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POLL NA GCÉIM, COUNTY CLARE IRELAND

by

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Entrance: O.S. 1:10560, Clare Sheet 4, E61.4 cm, N23.9 cm.
Townland: Knockaunsmountain
Altitude 242 m AOD
Estimated Length 890 m
Estimated Depth 181 m

ABSTRACT

An account is given of the discovery and exploration of Poll na gCéim, currently the second deepest cave in Ireland. It is shown to have reached this depth by having utilised a fault to pass from the upper Brigantian Limestone to the Asbian Limestone beneath. It is the first recorded active stream cave in this particular formation.

INTRODUCTION

The entrance to Poll na gCéim is located at the northern edge of the shale cap on the col between Knockauns Mountain and Slieve Elva, some 2-300 m south of the Balliny Depression (Figure 1).

The stream sink for this cave, B5, was first noted by this Society in the early 1950's, but as it was choked with domestic refuse it was not deemed to be worth digging open at that time. The present entrance, B5a, was investigated by one of the Society's parties in March 1978 (Irish Diaries, 1978), but, to their later chagrin, they dismissed it as nothing more than an enlarged grike. In 1985 a group of local cavers considered that a cave in this area might provide a lead towards the "enormous" cave that had been predicted to exist beyond the choke in Pollballiny (Lloyd and Self, 1982). This team soon broke into cave passage and over the ensuing years have explored a cave that has become the second deepest known in Ireland, as well as being one of the most arduous and technically difficult (Figure 3).

The details of these explorations have been well documented in caving journals elsewhere, (see especially Bunce and Judd, 1987 and Bunce 1991) and are therefore not repeated here, but the solutions to some of the technical problems are of interest. The approach to cave exploration was a new one for this area, and was necessitated by the unusual nature of the cave. It is deep, with numerous pitches, and narrow, and above all it has a series of sumps which have been successfully passed. The latter created a difficult logistic problem in a country with few active cave divers, and so led to the decision that these obstacles would be made passable to non-divers.

Sumps two and three whose roofs were only a short way below water level were excavated without difficulty by a combination of stoping out their roofs and cutting down through chert dams impounding water on their downstream sides. These are now wet crawls in

