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CAVES OF COUNTY ROSCOMMON

by

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ABSTRACT

Although limestones are widespread in County Roscommon the number of karst features known were few until recent field investigation revealed that diagnostic karstic landforms such as sinks, springs and dolines are abundant. A number of caves have been explored and surveyed including the 750 m long Pollnagran; the only stream cave known in the county.

INTRODUCTION

County Roscommon is an inland county with an area of 2,463 km^2, which is bounded by the River Shannon to the east and the River Suck to the west. Much of the county is low-lying with expanses of peat-land, river meadows and lakes. The average annual precipitation in the region is just over 1000 mm per year, and the average annual evapotranspiration is 400 mm.

Almost 90% of the county is underlain by limestones of Lower Carboniferous age and some 75% of these limestones are clean and well bedded (McDermot *et al*, 1996). The Geological Survey of Ireland have categorised two-thirds of the rocks in the county as regionally important karstified aquifers characterised by conduit flow (Lee and Daly, 2002). Consequently, karstification is a very significant process in Roscommon hydrogeology with, for example, over 75% of its water supply coming from karst springs. Yet very little is known about karst hydrogeology and the karst processes operating in Roscommon. Before this project was undertaken very few karst landforms had been recognised and only two caves were known to exist (Coleman, 1965; Devoy and Gilhuys, 1969; Fenwick and Parkes, 1997 and Burke and Drew, 1997).

The reason for this is probably because most of the midlands of Ireland are covered in a layer of Quaternary deposits. This layer varies in thickness getting thinner towards the west. As a result of this Quaternary mantle, the evidence of karstification is less apparent than in other areas in Ireland and until now Roscommon was overlooked as a potential cave area.

Studies undertaken recently have shown that Roscommon has an abundance of karst landforms including some newly discovered caves. This paper summarises these recent cave discoveries in the context of Roscommon karst.

GEOLOGY AND GEOMORPHOLOGY

The limestone geology of County Roscommon is shown in Figure 1. The rocks of Roscommon range in age from Dalradian to the Namurian Series of the Upper Carboniferous. The majority (90%) of these rocks are limestones of various degrees of purity and structure. All the limestones were deposited during the Lower Carboniferous, between 355 and 325 million years ago. The different limestone lithologies are summarised in Table 1 starting with the

youngest. The remaining 10% of the rocks consist mainly of Older Devonian and Ordovician sandstones and mudstones.

The structure of the county is influenced by two major events; the Caledonian and Variscan Orogenies. The Caledonian Orogeny affected the older, non-limestone rocks of Ordovician and Silurian age. The Variscan Orogeny, which occurred during the end of the Carboniferous period, resulted in gentle folds, uplift and block faulting of the Carboniferous rocks, but with little metamorphism (McDermot *et al*, 1996).

<table>
<tr><th>Age</th><th>North/West Succession</th><th>Mid Succession</th><th>South Succession</th></tr>
<tr><td rowspan="7">Lower Carboniferous
Visean</td><td>Bricklieve Lst (BK) Thick bedded, clean limestones with chert bands</td><td rowspan="3">Visean Limestones (Undifferentiated) (VIS) This is the most common division of bedrock in the county accounting for 60% of the total area. They are undifferentiated due to poor exposure but are generally composed of clean, medium to coarse grained, bedded limestones with some muddy units found north of Tulsk. Contains two diagenetic Lithologies the Oolitic Lst (oo) and Mudbank Lst (mk) which is a massive grey micritic limestone</td><td>Basinal Lst (CPU) Predominantly dark, laminated, fine-grained muddy limestone interbedded with calcareous shales</td></tr>
<tr><td>Croghan Lst (CL) Medium bedded, fine-grained, muddy limestones with shale partings</td></tr>
<tr><td>Ballymore Lst (BM) Thin bedded dark limestones, mudstones and shales</td><td>Shallow Water Lst (SHL) Predominantly pale grey, medium to coarse grained limestones with some darker fine-grained limestones</td></tr>
<tr><td>Oakport Lst (OK) Bedded, medium/fine grained, well jointed limestones with shelly horizons and evidence of a palaeokarstic surface</td><td rowspan="2">Allenwood Lst (AW) Pale grey, medium to coarse-grained, massive limestone</td></tr>
<tr><td rowspan="4">Courceyan</td><td>Kilbryan Lst (KL) Strongly muddy limestone interbedded with shales</td><td>Argillaceous Lst (AL) Dark, well-bedded, Fine-grained limestones with shale interbeds and chert</td></tr>
<tr><td colspan="2">Waulsortian Lst (WA) Massive, pale grey, fine-grained, clean fossiliferous limestone with calcite</td></tr>
<tr><td>Ballysteen Lst (BA) Dark grey, muddy limestones, interbedded with calcareous shales</td><td>Argillaceous Bioclastic Lst (ABL) Dark grey, fossiliferous, muddy limestones with thin calcareous shales</td></tr>
<tr><td colspan="2">Moathill Formation (MH) Limestone, calcareous sandstone and shale</td></tr>
<tr><td colspan="3">Meath Formation(ME) Limestone and calcareous sandstone</td></tr>
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Table 1. *The limestone lithologies of Roscommon*.

