SCHLOSS

13th MIRE EXCURSION

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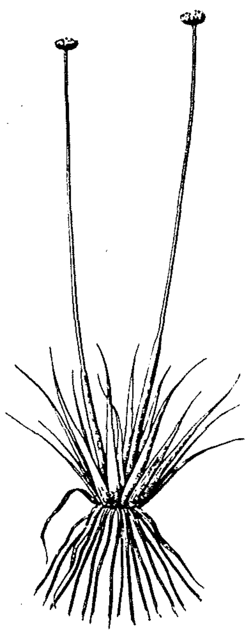
Excursion Guide to Connemara



Michael O'Connell,
Roinn na Luibheolaíochta,
Coláiste na hOllscoile, Gaillimh.

Lúnasa, 1989

INTRODUCTION

Connemara, though not an administrative unit, forms a well defined geographical entity that comprises mainly the west part of Co. Galway. The bedrock geology has two main components, the metamorphic rocks and the granites (Fig. 1). The metamorphic rocks include both metasediments – Dalradian (pre–/early Cambrian) – and a metagabbro suite where the rock is usually basic to ultrabasic. The granites, which form the main bedrock of southern Connemara, date to the late Caledonian. Though siliceous rocks predominate in the region, the gabbros and some of the schists, such as the Lakes Marble Formation which has a considerable carbonate content, yield reasonably fertile soils. In its bedrock, as in several other aspects, the Connemara landscape forms a sharp contrast to the karstic Burren region which lies to the south across Galway Bay.

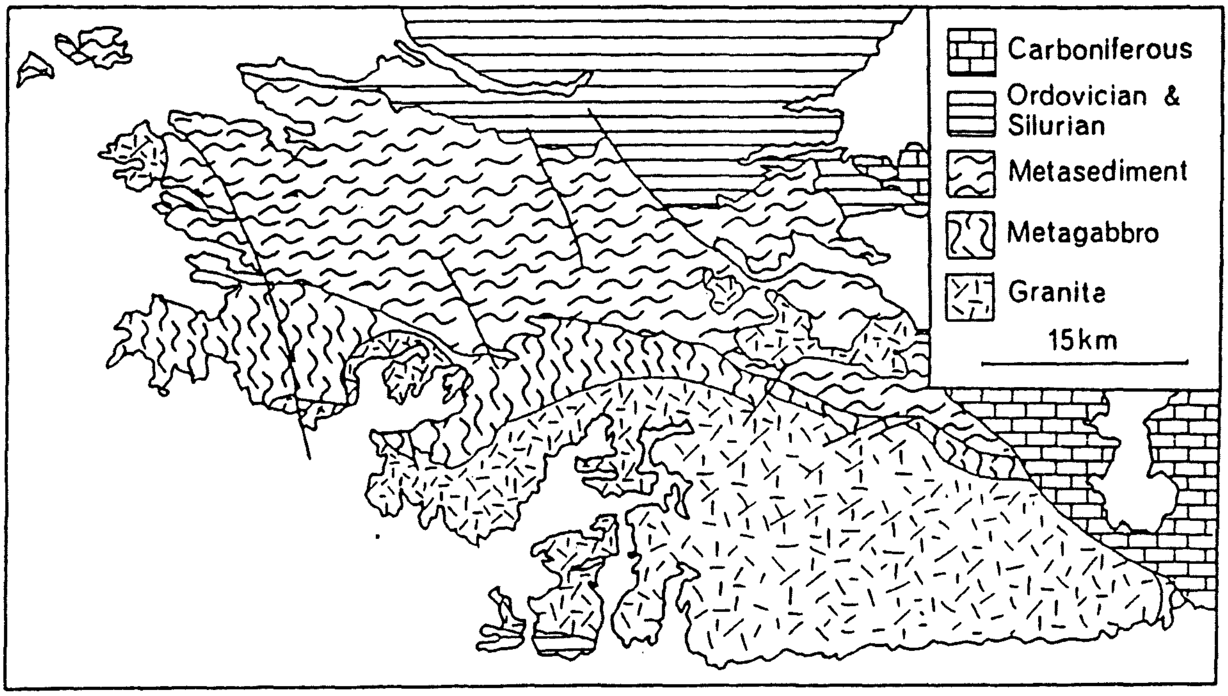


Fig. 1 Outline bedrock geology of Connemara.

Connemara, like most of Ireland, was severely glaciated during the last (Midlandian) glaciation. It is not possible to recognise deposits or features of more than one glacial period (Warren in O'Connell and Warren 1988). Glacial sediments are patchy in distribution and, where flat-lying, are usually covered by post-glacial peat. Drumlins are common and are generally dispersed or occur in small swarms. Many drumlins appear as islands bearing green pastures in a sea of blanket bog.

The pattern of glaciation as proposed by Kinahan and Close (1872) and considered by Warren (see O'Connell and Warren 1988) to be still the best account available is as follows: a very large dome centred on the area just east of the Beanna Beola (Twelve Pins), but covering both them and the Maumturks and radiating north beyond Clew Bay, north-west over Clare Island, south-west over the Aran Islands and south over Co. Clare. Its movement east was hindered by ice spreading from the Midlands, which influenced flow directions along the margins.

As in the case of the glacial geology, no up-to-date comprehensive account is available of the archaeological evidence for settlement in the region. This, however, should soon be rectified when the results of the Archaeological Survey of Co. Galway, which commenced in the mid-1980's is published (cf. O'Halloran and Gosling 1988). In the meantime, preliminary accounts are available (Gibbons and Higgins, in O'Connell and Warren 1988; Gibbons and Higgins 1988). The main evidence is as follows:

Evidence for Mesolithic settlement is known from Oughterard, NW Connemara (Higgins and Gibbons 1988).

Megalithic tombs, datable to the Neolithic and Bronze Age, are more or less confined to NW Connemara (Fig. 2). Several pre-bog stone walls have also been recorded in this area by M. Gibbons (Fig. 2). Pre-bog field systems, comparable to those in N.W. Mayo have not been found, and probably do not exist.

Several of the lake islands contain crannógs. It is generally assumed that these date to the later Iron Age/Early Christian period. Apart from these, there is other evidence, such as the extensive middens on the west coast, which suggests a substantial settlement in earlier Christian times (see also Higgins 1987). The present day pattern of settlement, which is mainly coastal, probably had its origins in the seventeenth century.

Connemara experienced the population explosion which occurred at the end of the eighteenth century (cf. the ubiquitous potato cultivation ridge) and also the sharp post–Famine (1846/47) population decline.

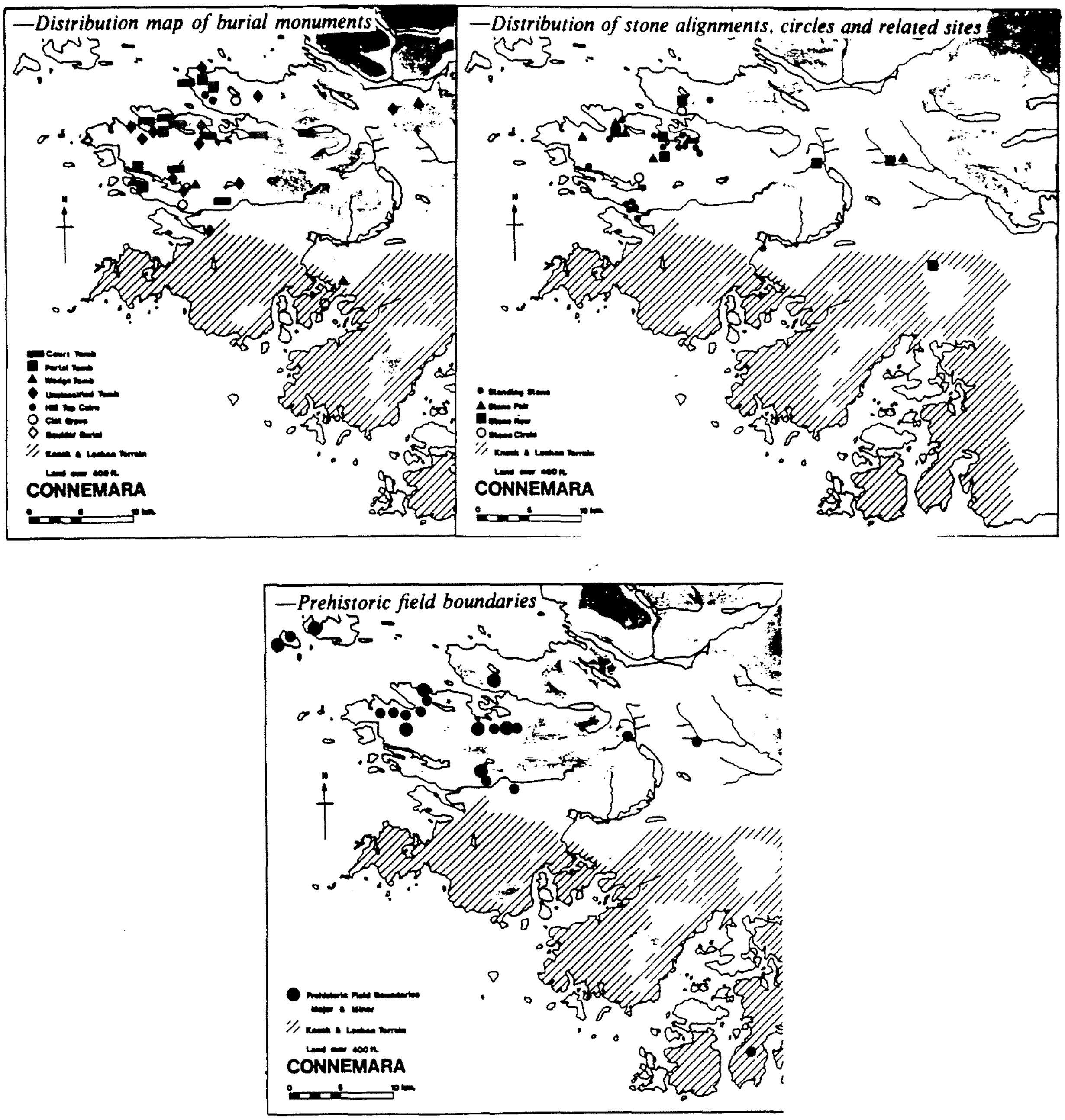


Fig. 2 Map of west Connemara showing the distribution of the main archaeological field monuments (after Gibbons and Higgins, 1988).

