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14.
The beetles, the body and the bog

Eileen Reilly

Introduction

The discovery of a bog body at Tumbeagh Bog, Lemanaghan, Co. Offaly, afforded a rare opportunity to examine well-preserved human remains and the environment in which they were found. Samples for insect remains and pollen were taken from close to the body. A column of insect samples from a peat section face near the body was taken, after consultation with Dr Wil Casparie, in order to provide close correlation between environmental proxies. Insects are useful environmental indicators. The habitat-specific nature of many species of beetles (Coleoptera), in particular, can help to determine the environmental conditions pertaining at the time of their deposition. From the results outlined below, it is clear that their real value to this study lies in their ability to provide a detailed picture of environmental change up to and including the time of deposition of the body.

Sampling strategy

A column of samples was taken from the eastern drain face of the field in which the body was found (B1, Table 21 and Fig. 3). A depth of 1.04m of peat was sampled in this column. Peat identifications were made in the field by Dr Wil Casparie (Casparie, Chapter 13). The stratigraphy here contrasted with the stratigraphy in the immediate environs of the body, and this contrast was considered important in understanding the wider environmental context of the body.

Samples were taken from peat in contact with the body under laboratory conditions. The body had been severely damaged by the milling machines, and very little intact flesh and bone survived. In particular, the head and torso were missing, so it was not possible to examine stomach contents or hair. However, it was hoped that a clear picture of the environmental conditions in which the body was deposited would come from an analysis of the samples around it. This would be correlated with the peat stratigraphical information to provide a more detailed picture. Initially, twenty samples were taken from the peat in contact with the body. However, these were subsequently amalgamated into ten samples: four above the body and six below (Table 22).

Sample no.	Description (top to bottom)	Level (top) (m OD)
1	Poorly humified sphagnum peat	57.02
2	Laminated peat and mud, Lake Phase 2	56.92
3	Drier phase, *Calluna* peat	56.81
4	Laminated peat and muds, Lake Phase 1;	56.75
5	*16cm in total, divided into two samples*	56.67
6	Very wet peat, with wood and some ericaceous inclusions	56.59
7	Fen peat (remains of carr woodland visible);	56.53
8	*56cm in total, divided into five samples*	56.41
9		56.29
10		56.18
11		56.07
Bottom of column (mineral soil not reached): 55.97m OD		

Table 21: Column samples.

Amalgamated sample no.	General location	Description
1	Samples from directly over the human remains	From bones at the highest level
2		Skin of left leg
		Bone of left shin
		Top of left tibia; also bottom of bone
		Top of left leg
3		Skin of right leg
		Right leg, north end, adipocere
4		Right foot (upper)
5	Samples from under the human remains	North-east, not in direct contact, left knee
		In direct contact, under knee region, left knee
6		Mid-east, not in direct contact, left shin
		Mid-east, in direct contact, left shin
7		South-east, not in direct contact, left foot
		South-east, in direct contact, left foot
8		North-west, not in direct contact, right knee
		North-west, in direct contact, right knee
9		Mid-west, not in direct contact, right shin
		Mid-west, in direct contact, right shin
10		South-west, not in direct contact, right foot
		South-west, in direct contact, right foot

Table 22: Bog-body samples.

Methodology

The samples were processed in the Zoology Department of the National University of Ireland, Dublin, using the paraffin flotation method outlined by Kenward *et al.* (1980) and modified by Kenward *et al.* (1986). The resultant flots were sorted in industrial methylated spirit, and all insect remains were extracted onto damp filter paper. All invertebrate remains, except mites, were recorded quantitatively, and the minimum number of individuals (MNI) was estimated on the basis of counts of fragments present. However, only beetles were examined in detail for this study. All specimens were identified as far as possible using the Gorham and Girling Collections housed in the University of Birmingham, a variety of identification keys and the writer's own collection of identified insect remains.

Species lists were drawn up for both sets of samples (Appendix 2, Tables 1, 2). These tables also contain ecological data and data on present-day occurrence in Ireland of each species or genus, where available. The habitats were grouped into refined ecological ranges, and assemblage statistics were produced (Tables 23, 24), as illustrated in Figs 35 and 36.

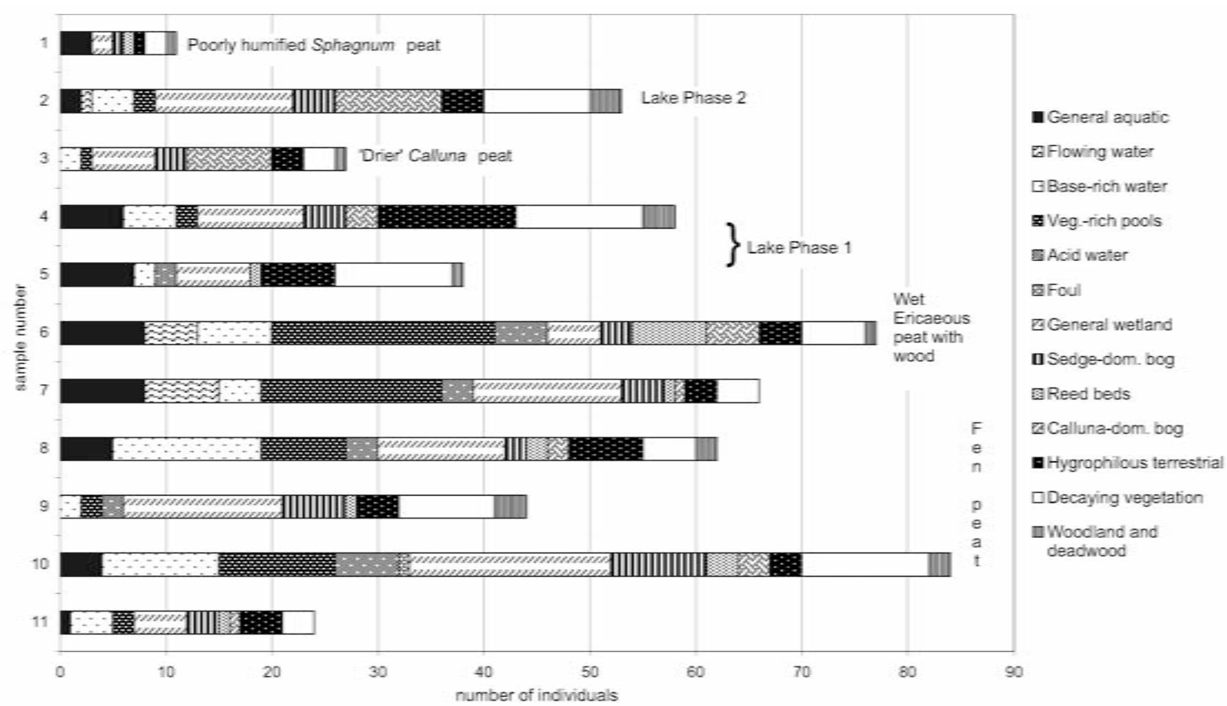
Overall, the numbers in each sample from Column B1 were quite good (Table 23). However, the samples did not contain the kinds of numbers needed for detailed statistical analysis (for different methodologies, see Kenward 1978). The index of diversity—a measure of species richness (Fisher's α, Fisher *et al.* 1943)—for each sample with an MNI of twenty or more was calculated, and a graph was produced (Fig. 37). Rank-order tables were also drawn up, and a graph of selected samples is