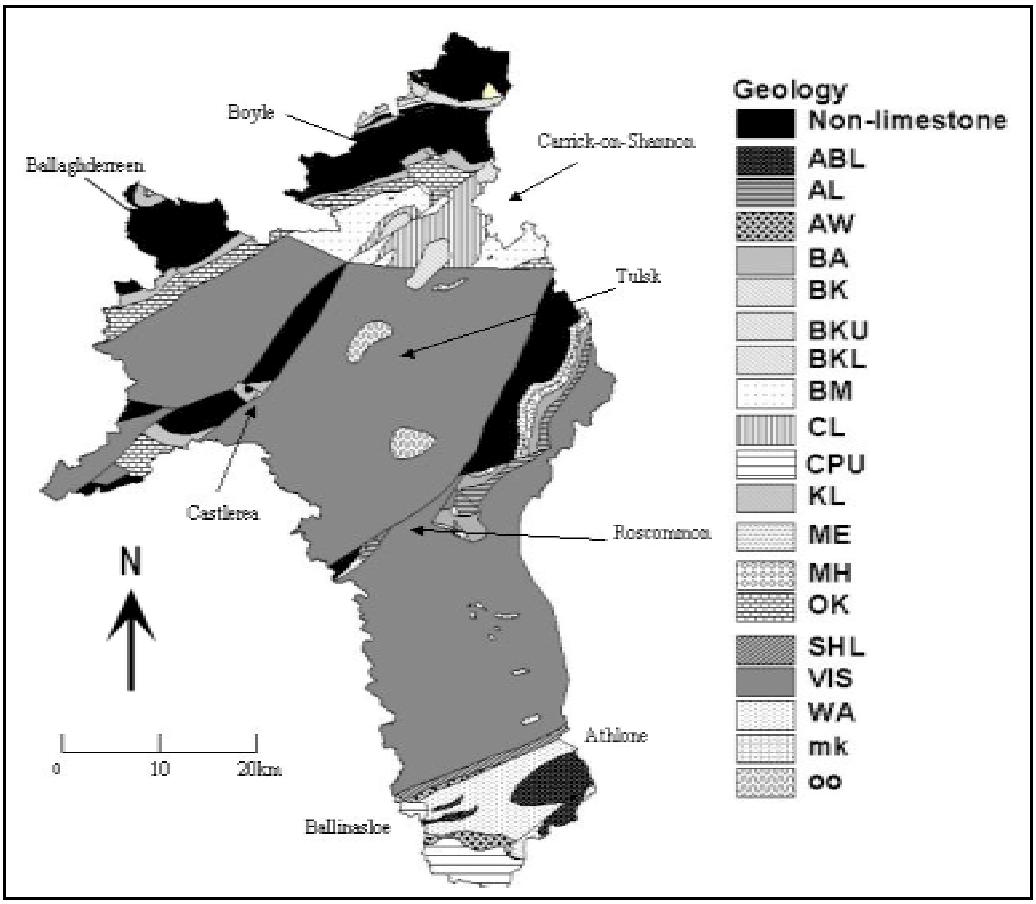

Figure 1. *The Limestone Geology of County Roscommon.*

Till is the dominant Quaternary deposit and has a variable thickness in Roscommon. It is generally thin or absent in elevated areas, with bedrock outcropping frequently, and thicker in low-lying areas where till thicknesses of over 30 m are not uncommon. These elevated areas are mainly plateau areas which are generally less than 200 m OD and are, on average, about 60-70 m higher than the surrounding countryside. The main elevated areas in Roscommon are the Plains of Boyle, the Fairymount plateau, the Tulsk to Bellanagare uplands, the Garranlahan plateau, the Lissalway uplands, the Four Mile House plateau, the Moydow uplands and the Cuilleenoolagh uplands. They are mostly underlain by clean, bedded limestone. This factor together with the shallow depth to bedrock renders these areas very susceptible to karstification. Figure 3 shows the location of these upland plateaux in Roscommon. The majority of the remaining low-lying areas are drumlin-covered, with a gentle rolling topography. Between these drumlins the land is boggy and poorly drained, with many lakes. Here the glacial deposits are thicker and rock outcrop is less widespread.

As can be seen from Figure 3, Roscommon has an abundance of surface streams and rivers. The majority of these feed into the two main rivers in the area, the Suck and the Shannon. There are also a large number of lakes evident in the low-lying areas. However, the

Figure 2. *Doline field in north Roscommon.*

elevated areas are characterised by very low drainage densities. Where surface drainage is present it is very often deranged with many streams sinking underground only a short distance from where they rise. Karst landform mapping on these plateaux areas has revealed a large number of swallow holes, dolines and collapses. There are also a large number of springs located at the periphery of these elevated areas. Dye tracing experiments in some of these areas has proved connections between swallow holes located on the plateaux and the springs located at the base (Hickey *et al*, 2002).

PREVIOUSLY KNOWN CAVES IN COUNTY ROSCOMMON

Although this paper is primarily concerned with newly discovered caves in Co. Roscommon, for the sake of completeness brief accounts and surveys are given of previously explored caves. Oweynagat (Uaim na gCat) (NGR M7958 8311, altitude 131 m), near Tulsk, was described by Coleman (1965) and more fully by Fenwick and Parkes (1997). A souterrain forms the first 10 m of the cave and is which is then followed by 37 m of straight rift passage trending north-west very close to the surface (Figure 4). Similar partly unroofed rifts exist in the vicinity.

The largely fossil Pollawaddy cave near Ballaghaderreen (NGR M5732 8924, altitude 94 m) at Lisacul* was discovered and described by Drew and Hickey (2000) and slightly extended in 2003. The cave, with some 50 m of surveyed passage, consists of partly infilled phreatic tubes (Figure 5), together with an active stream course (a stream sinks at the entrance), which becomes too low and too wet to explore for any distance. A small stream encountered at the end of the dry cave seems unlikely to be the stream sinking at the entrance.