Connemara is the headquarters for the Lusitanian and North American elements in the Irish flora. The former includes the ericoids, *Daboecia cantabrica*, *Erica erigena, E. mackaiana* and *E. ciliaris*. *Eriocaulon aquaticum*, the North American pipewort, is to be found in most lakes where, together with *Lobelia dortmanna* it forms the **Eriocaulon–Lobelietum** commmunity. Blanket bog, under threat from both commercial and private peat–cutting and also forestry, is characterised by high contribution of ericaceous and sedge species (including *Schoenus nigricans)* and low *Sphagnum* cover. In bog flushes, where there is some minerotrophic enrichment, species such as *Cladium mariscus* (common) and also *Eriophorum latifolium* and *E. gracile* (rare) can be found. Here also *Sphagnum pulchrum* and *Calliergon trifarium* occur (Lockhart, unpublished). Deciduous woodland is extremely scarce. The surviving patches (Spiddal, Derryclare and Kylemore, and woodlands on lake islands) are probably all secondary (cf. Hannon and Bradshaw 1989). They are mainly oak (*Quercus petraea*) dominated and show floristic affinity with the Killarney oakwoods. (cf. Webb and Scannell 1983; also Kirby and O'Connell 1982; Ferguson and Westhoff 1987).

Until recently Connemara has attracted scant attention from the palaeoecologist. Jessen's (1949) studies at Roundstone supplemented by a later unpublished study of Watts (cf. Watts, 1983) are the only investigations to–date into late–glacial vegetation and environment in the region. In 1980, the first pollen diagram with a full complement of NAP curves was published (Dolan profile, nr. Roundstone by Teunissen and Teunissen–van Oorschot). In 1984, when a research programme aimed at reconstructing the post–glacial environment of the region was initiated by the author, no ^{14}C–dated pollen diagram was yet available and only a couple of radiocarbon dates were available in toto. At present about 50 dates provide the basis of a sound chronology for the main vegetational and environmental developments of the post–glacial. Todate, summary accounts and papers on particular aspects of the vegetation history have been published (see below). An account of the history of lake island woodland vegetation in western Connemara is available in Hannon and Bradshaw (1989).

Note: This guide is intended for private circulation only. It is not a publication.

Connemara National Park (Saturday, 9. Sept 1989)

The sites chosen for palaeoecological investigations in Connemara National Park lie to the south–east of the Park Centre (grid ref. L 71 57) where blanket bog, now much cut over, dominates the treeless landscape (Fig. 3). Basin peat which featured an extensive intercalated layer of pine stumps was selected for the main profile (FRKII). The pine stump layer rested on 2.4 m of peat and, in turn was overlain by a layer 1.2 m of peat.

Pollen and macrofossil analyses on FRKII have been carried out by Bowler (1986) and Heijnis (1987), respectively. An account of the woodland history is published in O'Connell et al. (1988).

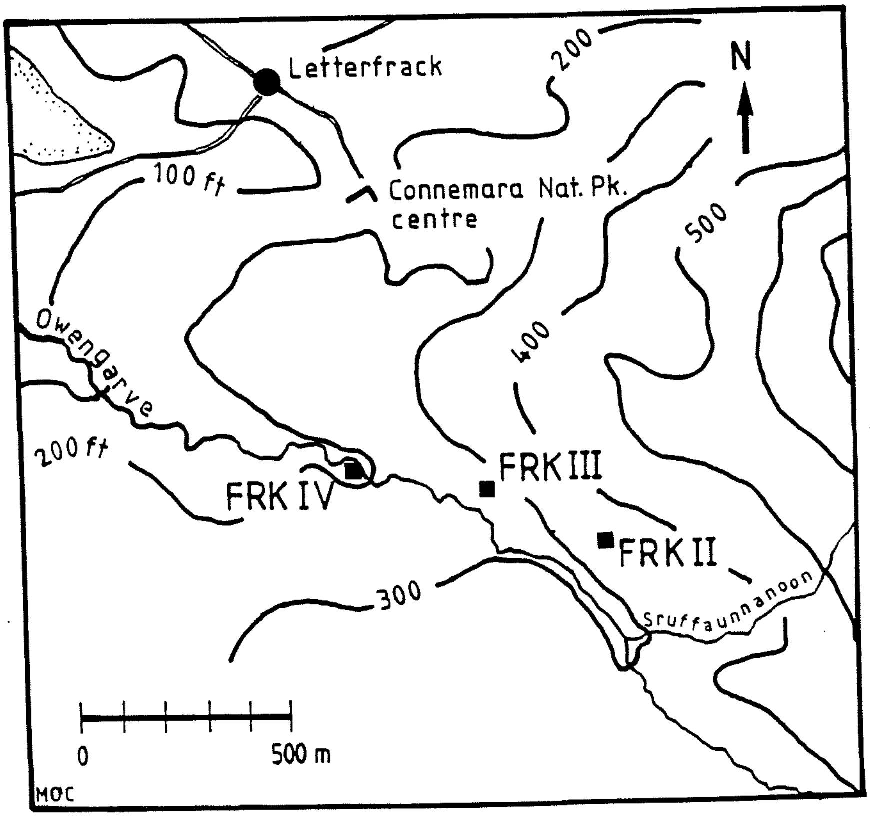


Fig. 3 Site map showing location of pollen profiles FRKII, FRKIII and FRKIV in the Connemara National Park, Letterfrack.

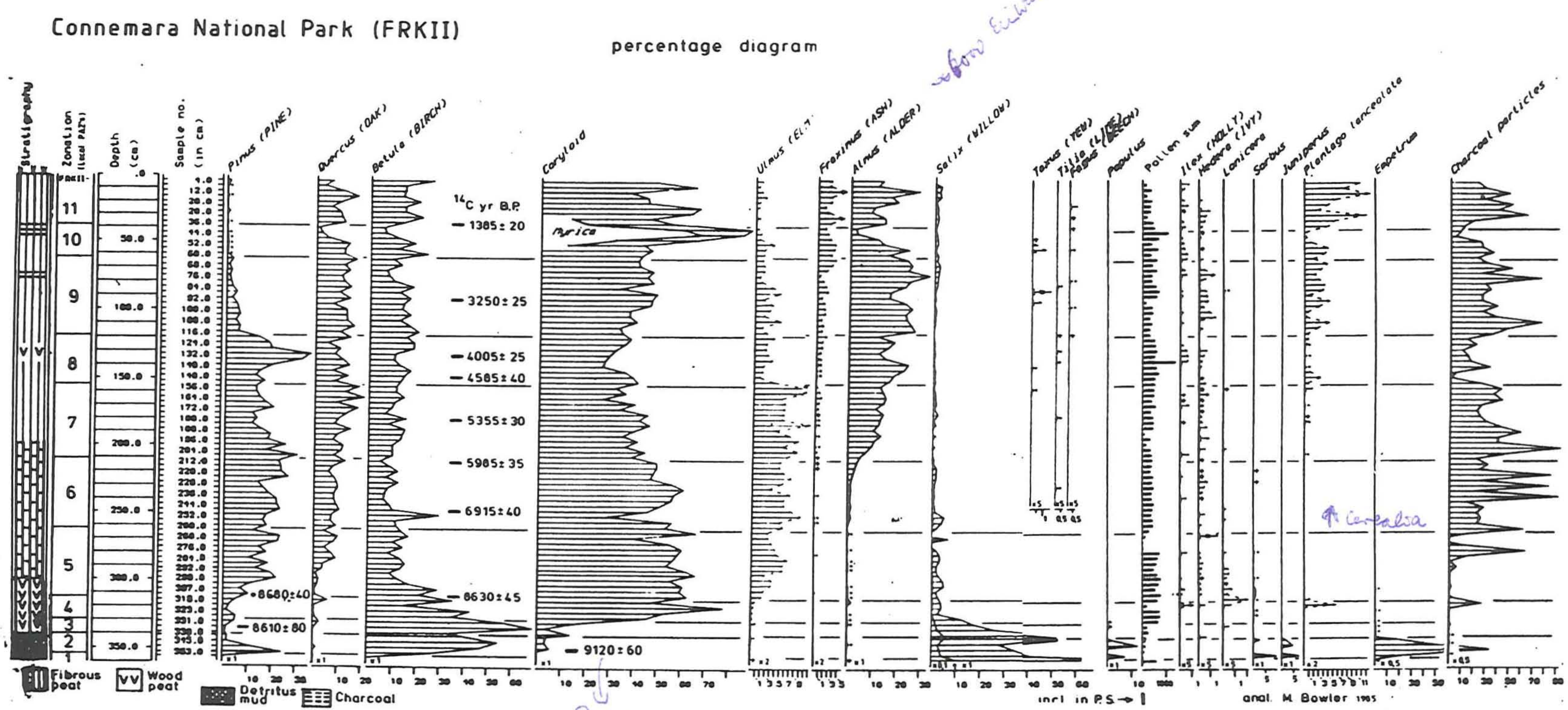


Fig. 4a Percentage pollen diagram (profile FRKII) based on an AP sum.