Sample no. (Column B1)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Sample size (litres)	2	2	2.5	2	2	3	2	2.5	2	2	3
No. of individuals (MNI)	11	53	27	58	38	77	66	62	44	84	24
No. of taxa (minimum)	10	26	15	30	24	31	28	27	27	32	17
Index of diversity (Fisher's α)	n/a	21	15	26	30	20	19	19	32	19	29r
Refined ecological ranges (MNI)											
General aquatic	3	2	0	6	7	8	8	5	0	4	1
Flowing water	0	1	0	0	0	5	7	0	0	0	0
Base-rich water	0	4	2	5	2	7	4	14	2	11	4
Vegetation-rich pools	0	2	1	2	0	21	17	8	2	11	2
Acid water	0	0	0	0	2	5	3	3	2	6	0
Foul	0	0	0	0	0	0	0	0	0	1	0
General wetland	2	13	6	10	7	5	14	12	15	19	5
Sedge-dominated bog	1	4	3	4	0	3	4	2	6	9	3
Reed beds	1	0	0	0	1	7	1	2	1	3	1
Calluna-dominated bog	0	10	8	3	0	5	1	2	0	3	1
Hygrophilous terrestrial	1	4	3	13	7	4	3	7	4	3	4
Decaying vegetation	2	10	3	12	11	6	4	5	9	12	3
Woodland and deadwood	1	3	1	3	1	1	0	2	3	2	0

Table 23: Assemblage statistics for Column B1 samples.

Sample no.	1	2	3	4	5	6	7	8	9	10
Sample size (litres)	1	1	1	1	2	2	2	1.5	1.5	1.5
No. of individuals (MNI)	31	28	35	19	12	43	35	11	19	21
No. of taxa (minimum)	12	12	15	8	5	7	8	7	12	11
Index of diversity (Fisher's α)	8	9	11	n/a	n/a	11	3	n/a	n/a	10
Refined ecological ranges (MNI)										
General aquatic	1	1	4	1	0	2	2	0	1	4
Flowing water	1	0	0	0	0	0	1	0	0	0
Base-rich water	0	1	1	0	2	2	2	1	2	0
Vegetation-rich pools	18	19	19	12	3	19	16	2	3	9
Acid water	1	0	0	1	0	0	2	0	1	0
Foul	0	0	0	0	0	0	1	0	0	0
General wetland	1	1	2	3	0	3	2	1	3	6
Sedge-dominated bog	3	2	4	0	6	6	4	3	5	2
Reed beds	0	0	0	0	0	0	0	3	1	0
Calluna-dominated bog	0	0	0	0	0	3	1	0	1	0
Hygrophilous terrestrial	1	0	3	0	1	3	1	0	2	0
Decaying vegetation	4	4	1	1	0	4	3	1	0	0
Woodland and deadwood	1	0	1	1	0	1	0	0	0	0

Table 24: Assemblage statistics for amalgamated bog-body samples.