Devoy and Gilhuys (1969) describe a small cave at Cavetown, 5 km south of Boyle, but do not provide a location or survey. A second cave in a limestone hillock near Cavetown was also described by them, again without a grid reference or survey being given. The first of these caves was located by the authors of this paper. The second cave could not be located with any certainty although what may be a different cave in the same locality (1 km west of Cavetown, near Clogher Lough) was explored and surveyed. Descriptions and surveys of these two caves are given in the following section on recent discoveries.

* Lisacul was misspelt in *Irish Speleology* as Liscahul

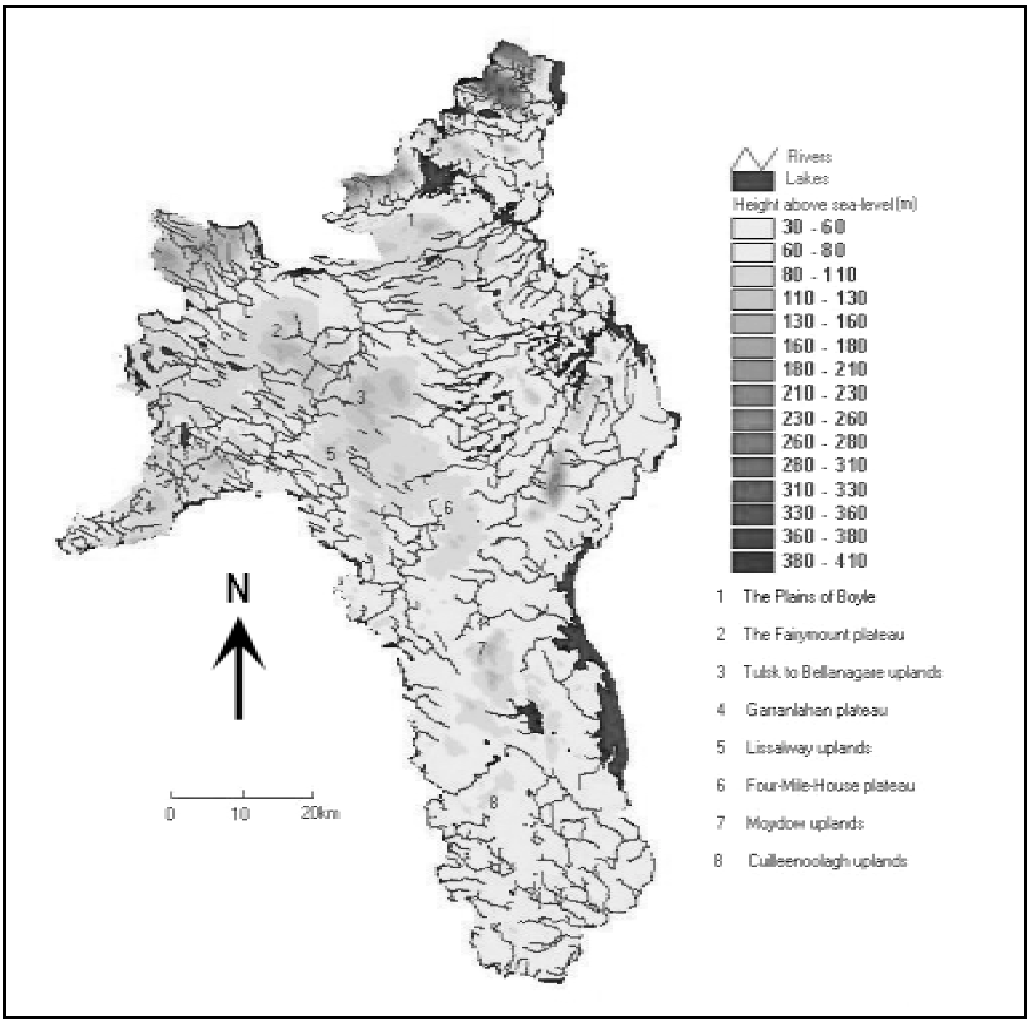

Figure 3. *Topography and drainage of Roscommon*.

RECENT CAVE DISCOVERIES

Pollnagran (M7352 8969)

Introduction

Some 1.5 km to the south of Frenchpark in the north-west of Co. Roscommon are four stream sinks. They are located over a 300 m long zone half a kilometre away from the contact with the Carboniferous limestone on the western side of an inconspicuous ridge of Boyle sandstone elevated some 10-15 m above the surrounding plains. The outcrop of Boyle Sandstone extends from just north of Frenchpark, south-westward to Castlerea, but the only known stream sinks are at its northern extremity. The two westerly sinks are only active under