5 boreal woodland

1/2 Emp./Junip. Phase

~ 9500

all Corylus

Cerealia

• Ulmus Abfall → Pland. Anstieg, Neolithikum Beginn

• Pinus Gipfel in 8, Ausbreitung auf Torf mit klimatischem Wechsel

• Cerealia bei 6915

• 5600 mehrere Stellen mit Cerealia

Fern fang? frühester neolith. Nachweis

kann nicht als Agriculture bezeichnet werden "genetic aberration" 2 Poren

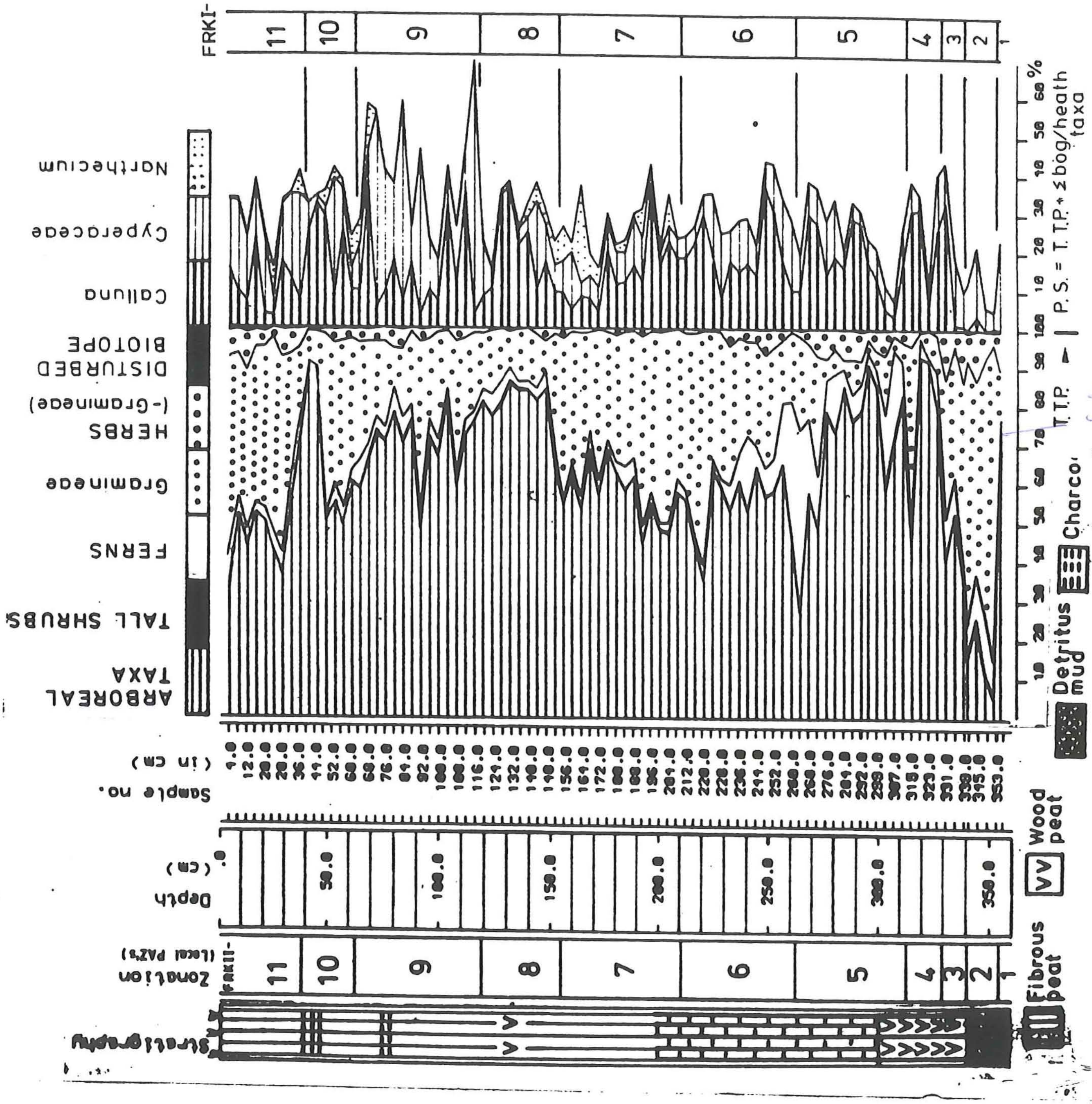


Fig 4b. Composite pollen diagram (FRK II)

The main features in the regional vegetational development as show by the profile FRKII are as follows:

FRKII–1, 2 and 3: Late–glacial/ post–glacial transition

The base of the diagram reflects vegetation development at the beginning of the Holocene. NAP dominate in PAZs 1 and 2 with *Salix* and *Empetrum* also important. Jessen's study had already shown that both these taxa were important in the early Holocene at Roundstone. *Juniperus* is normally but not always low (cf. McDonnell 1988) in areas with base–poor soils, such as Connemara. The ^{14}C date, 9120 +/– 60 BP from near the base of the profile, is probably over 500 years too young.

FRIKII–4 AND 5: Early woodland development

The displacement of *Betula* by *Corylus* and the establishment and expansion of *Pinus*, *Quercus* and *Ulmus* is recorded here. Irish diagrams are noted for the high early Holocene *Corylus* maximum (c. 9200 BP), often regarded as a response to the fertile base–rich soils. In Connemara, however, high *Corylus* values are also recorded at this time, even in granite areas (L. Namackanbeg, Spiddal in O'Connell et al. 1988). Note the early presence of *Ilex, Hedera* and *Lonicera* (c. 8700 BP).

FRKII–6 and 7: Atlantic woodlands

The *Alnus* curve is an interesting feature in this part of the diagram. It begins at c. 7000 BP but does not expand till c. 6000 BP, when *Narthecium* and *Assulina* form continuous curves. The expansion of alder was probably favoured by wetter conditions. The woodlands consisted mainly of pine and oak and elm was infrequent (even absent!) and ash was rare.

FRKII–8: The Elm Decline and pine woodland on bog

Though *Ulmus* is low (11% of AP – the highest value recorded to–date in Connemara) it falls sharply across the zones 7/8 boundary to 4.3% and at 4 cm higher drops to 1.0%. Note that, as in many diagrams from the west of Ireland, the *P. lanceolata* curve begins before the Elm Decline. The record about the Elm Decline is complicated by changes taking place on the bog surface (see below) which influence the course of the pollen curves and possibly also the ^{14}C dates (too young).

The *Pinus* peak, dating to 4000 BP reflects the invasion of pine onto the bog surface. This pine phase may have lasted up to 500 years. A *Pinus* peak is also recorded in the diagrams of Jessen, and Teunissen and Teunissen–van Oorschot in a similar position *vis–a–vis*the Elm Decline. This suggests that a regional drying out of the bog surfaces in W. Connemara took place at this time. If this is the case, it is likely that a climatic change is involved.

FRKII–9, 10 and 11: Decline and extincton of pine and elm and the expansion of ash.

At 3700 BP there is a substantial decline in the *Pinus* curve. Pine has died out on the bog surface and oak is now the dominant tree in the surrounding woodlands (see also FRKIII and FRKIV). After about 3000 BP, pine is only a minor component, or indeed it may be absent, in the local vegetation. Its extinction in Connemara is recorded at the top of PAZ 9. This event dates to the last century BC.

Zone 10 corresponds to the late Iron Age, which in Connemara, as elsewhere in Ireland, is marked by a lull in farming. The expansion of bog myrtle (*Myrica gale*) on the bog surface results in disturbance of the other curves, so that this feature, if present, is not to be readily seen.

The diagram ends before the 18th century.

History of blanket bog development and local woodland history.

Evidence of blanket bog development and local woodland history comes mainly from the investigations of two short cores from outside the basin (FRKIII and IV; for location see Fig. 3) and also from pollen and macrofossil analyses carried out on profile FRKII.

The evidence from FRKII indicates that, though terrestrial peat as distinct from limnic deposits began to accumulate in the pre–Boreal (zone IV, PAZs (local Pollen Assemblage Zones) FRKII–1 (this PAZ is omitted in Fig. 5) and FRKII–2, it was not until the mid–Atlantic period (post 6000 BP, FRKII–7), that a mire vegetation with at least some floristic affinities to present day blanket bog communities was established locally. The pollen evidence indicates that grasses (probably *Molinia*), *Narthecium*, sedges, *Calluna* and *Potentilla* (most likely *P. erecta*)) were frequent on the mire surface. Remains of the rhizopod *Assulina* are also frequent at these levels, indicating that wet habitat conditions prevailed.

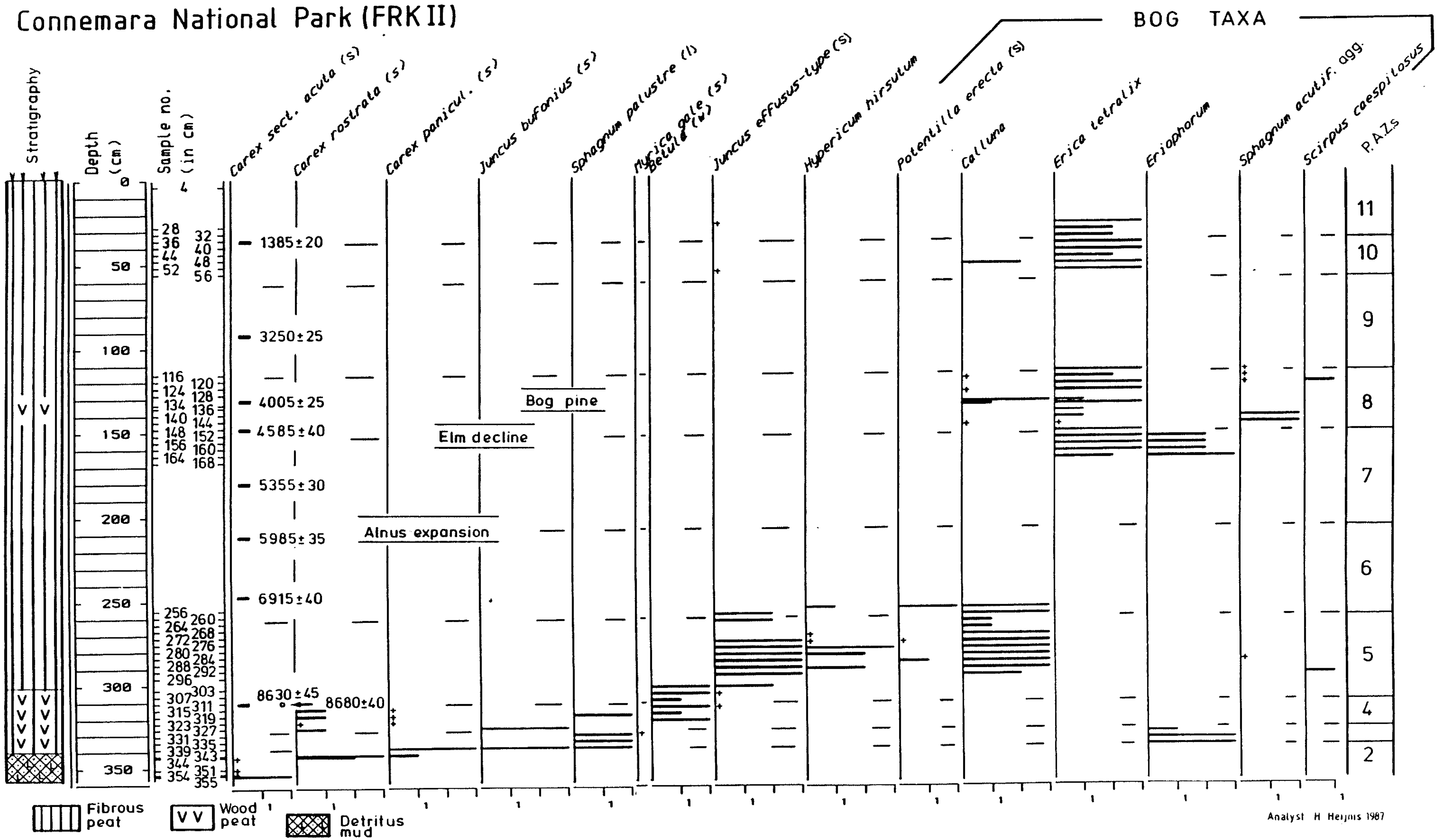


Fig. 5 Summary of results of macrofossil analysis (FRKII).