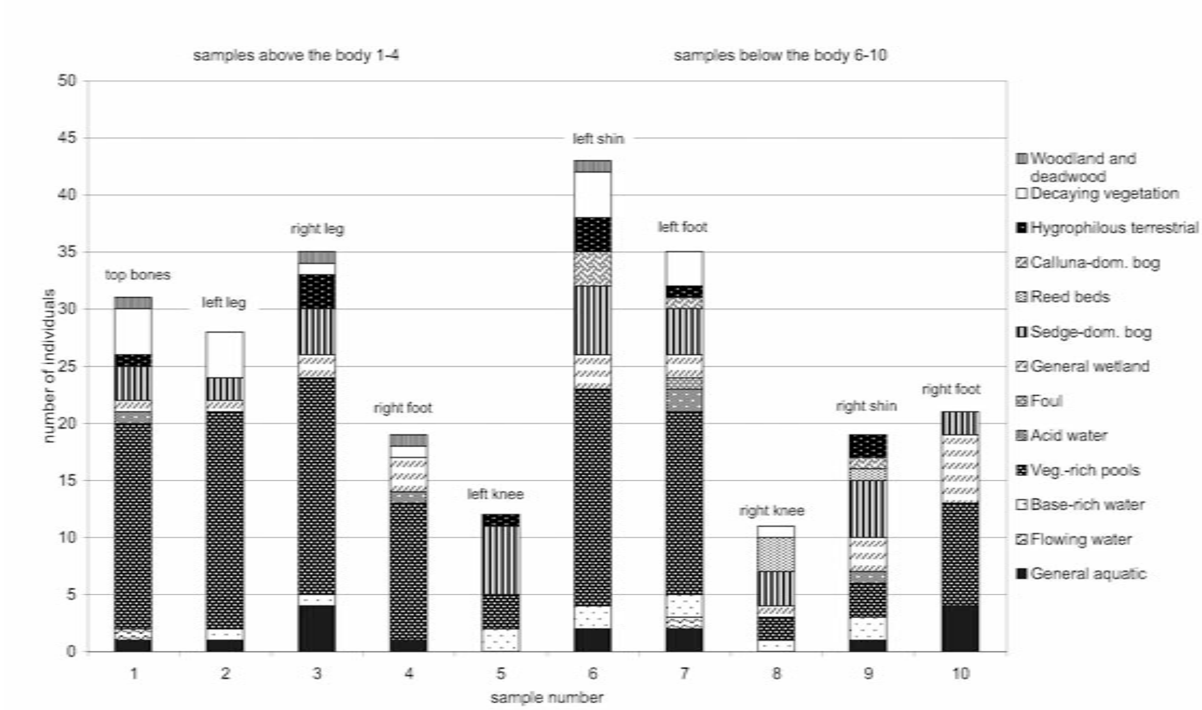


Fig. 36 (above): Refined habitat data for samples around the bog body, Tumbeagh, Co. Offaly.

shown in Fig. 38 to illustrate particular differences between phases of bog development.

The numbers from each sample around the body were quite low, and in many cases the index of diversity could not be calculated (Table 24). However, where it could be, it showed remarkable uniformity, and this is extremely important when analysing the environmental implications.

Analysis

Column B1 samples

Introduction

An analysis of the column is presented below. The sequence runs from bottom to top in chronological order. Three absolute dates anchor three phases in the sequence: the top of the fen peat, the top of Lake Phase 1 and the top of Lake Phase 2. Some approximate dating is also given, according to Casparie's analysis of peat accumulation rates. This sequence of samples was taken from between peat Survey Points 7 and 8, Transect 2 (Fig. 22), between 55.97m and 57.02m OD.

Fig. 35 (left): Refined habitat data for Column B1 samples, Tumbeagh Bog, Co. Offaly.

Samples 11 to 7: fen formation and development

The bottom five samples of this section were taken from fen peat (55.97–56.53m

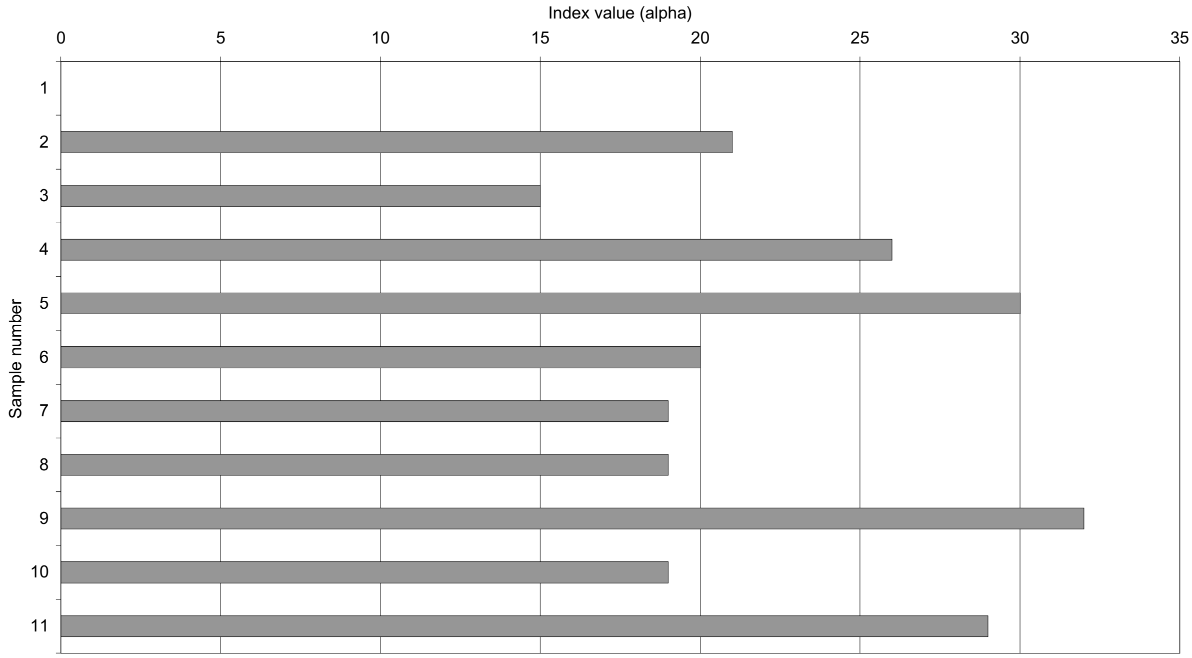


Fig. 37: Index of diversity for all samples from Column B1.

OD). Mineral subsoil was not reached in this location, as there was approximately a further 1.5m of fen peat before the subsoil. The fen peat showed relatively little stratigraphical variation from bottom to top, with Sample 9 (*c.* 56.29m OD) being the notable exception. However, subtle changes were noted throughout this period of fen-peat development, as represented by differences in the beetle assemblages. Fen-peat growth is thought to have ended by *c.* 779 cal. BC (UCD-01108).

