"ASPECTS OFAN INVESTIGATION OF THE VEGETATION HISTORY OF KILLARNEY"

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INTRODUCTION

This paper sets out to present data to date on the investigation of a lake site in Killarney presently undergoing study as part of a research project. A brief description of the characteristics of the area is offered, as well as a synopsis of the information available to date from both historical and palynological sources.

A tentative attempt is then made to interpret a relative pollen diagram which is as yet incomplete, with a view to encouraging discussion on the postulated zonation and the behaviour of a number of individual pollen taxa.

CLIMATE

The outstanding feature of the climate of the area is its extreme oceanicity. Rain is frequent, falling an average 223 days per year. The annual average rainfall for the Muckross area is 1712mm, but rainfall rises rapidly with altitude, being 3266mm at 808m on Mangerton mountain. However, dry spells, sometimes lasting for several weeks, occur from time to time, and during high periods of evapotranspiration can lead to considerable water stress in shallow soils.

The mean temperature at Muckross for July, the warmest month, and for January, the coldest month, are 15.1 and 6.7° respectively.

GEOLOGY

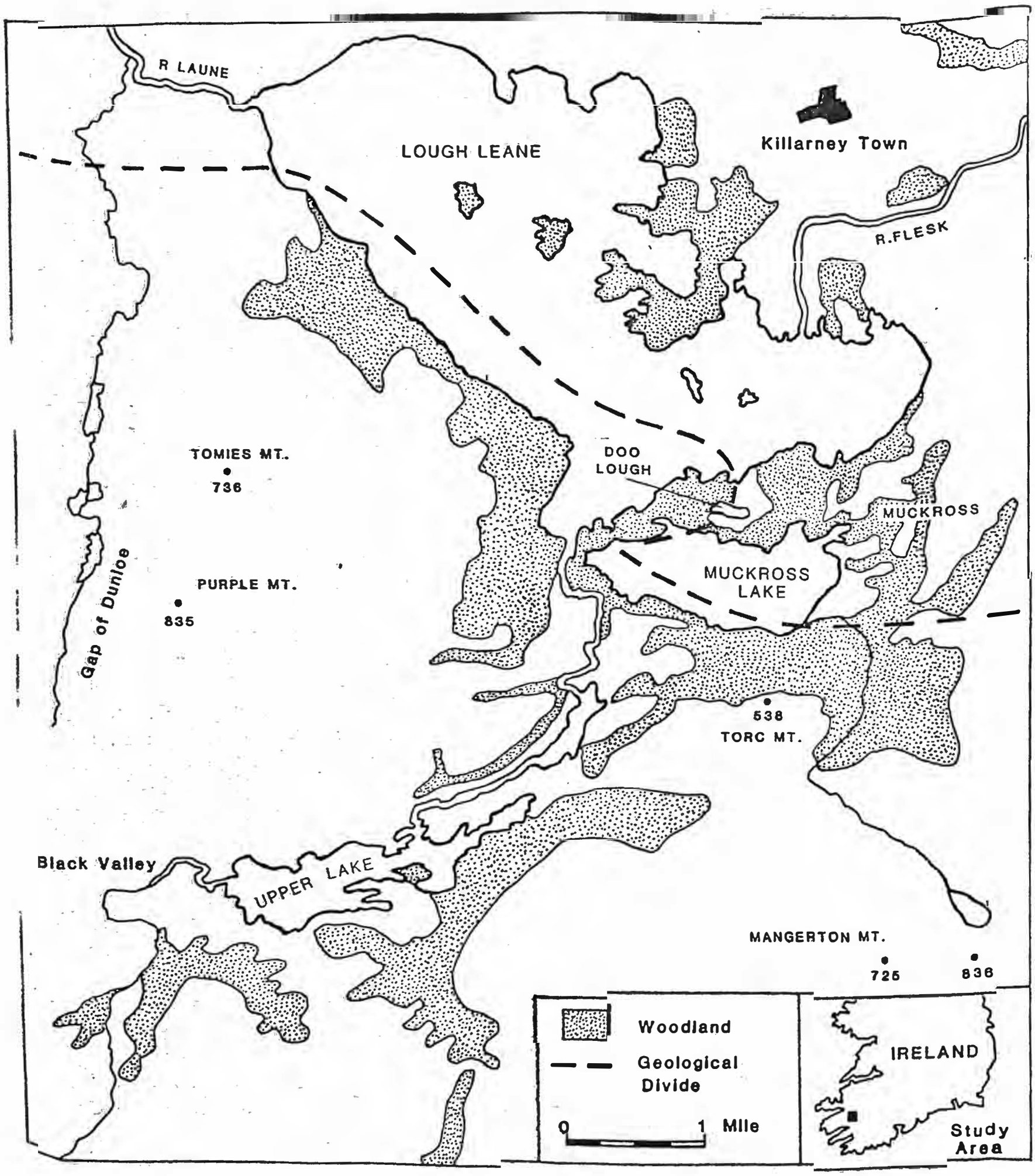
The Killarney region lies on a major geological fault, which runs through the Lower and Middle lakes. To the north of the fault Carboniferous limestone forms a low-lying, drift-covered plain. To the south, mountains of Old Red Sandstone rise abruptly from the shores of the lakes to over 600m. Most of the woods occur on better drained slopes in sheltered positions on the Old Red Sandstone, which consists of alternative beds of hard, gritty sandstone and softer, slaty shales overlain in places by drift derived from the same rock. Under the influence of the oceanic climate, this rock forms an infertile, stony podzolic soil, pH 4.0 - 4.5, with a very low base status. Within the woods the bedrock lies close to the surface, and the woodland floor is characteristically highly irregular. The soil depth is consequently very variable, often only a few centimetres.

