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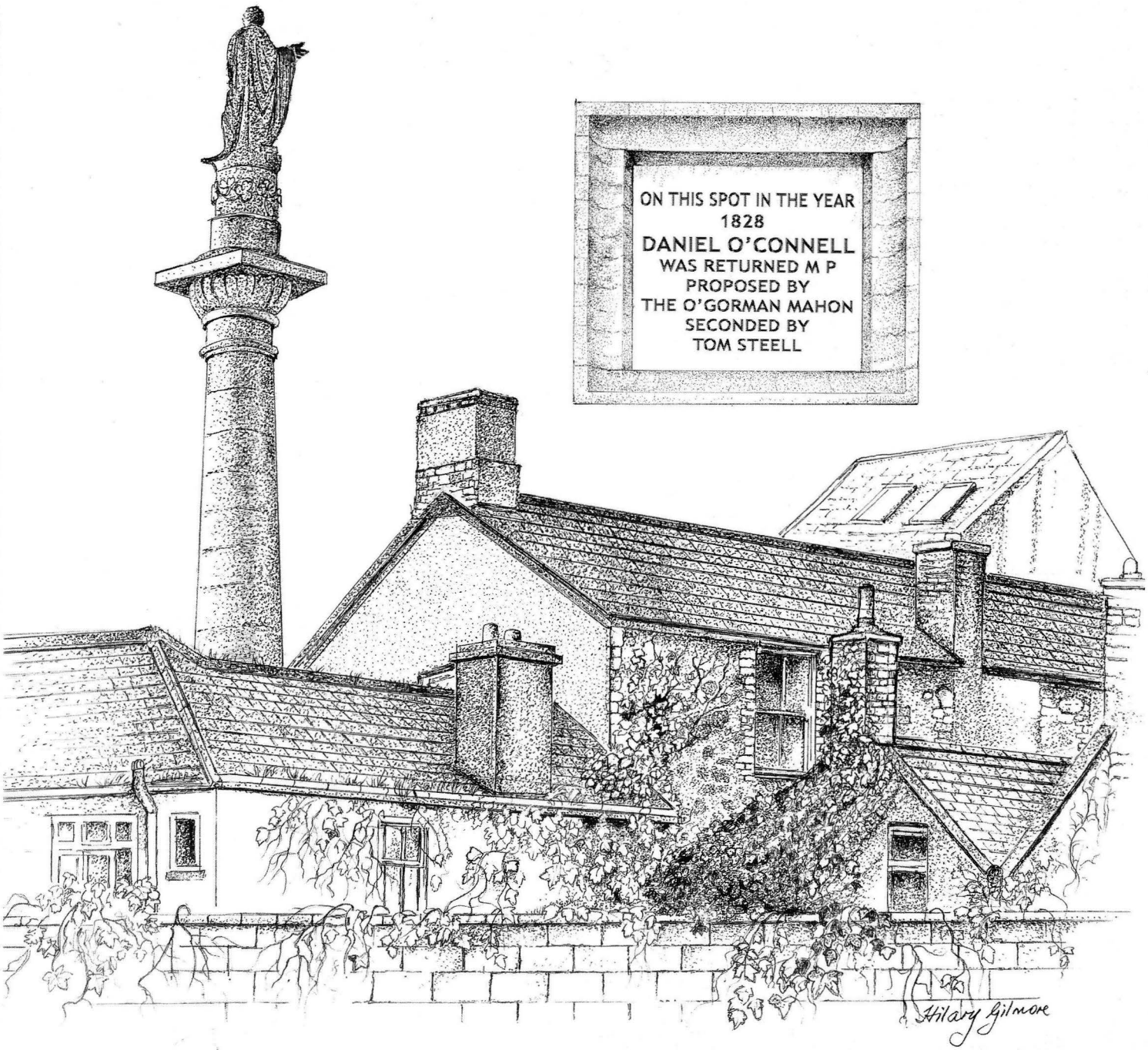

journal of the shannon archaeological & historical society
2022

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IN MEMORY OF

THOMAS JOHNSON WESTROPP

OF ATTYFLIN

16 AUGUST 1860 - 9 APRIL 1922

ANTIQUARIAN, ARTIST AND PHOTOGRAPHER

WHO DEVOTED HIS LIFE

TO RECORDING IRELAND'S ANTIQUITIES

COMMEMORATED ON THE CENTENARY OF HIS DEATH BY

SHANNON ARCHAEOLOGICAL AND HISTORICAL SOCIETY

Editorial

This year's issue of *The Other Clare* appears at a time of centenaries. One is the death of Thomas Westropp, the subject of our first article, who gave us the detailed works on the county that remain a bedrock for research. The formal ending of the Decade of Commemorations is also suitably marked by contributions. In addition, this year's papers cover the whole of the county, and periods of time from the ancient, the dating of wood from bogs; to the historical, from the eleventh century to the twentieth; and subjects as various as the text of a medieval Psalter, masons' marks, a lady's account books, Famine reports, the chemical uses of kelp, the life of a champion wrestler, and much more. It has been a privilege and a pleasure to edit a collection of such fine work, and it is astonishing how much high-quality new material is provided each year by our authors. As ever, the distinctive cover allows the journal to be identified, read and cited. We are grateful to faithful contributors, and hope too that the range of papers and approaches will inspire readers to send in their own papers, whether they find writing a new venture or are seasoned practitioners.

I am hugely grateful for the support received from committee members in making this journal, a truly collaborative venture, appear for its 46th edition. Thanks are due to readers and sponsors, and our ever-helpful printer, who make its appearance possible.

Our Chair asks readers to consider if they might contribute to the workings of the Shannon Archaeological and Historical Society. This includes the planning of talks and outings, keeping up-to-date membership lists, organising meetings in times of technological adventure, engaging with schools, proof-reading the journal, and much more. No special skills are needed, only the willingness to join a lively committee in its day-to-day work behind the scenes. He'd love to hear from you, at shannonsociety@gmail.com.

Rosemary Power, Editor.

Officers and Committee of the Shannon Archaeological and Historical Society 2022

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CONTENTS

Bog-deal in Co. Clare, with Particular Reference to Bog-pine and its Significance

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Abstract

The results of radiocarbon dating of bog-deal (three pine and one oak) from the north-west Burren (Gragan West) and south-west Clare (Binvoran and Tullaher) are reported on. The Binvoran and Tullaher samples yielded remarkably early dates (ca. 8800 and 8600 cal. BP, respectively) while the Gragan West sample dated to ca. 4900 cal. BP, a date regarded as typical for bog-pine, especially in western Ireland, where at this time pine growing on bogs was a widespread but relatively short-lived phenomenon. The significance of the new results are discussed in the light of much larger, recently published datasets from Counties Galway (Connemara) and Mayo. The contribution that dating of bog-pine can make to resolving issues, such as whether pine survived in Ireland, and specifically in Co. Clare, through to modern times is emphasised.

Introduction

Until recent times, bog-deal was something that many Irish people were very familiar with, often from first-hand experience gained from long days spent 'in the bog' cutting and saving turf. Bog-deal, given its size and frequency, could not easily be ignored; indeed, it was invariably viewed either as a curse or a valuable resource. For a turf cutter, it was normally the former in that it was a distinct and more or less immovable obstacle that hindered turf cutting. The upper layers of a bog — to a metre depth and usually more — having been cut away, turf cutters often encountered a layer of timbers, which in the days of turf cutting by sleán and few, if any, mechanical diggers, resulted in operations being abandoned in that particular patch of bog. Even in the case of Bord na Móna[1] — on both the deep raised bogs in the Irish midlands and the shallower blanket bogs such as in north-west Mayo — bog-deal must have been a nuisance, despite mechanised equipment being available. The timbers recovered during peat harvesting operations were usually collected into piles, away from the main area of operations.

On the other hand, bog-deal was regarded by many as a distinct blessing especially where other sources of wood were scarce or indeed absent. Indeed, it was often the only source of wood, especially in western Ireland where, in recent centuries, there was little or no woodland in many parts. A.T. Lucas[2] cites several accounts, including from Co. Clare, of bogs being actively searched using probes. Early dewy morning was regarded as optimum for such searches, as patches of ground without dew apparently signalled the presence of bog-timbers, even if at considerable depth.

In Ireland, bog-deal is usually considered to be oak but, in reality, pine is by far the more frequent, at least in western Ireland[3]. Apart from pine and oak, yew, a conifer with a particularly hard wood but which otherwise is not that dissimilar to pine though microscopically easily distinguished, is also a distinct possibility[4]. While pine, oak and yew are the main sources of bog-deal, timbers of hygrophilous, i.e. moisture-loving, trees such as birch, willow and alder are also frequently present (sometimes as distinct layers, especially in the case of birch) but the wood is generally softer and the specimens smaller, and so these are often not viewed as bog-deal[5].

As regards bog-deal in Co. Clare, there seems to have been little or nothing by way of scientific investigations up to now[6]. This is surprising given the widespread occurrence of bogs in Co. Clare[7] and the attention drawn to the phenomenon of bog-deal by visitors and especially those interested in natural history[8]. The description of the countryside near Miltown Malbay dating to 1809 by Joseph Woods is particularly apposite. 'The road hence to Miltown is all on a peaty soil but most of it very dry. A great quantity of oak and fir is dug up in these bogs, not turned black as is frequently the case, but preserving at a little distance from the surface the appearance and colour of fresh wood'. He goes on to write: 'Some native oak still remains in Ireland but the fir formerly the most abundant seems to be totally extirpated. ... the trees uniformly bore marks of fire near the roots ... The whole shore shows evident traces of having been once covered with a forest extending many miles in all directions though now trees will not bear the violence of the western winds.[9]

In this account it is the intention to build on the above insightful observations, mainly by providing hard evidence in the form of radiocarbon (^{14}C) dates for the age of bog-deal in Co. Clare and by discussing the significance of the new information for the post-glacial history of pine in Ireland.