At the bottom of the sequence (Sample 11) the insect fauna reflect a freshwater environment (Fig. 35). The water beetle *Agabus biguttatus/guttatus* is found in base-rich water. Other fen or freshwater pool species, such as *Chaetarthria seminulum* and *Graptodytes flavipes*, occur. There are also a number of wetland plant-feeders, including the genus *Bagous*, which could not be identified to species. This genus occurs throughout this entire sequence and is clearly endemic in Tumbeagh. However, almost all species of this genus are considered to be extremely rare, endangered or extinct in Britain and Ireland owing to shrinkage of their natural habitats, so its finding in such consistent numbers at all periods here is quite important (Hyman and Parsons 1992). *Plateumaris sericea*, also recovered at this level, is specifically associated with sedges, iris and great reed-mace. No specific indicators of woodland occur. A small but consistent number of what are know as 'hygrophilous terrestrial' species occur. These are species that otherwise occur on dry land but have a preference for moisture. They can, therefore, occur along riverbanks, in wet meadows, beside lakes or fens and in temporary water. The presence of these species indicates the proximity of upland to the fen edge at the time.

The second sample (Sample 10) from this sequence shows a big increase in the

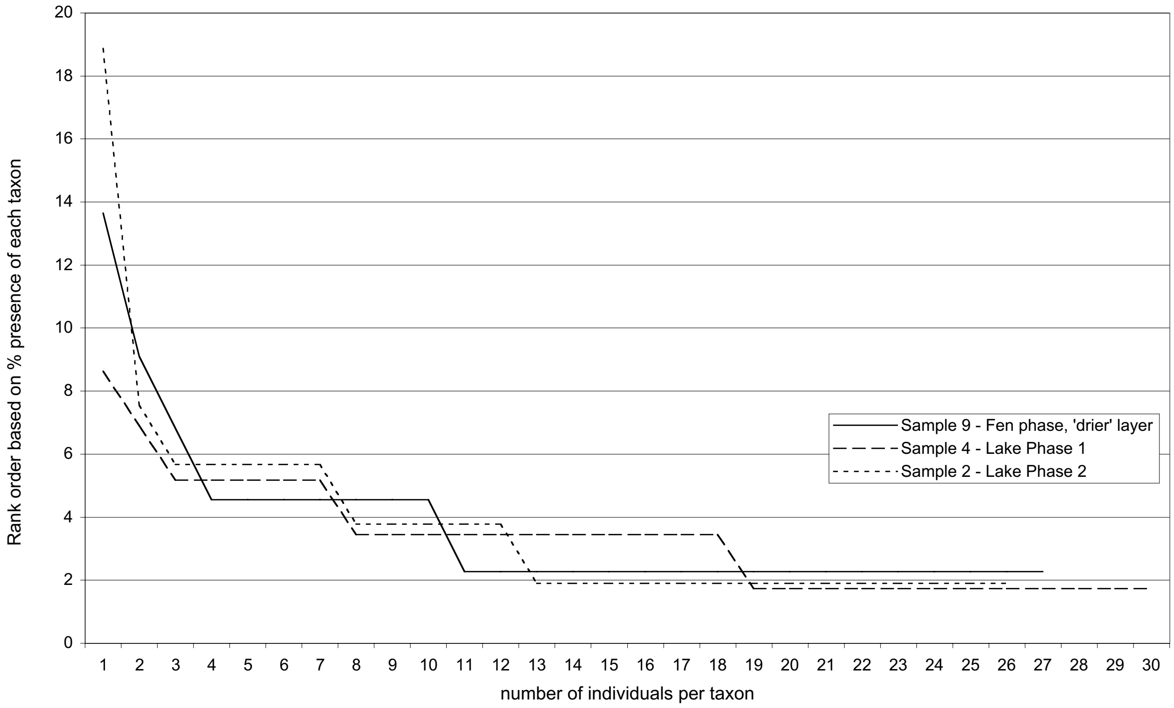


Fig. 38: Rank-order graph for selected samples from Tumbeagh Bog, Co. Offaly.

numbers of beetles recovered (Fig. 35). This is probably due to development or expansion of the fen in a northward direction. A large number of vegetated pool species occur, including *Enochrus* spp, although the underlying base-rich nature of the water here is still clearly indicated by the presence of a consistent number of *Chaetarthria seminulum* and *Agabus bigutatus/guttatus*. There is some evidence of acidification beginning or occurring in isolated locations, perhaps smaller, stagnant pools, with the presence of *Hydroporus ferrugineus* and *H. obscurus*. A large number of *Cyphon* spp also occur, along with *Bagous* sp. and other wetland plant indicators. Sedges, iris and reed-mace are indicated by the presence of *Plateumaris sericea* and *P. discolor*; the latter may also indicate the presence of *Sphagnum*, possibly in stagnant pools. Throughout the fen development phase and the first lake phase there is also a consistent presence of the plant-feeding genus *Phyllotreta* (could not be identified to species). Again, members of this genus are usually found in upland areas but have a preference for moisture, and their host plants include various crucifers in grasslands and riverside and woodland locations (Bullock 1993). There is some evidence of woodland in the vicinity here too, as the ground beetle *Pterostichus oblongopunctatus* is a forest-floor species and *Rhynchaenus* sp. is a leaf miner of various deciduous tree species. The close proximity of upland to this part of the fen is reflected in these species and other 'terrestrial' species.

The next level in the fen (Sample 9) is indicated by a sharp drop in the number of aquatic species. This may reflect a drop in water-level in the fen basin caused by climatic change or discharge from the basin to the south. The change is quite dramatic. Most notably, species with a preference for base-rich water drop considerably compared with the phase before or after, and a small number of acid-preferring species, such as *Hydroporus nigrita*, occur. It is possible that the stagnation of localised ponds occurred with a drop in the water-table and a low input of nutrient-rich water. The occurrence of decaying-vegetation species (over 20 per cent of all individuals) indicates that humification was taking place, but there are also large numbers of wetland plant indicators such as *Plateumaris discolor* and *Bagous* spp. Some woodland indicators, such as *Rhynchaenus* sp., are present. Together, this may indicate that the water-table dropped sufficiently to allow the growth of some trees and the decay of vegetation. However, the presence of reeds and sedges indicates that there was still some open water nearby. The index of diversity for this sample is higher than for all other fen-level samples, reflecting the slightly 'drier' nature of the layer and the ability for biological decay to set in (Fig. 37). It is not possible to date this event accurately, but an approximate date of 1000 BC is probable, based on the known date for the end of fen-peat development (≈780 BC) and an approximation of peat accumulation rates (Casparie, Chapter 13).