HISTORY

(i) The oldest documentary evidence of the exploitation and destruction of the woods is from the late sixteenth century, as recorded by Kelly (1973), Watts and McCracken (1976). The remoteness of the woods appears to have saved them from exploitation until the mid-seventeenth century, and even then it was on a limited scale. Ironworks and tanneries established in the area during the seventeenth century and eighteenth century lead to considerable destruction and by the mid-eighteenth century, when woodland patterns closely resembled those of today. Exploitation increased during the late eighteenth century and early nineteenth century. Large scale felling and planting, of oak especially, was undertaken in the estates of the two principal landowners. Most of the trees in the present woodland are probably less than 200 years old (Baillie M. pers comm), dating from early nineteenth century.

(ii) Grazing has had a large impact on woodland, with the native Irish Red Deer (C. Elaphus) being augmented and gradually replaced by domestic animals such as cattle, pigs, goats and sheep, and most importantly by Sika deer (C. Nippon). Since the mid-nineteenth century grazing and burning of woodland has occurred since the early eighteenth century with human habitation common and persisting probably past the mid-nineteenth century. In the twentieth century felling of trees occurred to varying extents during two World Wars, after the latter of

DOO LOUGH AND ENVIRONS KILLARNEY



which sheep became the main grazing animal, up to 1968 when the Agricultural Institute withdrew domestic animals from the area. Sika deer still persist as heavy grazing animals, both in the herb and shrub layer. Most of the woods are now owned by the Irish State, while some fragments remain in private hands.

(iii) Extensive conifer plantations of species such as *Picea, Pinus, Larix, Abies,* etc. have been established during the present century, and now make up some 40 per cent of the total area of forest in the Killarney region. Earlier plantations for timber were composed of oak, scots pine, ash, sycamore and larch (Radcliff, 1814). Beech, an alien species to Ireland, must also have been planted quite early. These old plantations intergrade with estate woods planted mainly for amenity, which include a great variety of tree species. Enclaves of exotic species have also been planted among the native forest in the more accessible parts of the lowland woods, but in the main expanse of oak woods on the Devonian sandstone few alien trees are found except close to old dwelling sites.

FOREST ON CARBONIFEROUS LIMESTONE

Here, the most remarkable feature is the *Taxus baccata* – dominated forest on bare limestone outcrops. Extensive stands of *Taxus* cover the limestone – pavement areas of Reenadina Wood. In areas of broken rocky terrain, there is commonly a mosaic of shorter *Taxus* on the limestone outcrops and taller *Quercus* (mostly *Q.petraea*) in the intervening soil-filled hollows. On deep well-drained soils practically all the original forest cover was cleared and replaced by agricultural land or planted woods. These stands comprise primarily of *Quercus Petracea*, but locally it is often *Fraxinus excelsior*, while excelsior *Quercus robur* is also common. *Fagus sylvatica*, an alien species, has penetrated many areas, often forming pure stands.