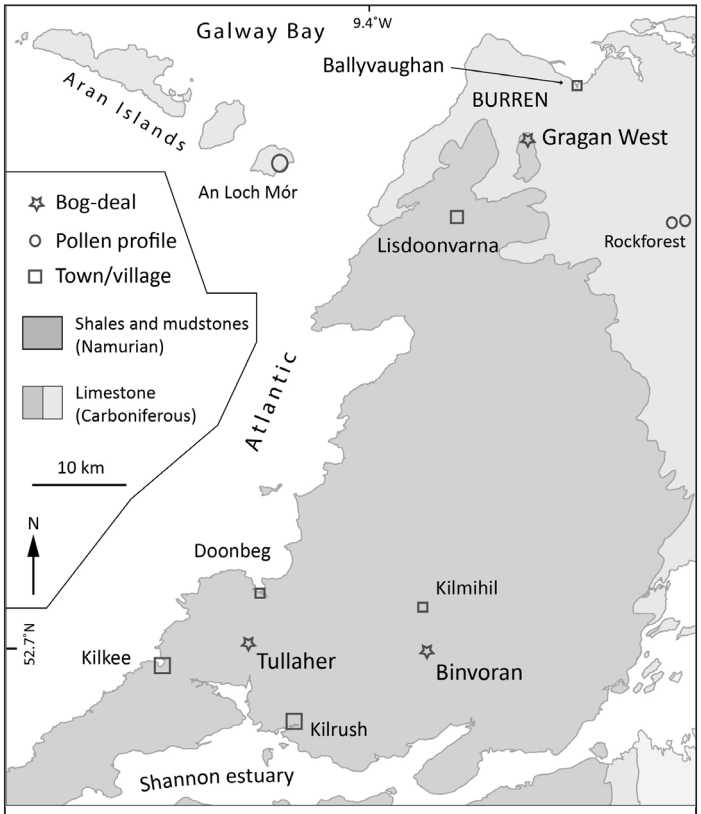

Fig. 1. Simplified geology map of the study area showing sites investigated for bog-deal, pollen profiles referred to in the text and selected centres of population.

Bog-timbers: sampling sites

Binvoran bog, south-west Co. Clare (bog-pine, sample no. P-CE-001)

Sample P-CE-001 was collected on 12 May 2019 from a large bog-pine trunk with a diameter of at least 50 cm (number of rings was not determined) that had been excavated in a small trapezoid-shaped, wet pasture in Binvoran townland[10], located 4.4 km south of Kilmihil (Figs. 1 and 2)[11]. The material dated (9 g) was from the outermost rings at about 2.5 m above the root system (Fig. 1c). It included about five rings of wood from close to the bark, i.e. wood from shortly prior to death of the tree.

The local geology consists of Namurian sandstones and shales (Fig. 1). Soils in the locality are poor and include much bog, now partly afforested (in the late 1980s and later). At the time of collection of the sample, drainage, involving digging a series of deep drains in the peat deposits to a depth of a metre and more, had taken place some days earlier. This revealed several large bog-timbers consisting mainly of tree stumps but also including substantial tree trunks (Fig. 2). All timbers examined were pine (Pinus sylvestris, Scots pine[12]). Some timbers were exposed in the drain cuttings; others had been brought to the surface by the mechanical digger, including the sampled specimen (Fig. 2, d and e). The sampled rings were thick (≈2 mm) and had approximately equal amounts of early and late wood, i.e. spring and summer/autumn/winter wood.

The specimen sampled was a substantial tree trunk, about 4 m long. The upper part was broken off, probably during excavation (Fig. 2d). The bark was well preserved in the basal 2 m of the trunk (Fig. 2e) and had scorch marks, and the wood near the base had been burned. Another pine trunk, 2 m long and of smaller diameter, lay nearby. Bark was present in the basal metre and the trunk ended in a rather blunt point but otherwise seemed to be intact. Here too the outer wood appeared to have been burned. Burning is assumed to have taken place towards the end of the life of the trees or shortly after death, and before burial in peat which served to preserve the timbers.

The depth of peat where the sampled specimen originally lay could not be ascertained but an estimate of about 2 m seems reasonable (or > 3m if peat had been removed by earlier turf cutting which is quite likely). It is assumed that the timbers generally lay within the peat body rather than resting on mineral ground beneath the peat. This conclusion is based on the observation that the bog-timbers exposed in drainage cutting were invariably within the peat and not on mineral soil.

At the eastern margin of the field, there were many large bog-pine timbers, including stumps and trunks (Fig. 2c). Several of the stumps had well preserved but burned bark. These stumps may have derived from earlier reclamation works prior to the conifer planting that borders the site and/or the recent drainage works. The overall evidence points to a rather small basin-bog with several pine trees, many substantial, and growing on peat at some point in the distant past.

Tullaher bog (Moanmore bog complex, west Clare; bog-pine, sample no. P-CE-002)

Sample P-CE-001 was collected on 16 July 2019 from wet pasture (reclaimed bog) in Tullaher Td., Moanmore (Móin Mhór) bog complex[13] (Figs. 1 and 3). The Moanmore bog complex, consisting mainly of raised bog, the most westerly in Ireland, originally occupied much of the area between Poulnasherry Bay, on the Shannon estuary west of Kilrush, and Doonbeg on the Atlantic coast, i.e. an area of about 40 km^2. Active turf cutting and reclamation involving drainage, already well underway in the early nineteenth century and continuing well into the twentieth century, have largely transformed the area into wet, rushy pastures[14] (Fig. 3, b and c), with the resultant loss of several rare wetland species[15]. Tullaher Lough and Bog SAC, which includes Tullaher Lough at its south-eastern end, now provides protection for 469 ha that include a variety of wetland habitats, but only a little over 10% of the original wetlands[16].

The specimen sampled was a substantial pine stump, diameter about 60 cm (rings not counted but probably 150–200 years old) with well preserved bark. This timber, which was still in situ, had been revealed about a week earlier during drain clearance by a mechanical digger (Fig. 3b). Probing revealed 50 cm of sediment beneath the specimen, consisting of peat, 20 cm thick, followed by dauby clay at the base. The area generally has been subject to much peat cutting and reclamation so that only about 1.5–2 m of peat, underlain by dauby clay, remains. Bog-timbers (only pine recorded) were noted in drains and in spoilage heaps derived from the drains.

Fig. 2. Photographs relating to Binvoran.

a: Aerial photograph, Binvoran. Location and direction of view of photographs b–d are indicated;

Sources of photographs: (a) USGS via ExpertGPS.com (accessed: 11/01/2022); (b–e) M. O'Connell (12/05/2019).

b: View to NE of sampling site showing drains and spoil heaps;

c: Large pine trunk: one of several pine timbers that may derive from earlier reclamation;

d: Large pine trunk sampled for ^{14}C dating;

e: Detail of lower trunk showing well preserved bark.

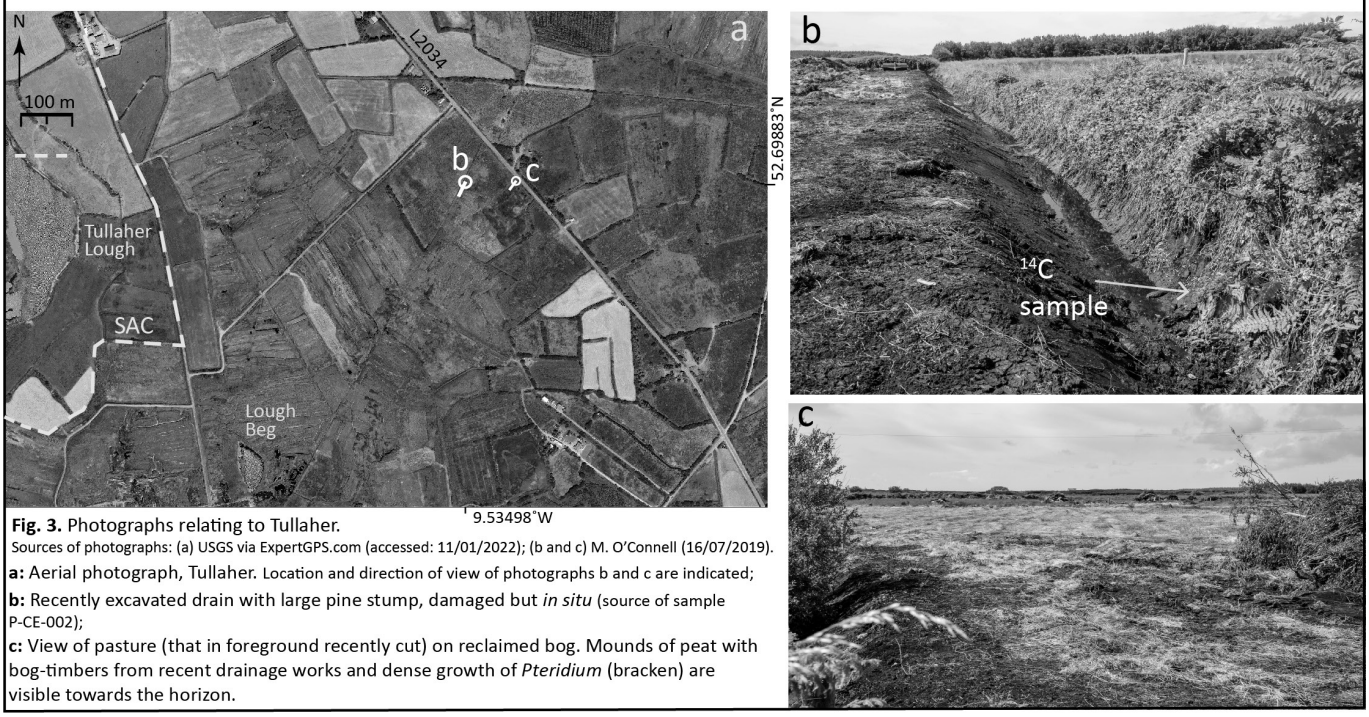

Fig. 3. Photographs relating to Tullaher.

