The origin and occupation history of  
Poll na mBéar, Glenade, Co.  
Leitrim

Michael J. Simms¹ and Nigel T. Monaghan²

1 Department of Geology, Ulster Museum, Botanic Gardens, Belfast BT9 5AB  
2 Earth Science Section, Natural History Division, National Museum of Ireland, Collins Barracks, Benburb Street,  
Dublin 7

INTRODUCTION

In May 1997 two cavers, Eoghan Lynch and Barry Keenan, were investigating the speleological potential of various small caves located high in the southern scarp overlooking the Glenade valley. The first cave they entered (see front cover) was only 7 metres long to a boulder choke. A second cave a short distance further west could be explored a little further, via a 6m vertical pitch, into an elongate north-south chamber 3 metres high and 15 metres long, though again choked at both ends. They found the floor of this chamber strewn with numerous bones, some of which were identified subsequently by Terry Bruton of the Ulster Museum as brown bear. The cave has since been named Poll na mBéar from the Irish meaning “cave of the bears”. Subsequent visits to the site with Terry Bruton, and later by Richard Watson and Janie Cronie of Marble Arch Caves together with the original discoverers, confirmed the significance of the site and recovered some of the more conspicuous material. These initial findings have already been reported in the caving press (Fogg 1997, Kelly 1997).

In September 1997 an expedition to the cave was mounted to investigate the extent of fossiliferous deposits and determine their context. The precipitous nature of the site location, on a very steep slope some 200 metres above the valley floor in frost shattered rock, required considerable safety measures which were undertaken by a team of Marble Arch Caves’ staff comprising Richard Watson, Nial Fulton and Janie Cronie. In addition to the well-preserved adult skull (with all teeth intact) and associated postcranial remains which formed the original discovery, a few additional adult molar teeth were found indicating that other adult bears had entered the cave. Furthermore, remains of several very young juveniles were also recovered in some of which the jaws were only weakly ossified and the teeth yet to erupt. All of the bear remains from the cave are now in the collections of the National Museum of Ireland, in Dublin. A partial adult skeleton and some juvenile remains are on temporary display at Marble Arch Caves. Although detailed study of the bear remains is continuing, investigation of their geomorphological and sedimentological context within the cave is largely complete and forms the basis of much of this account.

GEOMORPHOLOGY OF THE CAVE

Poll na mBéar is a relict cave developed in the thinly bedded Dartry Limestone Formation, of early Carboniferous age. It shows pronounced linear development along a prominent, near vertical fracture aligned approximately north south. It descends quite steeply to the south, via a 3 metre climb and 6 metre pitch, with at least two levels of choked passage heading northwards towards the cliff beneath the entrance passage. Phreatic dissolution pockets in the roof at

View north-west from Poll na mBéar across landslipped limestone pinnacle of Peakadaw. Photo by Mike Simms.

Nigel Monaghan negotiating the final traverse to Poll na mBéar. Photo by Mike Simms.
various levels, from the entrance passage down to the lowest region of the cave, indicate that it developed when the phreas (local water table) was very much higher than today. Other relict phreatic cave fragments nearby, such as that just a short distance to the east (see front cover), suggest a network of phreatic passages probably draining roughly north-south along strike. This phreatic network must have preceded the incision of the Glenade valley and the Glenar valley to the south, both of which would have effectively drained the limestone massif in between. However, because there is a slight regional dip to the east, the creation of the scarp to the west, overlooking Donegal Bay, would not necessarily have drained the limestone since a perched phreas could have been impounded by shaly units within the Glenar Limestone Formation below and by the underlying Ben Bulben Shales rising to the west. But, in essence, the original development of the cave probably was many hundreds of thousands of years ago and it has long since been abandoned by all but minor percolation-fed water flow.

Passages appear to be developed on at least three levels within the cave. These are represented by the present entrance passage, rather enlarged by frost shattering; a rubble-choked tube extending north from the foot of the 3 metre climb; and the northern end of the passage, ending in a choke of glacial till, at the foot of the 6 metre pitch. Although there is little fine sediment between the blocks which choke the northern end of the middle-level passage, suggesting that this blockage is part of a relatively recent surface scree, the solid blockage of stiff, clay-rich, glacial diamicton in the lowest passage indicates that it has not been open to the surface for a very considerable period of time.