Across the elm decline (FRKII–7/8 boundary), Gramineae values decrease from 42% to 8%, *Sphagnum* sect. *acutifolia* leaves are frequent, and *Sphagnum* spores are well represented. This suggests that the grass component of the mire vegetation declined at the expense of Sphagnum. *Assulina* is now rare so that a drying out of the bog surface may have occurred, but this cannot have been severe as *Narthecium* continues to be well represented for some time. In the middle of FRKII–8 (4000 BP), a pine woodland, with heathers (*E. tetralix* and also *Calluna*) important in the ground layer, became established on the mire surface. In this woodland, as *Pinus* representation begins to decline, *Sphagnum* sect. *acutifolia* leaves are again recorded. *Sphagnum* growth may have contributed to the demise of the bog woodland. In the period represented by FRKII–9 (3750 to 2200 BP), the pollen evidence and the frequency of *Assulina* in the pollen preparations suggest that the mire surface was wet and supported a grassy sedge–rich community that included *Rhynchospora*. However, *Narthecium* remained unimportant until the end of the zone. It is shown below that it was not until about mid–way in this zone that blanket bog began to grow on the relatively low–lying basin rim to the north–west.

Profiles FRKIII and FRKIV

Profile FRKIII lies c. 300 m north–west of FRKII and 70 m to the east of the Owengarve river, to which there is unimpeded drainage (Fig. 3). The basal peat was dark as a result of high charcoal content. The underlying mineral soil consists of a non–stony silty podzolic loam. No iron pan was present.

Profile FRKIV was removed from a freshly exposed, more or less vertically cut river section in the drift. The site lies 300 m downstream from FRKIII on the western bank of the Owengarve river (Fig. 3). At the point where the monolith was removed, the cliff was capped by c. 50 cm of undisturbed peat. The basal 5 cm layer of highly decomposed peat, with a substantial charcoal content, was distinctly different from the overlying brown fibrous peat. The uppermost mineral horizon, 28 cm thick, consisted of a moderately organic–rich fine sandy loam. A high stone/boulder content throughout, distinguished the mineral part of this profile from that at FRKIII.

The ^{14}C dates (Fig. 6) show that accumulation of organic matter on the mineral surface had begun at both sites by 3100 BP, a conclusion which is also supported by the pollen analytical evidence, especially the comparable course of the arboreal

pollen curves in the mid part of FRKII–9 (Fig. 4a). The dates for peat initiation at both sites lie so close together as to be statistically inseparable.
The mineral soil spectra in FRKIII are characterised by a relatively high NAP to AP ratio of 1.6, Gramineae average 28% (uppermost spectrum not included), and bog/heath taxa such as *Calluna*, Cyperaceae, *Narthecium* and *Rhynchospora* are well represented. While the bog/heath taxa may originate at least partly from the basin, they most likely reflect local conditions in the vicinity of the sampling site, where bog/heath species appear to have been present for a considerable time prior to initiation of peat accumulation. Maximum representation of only 1.4% is achieved by *Plantago lanceolata*, indicating that during the period of formation of this pollen assemblage, *P. lanceolata* was not important locally, though profile FRKII suggests the presence of open grassland (Figs 4a and 4b).

Samples 0 and –1 cm record the changes that occurred as humus began to accumulate on the soil surface. The vegetation cover became more closed as *Betula pubescens* and *Sorbus*, most probably *S. aucuparia*, replaced herbaceous taxa. The sievings from the 1 cm^3 pollen sample preparations from the uppermost mineral soil sample (0 to 1 cm) yielded *Juncus* seed (including *J. conglomeratus*).

The evidence suggests that as humus accumulation began, the wet, relatively infertile and acidic soils (pH 4.5) supported grassy communities with *Juncus*, which were subsequently colonized by *Betula pubescens*, *Sorbus* and *Ilex*. As woodland regeneration proceeded, which also involved pine, the herbaceous vegetation consisting of grasses, sedges and rushes was more or less completely displaced. The lower most organic–rich layer is probably best interpreted as a woodland mor humus.
At –3 cm (3 to 2 cm above the soil/mineral interface), further substantial changes are recorded. Pollen representation of scrub species has declined and that of herbaceous taxa has increased, especially Gramineae which now exceeds 50%. Other important indicator taxa include *Narthecium*, *Potentilla*–type and *Pedicularis*. Obviously, woodland has given way to a community with species composition broadly comparable to present–day **Pleurozio purpureae–Ericetum tetralicis** blanket bog communities.

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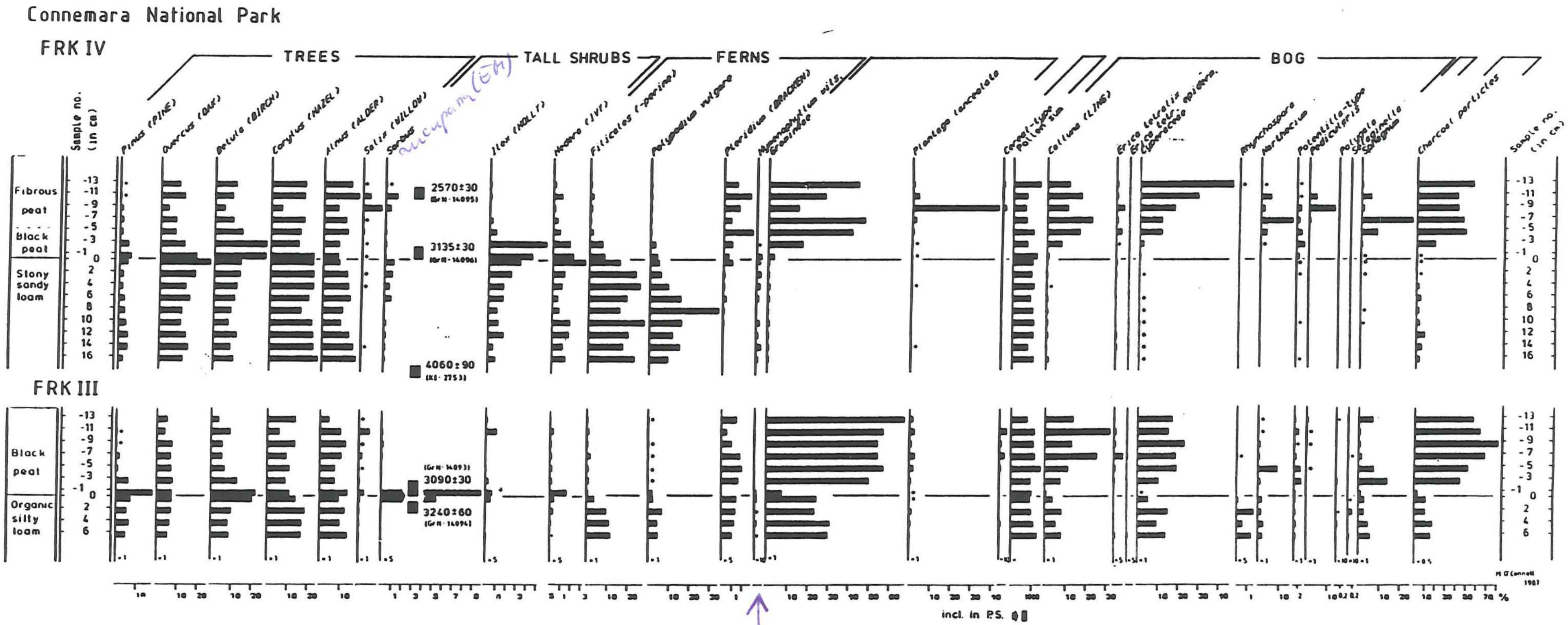


Indiz für woodlands

Profil zeigt großes Kohleband (durchgehend)
→ Feuer Teil der Bewirtschaftung

Blanket Bog beginnen ab 3000
auszubreiten über Buschland

Fig. 6 Percentage pollen diagram (FRKIII and FRKIV).

vgl. S. 16 → auch keine eigenständige Podsolierung! ⇒ bronzezeitlich anthropogene Entstehung

kein Ortstein!
dort wo Ortstein vermutlich erst in letzten 100 Jahren gebildet

At FRKIV, the mineral soil spectra contrast sharply with those of FRKIII. Here, tree, tall shrub and fern palynomorphs constitute 99% of total terrestrial pollen. This suggests that stable woodland cover, with a well developed fern understory, that included *Hymenophyllum wilsonii,* preceded peat accumulation. The dominant tree/tall shrub vegetation included oak (*Quercus*) and hazel (*Corylus)*; Pine was present but probably not in the immediate vicinity of the sampling site. The rather gradual changes in ash content and in pollen concentration over the mineral/peat interface suggest that the opening-up of woodland and its replacement by bog was a more gradual process than at FRKIII. At FRKIII the very high pollen concentrations in the basal peat samples suggest that the humus layer, which effectively sealed off the mineral soil, accumulated initially at a very slow rate, during which woodland regeneration occurred. At the mineral/peat interface in FRKIV, the first indications of change in the pollen record are represented by an increase in *Quercus* and *Ilex* (2 and 0 cm) and an overall decline in ferns. *Pteridium*, however, increases suggesting that an opening up of woodland has occurred. Mor humus accumulation begins and, in sample −3 cm, the pollen evidence suggests open woodland scrub in which birch and holly are important and with heath vegetation, including grasses, *Calluna* and *Potentilla erecta*, spreading locally. At −5 cm, the shrub community is largely replaced by vegetation comparable to present day blanket bog communities, with *Sphagnum*, *Narthecium*, sedges and *Calluna* being present locally.

Processes and factors involved in blanket bog formation in Connemara.