Sample 8 sees a return to more normal fen conditions, in particular a big increase in species preferring base- or nutrient-rich water such as *Chaetarthria seminulum* (Fig. 35). Various *Enochrus* species and plant indicators such as *Bagous* indicate the presence of open, vegetation-rich pools. There are also a number of interesting inclusions of upland, albeit moisture-preferring, species; such as *Phyllopertha horticola*, *Phyllotreta* sp. and *Calathus fuscipes*, a ground beetle often associated with cultivated ground and woodland margins (Lindroth 1974). All of these species may be casualties from the nearby upland or bog-marginal woodland and may indicate some run-off from that direction at this time. Other indirect indicators of woodland include *Rhizophagus bipustulatus*, found under the bark of various trees, and *Rhynchaenus* sp. It may be that small areas of carr woodland occurred in this area, as indicated in the phase below it (Sample 9), although roots and other wood fragments occurred fairly infrequently in these samples. Casparie noted the development of wood-rich peat in this location at this level, but in general the samples do not reflect a woodland environment in the immediate locality.

The last sample of this true fen phase is Sample 7. The first notable change is the presence of a species, *Ochthebius minimus*, indicating flowing or slow-moving water (Fig. 35). This is carried on into the phase above the fen (Sample 6) and may be related to the gradual development of the first phase of the bog lake. The number of species preferring base-rich water also drops quite dramatically, and there is an increase in species indicating vegetated pools, such as a number of species of the genus *Enochrus*. Also present are a number of acid-preferring species, such as *Agabus affinis* and *Hydroporus obscurus*. These various habitats occurring together are understandable in the context of an extension of the water body in which the fen is developing and an active fen edge with mature vegetation and some level of stagnation. The location only slightly to the south of the main discharge channel for the developing bog lake would explain the presence of moving-water species. The number of decaying-vegetation species is low, and no woodland indicators are present. The dominance of these last two samples by a single taxon—*Chaetarthria seminulum* in Sample 8 and *Ochthebius minimus* in Sample 7—means they have much lower indices of diversity than the previous fen phases (Fig. 37).

Sample 6: wet peat with ericaceous and wood inclusions

The next phase of bog development in this location relates primarily to the inundation of the area by the bog lake. The top of this level in this location is at 56.59m OD, and it is relatively short-lived, only 0.07m thick. The sample is dominated by aquatic species indicating a variety of hydrological conditions (Fig. 35). This phase is similar to Sample 10, during the fen development phase, but, unlike in that period, the presence of water largely 'drowns out' the presence of other ecological niches. In particular, there is a dramatic drop in the number of wetland plant indicators. It is clear that the 'fen-edge' environment as indicated in the previous samples is overtaken by a true aquatic environment. The fen edge has in effect shifted north, and the gradually developing lake is now the dominant habitat. However, there are two anomalous elements in this picture: firstly, the presence of a small but significant number of heather weevil *Micrelus ericae*; and, secondly, the presence of wood fragments and the pine-associated species *Dromius quadrimaculatus*. It is possible that *M. ericae* relates to an area of hummock–hollow development elsewhere in the basin that has been drowned by the rising water-table. The presence of *D. quadrimaculatus* is also unlikely to be the result of pine trees growing in the immediate vicinity but is probably an indication of woodland on the margins of the fen; however, as noted above, there may have been a small area of woodland growing in this part of the fen that was subsequently drowned by the rising water-table. This species has a preference for pine, but its presence on other tree species is not unknown (Lindroth 1974; Alexander 1994). It is quite common today owing to widespread planting of conifers in commercial forestry. This peat layer is quite thin and is eventually succeeded by the lake muds, gradually deposited to form a distinct layer.

Samples 5 and 4: Lake Phase 1

As noted above, the beginnings of the development of a lake in this part of Tumbeagh Bog are thought to date to shortly after the fen-peat development stage ended, *c.* 779 cal. BC (UCD-01108). The increased wetness in the sampling location is clear from Sample 7. However, it is clear that this is still a minerotrophic or mesotrophic environment and that ombrotrophic conditions have not developed (Casparie, Chapter 13). The layer is 0.16m thick and under normal rates of peat accumulation may represent a period of up to 200 years. However, the difference in age between the top of the fen peat and the top of Sample 4 (cal. AD 240: UCD-01109) is almost 500 years. Even allowing for the 0.07m of Sample 6 representing 100 years, this indicates that either lake-sediment accumulation took place over a prolonged period of time or a great deal of desiccation, decomposition and probable erosion of this layer occcurred.

The most striking thing about Samples 5 and 4 is that they clearly represent organic-rich sediment and not an aquatic-dominated peat layer, as can be seen during the fen development phase (Fig. 35). The most obvious difference is the huge drop in true aquatic species and the large increase in both decaying-vegetation species and hygrophilous terrestrial species. The index of diversity from Sample 5 is second only to Sample 9, during the fen development phase, indicating the similarities in environmental conditions pertaining at the two periods (Fig. 37). In effect, the insect death assemblages reflect both the active deposition of sediment during the lake phase and the aftermath of the emptying of the basin when the drop in water-table resulted in the drying out and partial decomposition of the gyttja layer. Sample 5 probably better reflects the deposition period, and Sample 4 probably better represents the post-lake phase. The main difference between the two layers is the smaller number of terrestrial species present in the upper part of the gyttja layer (i.e. Sample 4). As noted by Casparie (Chapter 13), the discharge of water from the lake led to drying out and subsequent partial desiccation of the gyttja, allowing some trees to colonise and drier peat types to grow. Some ericaceous remains were noted in the peat stratigraphy at this time at various locations along this section (Casparie, Chapter 13). It is clear that *Calluna* was growing on the surface of the drier gyttja layer at this location, as *Micrelus ericae* is recovered and various dryland plant-feeders such as *Chatocnema concinna*, *Apion* sp. and *Phyllotreta* sp. are also present. Both layers also have a small number of woodland-associated species, including *Rhynchaenus* sp., *Dromius quadrimaculatus* and *Agathedium* sp. These may be related to the recolonisation of part of the lakebed by trees. The lake phase appeared to last for a considerable time before the catastrophic event that resulted in the emptying of the basin. The top of the phase has been dated to cal. AD 238 (UCD-01110). However, this includes the period after it was emptied and the subsequent decomposition of the gyttja layer; it does not date the actual event that emptied the basin. This is assumed by Casparie to be a bog burst, which drained the bog to the south or south-east, toward the River Brosna, and lowered the water-table by up to 1m.