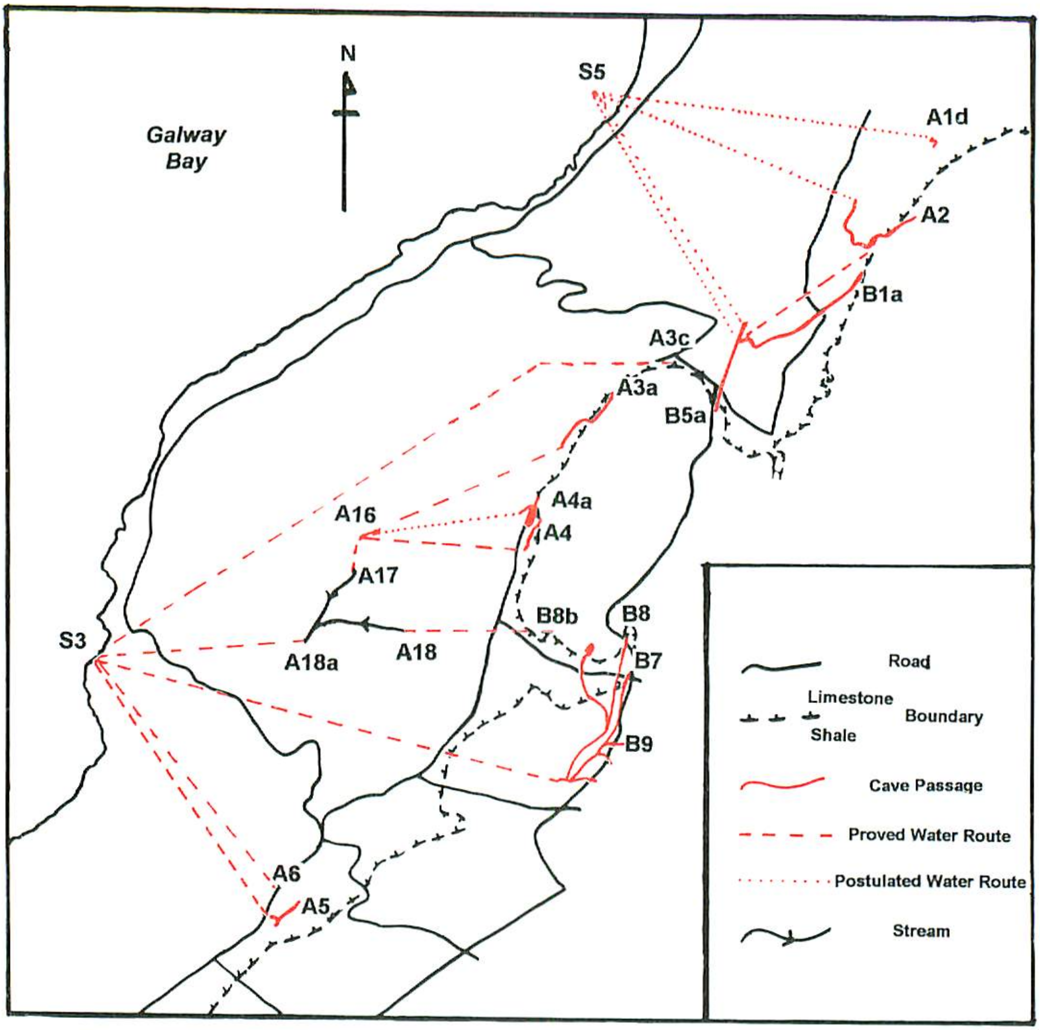

Figure 1. *Area map showing cave locations and hydrology (Code numbers are taken from Self, 1981).*

all but the wettest weather. Sumps one and four posed more difficult problems. Although neither of them is particularly long, 12 m and 14 m respectively, they are both relatively deep, at 3 m each. They were dealt with by building upstream dams to collect the water which was then piped into 150 mm plastic tubes laid through the sumps (Figure 2). Under normal flow conditions all the water flows through the the 150mm pipe from dam A. When valve 1 is opened water will fill the 20 mm syphon pipe. This primes the syphon so that when valve 1 is closed water will be syphoned from the sump through the one-way valve 2 and away down the cave. If air has got into the 20 mm pipe there may be insufficient head of water in dam A to clear it and valve 1 will need to be connected to the pipe from the higher dam B. Sump 4 is drained in the same way. Its 20 mm syphon pipe is tied to the wall above dam A.

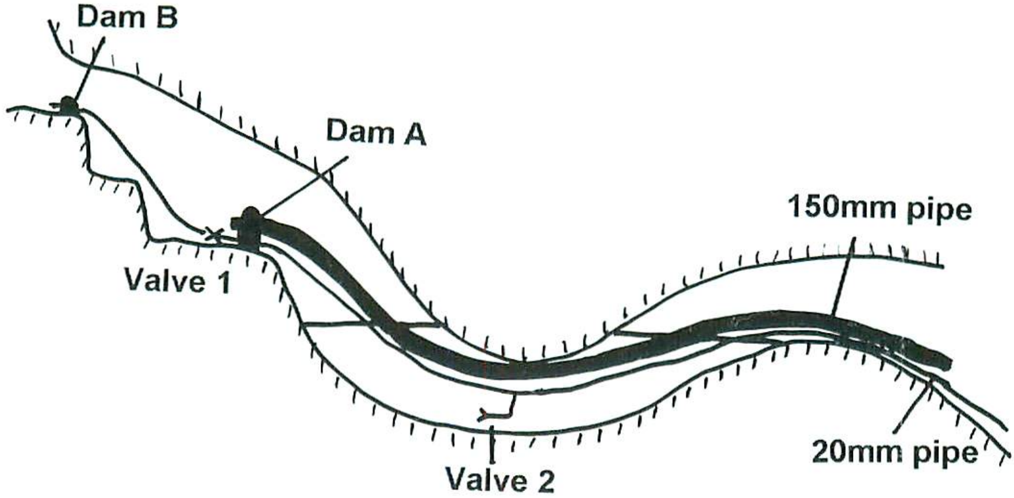

Figure 2. *Sump 1 drainage system (after Bunce, 1990)*

A further problem, caused by the lack of suitably qualified personnel, has been the need to engineer a route through the boulder chokes beyond sump four with a minimum amount of work. This has lead to explosives being used, with the full co-operation of the Garda, to destroy some of the boulders.