Iron pan formation, giving rise to waterlogging and decline in rates of decomposition, cannot be implicated, since iron pan did not form at FRKIII and is only weakly developed at FRKIV (where it is probably secondary, anyhow). Neither is drainage impeded by the local topography. **Increased soil wetness** at FRKIII appears to have been a factor operating for a considerable time prior to peat initiation, but it did not result in bog growth leading, in turn, to a decline in woodland.

Considerable amounts of charcoal are present in the mineral soil at FRKIII, indicating **fire** probably at or near the sampling site. It is difficult to assess what role, if any, occasional fire may have had in maintaining the open woodland structure. Immediately prior to and at the initiation of peat accumulation, charcoal levels decline and later rise rapidly as blanket bog-type vegetation takes over. This suggests that a decline in fire frequency was followed by repeated firing that would have prevented woodland regeneration. Tallis (1975) describes similar events as peat growth was initiated in the southern Pennines.

The pollen record suggests low but continuous levels of disturbance, possibly over centuries at FRKIII, while at FRKIV evidence for disturbance is present only in the uppermost soil spectra. The difference in vegetation cover at FRKIII and FRKIV in the pre-bog period may be accounted for by differences in degree of human impact at opposite sides of the Owengarve river. It has not been possible to fully substantiate such differences as there is no evidence, apart from that presented here, for human presence in either area at this time.

At both sites, mor humus appears to have accumulated during a period of reduced disturbance which, on the basis of the high pollen concentration (especially at FRKIII), is best regarded as lasting at least a century rather than decades. Intense firing then followed, so that regeneration ceased, the charcoal probably contributed to impeded drainage (Mallik et al. 1984) and blanket bog-type vegetation was established. All indications are that in the absence of firing, which was most probably anthropogenic in origin, woodland would not have been replaced by bog at this time in these areas. The evidence also indicates that, at least in this area, a model envisaging peat spreading laterally from a central focal point, in this instance the basin site represented by FRKII, and thereby displacing or enveloping grassland or open woodland, is inappropriate.

Lowland blanket formation in Ireland

Fig. 7 shows a schematic representation of blanket bog development and woodland history (left and right hand sides, respectively, of first 7 columns) in selected regions/sites where, today, blanket bog is a dominant landscape feature. In the **final two columns**, degree of podzolization (based mainly on the evidence from L. Namackanbeg, Spiddal) and variation in the level of human activity, based on pollen and archaeological evidence, are schematically indicated. In **columns 1 to 7**, widespread initiation and the growth of bog so that it constitutes the dominant feature in the landscape, are indicated by closely spaced thick horizontal lines; widely spaced thin lines show presence of small nuclei of bog. Undisturbed woodland prevailed at most sites until the end of the Atlantic period (c. 5100 BP). A progressive opening-up of the woodland cover follows, the density of dots reflecting the importance of woodland in each region/site. In most areas under consideration here, woodland had ceased to be the main vegetational element in the landscape by the late Bronze Age (end of 4th millennium BP) (from O'Connell 1989).

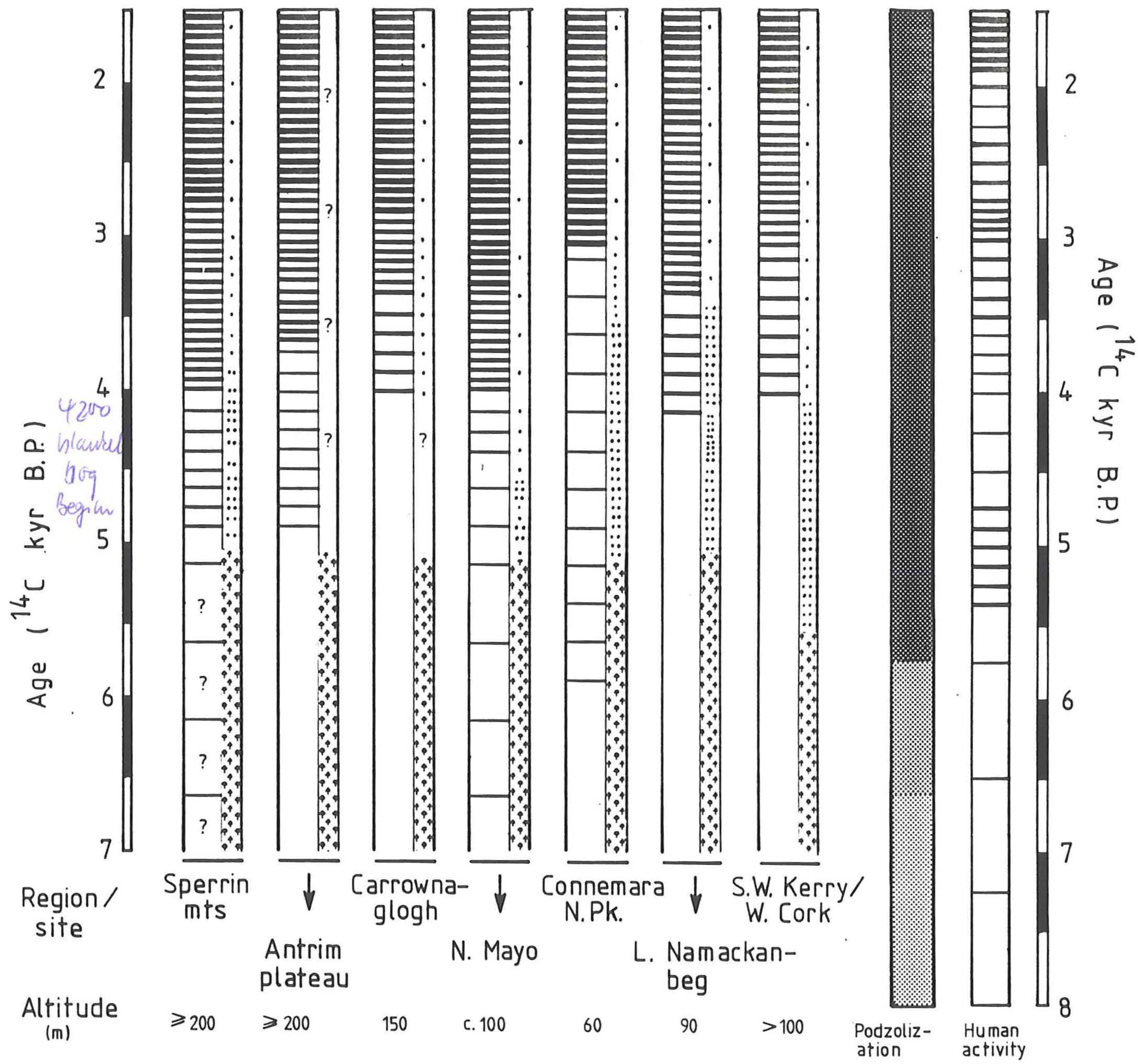


Fig. 7 Schematic representation of blanket bog development (see text).

Derryinver Hill, Rinvyle – reconstruction of land–use in the later prehistoric and Early Christian period.

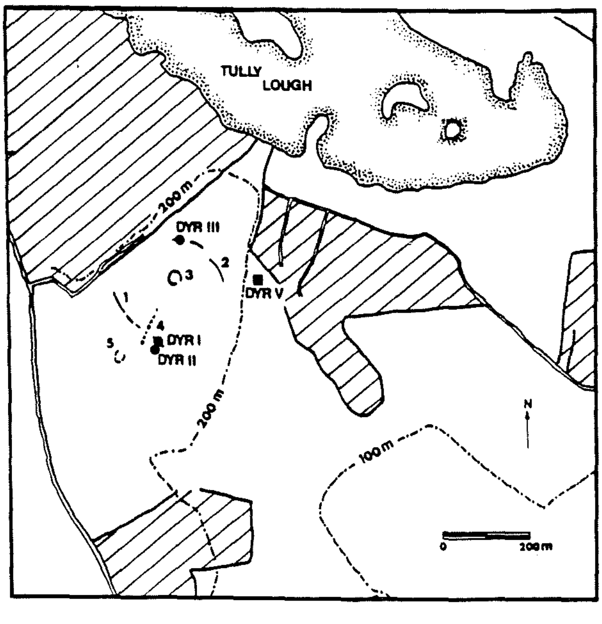
Palaeoecological investigations at this, one of most important archaeological sites in Connemara, have been carried out by Molloy (1989). Derryinver Hill or Tullach (grid ref. L695 615) is a relatively low–lying glacial ridge (c. 100 m O.D.) lying at the eastern side of Tully Mountain (357 m), in the Rinvyle peninsula. It has a rich variety of field monuments and, moreover, in the Rinvyle Peninsula, megalithic tombs, representative of all except the passage tomb–type have been recorded (Fig. 2).

The main archaeological structures on the hillside are as follows (Fig. 8): pre–bog stone walls (1 and 2); a graded six stone alignment (4) together with what appears to be a stone circle (ó Nualláin 1988) or a rather simple megalithic structure (5); a circular area defined by an inner ditch and substantial outer earthen bank with a gap in the east (3). It is tentatively classified as a hinge monument datable to the Bronze Age.

Sampling strategy

Monoliths were taken from beneath a stone wall c. 20 m to the east of the alignment (DYRI) and from beneath the curved wall (DYRIII) on the NW side of the Hill (Fig. 8). These should provided dates for wall construction and also evidence for land–use, in the period pre–wall construction. A monolith (DYRIII) that included mineral soil and peat was also removed from a point 7.5 m distant from DYRI. This should contain a record of events and processes which took place immediately prior to and after peat formation.

Note: the exact relationship of the wall to the alignment at the point of intersection could not be determined without excavation. It appears reasonable to assume, however, from the general context that the wall construction is, at earliest, contemporaneous with or post–dates the alignment.



Results of investigations

Soils

In the three sections examined, the silty loam soils were highly podzolized, but showed no evidence of iron pan formation. The profiles from beneath the stone walls had distinctive horizons, but differed substantially (Fig. 9). At DYRI, the uppermost mineral horizon (A_0/A_1), 5.5 cm deep, was organic rich (incl. charcoal) and relatively compacted. Between this and the C horizon at 25 cm, an indistinct A_2, a fairly well defined B_2 and a transitional B/C horizon were recorded. At DYRIII, on the other hand, the uppermost horizon (A_0) consisted of a layer of charcoal, c. 5 mm thick. An A_2 horizon, 6.5 cm thick and with low organic content, followed. The B_2 horizon, with a higher organic content and freckled with charcoal, especially in the uppermost 3 cm, extended to 30 cm. Mottling was evident in the lowermost 11 cm.