Sample 3: drier *Calluna* peat phase

The end of Phase 1 of the lake and the subsequent emptying caused a drying out of the lake sediments. This compacted layer allowed the growth of drier peat types, and this is very clearly reflected in the insect assemblage of Sample 3 (Fig. 35). This layer effectively represents the entire period of 'drier' peat growth, probably not a very long period of time, given the subsequent dates for Phase 2 of the lake. The assemblage contains a low percentage of true aquatics, and those present mainly indicate small pools of standing water: *Chaetarthria seminulum* and *Graptodytes bilineatus*. The presence of growing *Sphagnum* and other wetland plants is indicated by *Bagous* spp, *Cyphon* spp and *Plateumaris discolor*. However, the presence of *Calluna* is indisputably indicated by a large number of *Micrelus ericae*, representing 30 per cent of the individuals present (Appendix 2, Table 1). A drop in the index of diversity is also noted here owing to the dominance of one taxon (Fig. 37).

Sample 2: Lake Phase 2

Quite soon after the events described above, the discharge channel became blocked again and the beginning of a second lake phase is identified. Another gyttja layer represents this, and there are marked similarities between the insect death assemblages of Samples 4/5 and Sample 2. The layer here, however, is much thinner, and differences between the deposition phase and the post-emptying phase of the lake are more difficult to distinguish. There is a slightly higher number of freshwater/base-rich water aquatic species, including *Hydroporus rufifrons*, a species not on the current Irish list of Coleoptera (Anderson *et al*. 1997) and considered highly vulnerable in Britain (Hyman and Parsons 1992). Its habitat preference is temporary marsh in oxbow lakes or deep, vegetated ponds and pools (Shirt 1987). *Graptodytes granularis* is found in stagnant pools in fens, and the presence of this and other water beetles reinforces the picture of stagnant, vegetated water. This is probably related to the active deposition period. A number of ground beetles are present, which may reflect the post-emptying phase when the surface of the gyttja layer was temporarily dried out. In addition, a sizeable part of the assemblage is composed of decaying-vegetation species, and there are also some woodland indicators. The most notable feature of the assemblage is, again, the high number of *Micrelus ericae*, the heather weevil. This may indicate one of two things: the drowning of the earlier, *Calluna*-rich peat by the lake or the subsequent drying of the gyttja layer and regrowth of *Calluna*. *Calluna* is noted on the surface of the second gyttja layer in a number of locations in this section (Casparie, Chapter 13), so either scenario is possible. Unfortunately, the need for large samples for the processing of insect remains in effect masks any possibility of being able to distinguish when *M. ericae* was deposited. Although the index of diversity for this lake phase is higher than for the *Calluna* phase (Sample 3), it does not reach the same level as the first lake phase (Fig. 37). This would appear to be primarily a product of the duration of the second lake phase, the end of which is dated to cal. AD 430 (UCD-01110) and seems to have been due to a catastrophic emptying of the lake basin that caused huge erosion gullies (Casparie, Chapter 13).

Sample 1: poorly humified *Sphagnum* peat

The final sample, at the top of this sequence, is taken from poorly humified *Sphagnum* peat. It represents the peat that grew after the emptying of Phase 2 of the lake, after cal. AD 430 (UCD-01110). In other parts of this section, a clear transition from moderately humified *Sphagnum* peat to poorly humified *Sphagnum* peat is distinguished (Casparie, Chapter 13). However, it is possible that this sample came from a hollow in the hummock–hollow system that developed. It should be noted that the top sequence—the bog surface—was not sampled in order to avoid contamination. The beetle assemblage indicates poorly humified *Sphagnum*, as there is a marked drop in the overall numbers recovered (the index of diversity could not be calculated, for example). This is due to the nutrient-poor nature of such peats and the transition to true ombrotrophic conditions. Although some species present are aquatics and wetland plant-feeders, most of the assemblage is from very mixed origins.

Samples from the bog body

Introduction

As noted above, samples were taken from around the remains of the bog body in the laboratory. As far as was practicable, the samples were taken from peat in close contact with the body. The human remains were not stained very dark brown, as is often observed of bog bodies, but were light brown, indicating deposition in poorly humified *Sphagnum* peat (Bermingham and Delaney, Chapter 4). The peat stratigraphy analysis has identified the presence of a discharge system where the body was located. This channel, from earliest times, filled with soft, poorly humified *Sphagnum* peat and is the location of the two discharge events that emptied Phases 1 and 2 of the lake. Its presence has had a profound influence on the development of the bog in this location.

The peat below the body has been dated to cal. AD 1215–90 (GrA-14393), but the body itself is dated to cal. AD 1405–1635 (GrA-15627) (van der Sanden and van der Plicht, Chapter 6). The discrepancy in dates is most likely due to the displacement of younger peat owing to the weight of the body as it sank (see Discussion, below).

The insect assemblages from the samples around the body differ from each other in subtle ways but, overall, confirm this picture of very wet pool peat. The assemblages are discussed as follows: those below the body, around the left leg; those below the body, around the right leg; those above the body, around the right leg; and those around the left leg and upper bones. This is because the body appeared to be deposited on its left side, and some subtle differences in preservation of the skin were noted from the right leg, situated *c.* 5cm higher (Bermingham and Delaney, Chapter 4).