SEDIMENTS IN THE LOWER PASSAGE AND THEIR RELATIONSHIP TO THE BEAR BONES
Two distinct types of sediment are present in the northern part of this lowest passage. Immediately adjacent to the walls in places are patches of a stiff, pale-grey clay with angular rock chips; this is very similar to the diamicton which completely chokes the northern end of this passage. The other sediment type is a poorly-sorted gravel of angular chips of sandstone, chert and limestone. Patches of these still adhere to the pale-grey clay or are preserved on small ledges on the passage walls; bear bones and teeth have been found on top of some of these remnant patches. The distribution of these remnant patches indicates that although the still choked northern continuation of the passage is entirely filled with clay-rich diamicton, the passage for several metres south of this was, at one time, almost choked to the roof by angular gravels which overlie remnants of the clay-rich diamicton. However, both the gravels, and presumably the clay-rich diamicton before them, appear to have been largely flushed away by the prolonged erosional effect of a small inlet. This enters from the west wall and trickles northwards, dropping into a small pit it has excavated in the gravels before trickling southwards again, to percolate down through the gravel and clay floor. This small inlet stream may well be the same water which reappears in the southern part of the cave. The northern side of the small pit exposes about 1.5 metres of ill-sorted, muddy gravels containing a range of elas lithologies and with many of the elas very poorly rounded. Rather ill-defined bedding surfaces within these gravels dip gently to the north-

Mandibles of an adult and four separate infant bears recovered from Poll na mBéar. Photo by Nigel Monaghan.

Back end of a Brown Bear (Ursus arctos) as found on the floor of the cave. The pelvis, femurs and coccyx are clearly visible.
west. The poor sorting, angular nature of many of the clasts, muddy matrix and the north-westerly dip suggests that these gravels represent reworked glacial till or solifluxion debris which was emplaced fairly rapidly, perhaps by one or a series of flood events which entered the cave via the main pitch and then flowed north to fill this area. Since remnants of the clay-rich diamicton underlie the gravels in various places, it is possible that the small inlet stream that has now excavated much of the gravel infill, had also excavated a cavity in the pale-grey diamicton previously choking the passage. The gravels are capped by a thin layer of dark-brown laminated muds, mostly less than 1 cm thick but occasionally thicker where they infill hollows in the surface of the gravels. These laminated muds probably were deposited by minor floods generated by the minor inlet already alluded to, which continued to drain north into this region of the cave.

In the northern part of the lower passage a considerable number of associated bones of a juvenile bear were found, with several found in situ on top of the gravel infill. Some of the long bones appeared to be partly embedded in the top few centimetres of the gravels but most lay on top of the gravels and were covered by a thin layer of brown mud. This mud formed a rather even coating over the uneven surface of the gravels and, together with some rather poorly developed surge marks in the north-western corner, indicate that the mud was deposited by ponded water associated with one or more minor flood events. These may have mobilised the top few centimetres of the gravels as well as moving the bones, accounting for the relationship of some of the long bones to the sediment. The presence of bear bones on top of the main gravel deposit and on remnant ledges, and the occurrence of the mud layer underlying the bones, shows that bear occupation occurred after emplacement of the angular gravels but before the flooding events which deposited the mud. All of these events predate the removal of the gravels by the inlet stream.

The sediment sequence seen in the northern part of the lower passage is not evident in the central part of the cave, immediately at the foot of the 6 metre pitch, which also represents the highest point on the floor of this lower passage. The passage is floored by angular blocks of limestone which clearly represent collapse debris. Bear material was abundant in this region but much of it appeared to lie beneath or intermixed with the collapse debris. As far as can be judged from material recovered, the bear remains in this region appear not to have been coated with mud. This suggests that the flooding/ponding affected only the lower parts of the passage, at the northern and southern ends, and did not extend high enough to submerge this area.

The southern part of the lower passage forms a distinct chamber entered through a low rock arch immediately south of the foot of the 6 metre pitch. Much of the floor in this southern chamber is of mud, with minor flowstone and stalagmite deposits, although at the northern end this is partly buried beneath collapse debris which has moved down from the central chamber. On the eastern side of the chamber a shallow depression, about a metre across and 0.2 meters deep, has been excavated into the mud floor. Detail of the surface is rather degraded, although oblique scratch marks are visible on the eastern side immediately beneath the wall. This depression has been interpreted as a bear hibernation pit.

To the west of the 'Bear Pit' is a shallow trench, deepening to the south where it exposes fresh-looking faces of greyish-brown, laminated, silty clay up to 0.4 metres thick. Water sinking at the northern end of the cave is thought to follow a small immature passage beneath the western wall of the cave, a small stream being visible at a couple of points in the southern chamber, and these faces appear to have been formed by undermining from below by the stream. Many bones were found in this area, including several infant bears. To the south there is a shallow vadose trench in the limestone, descending to a low impenetrable outlet where more sheep bones occur.