At DYRII, the peat from −11 to 0 cm, the peat was dark due to the high levels of charcoal present. The transition to the mineral soil was very diffuse. At the top of mineral zone, the organic content rapidly declined, yielding to a poorly defined A_2 horizon (5 −11 cm), a B_2 horizon and a C horizon commencing at 21 cm.

Pollen analysis and radiocarbon dating (Fig. 9)

DYRI – profile from beneath the main stone wall

Pollen was preserved in reasonable quantities at deeper levels here than elsewhere (20 cm; B/C horizon); however, there was evidence of pollen corrosion and concentration was low at 20 cm. The spectrum suggests hazel-dominated scrub with the possible presence of oak. This gives way to a hazel-dominated scrub vegetation (13 cm) which becomes open (10 cm), as pasture expands (cf. *P. lanceolata*).

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

In spectra 5 to 0 cm, exceptionally high Gramineae and *Calluna* representation are recorded while *P. lanceolata* levels decline substantially. This indicates a vegetation dominated by grass and ling. It is assumed that low soil pH and the chemical characteristics of the litter led to a progressive increase in the organic matter content of the soil (Ao/A1 horizon) so that, at the time of wall construction (2370 +/− 60 BP), soil degradation was already at a fairly advanced stage.

DYRIII – profile from beneath curving wall

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

DYRII – peat/soil profile

It can be expected that the vegetational changes recorded here would post−date those represented in DYRI. This assumption is borne out by the 14C dates which indicate a probable minimum of 600 calendar years between wall construction (shortly after 2400 BP) and initiation of peat growth (c. 1700 BP)

The pollen from the basal level (8 cm), though affected by corrosion, reflects the hazel−dominated scrub phase recorded in DYRIII and the deeper spectra of DYRI. The next four spectra (5 to 0 cm) reflect primarily pasture−dominated farming (cf. exceptionally high *P. lanceolata* percentages, also Liguliflorae (dandelion), *Ranunculus* (buttercup) and *Trifolium repens* (white clover)). Cereal−type pollen is well represented suggesting that arable farming was also pursued on Derryinver. The increasing representation of *Calluna* and also *Succisa* suggest progressive acidification, culminating in the presence of *Sphagnum* as the uppermost mineral soil spectrum (0 cm) is forming. This is not surprising since ling was locally important here at c. 2400 BP (DYRI). Indeed, it appears that land–use practices halted or even reversed soil degradation and facilitated productive use of the land for a number of centuries.

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

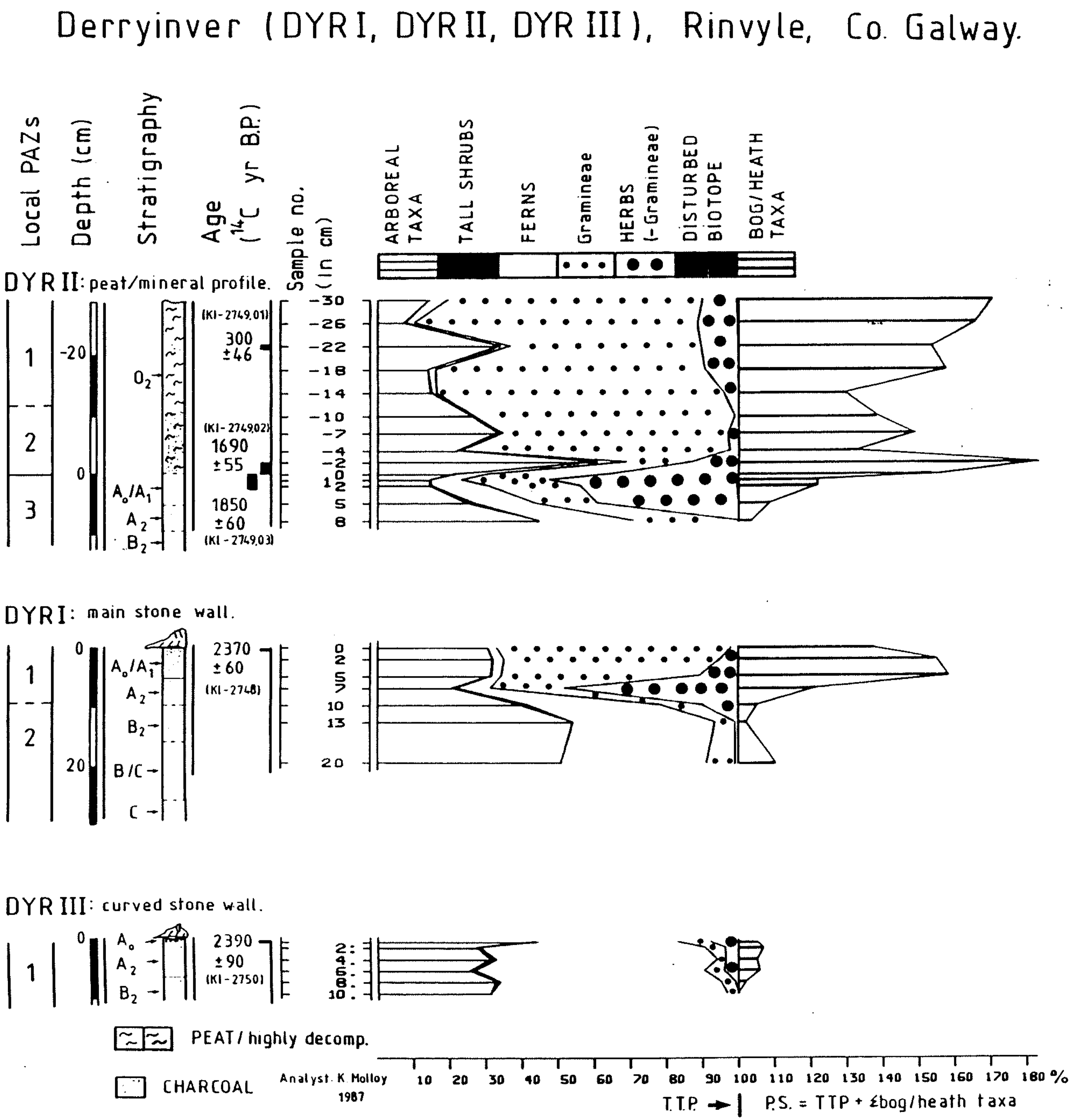


Fig. 9 Summary percentage pollen diagrams (DYRI, DYRII and DYRIII)

Land use on Derryinver Hill – conclusions

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

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

3) The megalithic structures on the hill top must considerably pre–date the wall construction, if the conventional dating (late Neolithic (ó Nualláin 1988), or mid to mid to late Bronze Age, 1400 – 500 BC (Lynch 1981)) for such structures is accepted. It seems justified to assume that they were put in place when the hilltop was more or less devoid of woody vegetation. The soil profiles contain no record of this. The record has probably been lost through subsequent pollen rejuvenation in the soil.

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

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

6) Finally, the evidence suggests that land management rather than climatic change is the crucial factor affecting spread of blanket bog during the post–glacial (cf. O'Connell 1989; also Fig. 7).

Profile DYRV: Base of Derryinver Hill

The basin to the east of Derryinver Hill contains an extensive area of much cutaway bog. At the edge of the bog, c. 30 m from the mineral soils of the lower hill slope, an area of peat 5 m deep was located. A pollen profile (DYRV), from this site will be presented in the field (see Molloy 1989). The main features are as follows:

1. At the Elm Decline and during the immediate post–Elm Decline period there is little evidence of anthropogenic activity.
2. The *P. lanceolata* curve begins at c. 4000 BP, i.e. in the late Neolithic/ Early Bronze Age. The stone alignment may have been constructed at this time.
3. At c. 3700 BP a particularly intensive farming phase (pastoral and also some arable) is recorded. *P. lanceolata* attains 44% (total pollen excl. bog taxa) and 4 cm higher *Anthoceros* peaks at 10%.
4. At 2800 BP these is substantial woodland clearance. Hazel and alder, in particular, are affected.
5. The lull in farming at the end of the Iron Age is clearly reflected. This is preceded by a short clearance phase that may correspond with the clearance recorded in DYRIII, immediately prior to wall construction on the Hill.

Sunday, 10. Sept 1989 – Lough Sheeauns, Cleggan: Post–glacial woodland history and prehistoric land–use.

Introduction

Lough Sheeauns lies within what is probably the most dense concentration of prehistoric field monuments in Connemara (see Figs. 2 and 10; grid ref. L625 582). This made it an obvious choice for the study of prehistoric impact in the region. Its small size (c. 120 m greatest diameter), its closed character and sheltered location suggested that its sediments might hold a good record of local vegetational changes and land–use.

Investigations

The main profile (SHEIII, Fig. 10), taken from the centre of the lake was investigated by Molloy (1989). Pollen analysis was also carried out on a 3 m peat core from the valley floor c. 33 m to the east of the lake (profile SHEIV, Fig. 11; Keane 1988). This investigation was carried out with a view to clarifying certain aspects of the main SHEIII profile. It showed, for instance, the pollen input as reflected in SHEIII, is, as was assumed in Molloy and O'Connell (1987), quite local in character. Thus, *Calluna* and *Melampyrum* peaks recorded at the base of SHEIV do not register at all in SHEIII.

Results and Conclusions

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

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

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

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

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

Detailed consideration of the vegetational changes and land–use history at and about the elm decline (5000 BP) has been presented by Molloy and O'Connell (1987; 1988; Molloy 1989). The main conclusions are as follows:

1. In the century prior to the elm decline, Neolithic farming commenced. The main evidence is the presence of *Triticum*–type (wheat) pollen. The NAP component, including *P. lanceolata*, expands indicating opening–up of the woodland canopy. However, no large scale woodland clearance took place.
2. The elm decline *(Ulmus* representation drops from 2.8 to 1.2% (TTP) across the zone boundary in SHEIII) is recorded as an event distinct from the following Landnam episode. An anthropogenic explanation for this event is considered to be no longer sustainable, at least at this site. Disease appears to be the most likely cause of this decline in *Ulmus* pollen representation.

