton containing abundant erratic clasts	2.00–8.00
5	Greyish olive silt. (5 Y 5/3)	0.30
4	Bright reddish brown (2.5 YR 5/8) silty clay with stone inclusions with red mottling (10 R 5/8) at upper surface. Colour intensity and silt content decrease down profile into granite-rich diamicton	0.15–0.45
3	Granite-rich diamicton containing cobbles of granite, quartzite and gneiss in a disaggregated granite matrix	1.80
2	Greyish olive (5Y 5/3) silty clay draped over part of bedrock and within cracks in the bedrock	0.20
1	Bedrock protrusion overlain by corestones	Seen to 1.00

Pollen counts from quarry 1.

Family	Genus	Species	Unit 2	Unit 4
Osmundaceae	*Osmunda*	sp.	+	
Dryopteridaceae	Polypodiaceae	undiff.	+	
Pinaceae	*Picea*	sp.	+	
	Tsuga	sp.	+	
	Pinus	sp.	++	+
Taxodiaceae	*Taxodium*	sp.	+	
	Taxodiaceae	undiff.	+	
	Sequoia	sp. (type)	+	
Cupressaceae	*Juniperus*	sp.	+	
	Cupressaceae	undiff.	+	+
Ulmaceae	*Ulmus*	sp.		+
Juglandaceae	*Carya*	sp.	+	
Myricaceae	*Myrica*	sp.	++	
Fagaceae	*Quercus*	sp.	+	+
	Quercoidites	type	+	
	Castanea	sp.	+	
Betulaceae	*Betula*	sp.	+	+
	Alnus	sp.	++	+
	Corylus	cf. *avellana*	+	
	Betulaepollenites	type	+	
Tiliaceae	*Tilia*	sp.		+
Symplocaceae	*Symplocus*	sp.	+	
Ericaceae	Erica	sp.	++	+
Onagraceae	*Corsinipollenites*	type	+	
Asteraceae	Asteraceae	Tubuliflorae		+
Poaceae	Poaceae	undiff.		+
	Total pollen count (P)		43	12
	Indeterminable		12	5

The exposures at quarries 1 and 2 show that the buried granite tors and corestones on the northern flanks of Cnoc Mordáin are surrounded by a weathered drape of granite debris. The debris contains occasional lenses and fills in cracks in the bedrock or between corestones of silty clays that probably represent partial sections of palaeosols. The apparent Pliocene pollen assemblage from one of these silty clays (unit 2) is of great interest as it provides a minimum age for the mantling of the granite bedrock (and its associated tors). The survival of such a weathered mantle is extremely fortuitous as it provides a rare insight into the geomorphology of the western Irish landscape at the close of the Tertiary. Deeply weathered *in situ* mantles (saprolites) are well known from other glaciated areas where they are a testament to the survival of former landscapes (e.g. Lidmar-Bergström *et al* 1997) but they have not yet been recorded and dated in an Irish context. Some authors have commented on the possibility that glaciated terrains owe some of their morphology to pre-glacial deep weathering and subsequent exhumation (Thomas, 1974). It is suggested here that the hummocky nature of the present day bedrock exposure over much of the area on figure 1A may owe its morphology to Tertiary weathering producing an undulatory weathering front. Subsequent exhumation of the bedrock and its tors during the Late Tertiary and the Pleistocene, including partial alteration by glacial erosion to form *roche moutonées* and whaleback ridges has left the present surface; a remnant of Tertiary weathering. Further work will involve both an analysis of the bedrock structure and a search for further weathered debris that may have survived the exhumation process. Similar views regarding the Tertiary geomorphology of this region were expressed by Coudé (1983; 1985) although no firm dating was presented in the latter work. It is possible that we may now be able to date this episode of landscape evolution as the Pliocene soil gives a minimum age for the weathering mantle covering the tors at Gowlan East.

Following the deposition of the palaeosol draping the bedrock (unit 2) a diamicton unit was emplaced (unit 3). At present the origin of this material is unknown but it is waterlain in part (exhibiting channels and laminated fills) and contains local bedrock clasts, highly weathered and physically disaggregated granite (gruss), quartzite pebbles and cobbles. Formed on the upper surface of the diamicton is a reddened silty horizon believed to be a palaeosol (unit 4). The pollen assemblage from this red soil (and the soil micromorphology itself) requires further work in order to attempt a biostratigraphical correlation and a detailed analysis of the soil forming conditions. The reddened nature of the soil is unlike Holocene (and interglacial) soils in the west of Ireland and is more reminiscent of Middle Pleistocene palaeosols in the UK (e.g. Kemp 1985).

Overlying the palaeosol of unit 4 is a massive till containing abundant erratics (including gneiss, quartzite and granite). Again further analyses on this unit are required but it is probably a lodgement till. The unit has a strong fabric and has deformed unit 4 beneath indicating ice movement from the north.

References:

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2.1. Crocknaraw (*Cnoc na Rátha*), near Clifden. M.O'C.