DESCRIPTION OF THE CAVE

The entrance is a large boulder-roofed grike with a 0.6 m circular hole at the northern end, covered by an old oil drum. This should be replaced after trips. The 4.5 m entrance pitch can be free-climbed with difficulty, but a ladder is advisable. A bolt belay is situated on a slab 5 m to the south. This pitch leads to a boulder slope and a second 5 m pitch (bolt belay) into a chamber. A small stream enters at this point and is thought to be the water from the end of Poll na Fhia (B5) the stream sink (Figure 3). The chamber is followed by a 31 m pitch decorated with soft flowstone (2 bolts on left wall and further bolt for deviation on right wall). A high rift leads to four further pitches, 5.1 m, 3.4 m, 5.9 m and 8.5 m. All four pitches can be rigged using one 50 m rope rebelayed from bolts at all the pitch heads. At this point the stream volume is doubled by an inlet, thought to be from the entrance of Poll na Fhia, this is the main flow and is not the same stream as seen at the end of Poll na Fhia (see Figure 3). A small passage leads on, dropping down a series of climbs to a shallow lake followed by Sump 1.

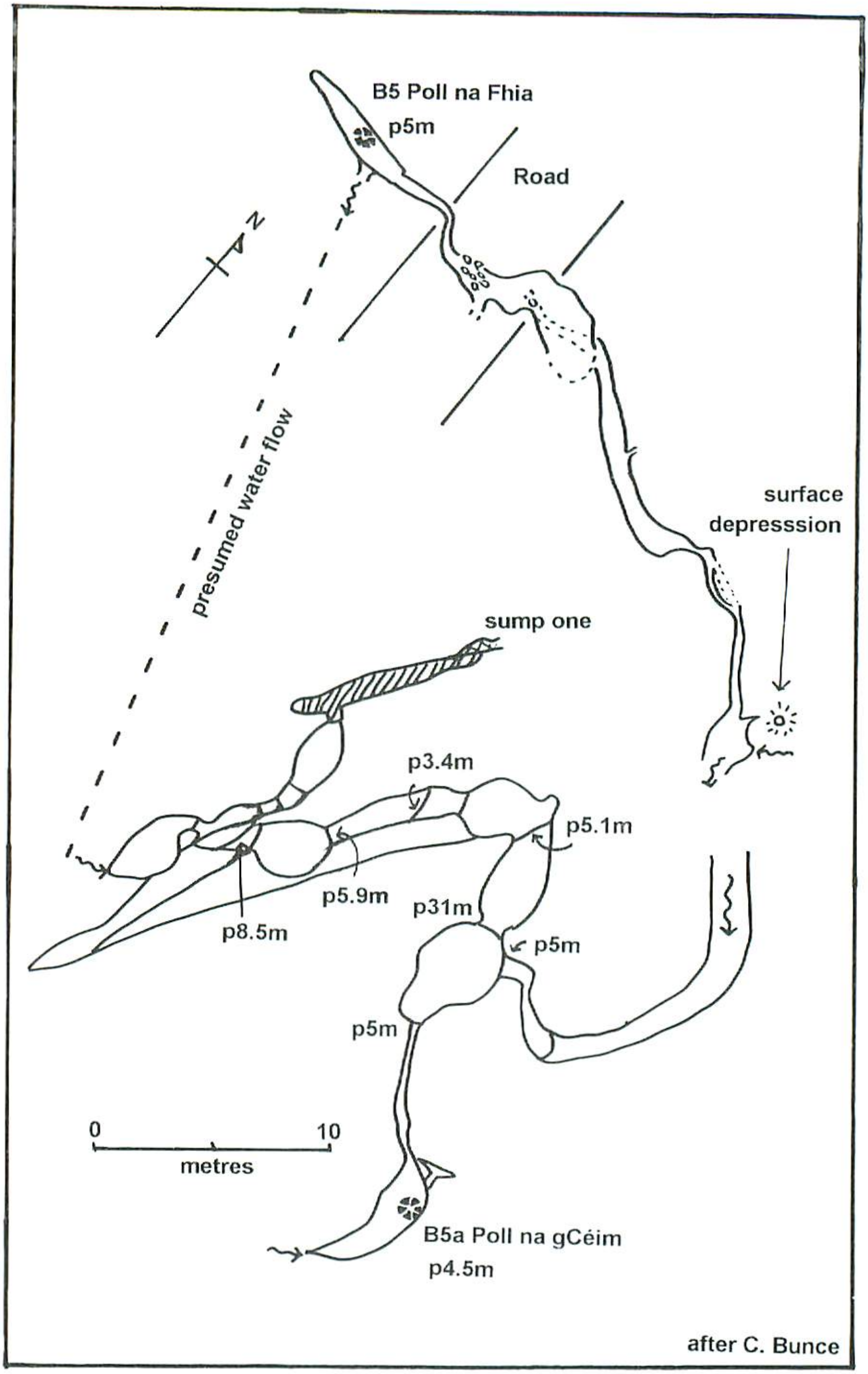

FIGURE 3. *Survey of Poll na Fhia and Poll na gCéim entrance passages (redrawn from Bunce and Judd, 1987)*

Sump one is 12 m long and 3 m deep and is followed by a small chert waterfall and a series of cascades descending 6 m in a narrow rift passage. The passage gradually enlarges and Sump 2 is reached after 30 m. The sump was 10 m long, through a bedding plane constricted by mud. A short length of high rift passage leads to the 6 m long Sump 3, also drained and also followed by a chert waterfall. Fifty three meters of well decorated crawling passage follow, gradually enlarging to 1.5 m wide by 6 m high and ending at sump 4, 14 m long and 3 m deep and constricted by a boulder in the mud floor. The passage beyond is at first 2 m high, but enlarges to 3.5 m and after 30 m reaches a 6 m pitch. Further pitches of 2 m (free climb), 10 m, 3 m (free climb), 3 m and 14 m lead to a canyon passage 3 m wide and 15 m high ending at Sump 5. All the pitches have bolt belays in position. Approximately 50 m separates Sumps 4 and 5. Above Sump 5 is a 30 m high aven with a large inlet stream.The aven has been climbed for about 15 m but becomes too tight. The source of its stream is unknown.