Sources of photographs: (a) USGS via ExpertGPS.com (accessed: 11/01/2022); (b and c) M. O'Connell (16/07/2019).

a: Aerial photograph, Tullaher. Location and direction of view of photographs b and c are indicated;

b: Recently excavated drain with large pine stump, damaged but *in situ* (source of sample P-CE-002);

c: View of pasture (that in foreground recently cut) on reclaimed bog. Mounds of peat with bog-timbers from recent drainage works and dense growth of *Pteridium* (bracken) are visible towards the horizon.

The wood that was ^{14}C dated (8 g) derives from about six outer rings (but some rings in from the bark). The rings were thick, early and late wood being 2 mm and 1–1.5 mm wide, respectively.

Gragan West (upland blanket bog, NW Burren; bog-pine, sample no. G21)

In connection with pollen analytical investigations carried out by W. Dörfler in 1994 on the north-west end of extensive blanket bog on a Namurian shale outlier at a site referred to as GRW (≈260 m asl, 1 km north-west of Corkscrew hill; bog timbers G21–G25 were also investigated (Figs 1 and 4; Table 2)). The bog extends over parts of several townlands (Fig. 3a)[17]. Most of the timbers and pollen core GRW relate to Cahermacun Td., but Gragan West, the name of an adjoining and much larger townland to the east, has been used to refer to the area. In 1994, four bog-pines and one bog-oak (samples G21–G25; Table 2) were noted in peat cuttings, and sampling was carried out for dendrochronological and ^{14}C dating investigations in the laboratory. In 2022, the site was revisited, bog-timbers were noted and photographed (Fig. 4). On that visit, in addition to two large twisted pine timbers (Fig. 4, b and c), several small pine timbers and two small oak timbers were noted.

The overall impression was that the bog timbers derive from a considerable depth in the peat body. At G23, for instance, the oak timber was estimated to be at a depth of 160 cm beneath the original bog surface. The timbers seldom, if ever, rested on mineral ground, i.e. the basal silt/clay-rich sediments derived from the underlying shale (so-called Clare shales).

Results

The ^{14}C dates obtained for the three pine timbers are given in Table 1[18] and calibrated ages are shown in Figs 5 and 6a. The ^{14}C dates were calibrated using OxCal and the most recent ^{14}C calibration curve.[19]

For each date in Fig. 5 the relevant part of the ^{14}C calibration curve is shown; this is referred to here as a curve segment (see Fig. 5a where the various parts of the output from OxCal are labelled). The curve segments show the relationship of ^{14}C years to calendar years in the relevant time interval for each date. Ideally, this should be a straight line but this is seldom the case as can be seen in Fig. 5 where the three curve segments are wiggly. The curve segment in Fig. 5a is particularly wiggly with the result that there are two dates (4865 and 4950 cal. BP) that, with high probability, may be the true age of this sample. A 'flat' curve is also undesirable; see, for example, Fig. 5c. Such a curve results in a wide age range if the ^{14}C date falls in this part of the calibration curve. Thus the ^{14}C date from the Binvoran pine may lie, with more or less equal probability, at any point in the range ca. 8620 to 9000 cal. BP. It is also important to bear in mind the part of the tree that was submitted for ^{14}C dating. A date from a sample derived from early (inner) tree rings will be indicative of the early life of the tree; on the other hand, a sample taken from the outer rings, e.g. from immediately beneath the bark, will reflect the time of death. In the case of bog-pine generally, the trees are often short-lived — 250 years is seldom attained — the more usual life-span being about 100 years. Thus differences in age, based on whether early or late rings were sampled, are not of major concern. As regards the Clare pine samples, it is only in the case of the Gragan West sample that wood from the inner (early) rings was used and so the age attaches to the early years in the life of this tree.[20]

Returning to the details presented in Fig. 5, the probability distribution curves (so-called normal or Gaussian curve) for the ^{14}C dates are plotted on the y-axes and, on the x-axes, probability curves that indicate where the true age for each ^{14}C date most likely lies. The true age is expressed in years cal. BP; i.e. calibrated (≈calendar) years before present; present being taken to be AD 1950. The calibrated age ranges (at 68% and 95%, i.e. the so-called 1σ and 2σ probability ranges (probable and highly probable)), and also the median calibrated age are indicated beneath the probability plot.

Table 1. Details of bog-pine samples including ^{14}C dates.

Sample No.[a]	Description	^{14}C lab. no.[b]	^{14}C date (BP)	Age range[c]	Age range[d]	Age (median)[e]
P-CE-001 26/08/2019	Outer rings of large pine trunk from a valley bog in Binvoran Td.	UBA-41515	7957 ± 49	8982–8654	8991–8643	8823
P-CE-002 16/07/2019	Outer rings of large pine stump *in situ* within cutover peat, Tullaher Td., north-west of Kilrush	UBA-41516	7805 ± 57	8642–8479	8771–8423	8579
G21 7/02/1994	Pine in upland blanket bog at Gragan West. Rings 15–40 dated	GrN-21437	4340 ± 20	4959–4853	4962–4851	4897

[a] Galway lab. no. and date of sampling in the field
[b] ^{14}C lab. no.; UBA = QUB (mass spectrometry ^{14}C date); GrN = University of Groningen (conventional ^{14}C date)
[c, d] Calibrated age ranges at 1σ and 2σ probabilities, respectively; years cal. BP
[e] Median calibrated age (cal. BP)

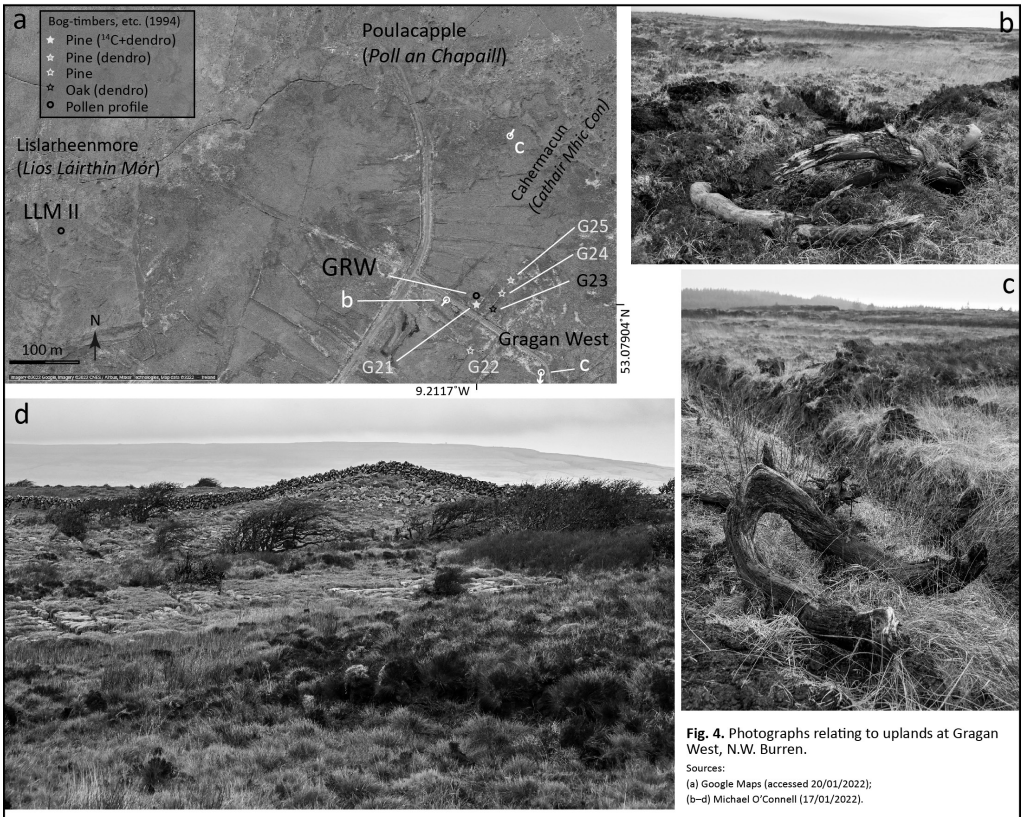

Fig. 4. Photographs relating to uplands at Gragan West, N.W. Burren.

Sources:
(a) Google Maps (accessed 20/01/2022);
(b–d) Michael O'Connell (17/01/2022).

a: Aerial photograph, upland blanket bog on shale and adjoining karstic landscape, NW Burren. Sites relating to the early 1990s, townlands, and the location and direction of view of photographs b–c, and townland names are shown;

b, c: Pine timbers brought to the surface during recent drainage; the timbers were charred; pine timber **c** is from outside the image, 204 m south of where indicated;

d: Photograph showing the typical abrupt transition between bog on shale and karstic limestone with a stone-wall field boundary and *Crataegus* bushes bent by the prevailing westerlies. In the distance are the limestone hills west of Ballyvaughan.

Table 2. Details of bog-timbers at Gragan West (altitude ≈260 m asl).