Samples 5, 6 and 7: below the body, left leg

The assemblages are dominated by the genus *Enochrus*, except the sample taken from around the knee (Sample 5) (Fig. 36). These water beetles mainly prefer well-vegetated pools, tending toward stagnation. The main reason for the poor numbers of insects recovered from the sample around the knee appears to be that the peat had dried out. This is probably a direct result of the effects of milling and does not reflect a dry period contemporary with the deposition of the body. The fact that the peat in the discharge channel was subject to flow is indicated in species found more commonly in base-rich environments and flowing water, but the numbers are very small, and clearly the overwhelming environmental context is poorly humified *Sphagnum* peat. The plant-feeding species—*Plateumaris sericea* and *P. discolor*—indicate *Eriophorum*, sedges and *Sphagnum*; a small number of *Micrelus ericae* are also present, possibly reflecting drier, more humified hummocks near the discharge channel. Other species typical of raised-bog environments, such as the ground beetle *Pterostichus minor*, are also present. One interesting inclusion is the dung beetle *Aphodius* sp., but this is almost certainly just a casualty from the nearby upland. Although a graph has not been produced, the index of diversity for Sample 6 (the shin) and Sample 7 (the foot) were calculated, and both show low values (Appendix 2, Table 2). However, the sample from around the foot is particularly low, and this may reflect the pool of poorly humified *Sphagnum cuspidatum* peat identified around the feet of the body, which was entirely dominated by the genus *Enochrus* (Casparie, Chapter 13).

Samples 8, 9 and 10: below the body, right leg

As noted above, the right leg lay above the left leg, and the skin of the right foot, in particular, appeared to be less well preserved. The pool of *Sphagnum cuspidatum* peat around the feet is certainly confirmed by the insect assemblage (Sample 10), which contains many pool aquatic species and plant-feeders that occur in *Sphagnum*. One interesting inclusion here is the ground beetle *Cymindis vaporariorum*. This species is considered quite rare today, and there are only three recorded findings of the species in Ireland, all before 1970 (Luff 1998). It is generally considered to prefer drier moorland and upland bogs but has been found in association with *Sphagnum* (Eyre *et al.* 1998) and so may also occur in raised bog. However, this is the first time that it has been recovered from a wetland archaeological context in Ireland. In Britain and the rest of Europe it has generally been found in late glacial or very early Holocene contexts (Coope 1968; Lemdahl 1988). Elsewhere, around the rest of the leg and knee, the number of pool species drops off, but the assemblage still indicates the presence of *Sphagnum* and possibly also *Eriophorum* (Fig. 36). Reeds or possibly sedges are indicated by the species *Chatocnema subcoerulea*. It is perhaps unlikely that stands of reeds were present in the channel, unless there was some flow or input of mineral-rich water. It is more likely that this species is associated in this location with *Eriophorum* or other sedges. Some upland indicators are also present, including *Chatocnema concinna*. In general, the number of individuals from each of these samples was low, and the index of diversity could be calculated only for the foot sample; it was unsurprisingly low, reflecting the dominance of one particular taxon (Appendix 2, Table 2).

Samples 1 and 2: above the body, left leg

The two samples from above the left leg and tibia in this location are very similar in that they are dominated by the genus *Enochrus*. One identifiable species of this genus, *Enochrus testaceus*, is generally found in richly vegetated pools occupied by *Sphagnum* but is not considered to be particularly tolerant of acid (Balfour-Browne 1958). This is a very interesting aspect of all of the samples from around the bog body, because, although the gully was dominated by poorly humified *Sphagnum* peat, the samples are not dominated by acid-tolerant taxa. Indeed, from all ten samples only three truly acid-tolerant species occur. This may be because there was, to some degree, a constant throughput of water in the discharge channel and the surface water never acidified to any great extent. One possible running-water species, *Hydroporus marginatus*, is found in the sample from around the top bones. This may also indicate some movement at the surface of the bog, perhaps at certain times of the year after heavy rainfall. The indices of diversity for both samples are very low, reflecting the dominance of *Enochrus* (Appendix 2, Table 2).

Samples 3 and 4: above the body, right leg

The peat above the right leg was again dominated by *Enochrus*. The sample from above the foot contained fewer individuals, but this may simply be due to poorer preservation, as noted earlier. The rest of the assemblage is dominated by plant-feeding species that occur in *Sphagnum* and *Eriophorum*. Both samples contained a very small number of species that are associated with decaying vegetation and woodland. The ground beetle *Nebria brevicollis* is found in forest floors and, along with *Agathedium* sp., which is found under bark, may indicate some woodland nearby. Alder was noted in contemporaneous levels north of the discharge channel (Casparie, Chapter 13). *Cercyon* sp. is a genus normally found in decaying vegetation and other foul habitats and is not generally associated with wetlands. *Anotylus nitildulus* is a decomposer of vegetation but is also found commonly in carrion (Larsson and Gígja 1959). It is interesting that the only place where taxa possibly associated with decaying flesh are found is above the right foot. It is thought that this foot may have been exposed for a longer period in antiquity than the rest of the body (see Chapter 7).

Discussion

The finding of the body in Tumbeagh Bog has provided an important opportunity to examine in detail the environmental history of the bog in this location. The discharge channel above which the body came to lie in the late fifteenth/early sixteenth century drives the dynamics of this particular bog. The absence of trackways noted during the survey of the bog by the Irish Archaeological Wetland Unit pointed to particular phenomena affecting this area from earliest times (Casparie, Chapter 13). From an examination of the peat, insects and pollen, a more complete picture can be drawn of the development of the bog up to the time of the death of the person in Tumbeagh.