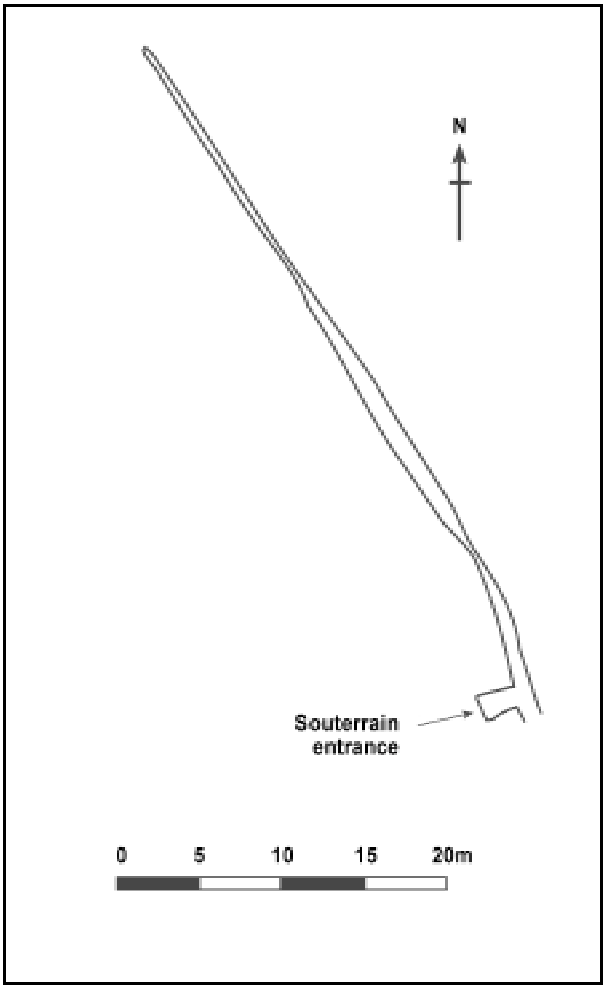

Figure 4. *Plan survey of Oweynagat (Uaim na gCat).* **(after Fenwick and Parkes 1997).**

wet conditions. The other two, more southerly, sinks are both named on the IOS 1:10,560 map. Pollbaun, the more westerly, is active in all but drought conditions, whilst the Pollnagran stream has not been known to dry despite its very limited catchment area of afforested bog land.

Stream sinks with allogenic waters are uncommon in Co. Roscommon and in adjacent areas of lowland karst in counties Galway and Mayo. Most sinking streams in this area are generated by runoff on till-mantled limestone. Thus, Pollnagran ('hole of the tree') with a large, allogenically derived stream and a well-developed blind valley at the sink seemed a promising site for a cave. Two digging trips by the authors in 2003 enabled access to be gained to the cave system, Roscommon's only known active stream cave. Some 750 m of cave passage have been surveyed (Figure 7) extending over a vertical range of 10-15 m.

Cave Description

Pollnagran is located at the end of a 3 m deep blind valley at an altitude of 96 m O.D. in the townland of Leggatinty. Entry to the cave is via an awkward and constricted Z-bend followed by a flat out crawl in the stream in a cobble-floored bedding plane for 10 m. At the point where the passage enlarges to a hands and knees crawl an inlet passage on the left (west) side can be followed for 25 m as a crawl to a junction. The right hand passage at this junction is where the stream sinking at Pollbaun, 100 m distant, enters. This passage is choked with a cobble fill to within 0.2 m of the roof after only 4 m. The main inlet passage, the left passage at this junction, has been followed for a further 15 m without reaching a definite end. The source of the water in this passage is unknown and the location of this passage makes it unlikely that it is from the most westerly pair of sinks some 300 m away.

Downstream of these inlets, the main streamway enlarges to become 2 m wide and 0.8 m in height. Some 50 m from the junction the passage, oriented almost due north until this point, assumes a north-easterly orientation that continues for the remainder of the explored streamway. Henceforth, the most common passage cross-section consists of a vadose trench

about 2.4 m in height with an enlarged bedding plane about 3-4 m wide at floor level. The bedding plane component of the passage, containing the stream, meanders sharply over much of the length of the cave whereas the vadose trench is commonly straight and is the easier route to follow, although on occasions it is necessary to progress in the bedding plane, either via crawls in the stream or in dry ox-bows. Thus the typical passage cross-section has the form of an inverted T or L depending on the location of the vadose trench.

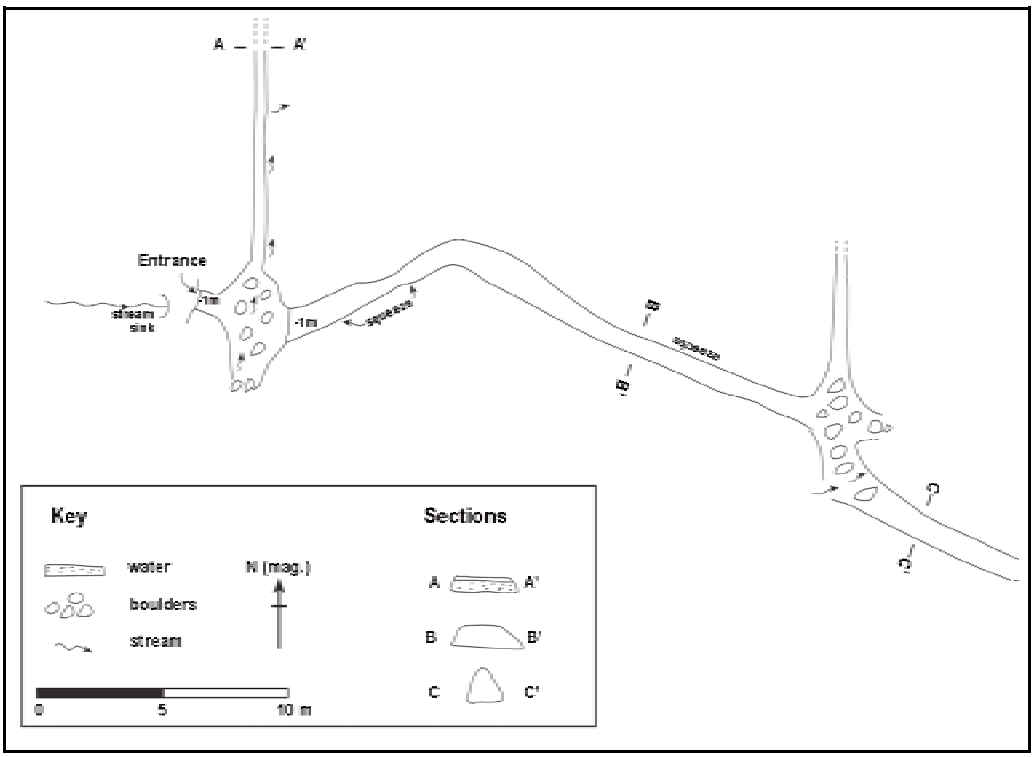

Figure 5. *Plan survey of Pollawaddy cave*.