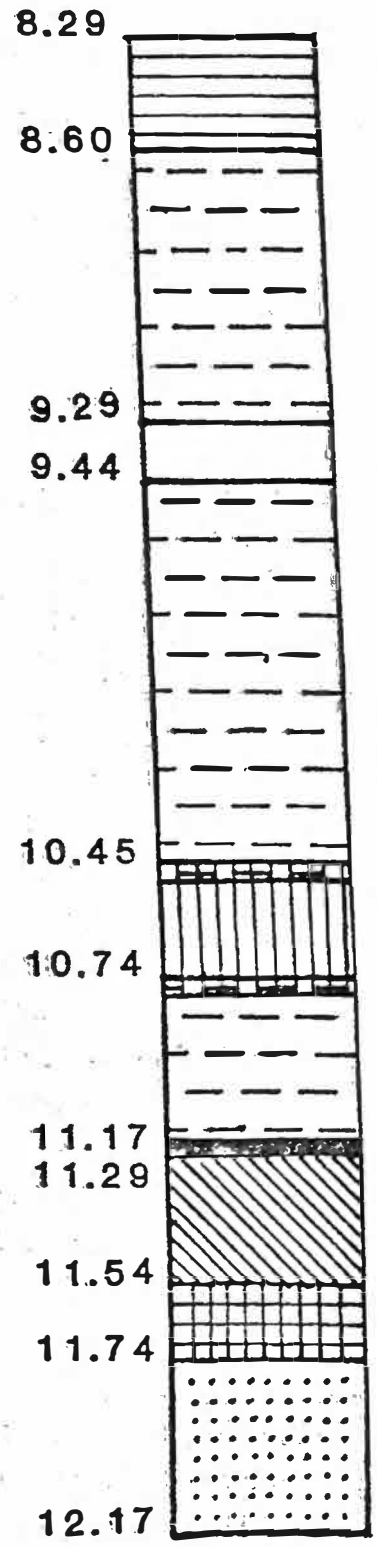
THE POLLEN RECORD

The post-glacial history of the vegetation of the extreme south-west of Ireland has been shown by Jessen, Welten, Vokes and Vokes and Watts to be considerably different from that of the rest of Ireland. It has been shown that during the Boreal and the Atlantic periods the greater Killarney region was dominated by forests of *Pinus* and *Quercus*. It is argued that the *Pinus* curve reflects a dominance of that species in this area long after it had become scarce elsewhere, remaining into the later pagan period before falling away sharply (Watts). Vokes does not ascribe this decline to anthropogenic factors, and Kelly (1973) concludes that the most likely agent was a climatic deterioration. Here too the behaviour of *Ulmus* differs greatly from other areas, never rising above low levels even on a limestone substratum, making the determination of an Ulmus decline difficult.

Vokes has established that the composition of the woods on the Old Red Sandstones and the Carboniferous limestone were different as early as 200 A.D. On the latter substratum, following the *Pinus* decline, it is *Taxus* which expands rapidly, with *Fraxinus excelsior* becoming much stronger. A rise in *Betula* and *Quercus* is also noticeable. This abnormal organisation appears to have survived in those woods extant today. On the Old Red Sandstone substratum, *Quercus* and *Betula* with significant amounts of *Taxus* and *Fraxinus* pollen follow the *Pinus* decline. Vokes postulates *Quercus Betula* woodland on the lower hillsides with an *Ilex* under-canopy. This situation again broadly reflects woodland composition as it is today, allowing for the later expansion of other species.

In the context of the aforementioned work on the vegetation history of the Killarney region, it was decided to undertake further palynological investigations with a view to gaining information on the behaviour of vegetation in the pre-historical as well as the historical period. To this end, a lake site on the Muckross Peninsula, close to the aforementioned geological divide, was chosen as suitable for investigation. The site, Doo Lough, is fed by a small stream from the south-west, and does not have a visible outlet channel. Lying between the two major lakes of Killarney, the lake is relatively undisturbed and not affected by significant pollution levels. The maximum water depth is 8.29 metres in the deeper section of the double basin. At this point, a core of 3.80m was extracted for Palynological, Stratigraphical and Chemical analysis, using a Livingstone corer. The following is a description of the stratigraphic column and the results from pollen analysis in the form of a relative pollen

DOO LOUGH
Description of Unconsolidated Sediment



Ld 4(Dh)<1/8

Ld 4(Sh⁺ Dl⁺ Dh⁺⁺)

Ld 3 Ag (Dh)
Ld 4(Sh Dl Dh⁺⁺)

Ld 3 Ag (Sh⁺ Dh⁺)
Ld 3Ag1(Dh⁺⁺⁺Ga⁺As⁺)

Ag2 As1Ga1(Gs⁺)

Ld 3Ag (Dh⁺⁺⁺Ga⁺As⁺)

Ag3As1(Reworked?)