Sample No.	Co-ordinates (degrees; WGS84)	Description	Investigations carried out
G21 (pine)	53.07904, -9.21177	Pine stump exposed by peat cutting within ≈15 m of core GRW	Rings measured by E. Jennings along two radii; 137 and 120 rings counted; widths (mm; average and std): 0.96 ± 0.66; 1.06 ± 0.72; outer rings very narrow (often < 0.4 mm). Dendro attempted but rings poorly defined (EJ). Wood from rings 15–40 ^{14}C dated; these rings were ≈2 mm thick
G22 (pine)	53.07843, -9.21189	Pine stump exposed by peat cutting	Not investigated
G23 (oak)	53.07895, -9.21147	Short oak trunk stump at ≈160 cm from bog surface in a peat bank.	Dendro attempted (QUB^) but the rings, and especially outer rings, poorly defined. Wood from outer rings (rings ≈156–231) ^{14}C dated*
G24 (pine)	53.07909, -9.21134	Pine stump in turf bank (nr. G23)	No further details available
G25 (pine)	53.07921, -9.21121	Pine trunk in turf bank (nr. G24)	Dendro attempted by EJ. Rings difficult to count and measure; two radii measured with 147 and 144 rings, respectively; several rings < 0.4 mm
Pines b and c in Fig. 4	53.07911, -9.21245 53.0763, -9.21	Pine specimens removed during drainage; probably recently	Twisted trunks; both specimens well preserved but surfaces partly burned; unsure if burning recent or original; bark preserved in specimen b

Notes: G21–G25 recorded in 1994. Pine trunks b and c photographed on 17 January 2022; these had been recently excavated during drainage

^ QUB: Queen's University Belfast (David Brown, personal communication)

* G23 (oak) ^{14}C date: 6918 ± 70 BP (^{14}C lab. no.: KI-4028.01; age ranges (cal. BP): 7832–7677 and 7928–7617 (1 and 2σ probability, respectively); median age: 7754)

dendro = dendrochronology/ dendrochronological; std = standard deviation

The pine from Binvoran returned the oldest date (8820 cal. BP)[21]. The Tullaher pine is somewhat younger (8580 cal. BP) but the difference is such that it is quite likely that the life-spans of these pines overlapped. Ring counts are not available but given the sizes of the timbers, these trees probably began life at about 9000 cal. BP (Binvoran) or shortly after that (Tullaher). We know that the sharp climate warming-up that heralded the beginning of the post-glacial (Holocene) took place at ca. 11.7 ka[22]. This was preceded by a cold snap of about 1000 y duration, i.e. the Younger Dryas. The cold snap was particularly severe in Ireland so that it resulted more or less in a tabula rasa into which plants and animals spread in the early Holocene. As regards woody plants, shrubs (juniper, birch and hazel; in that order) spread first, quickly followed by trees, initially pine, and shortly afterwards oak and elm. The sequence of developments can be clearly seen in the pollen profile from An Loch Mór, Inis Oírr.[23] Pine had spread to Inis Oírr by 10.8 ka, and by 10.45 ka it had become an important component in a hazel-dominated landscape that also had substantial birch, juniper and willow. The evidence for this relies mainly on the pollen record. However, in the case of pine and juniper, local presence is confirmed by fossil stomata[24].

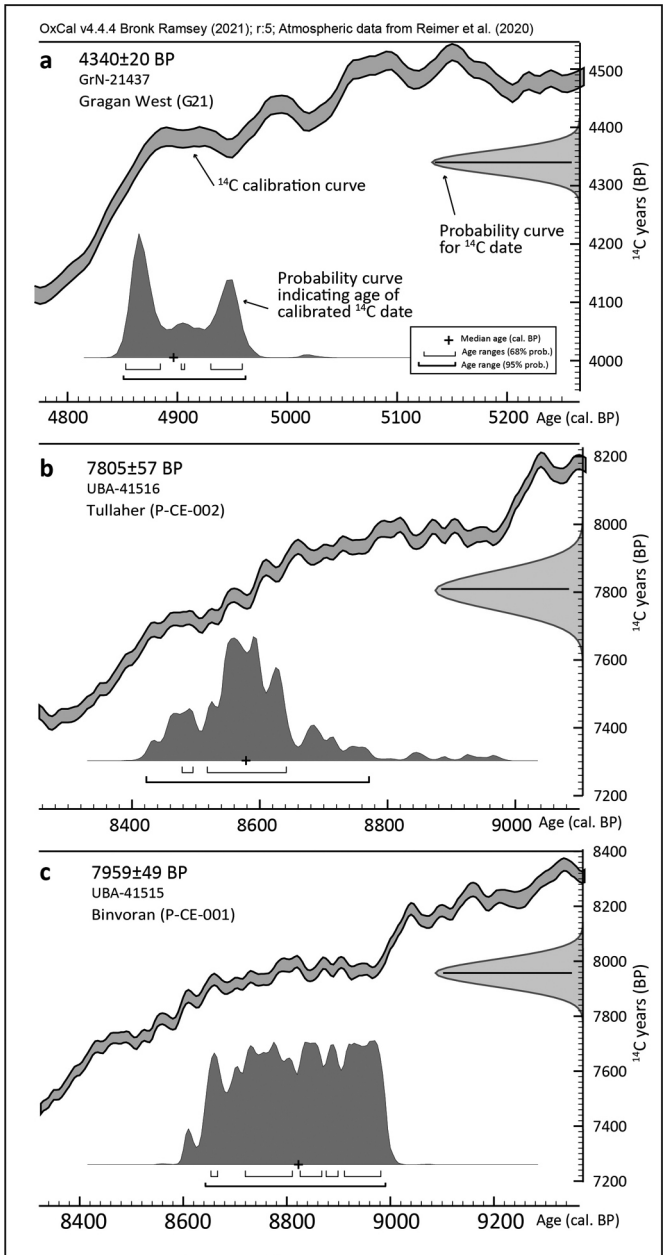

Fig. 5. Outputs from the ^{14}C calibration program OxCal.

When considering the history of bog-pine, it must also be borne in mind that there was little or no peat present at the beginning of the post-glacial and it was only with the passage of time that peat accumulated initially in wet basins and shallow lakes. Under favourable conditions, peat spread out from the initial foci to eventually become the extensive bogs that were once a key feature of the Irish landscape[25]. So given the time required for pine to spread from refugia outside Ireland and the requirement for peat to be locally available as a substrate for trees to establish, grow and, after death, to be preserved by peat actively growing about them, these records from the early Holocene are indeed remarkable.

On the other hand, the bog-pine from Gragan West is considerably younger; the date obtained — 4900 cal. BP (near start of life date) — indicates that it is younger than mid-Holocene. The investigations by W. Dörfler indicate that peat began to accumulate locally at ca. 9500 cal. BP and, already at that time, pine was a substantial contributor to local woodlands. There is much bog-deal in the general area so in all probability the phenomenon of pine and oak growing on peat continued for a long time during the mid-Holocene[26]. That said, the date for this bog-pine is interesting in light of what we now know about bog-pine during the mid-Holocene in western Ireland which is now discussed.

Discussion

To provide background for the discussion, dates from bog-pine in Counties Galway and Mayo are compiled in Fig. 6.[27] In Fig. 6a, in addition to the calibrated dates relating to three pine dates from Co. Clare, dates from two pines from Carrowkennedy, west Mayo are shown[28]. These fine specimens are on display in the Visitor Centre, Connemara National Park which, in addition to their age, gives them added interest. In both cases, wood from outer rings was dated. In the case of the long trunk (W6), ring counts indicate that the tree lived for not more than 150 y and the ^{14}C date indicates that it died at ca. 6250 cal. BP. Bog-pine W7 (shorter trunk; in the main display in the Visitor Centre) died, according to the ^{14}C date, at ca. 8560 cal. BP. So it is similar in age to the Tullaher pine and may have ended life while the Binvoran pine was alive.

In Fig. 6 (b and c), the ages of pines from Counties Mayo and Galway, as derived from ^{14}C dates, are plotted. A box represents the age of a single pine timber. The Galway dates[29] cluster around 5000 cal. BP and the temporal spread is rather short (most relate to 6000–4000 BP). In the case of Mayo, the pattern is similar but here most dates are decidedly concentrated in the interval 5200–4040 cal. BP with a distinct peak in the interval 5020–5000 cal. BP. Outliers are mainly older and consist of a scatter of dates that extend as far back as 8560 cal. BP (W7 from Carrowkennedy). The most striking feature of the data sets is not only this long tail, but also the distinct concentration of dates at ca. 5000 cal. BP and the scarcity of dates after 4000 cal. BP.

The cause of the 'pine decline' at ca. 4000 cal. BP, a feature in many Irish and British pollen diagrams, has been the subject of much debate[30]. Climate change and human impact are frequently invoked. The overall synchroneity of the event would favour the former and this is supported by independent evidence for a distinct shift at this time towards wetter and cooler conditions[31]. At this time also there is a distinct increase in human impact, including substantial woodland clearance, connected with cultural and economic developments in the Bronze Age[32]. By this time, pine was largely confined to poorer mineral grounds where it had the possibility of out-competing its main competitor, namely oak. While human impact also affected such areas and undoubtedly contributed to the decline in pine, it is generally agreed that the failure of pine to become established on bog surfaces in the later Holocene was due mainly to climate change, involving increased precipitation and/or cooler temperatures which rendered bog surfaces unsuitable for pine.

Finally, the recent assertions that Rockforest, in the southern Burren (Fig. 1), as the first to be discovered site for the survival of pine into modern times in Ireland deserves consideration[33]. This has the implication that it is no longer necessary to regard pine as having become extinct in the early historical period to be re-introduced several centuries later, possibly initially in the seventeenth century and, on a wider scale, during the following century. Of course, this is an exciting prospect especially given the ongoing debates regarding rewilding, but sounding a note of caution is not out of place. The assertions regarding survival of pine at Rockforest rely on pollen evidence which, given the wide dispersal potential of pine pollen, presents particular challenges when attempting to prove local presence during the historical period. At Rockforest, there are also the additional challenges connected with interpreting records from a turlough, given the unusual hydrological and taphonomic processes associated with such karstic features[34]. A ^{14}C date from a pine timber would certainly go a long way towards demonstrating beyond doubt that pine indeed survived into the historical period in Ireland[35].