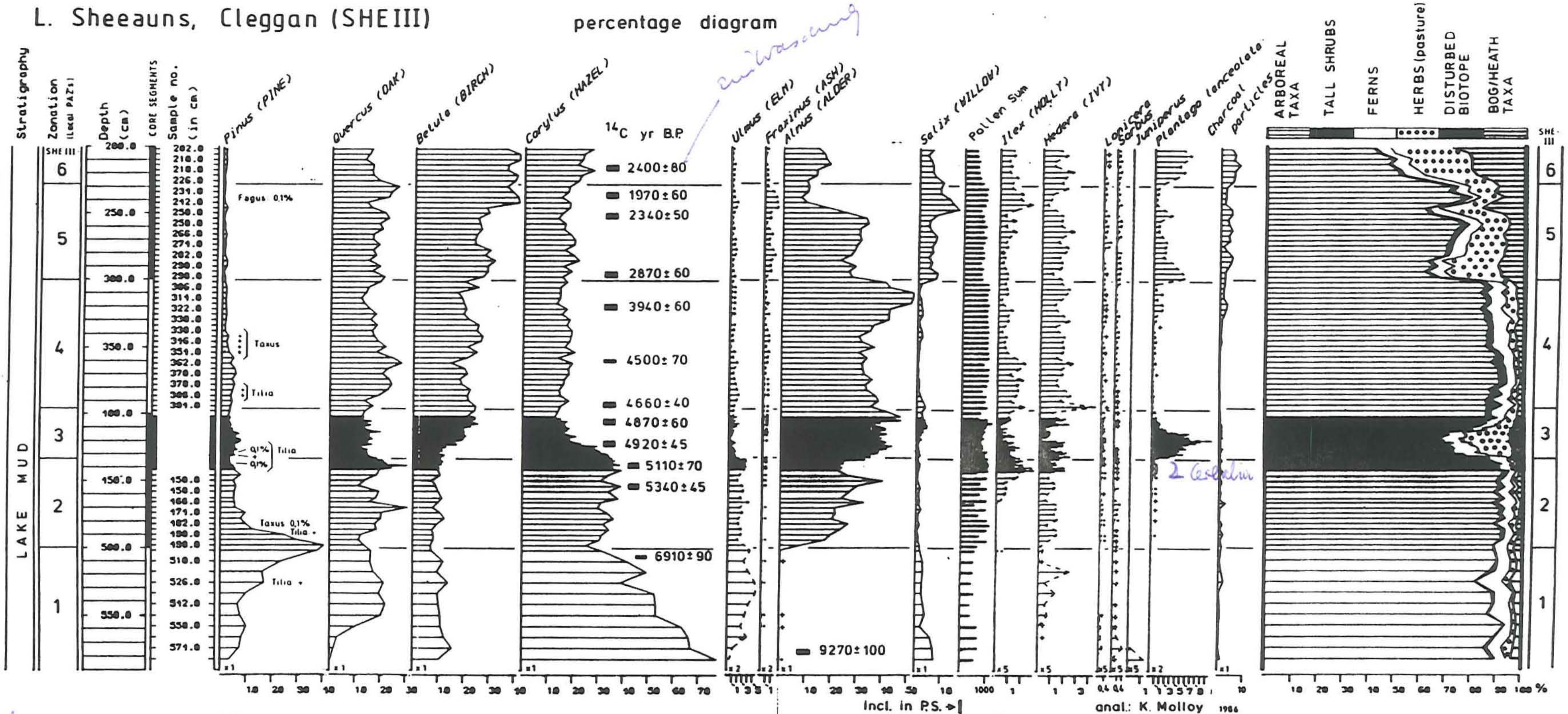


Fig. 10 Summary percentage pollen diagram (SHEIII).

26

Zone 4 = normaler Waldbestand
3 = Störung neolithisch

bei Pinus Peak Seespiegelschwankung (hypnophiles)

1970±60 Waldschließung / Ende der Mittleren ? Eisenzeit ; 2340±50 Landnahme

Vor Ulmus Abstieg war bereits Ackerbau wegen 2 Cerealia

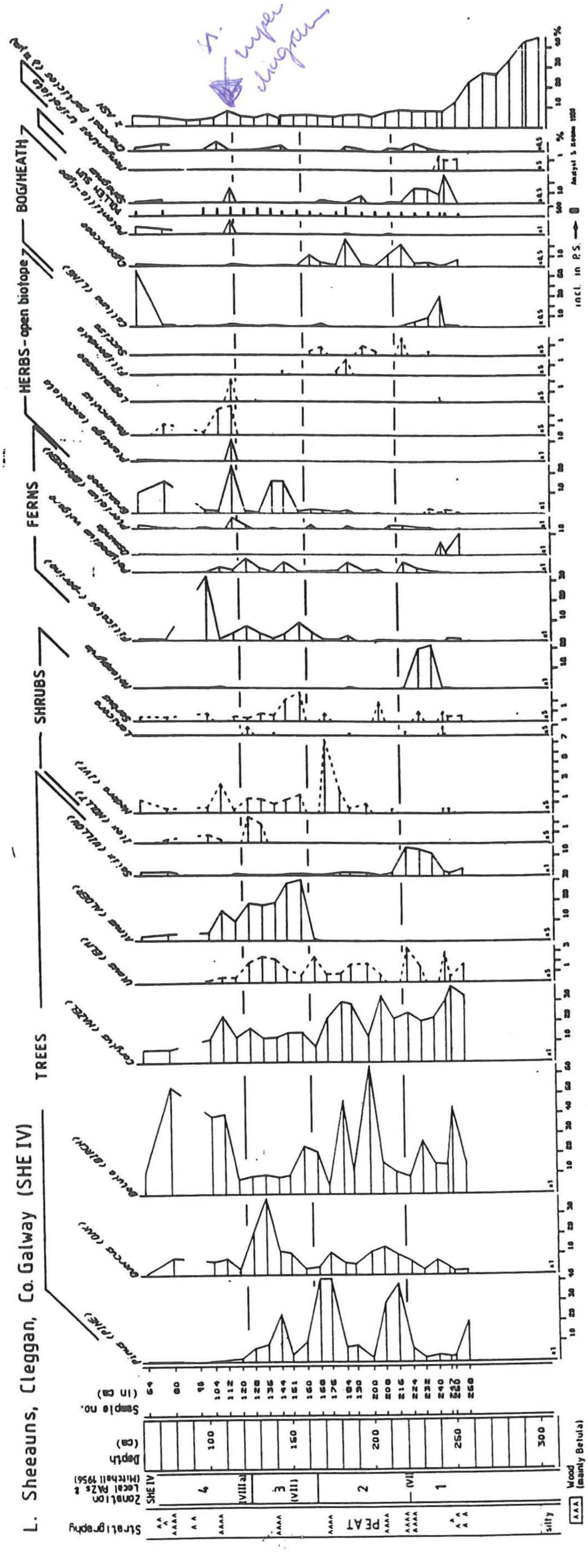


Fig. 11 Summary percentage pollen diagram (SHEIV).

3. The Elm Decline is followed by a Landnam phase during which there was widespread woodland clearance. The high Gramineae, *P. lanceolata* and Liguliflorae (dandelion) representation and the overall high diversity of NAP taxa, most of which are common today in grasslands and especially closely grazed pastures, suggest that the Neolithic economy was pastoral based. In the later part of the Landnam phase, as the NAP begin to decline, the pollen of weeds of disturbed habitats which includes those of cultivated land are recorded. This, together with evidence for soil erosion in the chemical record, suggests that a shift towards arable farming may have taken place as the intensity of agricultural activity declined and the woodlands began to regenerate.

4. This major Landnam phase lasted from c. 5000 to 4800 BP (see Fig. 12 for estimation of duration of the various phase in calendar years). For the remainder of the Neolithic, the palynological record, as far as human activity is concerned, is largely silent. From 4500 BP onwards, however, small changes in the NAP and more substantial movement in the AP curves indicate that changes are taking place in the woodland environment. It is possible that events of a regional rather than a local character are reflected here.

In the original publication, Molloy and O'Connell (1987) regarded decline in soil fertility as an unlikely cause of the abandonment of farming at the end of the Landnam phase. The small increase in representation of bog/heath taxa recorded during the Landnam phase in SHEIII need not necessarily indicate an expansion of bog or heathland. The increased input of these taxa may be more apparent than real, being the result of the percentage method of calculation, though the increase in concentration levels suggests that the latter may be the case. This may well be due to increased input of pollen as a result of the more open landscape rather than an actual increase in heathland. When the Landnam phase reaches its maximum, the *Betula* curve begins a sustained rise and *Corylus* remains low. This could be interpreted as birch replacing hazel in the regenerating woodlands due to soil deterioration. However, the evidence from SHEIV–4 and from coring in the valley floor shows that there was widespread development of birch on peat at this time and it is likely that this, rather than a change in the woodland shrub layer, is reflected in the main diagram (SHEIII–3). Soil impoverishment seems unlikely to have been the cause of cessation of farming activity in the area.