Troels-Smith Classification

DOO LOUGH, KILLARNEY RELATIVE FREQUENCY POLLEN DIAGRAM

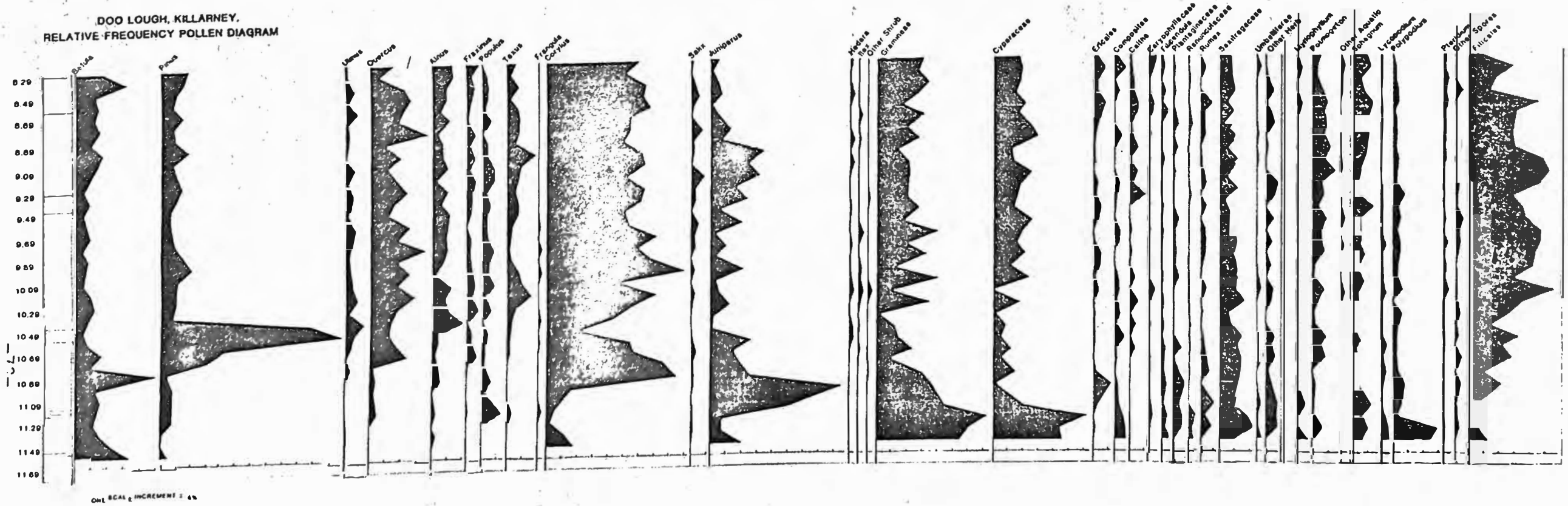


diagram.

It is necessary for me to stress that the results shown are part of an ongoing research project, that the postulated zone boundaries are not supported by radio-carbon dates or any other concrete dating method, and I present these findings in the hope of generating discussion rather than advancing hypotheses.

POLLEN DIAGRAM AND STRATIGRAPHIC COLUMN
DESCRIPTION OF STRATIGRAPHY (Troels-Smity Classification, 1954)

The base of the core (12.17 - 11.74 metres) is formed of a grey, sticky late glacial mud. This is an entirely mineral deposit, and contains no organic fossils of any kind. The deposit is composed of sand, silt and clay, primarily the latter, and reworking in the high-energy environment of the immediate post-glacial is entirely possible.

Between 11.74 and 11.54 metres a sudden change from a mineral deposit to a mixed minerogenic-organic fraction occurs. This may be due to a brief, local climatic amelioration, or an inherent change in the character of the drainage basin catchment, but in the uppermost five centimetres of this deposit a significant number of pollen grains were retrieved.

Moving upwards through the core from 11.54 to 10.45 metres, the character of the sediment gradually changes from being primarily minerogenic to being primarily organic, and through this change can be traced changes in the character of the prevailing vegetation over time (see Plate 3).

The uppermost section of the core is primarily composed of organic detritus which, on the whole, is highly decomposed with little change in character through 2.16 metres.

NOTES ON THE RELATIVE POLLEN DIAGRAM FROM DOO LOUGH, KILLARNEY

The stratigraphic core from Doo Lough was sampled at 10cm intervals with further samples at 5cm and 2cm at critical boundaries. The minimum pollen sum of arboreal pollen was 500 grains. The base of pollen-rich sediment was 11.59 metres (see stratigraphic column) and this represents the effective base of the pollen diagram.