Much remains to be learned about the history of pine in Ireland and especially in Co. Clare. It is hoped that this article makes a worthwhile, even if small, contribution in this regard.

Acknowledgements

Eneda Jennings undertook dendrochronological investigations of pine timbers at Gragan West while researching towards a PhD[36] and Dave Brown (QUB) investigated an oak timber from Gragan West. The incentive to carry out the studies at Gragan West arose from pollen analytical investigations in the area undertaken by Ljubica Jeličić[37] and later (1994) by Walter Dörfler. WD has generously shared his unpublished pollen data and also arranged for the dating of a bog-oak timber at the ^{14}C laboratory, Kiel University. Martin Griffin (Caherfeenick) provided guidance to bog-deal on his lands at Tullaher and assisted with sampling, and Gearóid O'Connell (Killimer/London) contributed financially to a ^{14}C date from that site. Sincerest thanks to all of the above and also others in the Palaeoenvironmental Research Unit, NUIG who helped during these investigations. I am grateful to Rosemary Power, editor of The Other Clare, for encouraging me to write this account.

Notes and references

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The above volume has much interesting material (text and photographs) relating to Bord na Móna.
2. A.T. Lucas, 'Bog wood: a study in rural economy', *Béaloideas* 23, (1954), pp. 71–134.
3. At Curraghkeel, Corofin, south of L. Inchiquin in the flood-plains of the river Fergus, bog-deal is particularly frequent and here it seems to be exclusively bog-oak (not dated). I thank Michael Killeen, the landowner, for bringing this to my attention. In the Irish context, oak can refer to *Quercus robur* (English/pedunculate oak) and/or *Q. petraea* (Irish/sessile oak). In the case of bog-oak and western Ireland today, it is more likely to be the latter though both species are probably native. This assumption is based on present-day ecological preferences; also macro-remains, identified as of *Q. petraea* and of mid post-glacial (mid-Holocene) age, have been recorded in Ireland; see Knud Jessen, *Proceedings of the Royal Irish Academy* 52B (1949), p. 195. While the anatomy of oak wood is distinctive, anatomical differences in the wood of these two species is insufficient as a basis for secure differentiation.
4. Feehan and O'Donovan, *The Bogs of Ireland,* pp. 439–440 (op. cit.). A particularly yew-rich bog at Ballyfin, Co. Laois is remarked upon and there is a photograph of a large and irregular yew specimen that had lived for about 400 years. The authors report that the timbers were used locally for house timbers and gate posts.
5. M. O'Connell, E. Jennings, K. Molloy, 'Holocene vegetation dynamics, landscape change and human impact in western Ireland as revealed by multidisciplinary, palaeoecological investigations of peat deposits and bog-pine in lowland Connemara', *Geographies* 1 (2021), pp. 251–291. https://www.mdpi.com/2673-7086/1/3/15.
In this publication, wood remains in peat at Ballydoo Bog, near Cornamona, Co. Galway are detailed.
6. A.H. McGeever, F.J.G. Mitchell, 'Pine stumps in Irish peats: is their occurrence a valid proxy climate indicator?', *Journal of Quaternary Science* 30 (2015), pp. 489–496.
This paper includes a compilation of ^{14}C dates from bog-pine in Ireland. There are no dates given for Co. Clare.
7. R.F. Hammond, *The Peatlands of Ireland. Soil Survey Bulletin No. 35,* (An Foras Talúntais, Dublin, 1979).
In the meantime, the detailed map in this book and versions thereof have been reproduced in several publications.
8. B. Ó Dálaigh (ed.), *The Strangers Gaze.* Travels in County Clare 1534–1950 (Clasp Press, Ennis, 1998).
9. Joseph Woods, 'Scientific Tour through Clare, 1809' in *The Strangers Gaze*; quotation is from p. 145.
As is usual in these early accounts, pine is called fir. Also noteworthy is the reference to bog-deal on the shore near Milltown Malbay (on intertidal peats) that is correctly interpreted as evidence for former extensive forests (and also lower sea-level). For a modern account, including ^{14}C dates, see: D.M. Williams, E. Doyle, 'Dates from drowned mid-Holocene landscapes on the central western Irish seaboard, *Irish Journal of Earth Sciences* 32, (2014), pp. 23–27.
Intertidal and mud-flat records of ancient timbers are not included in the present account.
10. This townland (Td.) (Binn Mhóráin; https://www.logainm.ie/ga/6996, accessed 20 January 2022) is referred to by the name used in Ordnance Survey of Ireland (OSI) maps. Elsewhere, it is frequently referred to as Benvoran. The present-day wet pasture derives from a valley bog that has been 'reclaimed'. Geographical co-ordinates (WGS84): 52.683288, -9.31361; altitude: 30 m asl (above sea level).
11. These timbers were accidentally discovered on 12 May 2019 while taking a short-cut off the main Kilmurry-McMahon/Ennis road. Sampling was carried out and photographs taken on that day.
12. There are several pine species native to Europe. *P. sylvestris* (Scots pine), however, is the only pine that occurs naturally in north-west Europe. Once common in oceanic parts including

Ireland, naturally occurring populations of Scots pine are now largely confined to the Highlands of Scotland, central Europe and Scandinavia; see:
A. Carlisle, A.H.F. Brown, '*Pinus sylvestris* L.' (Biological flora of the British Isles, No. 109). *Journal of Ecology* 56, (1968), pp. 269–307.
13. Geographical co-ordinates and altitude of the Tullaher pine: 52.69883, -9.53498; altitude: 14 m asl.
14. C. Mac Cárthaigh, 'Turf boats and turf cots of the Shannon estuary', *Béaloideas* 79 (2011), pp., 165–175.
See also: Killimer Local History Group, *Living on the Wild Atlantic Way through a Lens,* (Killimer (Co. Clare), 2021). In p. 71 photographs from Kilrush are reproduced showing (a) horse carts laden with turf for Glynn's Flour Mills (during WW II) and (b) a sailing boat laden with turf destined for Limerick. These convey the industrial scale of peat cutting in south-west Clare, presumably all by hand, in the first half of the twentieth century. The turf is undoubtedly of local origin and probably mainly from Moanmore.
15. Important wetland plants that have become extinct in the area include six-stamened waterwort (*Elatine hexandra*), American pipewort (*Eriocaulon aquaticum*), spring quillwort (*Isoetes echinospora*) and brown beak-sedge (*Rhynchospora fusca*).
For an account of a botanical field trip to west Clare, including Moanmore bog, in August 1980 see:
M.J.P. Scannell, M. O'Connell, 'S.W. Clare, 23rd–24th August', *Watsonia* 14 (1982), pp. 116–117.
16. For details of this SAC (Special Area of Conservation) see https://www.npws.ie/protected-sites/sac/002343; accessed 12 January 2022.
17. Pollen profile LLM II is from the north-west margin of this bog; see Fig. 4. Details are available in:
Lj. Jeličić, M. O'Connell, 'History of vegetation and land use from 3200 B.P. to the present in the north-west Burren, a karstic region of western Ireland', *Vegetation History and Archaeobotany* 1 (1992), pp. 119–140.
18. A ^{14}C date for bog-oak G23 from Gragan West is given in Table 2.
19. For OxCal v. 4.4.4 see https://c14.arch.ox.ac.uk/oxcal.html, accessed 20 January 2022; OxCal program by Christopher Bronk Ramsey, 2021.
For the ^{14}C calibration curve IntCal20 see: P.J. Reimer, et al., 'The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0–55 cal kBP)', *Radiocarbon* 62 (2020), pp. 725–757.
20. In Fig. 6a, an arrow pointing to the left is used to indicate that the tree continued to live beyond the date indicated; this is in contrast to the other samples in which outer timber was sampled.
21. For ease of presentation, the median date is regarded as indicative of age; the age ranges (at 1σ or to be surer at 2σ probabilities) and/or the graphical output from OxCal should also be consulted.
22. M. Walker, et al., 'Formal subdivision of the Holocene series/epoch: a summary', *Journal of the Geological Society of India* 93 (2019), 135–141. Note: ka indicates 1000 years; thus 11.7 ka = 11 700 cal. BP.
For Lateglacial/early Holocene sites of Clare interest — at Fiddaun and Lurga, Co. Galway (NE of Tubber) and Illauncronan, Co. Clare (NE of Crusheen) — see:
Andrieu, V., Huang, C.C., O'Connell, M., Paus, A., 'Lateglacial vegetation and environment in Ireland: first results from four western sites', *Quaternary Science Reviews* 12, (1993), pp. 681–705.
van Asch, N., Lutz, A.F., Duijkers, M.C.H., Heiri, O., Brooks, S.J., Hoek, W.Z., 'Rapid climate change during the Weichselian Lateglacial in Ireland: chironomid-inferred summer temperatures from Fiddaun, Co. Galway', Palaeogeography, *Palaeoclimatology, Palaeoecology* 315–316, (2012), pp. 1–11.
23. K. Molloy, M. O'Connell, 'Post-glaciation plant colonisation of Ireland: fresh insights from An Loch Mór, Inis Oírr, western Ireland', in: *Mind the Gap II. New Insights into the Irish Postglacial.* A special supplement of the Irish Naturalists' Journal (Irish Naturalists' Journal, Belfast, (2014), pp. 66–88).
The pollen profile MOR1 from An Loch Mór, is still probably the most detailed Holocene pollen diagram available in Ireland and Britain.
24. Stomata derive from leaves, which, unlike pollen, are not subject to long-distance dispersal. The guard cells of stomata regulate gaseous exchange, and are thick walled and thus resistant to decay. Like pollen, stomata preserve well in peat and lake sediments, and, in the case of some species, can be distinguished microscopically to genus/species level.
25. Feehan and O'Donovan, *The Bogs of Ireland,* op. cit.
26. The age of bog-oak G23 (6918 ± 70 BP; 7754 cal. BP) supports this idea; see Table 2.
27. For details regarding the sources of these dates see:
M. O'Connell, 'Post-glacial vegetation and landscape change in upland Ireland with particular reference to Mám Éan, Connemara', *Review of Palaeobotany and Palynology* (2021), 290, 104377.
M. O'Connell, K. Molloy, E. Jennings, 'Long-term human impact and environmental change in mid-western Ireland, with particular reference to Céide Fields — an overview', *E&G Quaternary Science Journal* (2020) 70, pp. 1–32.
O'Connell, Jennings and Molloy, 'Holocene vegetation dynamics, landscape change and human impact in western Ireland', *op. cit.*
28. Details are available in O'Connell, Jennings and Molloy, *ibid.*
29. Included in the plots are 66 and 19 ^{14}C dates from Mayo and Galway (Connemara only included), respectively. Dates from intertidal peats are not included; for these see: M. O'Connell, K. Molloy, 'Mid- and late-Holocene environmental change in western Ireland: new evidence from coastal peats and fossil timbers with particular reference to relative sea-level change', *Holocene* 27 (2017), pp. 1825–1845.
30. See for example:
A. McNally, 'Dendrochronology of subfossil pine as evidence for environmental change. In: G.J. Doyle (ed.), *Ecology and Conservation of Irish Peatlands,* (Royal Irish Academy, Dublin, 1990), pp. 15–22.
McGeever and Mitchell, 'Pine stumps in Irish peats' op. cit.
T.M. Mighall, J.G.A. Lageard, F.M. Chambers, M.H. Field, P. Mahi, 'Mineral deficiency and the presence of *Pinus sylvestris* on mires during the mid- to late Holocene: palaeoecological data from Cadogan's Bog, Mizen Peninsula, Co. Cork, southwest Ireland', *The Holocene* 14 (2004), pp. 95–109.
J.R. Pilcher, M.G.L. Baillie, D.M. Brown, F.G. McCormac, P.B. MacSweeney, A.S. McLawrence, 'Dendrochronology of subfossil pine in the north of Ireland'. *Journal of Ecology* 83 (1995), pp. 665–671.
G. Plunkett, D.M. Brown, G.T. Swindles, '*Siccitas magna ultra modum*: examining the occurrence and societal impact of droughts in prehistoric Ireland'. *Proceedings of the Royal Irish Academy* 120C (2020), pp. 83–104.
31. Several of the publications already cited provide evidence for climate downturn around the mid-Holocene and later. For an example from Germany see:
J. Eckstein, H.H. Leuschner, A. Bauerochse, 'Mid-Holocene pine woodland phases and mire development — significance of dendroecological data from subfossil trees from northwest Germany', *Journal of Vegetation Science* 22, (2011), pp. 781–794.
32. See for example: O'Connell, Jennings and Molloy, 'Holocene vegetation dynamics, landscape change and human impact in western Ireland', *op. cit*.
33. A.H. McGeever, F.J.G. Mitchell, 'Re-defining the natural range of Scots Pine (*Pinus sylvestris* L.): a newly discovered microrefugium in western Ireland', *Journal of Biogeography* 43 (2016), pp. 2199–2208.
J.R. Roche, F.J.G. Mitchell, S. Waldren, B.S. Stefanini 'Palaeoecological evidence for survival of Scots pine through the late Holocene in western Ireland: implications for ecological management', *Forests* 9 (2018), 350.
34. For further discussion as to the reasons why the data from Rockforest may not provide the rigorous evidence that is desirable and required see:
M. O'Connell, K. Molloy, 'Aran Islands, western Ireland: farming history and environmental change reconstructed from field surveys, historical sources, and pollen analyses', *Journal of the North Atlantic* 38 (2018), pp. 1–27.
35. Survival of pine into the historical period in Ireland is plausible. An eight century Irish legal tract lists pine as one of the seven 'nobles of the wood'; see: F. Kelly, 'The old Irish tree-list', *Celtica* 11 (1976), pp. 107–124.
Radiocarbon dating of a pine stump from Clonsast, Co. Offaly (it has been triple dated, each time with a similar result), suggests that the stump dates to ca. AD 450, i.e. early Medieval times; see: I.R.