A zone of roof breakdown 280-290 m from the entrance complicates the passage morphology and typically the passage is 4 m (0.5 m in trench) wide with numerous fallen blocks obstructing the route. Beyond the breakdown zone the passage resumes its inverted T cross-section and progress is straightforward with the exception of further, less extensive, breakdown zones at 450 and 570 m. Some 700 m into the cave, a second, more precarious breakdown zone necessitates crawling over fallen rocks above the stream to reach a small chamber floored by fallen blocks. The way on is at floor level on the right (east) into the streamway. A flat out crawl in the stream for 20 m is followed by a hands and knees crawl. An inlet on the right brings in a stream that is more sewage than water. This 1 m x 0.6 m inlet passage has been followed for 5 m but continues further. Beyond the inlet the stream passage has been followed for a further 15 m in a bedding passage 4 m wide, 0.4 m high with an air space of 0.2 m. Further progress is possible but involves facial immersion in the highly polluted water. The vadose trench is still evident at the explored limit of the cave and although it is partly infilled with sand it may be possible to excavate a route onwards in this passage, which is

1.5 m high, and 0.4 m wide at this point. When visited in warm weather conditions, high carbon dioxide concentrations were encountered in this part of the cave.

The explored limit of the cave is located under or close to the N5 main road at NGR M7371 9014 and 160 m south-west of the rising at Cloonshanville. The collapse zones seem to be related to shallow dolines on the land surface.

Figure 6. *Pollnagran sinkhole.*

Geology and Geomorphology

Pollnagran is developed in the undifferentiated Visean limestone, generally clean, medium to coarse grained and well bedded. Chert is evident in the passage walls in the further reaches of the cave. The limestone dips to the north at 2-3° and the cave follows a single bedding plane down dip and to a lesser extent along the strike eastwards. The vadose trench is developed mainly in the north north-east - south south-west joint set and to a lesser degree in the east-west joint set. The vadose trench continues to the limit of the explored streamway as an abandoned, largely sand-filled passage in its furthest reaches. This contrasts with stream caves in Co. Clare where the vadose trench disappears in the downstream section of many caves and the passage is simply an enlarged bedding plane. There are scallops throughout most of the cave. They are mainly located on the lower metre of the walls and are numerous and overlapping. The average scallop diameter is 3-4 cm, indicating fast flowing water. The scallops