The analysis of insect remains has provided useful and corroborative evidence for the peat stratigraphical analysis. Insects tend to complement peat stratigraphical analysis, as the samples relate specifically to the stratigraphy of peat growth rather than arbitrary sampling intervals through peat layers. Large layers, however, by necessity are divided into more manageable sample sizes, as in the case of the fen peat. This has afforded an opportunity to observe some changes during the development of the fen, most clearly illustrated in the change from Sample 10 to 9 to 8. Here, the early stages of fen development were illustrated by the increased diversity of the taxa owing to the minerotrophic conditions pertaining, but also the possibility that the basin discharged earlier, as seen in Sample 9. Figure 38 illustrates the rank-order curve for three samples from Column B1: Sample 9, Sample 4 (upper layer of lake Phase 1) and Sample 2 (top of Lake Phase 2). All three show remarkably similar curves, with dominance by one or two key taxa but with a large diversity leading to a gradually flattened profile. All three also have quite high indices of diversity, as noted already, which indicate a complex range of ecological niches present during each phase. As noted by Casparie, the emptying of Phase 1 of the bog lake (and, to a lesser extent, Phase 2) would have induced a considerable increase in biological activity, including the decay and rotting of vegetation of the drained soil and shore area. This is clearly reflected in the insect assemblages from these two phases.

Casparie (Chapter 13) also noted that an increased water supply was the most likely cause of a shift from fenland to Phase 1 of the lake. This is also reflected in the assemblage from Sample 6, which shows an increase in true aquatic species and an overall drop in taxa of other ecological ranges (Fig. 35). This is a gradual shift, however, as the increase began slowly from the ending of the possible 'drier' phase during fen development (Sample 9).

The post-lake phases differ from one another as a result of additional environmental factors. The *Calluna*-dominated peats that grew after the emptying of Phase 1 of the lake developed as a direct result of the presence of the dry gyttja layer. However, this short phase, which was followed by the development of Phase 2 of the lake, indicated an overall shift in either the water-table or the climate, giving rise to true oligotrophic conditions. Again, the insect assemblages reflect this development of oligotrophic peats, in terms of a drop both in diversity and in numbers.

There is a gap in the story from the peat examined at the top of the column (*c.* AD 500) and the peat under the body (*c.* AD 1250), owing to the unavailability of peat from the intervening time period. The column of samples taken from the field edge was most likely truncated as a consequence of the milling process, which often sees peat at the field edges more truncated than the centres to aid drainage. The 'young' date for the peat below the body, some three hundred years earlier than the proposed date for the body itself (*c.* AD 1500), is most likely due to the displacement of peat as the body sank. Although the discharge function of this gully had probably lessened or ceased by the time that the body was deposited, it continued to be a very wet lawn of poorly humified *Sphagnum* and the date discrepancy would appear to reflect this. These discrepancies ruled out the possibility of looking at samples from the discharge channel. This gap, however, has been addressed within the peat stratigraphic analysis in other parts of the section and by extrapolation based on surviving sections of younger peat farther away (Casparie, Chapter 13).

The samples from the body confirm the presence of the channel, the overwhelming presence of water and *Sphagnum*, and the likelihood that the body was submerged relatively quickly. The only sample that produced any insect evidence of possible post-mortem decay in antiquity was from the top of the right foot. This foot was possibly exposed for slightly longer than the rest of the body. However, it is not possible to say whether the taxa found were directly associated with the body. Larger numbers would be needed to conclude this.

Few bog bodies in their environmental and landscape context have been studied in such a complete way in Ireland, in Britain or on the Continent. Samples were taken from around Lindow II (known as 'Lindow Man') and Lindow III for environmental analysis, but this analysis concentrated on the immediate body environs and the contents of the stomach (Dinnin and Skidmore 1995). It is interesting that no carrion beetles or flies were found in association with these bodies, and the conclusion was that they were buried or submerged quickly. It is clear from the limited findings from the Tumbeagh bog body that a similar conclusion can be reached. However, in this case the overall environmental context of the findspot can be better understood owing to the examination of the wider landscape using a number of overlapping and integrated proxies. It is certainly hoped that this study can provide a framework for future research into other bog bodies that may be found.

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15.
Trees, crops and bog plants

David Weir

Methods

Pollen analysis

Under the advice of Dr Karen Molloy (National University of Ireland, Galway), a large monolith of peat was cut from the block of peat on which the body lay (Fig. 8). The monolith was closely wrapped in polythene and stored under a variety of conditions, mostly in cold storage in the National Museum of Ireland. The monolith was sampled for pollen analysis in August 2001; the length of time in storage, however, made changes in stratigraphy difficult to discern clearly, and so no detailed stratigraphical record was made. The monolith was cleaned, and pollen samples were taken at contiguous 5mm intervals using a scalpel.

Samples for pollen analysis were prepared using standard techniques (Moore *et al.* 1991), including sieving at 105μm and 10μm, boiling in hydrofluoric acid, acetolysis and a second sieving at 10μm, to remove all fine particulate matter. The samples were dehydrated in an alcohol series, stained with safranine and mounted in silicone fluid for counting.

Palynological analysis was conducted using a Leitz Ortholux microscope at x625 magnification, with x984 or x1563 with phase contrast used for critical identifications. A minimum of 300 identified pollen grains and fern spores were counted in each sample, with most samples counted to a minimum of 400. Pollen identification was aided by standard keys (for example, Moore *et al.* 1991) and by pollen reference material. No attempt was made to separate pollen of *Corylus avellana* (hazel) and *Myrica gale* (bog myrtle), which were recorded under a single category of *Corylus*-type pollen. Cereal-type pollen is defined as having a minimum length of 37μm and an annulus diameter of over 8μm, but this may also include some wild grass species (Beug 1961). Charcoal particles were counted as they were encountered during pollen analysis (Patterson *et al.* 1987) and expressed as a percentage of the pollen sum. Pollen diagrams have been drawn using TILIA and TILIA.GRAPH (Grimm 1991–3); plant taxonomy follows Kent (1992). The pollen diagram is divided into a series of Local Pollen Assemblage Zones (LPAZ) and sub-zones, which were determined by visual