McAulay, W.A. Watts, 'Dublin Radiocarbon Dates I', *Radiocarbon* 3 (1961), pp. 26–38.
A pointer towards survival into the late Medieval period is provided by a ^{14}C date of pine charcoal from Inis Oírr, i.e. 610 ± 45 BP (GrA-24632) which indicates ca. AD 1350; see:
K. Molloy, M. O'Connell, 'Fresh insights into long-term environmental change on the Aran Islands based on palaeoecological investigations of lake sediments from Inis Oírr', *Journal of the Galway Archaeological and Historical Society* 59, (2007), pp. 1–17.
36. E. Jennings, *Palaeoecological Studies Towards the Reconstruction of the Holocene History of* Pinus sylvestris L. *in Western Ireland,* (Ph.D. thesis (unpublished), National University of Ireland Galway (NUIG), 2007).
37. Lj. Jeličić, *Investigations towards the Reconstruction of the Palaeoenvironment at Lislarheenmore, north-western Burren, Co. Clare,* (M.Sc. (unpublished), Department of Botany, UCG [NUIG], 1991).

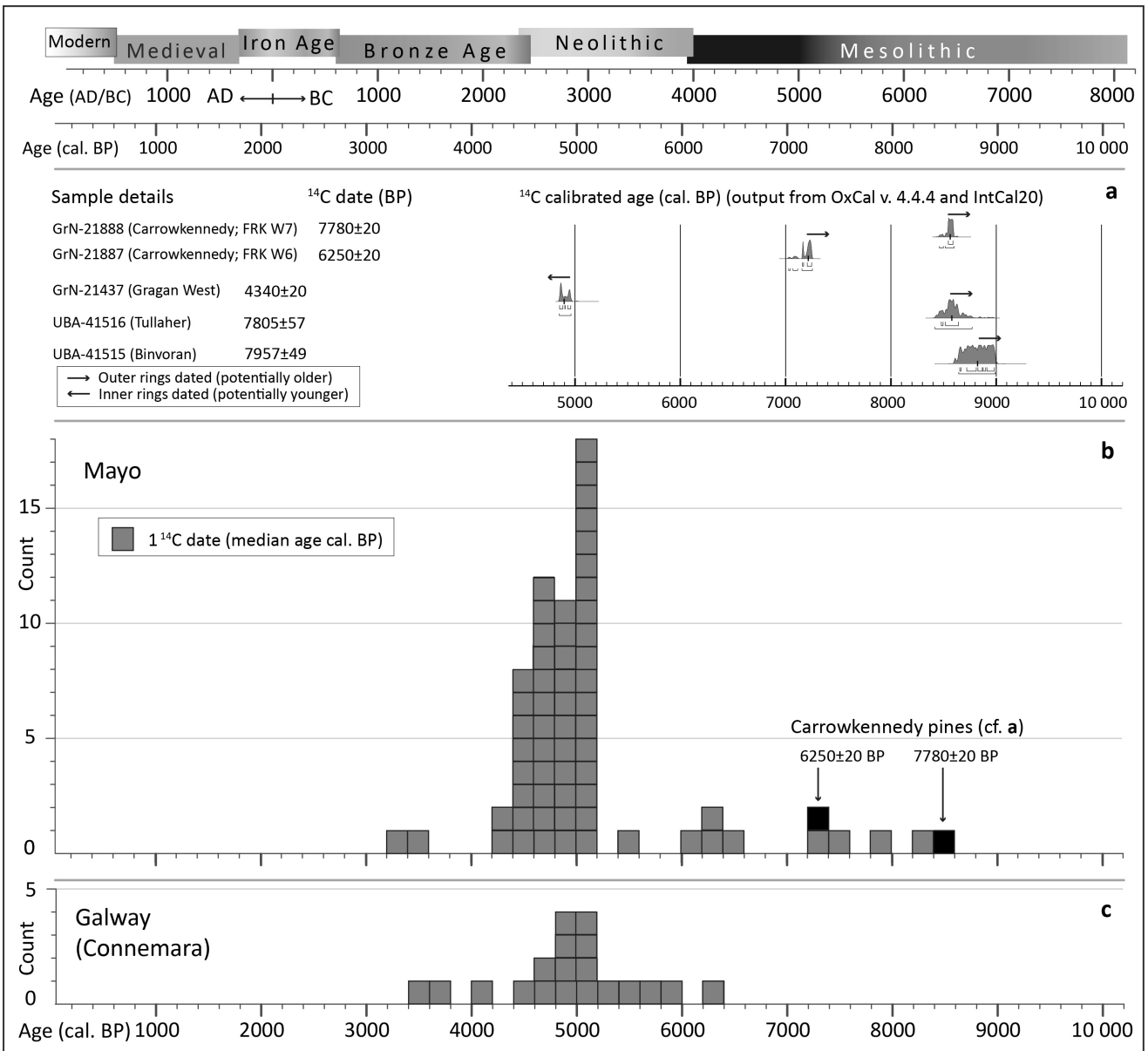


Fig. 6. Overview of ^{14}C dates derived from bog-pines, counties Clare, Galway and Mayo. All data are plotted to a common time scale in cal. BP years; the equivalent in AD/BC and cultural periods as widely accepted in Ireland are shown.

a: Outputs from calibration of ^{14}C dates (from Co. Clare and Carrowkennedy, west Mayo) by OxCal. Probability calibration curves are shown; also 1σ and 2σ ranges, and median dates. Outer wood were dated from all samples except Gragan West;

b: Histograms showing frequency of median cal. ages (classified in 200 y intervals) derived from ^{14}C dated timbers from Co. Mayo (66 ^{14}C dates);

c: As in **b** but pine timbers are from Connemara, Galway (19 ^{14}C dates).