PRELIMINARY ASSEMBLAGE ZONES

The Doo Lough Zone I (11.59 - 11.49 metres) is characterised by *Betula* and an abundance of varied herbs, termed Park tundra. Along with Doo Lough Zone II (11.49 - 10.80 metres) in which *Juniperus* forms a major component, this section of the diagram represents the Late Glacial, where temperatures were low and sedimentary structures were highly unstable, affording little chance to any but the hardiest colonisers.

The pre-Boreal Zone III (10.30 - 10.75 metres) shows an increase in the arboreal pollen fractions, with *Betula, Pinus, Quercus* and *Alnus* expanding, and *Corylus* forming the single major pollen producer. The representation of the various herbs from this zone onwards remains constant, with relatively few significant variations. The first zone which represents Flandrian time is Doo Lough Zone IV. This period is characterised by the approach the maximum pollen representation for *Pinus* while *Betula Carylus* and *Quercus* maintain their increased pollen production.

Doo Lough Zone V (10.69 - 10.43 metres) includes the pollen maxima for *Pinus, Ulmus* and *Almus,* while *Corylus* also is well represented here. It would be unwise to assume that it was during this period that these taxa achieved their maximum actual representation, as the producing population and the fossil pollen/representation do not always exactly reflect one another (see Birks & Birks, 1980).

Doo Lough Zone VI (10.43 - 9.23 metres) shows a mixed woodland vegetation characteristic of the Flandrian Zone II. Vegetation at this point is apparently very similar to that which characterises Killarney today. Values for *Alnus, Quercus, Ulmus, Pinus* and *Taxus* are high, with high *Crylus* and intermittently high *Juniperus.*

The *Ulmus* decline, often used as a temporal indicator by palynologists, has been found to be somewhat ineffective in south-west Ireland (Vokes, 1966). At Doo Lough Zone VI (9.09 metres) an

apparently sharp reduction in *Ulmus* pollen representation occurs, which may indicate the *Ulmus* decline. *Juniperus* also declines at this stage, while *Ulmus*, *Quercus* and *Taxus* are significant.

Doo Lough Zone VIII (8.95 - 8.29) metres) broadly represents the floristic arrangement of Killarney in the present day.

In conclusion, it can be said that while the character of Killarney and south-west Ireland as a whole is unique in terms of its climatic regime and the resultant flora which it supports, the vegetation record through the late-glacial and quaternary period follows the broad patterns typical of Ireland, Britain and North-West Europe.

The behaviour of individual taxa will vary to a greater or lesser extent within the overall total fossil pollen assemblage, and for this reason local pollen sub-assemblages are outlined. The zonation of a pollen diagram is not an end in itself. The zones are localised according to site and it is only by comparison between sites that regional pollen zones can be defined, and mapped temporarily and geographically. Each site investigated is one contribution towards an overall understanding of the behaviour of vegetation over time, and it is within this broad context that the results of each pollen analytical study must be evaluated.

GLOSSARY OF TERMS

Latin Names	Common Names
Betula	Birch
Pinus	Pine
Ulmus	Elm
Quercus	Oak (specified)
Alnus	Alder
Fagus	Beech
Fraxinus	Ash
Populus	Poplar
Taxus	Yew
Corylus	Hazel
Juniperus	Juniper
Ilex	Holly
Gramineae	Grasses

PLATE 4: Preliminary Assemblage Zones from Doo Lough

Late Glacial (Zone II)	Doo Lough I	11.59 - 11.49m	*Betula* & Park Tundra
(Zone III)	Doo Lough II	11.49 - 10.80m	Low arboreal fraction *Juniperus*++ Rich in herbs and grasses
Pre-Boreal (Zone IV)	Doo Lough III	10-80 - 10.75m	*Betula* increase Continuing herbs
Flandrian I (Zone V)	Doo Lough IV	10.75 - 10.69m	*Betula*, Pinus++, Quercus+ Corylus++.
(Zone VI)	Doo Lough V	10.69 - 10.43m	*Pinus* maximum *Ulmus* maximum *Carylus*++ *Alnus* maximum
Flandrian II (Zone VII)	Doo Lough VI	10.43 - 9.23m	*Alnus/Quercus/Ulmus/* *Pinus* High *Carylus* Intermittently high *Juniperus* Significant *Taxus*
Flandrian III (Zone VIII)	Doo Lough VII	9.23 - 8.95m	*Ulmus* decline? *Alnus/Quercus/Taxus* *Carylus* Juniper decline
(Zone IX)	Doo Lough VIII	8.95 - 8.29m	*Betula, Quercus, Pinus,* *Taxus, Carylus*++

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