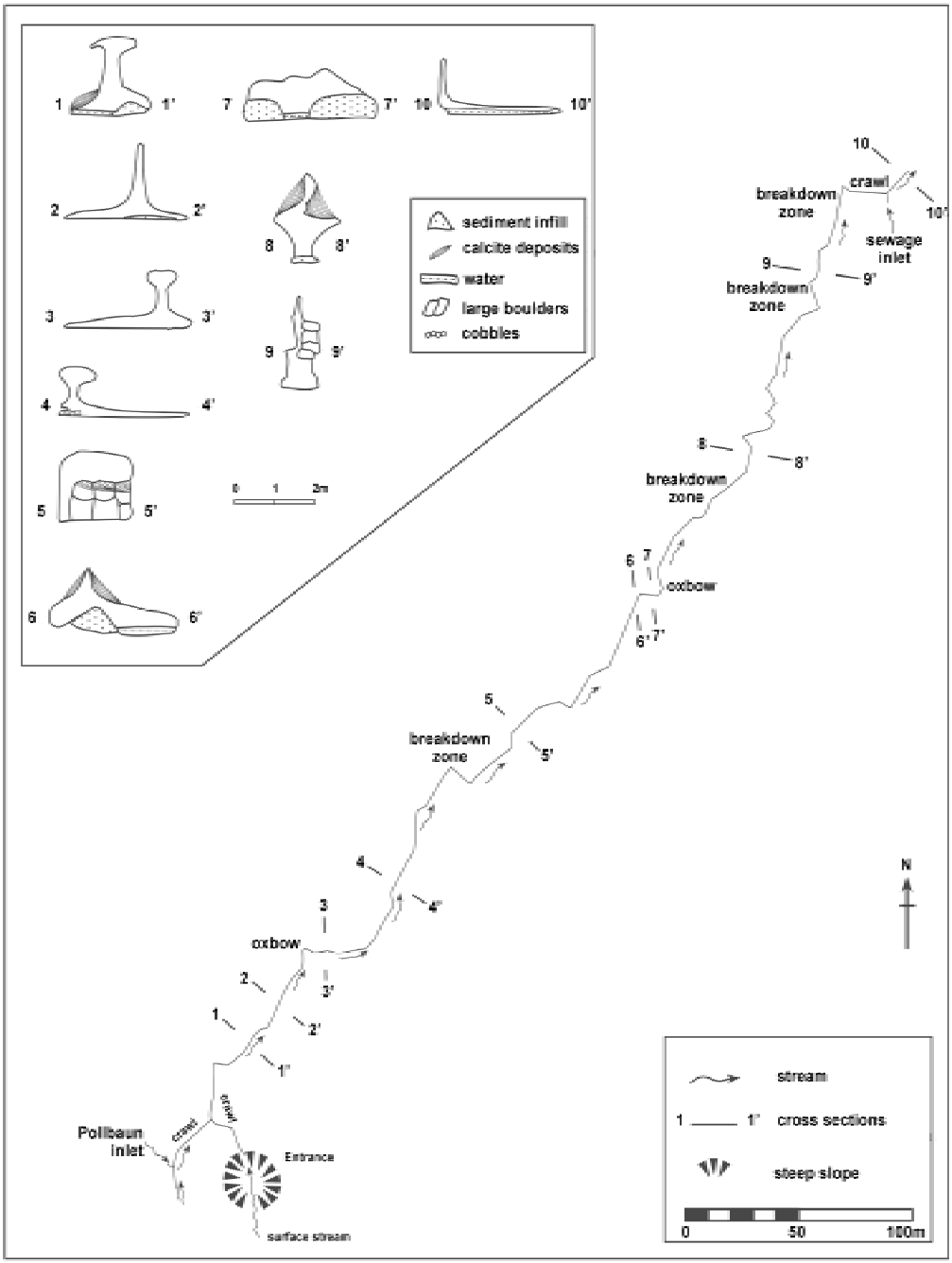

Figure 7. *Plan survey of Pollnagran.*

Figure 8. *Active breakdown near the end of Pollnagran.*

towards the end of the cave are largely covered by flowstone deposits and are hard to measure accurately but seem to be smaller in size, indicating faster flow here.

The cave has been largely filled with cobbles of sandstone and limestone, presumably reworked till. Between cross-sections 4 and 5 is a calcite pendant with a portion of flowstone floor at its base forming an inverted mushroom-shaped feature. Cobbles still remain cemented to the base of the flowstone indicating that the fill over which the calcite was deposited was some 0.55 m thick, a value that seems to be consistent throughout the cave.

The cave has had a complex history. Although apparently initiated along a bedding plane, the vadose canyon was the dominant conduit until bedding enlargement took place at floor level and this is now the active stream course. Filling with cobbles in the upstream cave and sand and silt in the lower streamway was followed by considerable calcite deposition in parts of the cave. The present stream is eroding the infill and some calcite is being dissolved, though this is not true of the tributary passages near the entrance where the fill is intact. This suggests that the Pollnagran stream has retained sufficient capacity to move the coarse bed load whereas the streams from the tributary sinks have not. Nowhere along its course can the cave be more than a few metres below the ground surface as is evidenced by the zones of active collapse.

Hydrology

The discharge at the Pollnagran sink is very similar to that at the rising at Cloonshanville (M7399 9032) at approximately 8 litres/sec under low flow conditions. Thus under present day conditions the cave hydrology is a simple flow through system with an underground flow rate of 50-70 m/h under low flow conditions. The spring, which rises through boulders, is a short distance from the Carricknabraher River, which in turn flows into the Breedoge River.

Figure 9. *Calcite deposited on fill deposit which has subsequently been largely eroded by the present day stream, Pollnagran.*

Pollnagollum Cave and Doline (M7308 9112)

This feature was first noted on the IOS 1:10,560 sheet number 15. It is located in the south-west of Frenchpark behind the primary school on the main Dublin - Westport road (N4) in the townland of Orskeagh. It is located in the Undifferentiated Visean limestone and is approximately 1 km west of the contact with a non-limestone rock, the Boyle Sandstone Formation.

The doline is a large collapse feature with vertical bedrock walls some 4-5 m deep. The collapse feature is orientated 110° east west and is approximately 7 m long by 4.5 m wide. There are a number of smaller rifts located at the base of the southern side but they are too small to enter.

Pollnagollum (M7303 9113) is located in the extreme west side of the doline, 2 m higher than the floor of the main collapse, just below surface level. A small stream, heavily contaminated with sewage, emerges from the cave at the entrance and enters the main collapse area below where it sinks underground via one of the small rifts. Entrance is through a vertical joint, 1 m high and 30 cm wide, making entry an awkward sideways crawl in the stream. The cave is orientated at 256° for about 2 m before turning to the right. After a further metre, the cave seems to turn back on itself, in line with the main doline, but the passage is blocked by a large flowstone deposit. The total surveyed length is just over 3 m. Figure 10 shows the survey of the doline and cave.