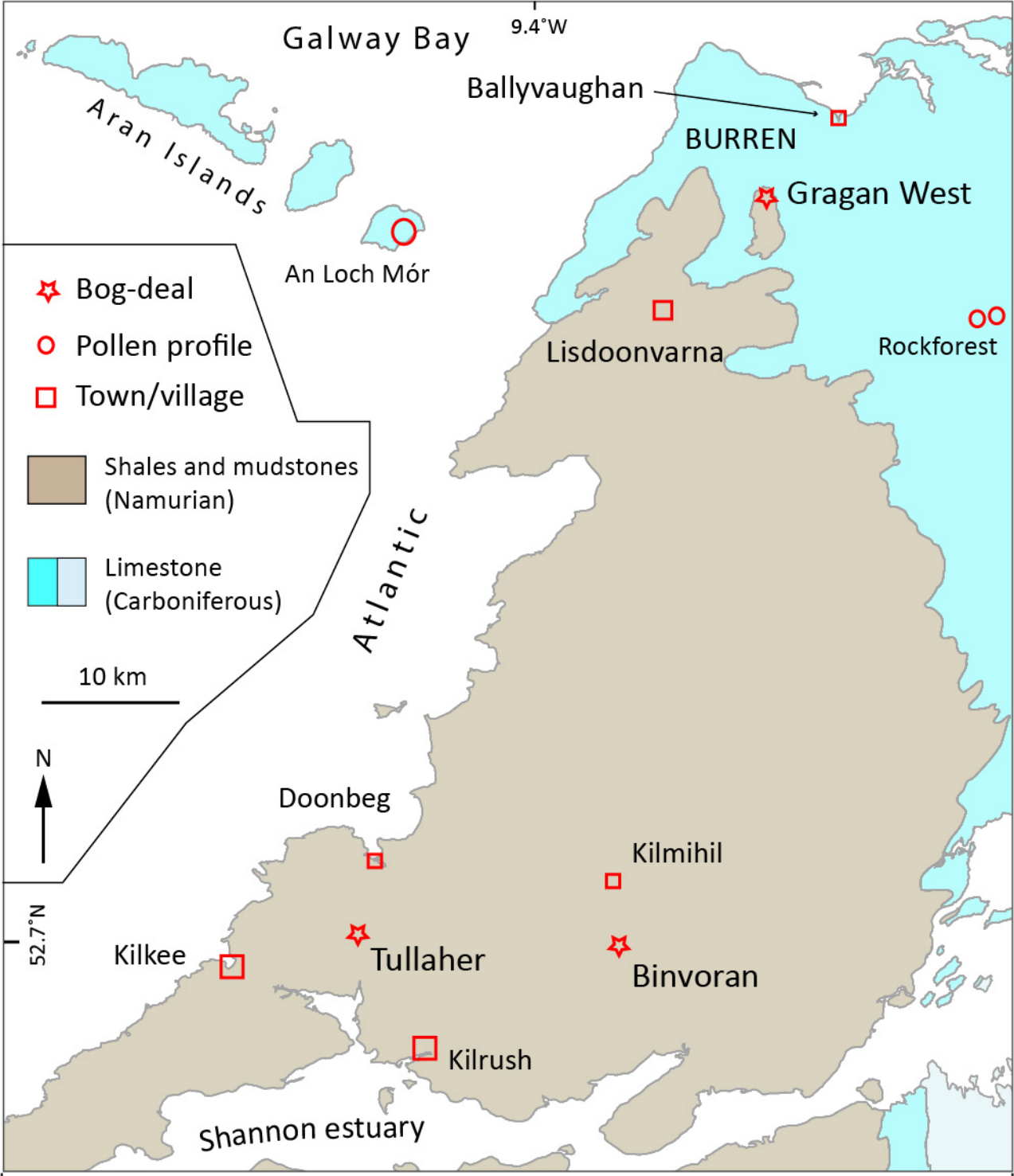
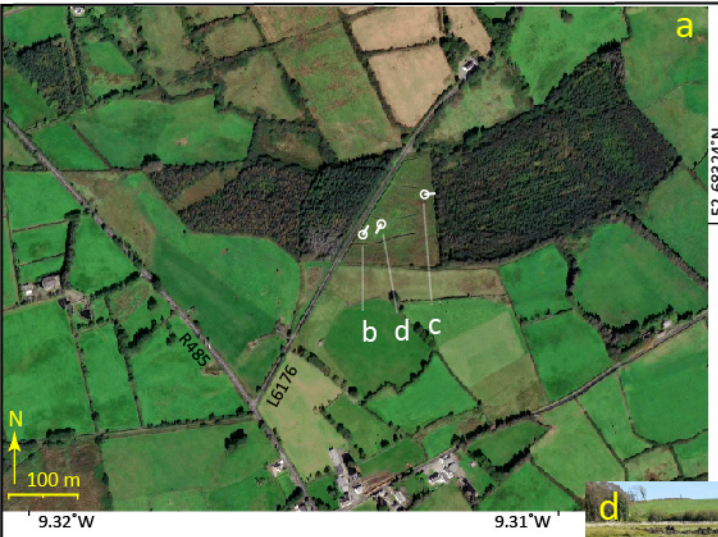


Fig. 1. Simplified geology map of the study area showing sites investigated for bog-deal, pollen profiles referred to in the text and selected centres of population.



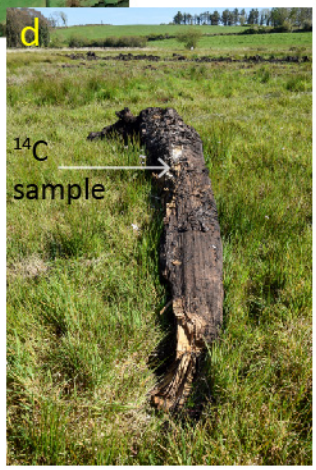


Fig. 2. Photographs relating to Binvoran.

a: Aerial photograph, Binvoran. Location and direction of view of photographs b–d are indicated;

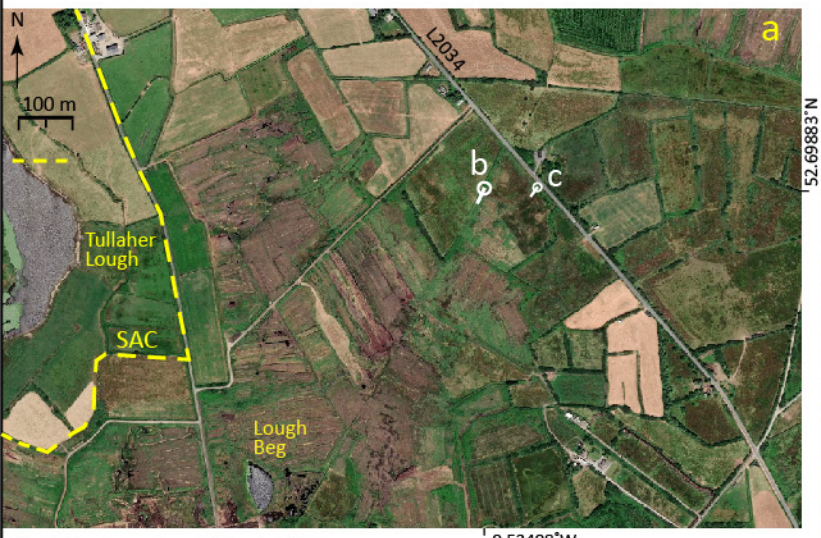
b: View to NE of sampling site showing drains and spoil heaps;

c: Large pine trunk: one of several pine timbers that may derive from earlier reclamation;

d: Large pine trunk sampled for ^{14}C dating;

e: Detail of lower trunk showing well preserved bark.

Sources of photographs: (a) USGS via ExpertGPS.com (accessed: 11/01/2022); (b–e) M. O'Connell (12/05/2019).



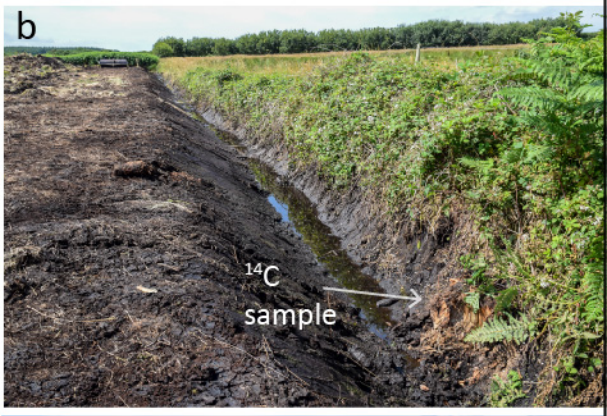


Fig. 3. Photographs relating to Tullaher.

Sources of photographs: (a) USGS via ExpertGPS.com (accessed: 11/01/2022); (b and c) M. O'Connell (16/07/2019).

a: Aerial photograph, Tullaher. Location and direction of view of photographs b and c are indicated;

b: Recently excavated drain with large pine stump, damaged but *in situ* (source of sample P-CE-002);

c: View of pasture (that in foreground recently cut) on reclaimed bog. Mounds of peat with bog-timbers from recent drainage works and dense growth of *Pteridium* (bracken) are visible towards the horizon.