Behind a boulder against the west wall a small gap contained an almost complete bear cub skeleton with many of the bones in articulated position. Some of the bones were visible and loose on the surface while others were beneath several centimetres of clay. Many Diptera pupae were found vertically orientated in the mud around the bear skeleton and in contact with other bear bones in the cave. The fly pupae in the mud suggest that this bear was only dead a very short while before it was at least partly buried by mud. This suggests that it perhaps died as a result of flooding in this part of the cave, its corpse then becoming infested with maggots. Such flooding events when the bears were in occupation may have been a major cause of the failure of some hibernators. These floods may have happened in the Spring, perhaps as a result of snow meltwater, with subsequent maggot infestation occurring in the warmer summer months.

**SEQUENCE OF EVENTS**

1. Cave forms as phreatic conduit along major joint or minor fault at a time when the Glenade valley has yet to be incised. This probably occurred at least several hundred thousand years ago and probably in excess of 1 Ma.

2. Incision of Glenade valley drains phreatic network. The cave is abandoned except for minor percolation flow and occasional overland flow.

3. Northern end of the lower passage becomes plugged by diamicton. The minimum date for deglaciation of this area is about 14 ka (Lambek 1996), but if the clay plug at the northern end of the passage really is of glacial till,
then its height above the valley floor suggests that the till must have been emplaced around the last glacial maximum, perhaps at about 26 ka, when glacier depth was at its greatest. Upper entrances may have remained unblocked as a result of their higher position above the level to which glacial till was deposited, or may have been reopened through cliff retreat in post-glacial times.

4. The inlet stream in the northern end of the lower passage excavates a cavity in the diamicton plug.

5. Emplacement of poorly-sorted angular gravels, by debris flow or flood, into cavity previously excavated in the diamicton by the inlet stream.

6. Bears occupy cave for at least a few seasons. Hibernation failure and infant mortality leads to accumulation of adult and juvenile bear skeletons. Contemporaneous infestation by Diptera, with larvae feeding on the corpses during summers following birth of the young.

7. Minor flooding and ponding coats gravels and bear bones with thin layer of mud. Some floods possibly contemporaneous with bear occupation period.

8. Abandonment of cave by bears (extinction in Ireland at c.7 ka?).

9. Some collapse in central chamber, continuing a process of gradual collapse which began long before occupation by the bears and accounts for the high point on the passage floor immediately at the foot of the 6 metre pitch.

10. Sheep enter and die in the cave.

11. More sheep enter.

12. Still more sheep.

13. Richard Watson fits fence across entrance to exclude sheep, thereby ending taphonomic experiment.

CONCLUSIONS
The bear remains discovered in Poll na mBéar clearly are representative of a population which was using the cave both as a hibernaculum and a nursery for at least a few seasons. Although there is some evidence of small-scale dispersal of bones by floods, the presence of a hibernation pit and of articulated juvenile remains indicates that neither the adults nor infants were either washed in by floods or were the victims of a pitfall trap, represented by the 6 metre pitch. Instead they clearly represent a biotic autochthonous assemblage of troglobilinic cavernicolous (Simms 1994).

The occupation of the cave by bears is one of the most recent events to have occurred in the cave, although minor ponding events have coated some of the remains with a thin layer of mud. The cave itself, and others nearby, relate to a phreatic phase of development which must have occurred long before the establishment of the present topography, probably more than a million years ago. Subsequent drainage of this phreas, perhaps through incision of the Glenade valley, led to abandonment of the cave by all but minor percolation flow and occasional overland flow perhaps associated with snowmelt. At some time in the past the northern end of the lower passage was plugged with clay-rich diamicton, perhaps a glacial till, but this was subsequently re-excavated by percolating water before the cavity was filled once again with poorly sorted angular gravels, probably in late glacial or early Holocene times (c.14-10 ka). The bears appear to have occupied the cave when this gravel fill was largely intact, but percolating water has subsequently removed much of this gravel fill, scattering many of the bones in the northern part of the cave. The southern chamber appears to have experienced only ponding and mud deposition, and invasion by innumerable sheep that fell down the 6 metre pitch to suffer a lingering death through starvation. Although the sheep are a relatively recent introduction to the cave, their remains here represent a fine example of an abiotic allochthonous assemblage caused by a pit fall (Simms 1994).

Many aspects of this discovery remain to be investigated. In particular it is planned to have some of the bear remains Carbon-14 dated but it is also hoped that funds will be found to analyse carbon, oxygen, nitrogen and strontium isotopes of the teeth and bones in order to learn something of the diet and environment of these bears (Hilderbrand et al. 1996). On a more mundane level, though still invaluable for reconstructing the life and death of these animals, analysis of wear and other damage on the bones and teeth will be undertaken (Stiner et al. 1998).

REFERENCES