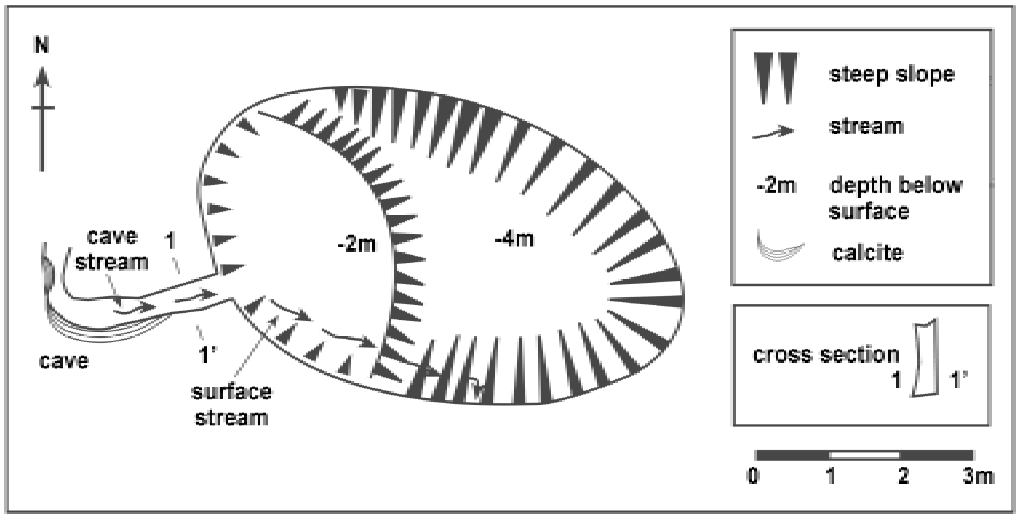

Figure 10. *Plan survey of Pollnagollum (Frenchpark).*

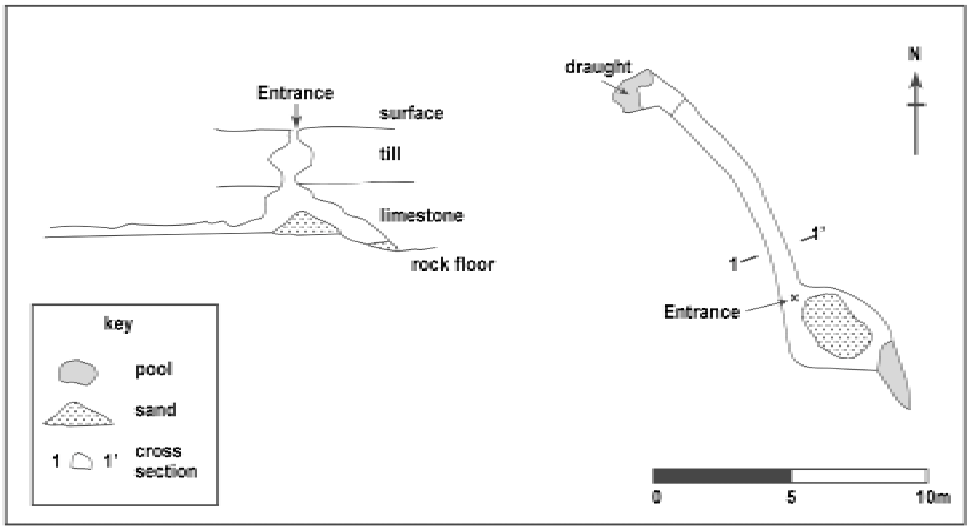

Figure 11. *Plan and section of Lissananny Cave.*

Lissananny Cave (M6817 8359)

This cave is located in a highly karstified area 3.5 km north of the town of Castlerea, in the north-west of Roscommon. Again this cave is located in the Undifferentiated Visean limestones just over a kilometre west of the contact with the Boyle Sandstone Formation. The

Figure 12. *Resolution of calcite gour, Pollnagran.*

area has many collapse features and dolines, which initially drew the authors' attention. Most of these vertical collapse areas have been filled in by the landowner almost immediately after formation and now only piles of stones can be seen. The area around Lissananny Cave is actively collapsing to the extent that the landowner reported that the entire road collapsed under his car on his way to Mass one Sunday morning and it had to be towed out with the help of tractors. There are also subsidence dolines located over the entire area, ranging from large steep sided holes up to 4 m deep to shallow solution dolines.

The cave is located on the south-west edge of a large area of peat bog. There are numerous permanent swallow holes draining the bog approximately 1 km north-east of the cave. It is thought that this water rises south-west of the cave near Cloonard Bridge. The cave entrance, which is a small open hole in the grass, was first noted in March 2003. At this time the cave was not entered but water could be clearly heard at the bottom of the shaft flowing in a south-easterly direction. The cave was first entered in May 2003, after a two-month drought and was found to be dry. During a later trip, in August 2003, the cave was dry but showed no evidence of previous trips, demonstrating that water had recently flowed over the floor. This visit was cut short due to dangerously high CO^2 levels, which caused breathlessness and headaches within minutes of descent. It is therefore suggested that the cave be avoided during hot summer months.

Entrance to the cave is effected by a 3.7 m ladder pitch. The ladder can be belayed to a fence post about 3 m away. The first 2.2 m of the pitch is through till which is crumbling in places. The last 1.5 m leads to the west edge of a bedrock chamber some 5 m long and 4 m

wide. A large mound of fine sand, almost half a metre high and 2 m wide, fills the centre of this chamber. The main passage is a tight crawl to the north of this chamber and runs in a north-westerly direction for about 11 m before ending in a smaller chamber with a pool. A draught was noted here but the passage has not been excavated to date. The passage is covered by a layer of clean medium to fine sand and has clean washed roof. There is also another smaller passage off the main chamber to the south but this ends in a deep pool of water within a short distance. It seems likely that under wet conditions water flows from this pool, bringing with it the sand, and flows along the crawl. Figure 11 shows both the vertical section and plan survey of this cave.

Caves of Cavetown

Ballynahoogh/Cavetown Cave: (M8446 9777)

This cave may be the one first described by Devoy and Gilhuys in 1969 although their description does not fully correspond to the site described below. The cave is located 5 km south-east of Boyle in a limestone hillock just north of the road at M8443 9768 in the townland of Cavetown/Ballynahoogh. The outcrop is composed of 6 m high cliffs of Bricklieve Limestone, which are thick bedded, clean limestones with chert bands. Numerous arch-like rifts were noticed on the south facing side of this outcrop but they were not enterable. On the east side another large and enterable opening was found. This is at an altitude of 91 m. The cave entrance is a large arch-like rift approximately 4 m high and 2 m at the base. This closes down rapidly to a smaller rift, which is 1.5 m high and 1.2 m wide and these remain the passage dimensions for most of the cave (Figure 13) suggesting a mainly phreatic development with some undercutting. The cave is oriented at 248°, following the main south-west dip in the area, for just over 6 m before curving slightly to the left. After a further 5 m the passage then splits with the main passage going off to the left and becoming blocked almost to the roof with fill within a few metres. From the junction there is a secondary passage with the same orientation as the entrance passage. A climb over a mound of sandy fill leads to a 5 m high rift passage that must reach almost to the surface. This passage continues for about 5m before becoming blocked. The total surveyed length of the cave is 24 m.