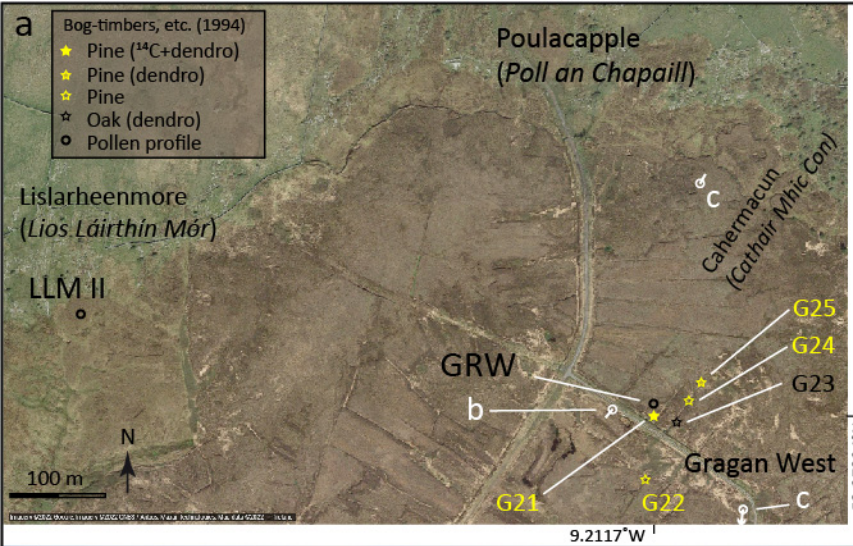


Fig. 4. Photographs relating to uplands at Gragan West, N.W. Burren.

Sources:
(a) Google Maps (accessed 20/01/2022);
(b–d) Michael O'Connell (17/01/2022).

a: Aerial photograph, upland blanket bog on shale and adjoining karstic landscape, NW Burren. Sites relating to the early 1990s, townlands, and the location and direction of view of photographs b–c, and townland names are shown;

b, c: Pine timbers brought to the surface during recent drainage; the timbers were charred; pine timber **c** is from outside the image, 204 m south of where indicated;

d: Photograph showing the typical abrupt transition between bog on shale and karstic limestone with a stone-wall field boundary and *Crataegus* bushes bent by the prevailing westerlies. In the distance are the limestone hills west of Ballyvaughan.

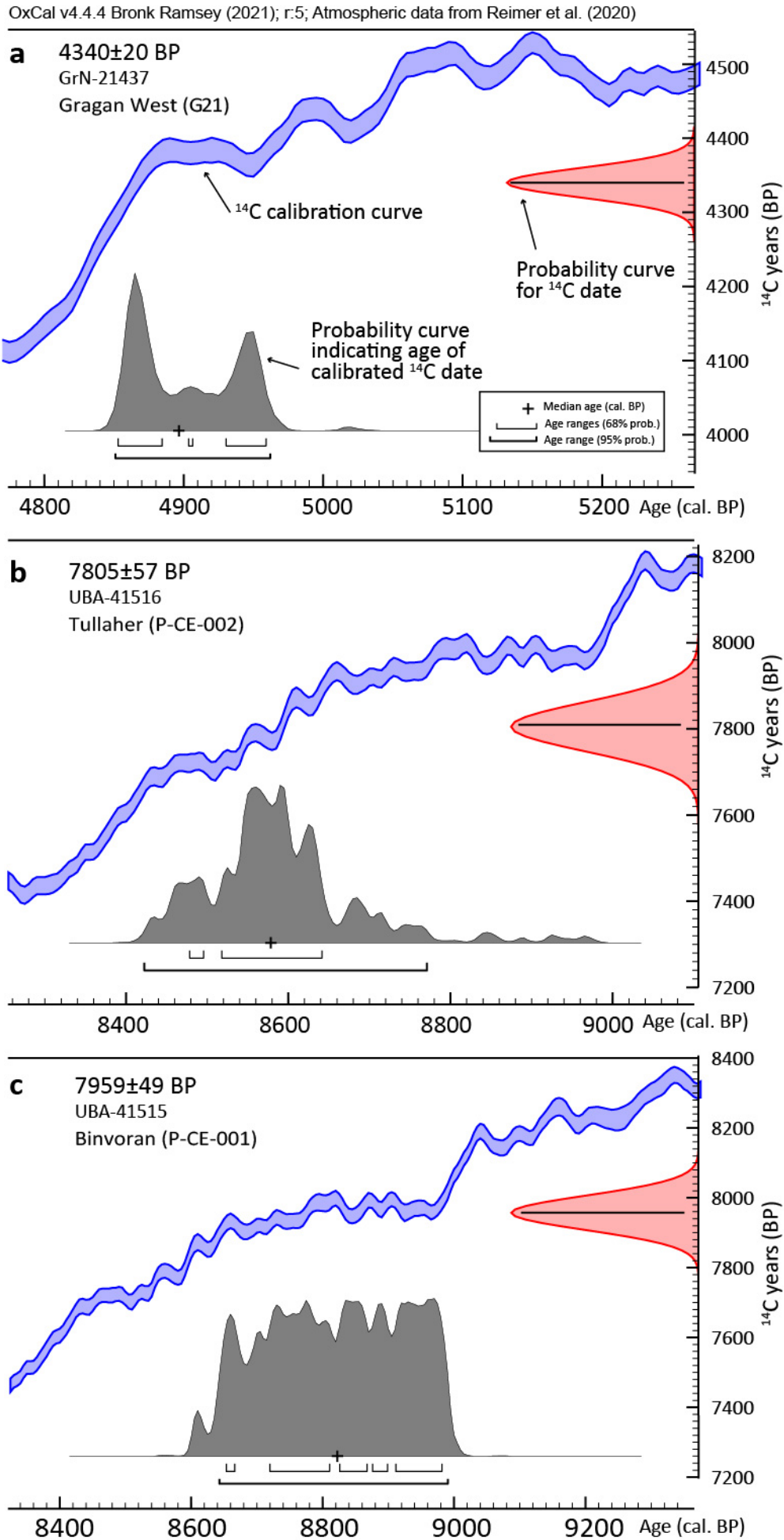
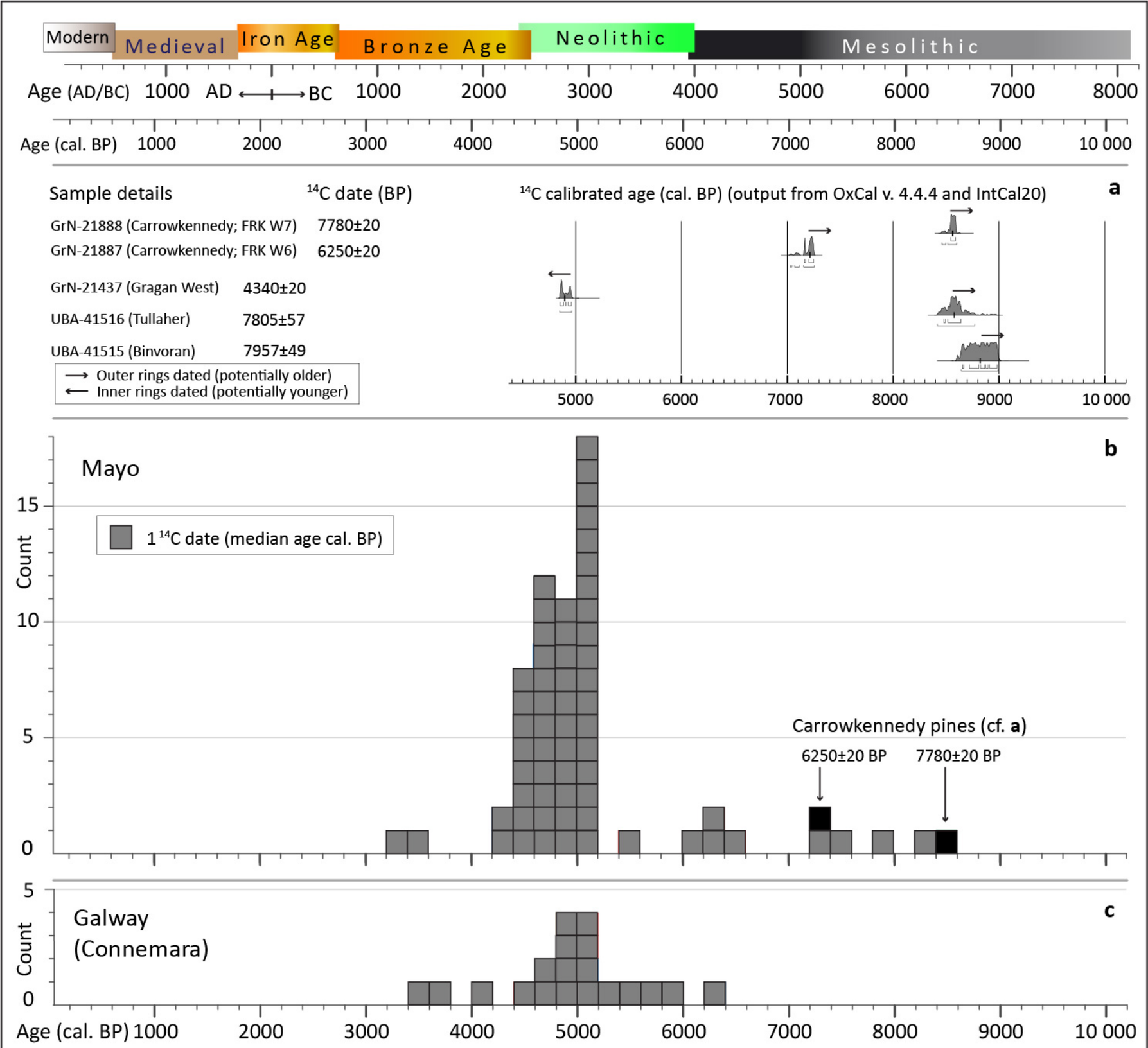


Fig. 5. Outputs from the ^{14}C calibration program OxCal.



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a: Outputs from calibration of ^{14}C dates (from Co. Clare and Carrowkennedy, west Mayo) by OxCal. Probability calibration curves are shown; also 1σ and 2σ ranges, and median dates. Outer wood were dated from all samples except Gragan West;

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