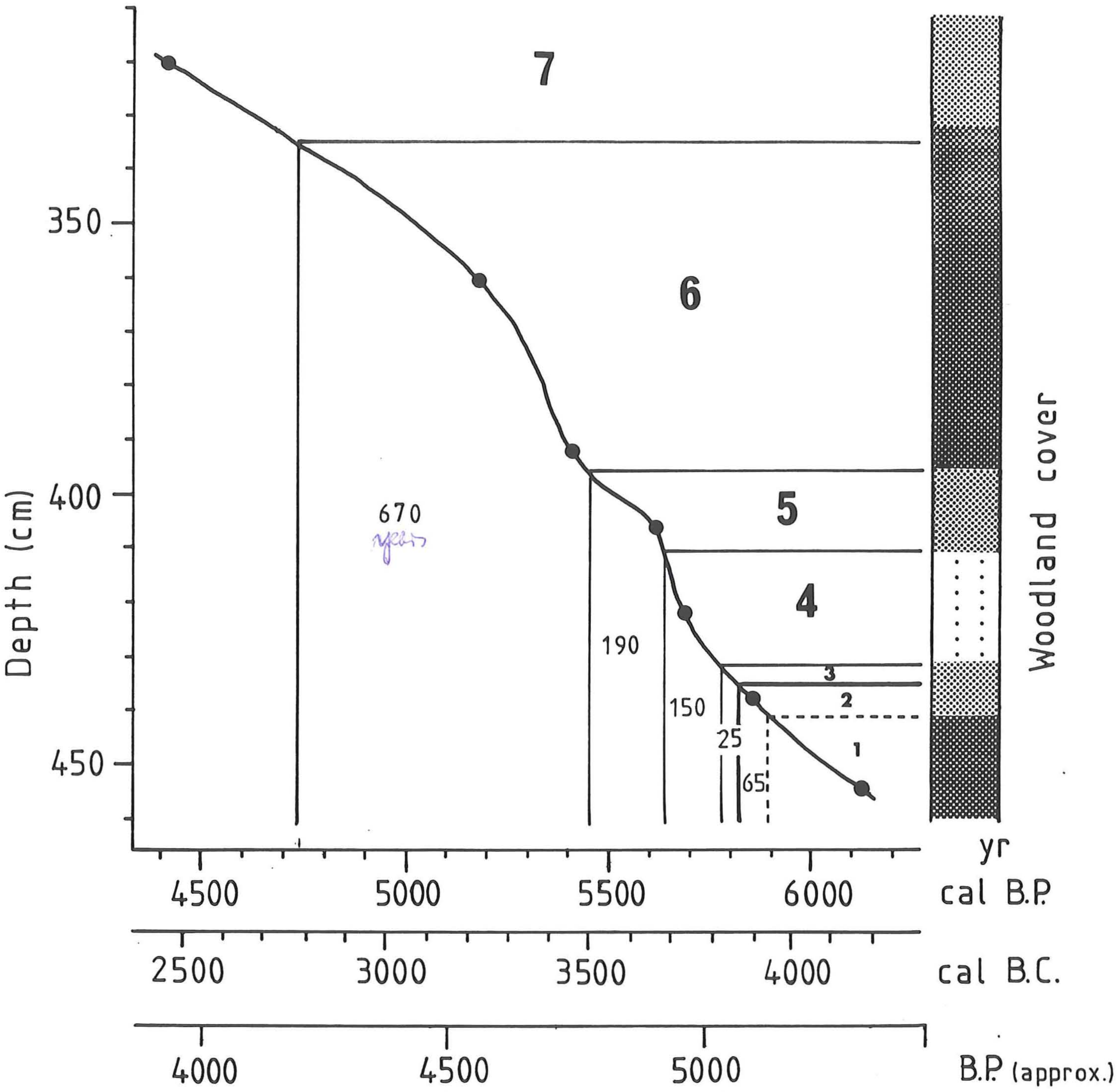


Fig. 12 Neolithic land use (SHE III) vgl. Diagramm Stein Lupendiagramm von Zone 3

s. 28 links

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

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

The changes seen at the base of SHEIII-5 may be reflecting those of a regional rather than a purely local character. At this time, in the Connemara National Park, blanket bog expansion takes place most likely in the context of prolonged intense human activity (O'Connell, 1989). In SHEIII, too, an expansion of bog/heath taxa takes place and Fe levels increase suggesting reducing conditions in the catchment favourable to bog/heath expansion.

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

CONCLUSIONS

The investigations carried out todate show a considerable temporal and spatial variation in vegetation history and land-use in the Connemara region. In Fig. 13, the main AP curves from 4 profiles, each spanning the greater part of the Holocene, are presented. The diagrams are drawn to an uncalibrated ^{14}C time scale. ^{14}C dates are not available for the diagram from L. Corcal, Carna (McDonnell 1988); however, the chronology, based on pollen criteria, is considered to be reliable. These results and other aspects of the vegetation and land-use will be discussed in the field.

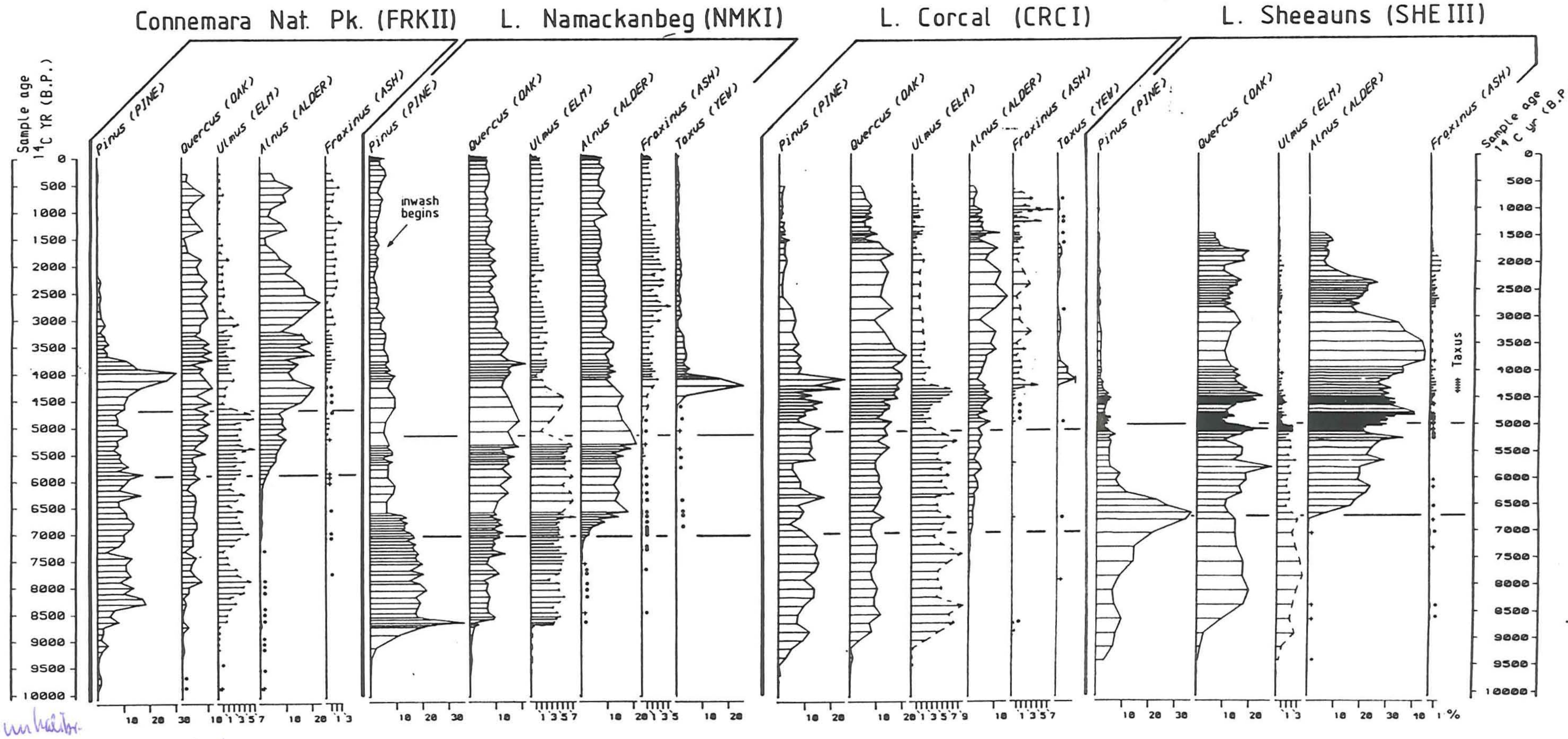
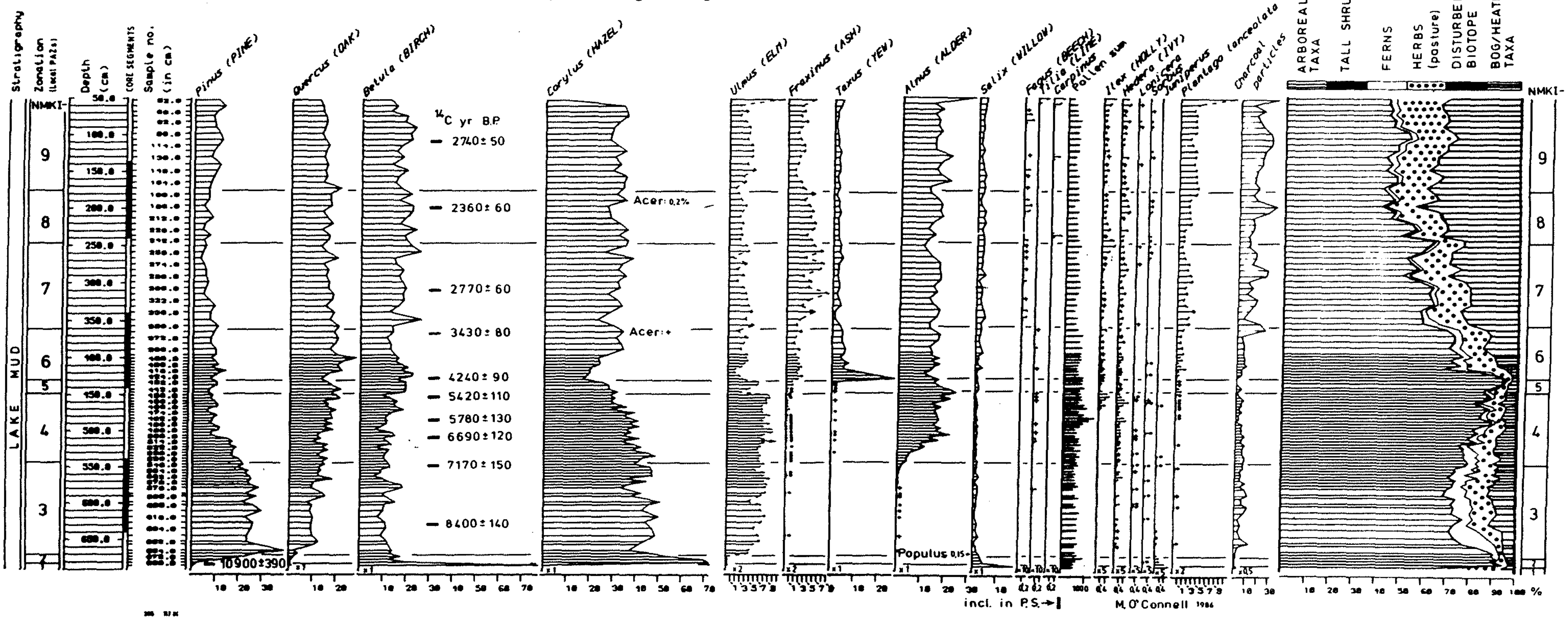


Fig. 13 Selected percentage AP curves from 4 profiles expressed as a percentage of total terrestrial pollen.

L. Namackanbeg, Spiddal (NMKI) percentage diagram



30a.

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