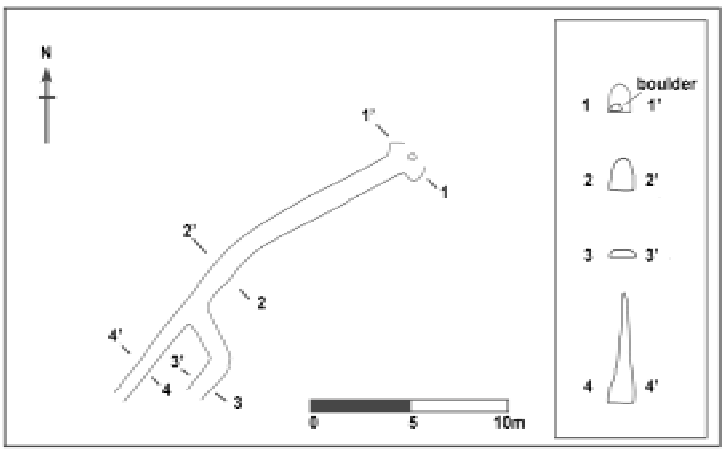

Figure 13. *Plan survey of Ballynahoogh/Cavetown Cave.*

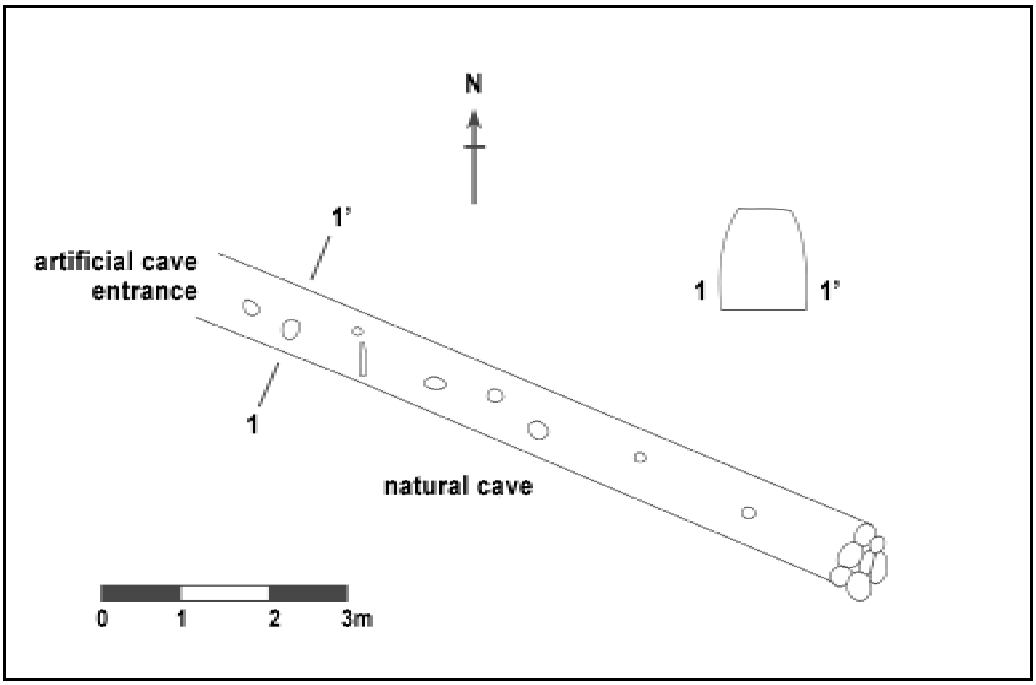

Figure 14. *Plan survey of Estersnow Cave.*

Estersnow Cave: (M8512 9846)

The cave entrance was first noted by Devoy and Gilhuys (1969) as being some 300 m from the back of a public bar north of the Cavetown cross roads, but no survey or grid reference was given. It is located just north of the river running from Clogher Lough to Lough Eidin and half a kilometre east of Clogher Lough in a small outcrop of Bricklieve Limestone. The cave has a man-made entrance 1 m wide x 1.3 m high, which has stone walls on either side of it. The cave is oriented at 332° with the same dimensions throughout (Figure 14). The first 3 m of the cave are man-made. The cave ends after 9 m in a stone fill, rather than the collapse reported by Devoy and Gilhuys (1969). The cave is fossil with a floor of soil littered with debris of human origin and stones.

DISCUSSION

Karstification is highly developed over wide areas of limestone in County Roscommon and landforms such as dolines are more abundant than in the better-known lowland karst in counties Galway and Mayo. However, accessible caves are uncommon, presumably owing to their burial beneath glacial deposits, yet underground drainage is common. The majority of the known caves are inactive. Even Pollnagran was extensively infilled with sediment and the present day invading stream has only partially removed these materials. Although few active stream caves are known from the karst lowlands of Roscommon, east Galway and south Mayo, those that have been explored all exhibit extensive sediment infilling which is being removed by the invading stream; for example, Ballyglunin Cave in east Galway.

The lack of allogenic streams sinking at the contact with limestone has limited the potential for the development of active stream caves and in this respect Pollnagran is an exception. However, it may be possible to enter caves from dolines as geophysical work and the results of drilling in County Roscommon (McGrath and Drew, 2002) suggest that major conduits are often associated with dolines and in particular with linear doline assemblages (Hickey *et al*, 2002).

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