The site, Crocknaraw (*Cnoc na Rátha*, i.e. the hill of the fort (Robinson, 1990)), consists of a small hillock on a low plateau (114 m O.D.) between Streamstown Bay and Ballynakill Harbour (grid reference L 659 558; 10° 01'W, 53° 32'N; Fig. 7.1). The local bedrock consists of Dalradian schists. Schists classified as Streamstown Formation constitutes the bedrock at the site, while within 2 km there are extensive outcrops of schists classified as Lakes Marble Formation and Ballynakill Formation (to the north and west, respectively) and Bennabeola Quartzite Formation to the south (Leake *et al*., 1981; Morris and MacDermot, 1995). The area for several kilometres about is today covered by blanket peat that is much cutover. From sections provided by road cuttings, the bedrock appears to be covered by locally-derived drift that gives rise to a relatively base-poor soil.

From the archaeological viewpoint, the site lies between two areas with dense concentration of megaliths (tombs and standing stones) namely, Streamstown Bay to the south-west and the Cleggan/Kylemore area to the north (Henry, 1992; Gosling, 1993). Other evidence of early human presence include limited stretches of pre-bog wall some distance to the south-west of the site (Gosling, 1993). The site itself is marked by a pair of large white quartz standing stones, which have been estimated to weigh 1.2 and 0.8 tonnes, respectively (this and the site information that follows was kindly supplied by Michael Gibbons, who excavated the site). In the course of construction of a bog road, the standing stones were dislodged. The northern stone had no peat beneath it but there may have been some peat beneath the southern stone. Unfortunately, neither stone was in position at the time of excavation (May 1995), but there was no evidence that the stones had been set into the mineral soil. The excavator had the impression that some peat may have accumulated prior to the stone being placed in the ground.

A short monolith (CNR I) was taken for pollen analysis from within less than 10 cm of where a flat-bottomed coarse pottery vessel, which contained cremated human remains, had been placed in the peat (M Gibbons, pers. comm.). The discovery of the vessel was made in the context of the rescue excavation. The northernmost of the pair of standing stones lay c. 2 m to the south of the area in which the vessel was found and the monolith taken.

Details of the palaeoecological investigations at the site carried out by Jennings (1997) will be presented and evaluated in terms of when is know about vegetation and landscape evolution in western Connemara.

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Connemara National Park, Letterfrack. M.O'C.

Several palaeoecological investigations have been carried since the 1980s in the Letterfrack/Renvyle area of north-west Connemara. Most of these investigations have been published (see Reference list) but a number of smaller investigations have also been carried out, the results of which have not been published to date. It is intended to present the new information which relates mainly to blanket bog development and the history of pine in the Connemara National Park.

Relevant palaeoecological publications

Molloy, K. and O'Connell, M. 1993. Early land use and vegetation history at Derryinver Hill, Renvyle Peninsula, Co. Galway, Ireland. In: Chambers, F.M. (Ed.). *Climate Change and Human Impact on the Landscape.* London, Chapman and Hall, pp. 185-199.

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2.2. Beaghcauneen (Lough Beitheach Cháinín). CD

Lough Beaghcauneen (L 680 475) is a small lake situated south of the link road across Roundstone Bog between Ballinaboy and Toombeola. There is parking for 2-4 cars and then at various spots along the road.

Four salmon net pens were placed on Lough Beaghcauneen in 1979 and the number was increased to 10 in 1981. Each cage presently holds up to 40,000 fish. The lake will be form the basis of a research project looking at baseline reference conditions (in the very recent past) using palaeolimnolgy and diatom analysis to examine recent environmental change in the system.

The algal flora of this lake was examined by West & West in 1906 and again by Pearsall & Lind in 1942 and the results of this work will provide useful material to help validate palaeolimnological reconstructions.

References

Bennion, H., Wunsam, S. & Schmidt, R. (1995) The validation of diatom-phosphorus transfer functions: an example from Mondsee, Austria. Freshwater Biology 34, 271-283.

Pearsall, W.H. & Lind, E.M. (1942) The distribution of phytoplankton in some north west Irish Loughs. Proc. Royal Irish Academy, Vol. XLVIII, Sect. B: 1-24.

West, W. & West, G.S. (1906) A comparitive study of the plankton of some Irish Lakes. Royal Irish Academy Trans. B, Vol. 33, Part 2: 77-122.

I will also refer to my PhD study sites which are situated in and adjacent to Cloosh Forest, south-east Connemara in the Owenboliska, Crumlin and Cashla river systems. The main study site was Loughaunyella (M 100 306) from which a Holocene lake sediment core was retrieved. The research was entitled 'A palaeolimnological investigation of acidity in humic lakewaters in Connemara, W. Ireland'

Contemporary studies in Connemara found that drainage from afforested catchments in Connemara tend to be more acid than unafforested counterparts, despite being distant from sources of air pollution. An important issue is the contribution of organic acidity to acid status of these highly coloured surface waters. A palaeoecological past-analogue approach is used to link modern water chemistry with historical variation to test competing hypotheses for causes of variation in surface water chemistry. This study examined temporal changes and explored mechanisms coincident with changes in the organic carbon regime. Twenty-two lakes provide chemistry and modern diatom data that form the calibration dataset for palaeo-reconstructions of DOC using diatom transfer functions. The Holocene lake sediment core reconstructions from Loughaunyella will be presented in the course of the field excursion.

References

Dalton, C. (2000). Organic acidity in lake waters in Connemara, W. Ireland: a preliminary investigation using diatom analysis. Verhandlungen Internationale Vereinigung für Theoretische und Angewandte Limnologie Vol 27: 1193-1198

Dalton, C.P. (1999) A palaeolimnological investigation of acidity in humic lakewaters in Connemara, W. Ireland. Ph.D. Thesis, Department of Geography, University College London