Sump 5 is 65 m long and starts as a tight muddy bedding plane. It turns west between mud banks, along a cross joint until a small airbell is reached. The sump now changes in character to a 1 m diameter phreatic tube which runs north, reaching air surface after 30 m. The phreatic tube enlarges and develops into a small canyon passage by entrenching its floor which drops down a series of cascades. There are several oxbows in this area. A number of boulder collapses are passed until a major boulder choke is reached about 250 m from Sump 5, where a major inlet stream enters from the north. This is possibly the stream from Pollballiny. Beyond the choke, which was easily passed with a little digging, a further 250 m of walking passage, interspersed with squeezes and ducks leads to Sump 6.

The most recent phase of exploration resulted in the successful passage of Sump 6, after an easy and shallow dive of only 15 m. Poll na gCéim 7 consists of a further section of narrow rift passage, with one aven over 10 m high. Unfortunately the cave encounters a further boulder choke immediately after this, and the route forward is not obvious, although falling water can be heard a little distance ahead.

GEOLOGICAL SETTING

The entrance to Poll na gCéim is situated at the point where the Shale uplands of Western Slieve Elva and Knockauns mountain give way to the outcrop of the underlying Carboniferous Limestone. The basic geology of the area around the cave is shown in Figure 6. The overlaying shales, of Namurian age, rest unconformably on Viséan Limestones some 900 m thick. Figure 5, after Drew (1989), gives the lithology of the limestone in more detail. All of the known active swallet caves associated with the present shale edge are confined to the upper, Brigantian, beds, with the exception of Poll na gCéim which has penetrated into the underlying terraced member of the Asbian. The geological structure of the area is essentially very simple. Average dip is about 2° south to south west, although it varies locally from horizontal to up to 10° at any particular point. The limestone is cut by two sets of joints, one on a bearing of about 190 - 200° and the other on about 270° The north-south jointing is much better developed than the east-west and is also much more highly mineralised.

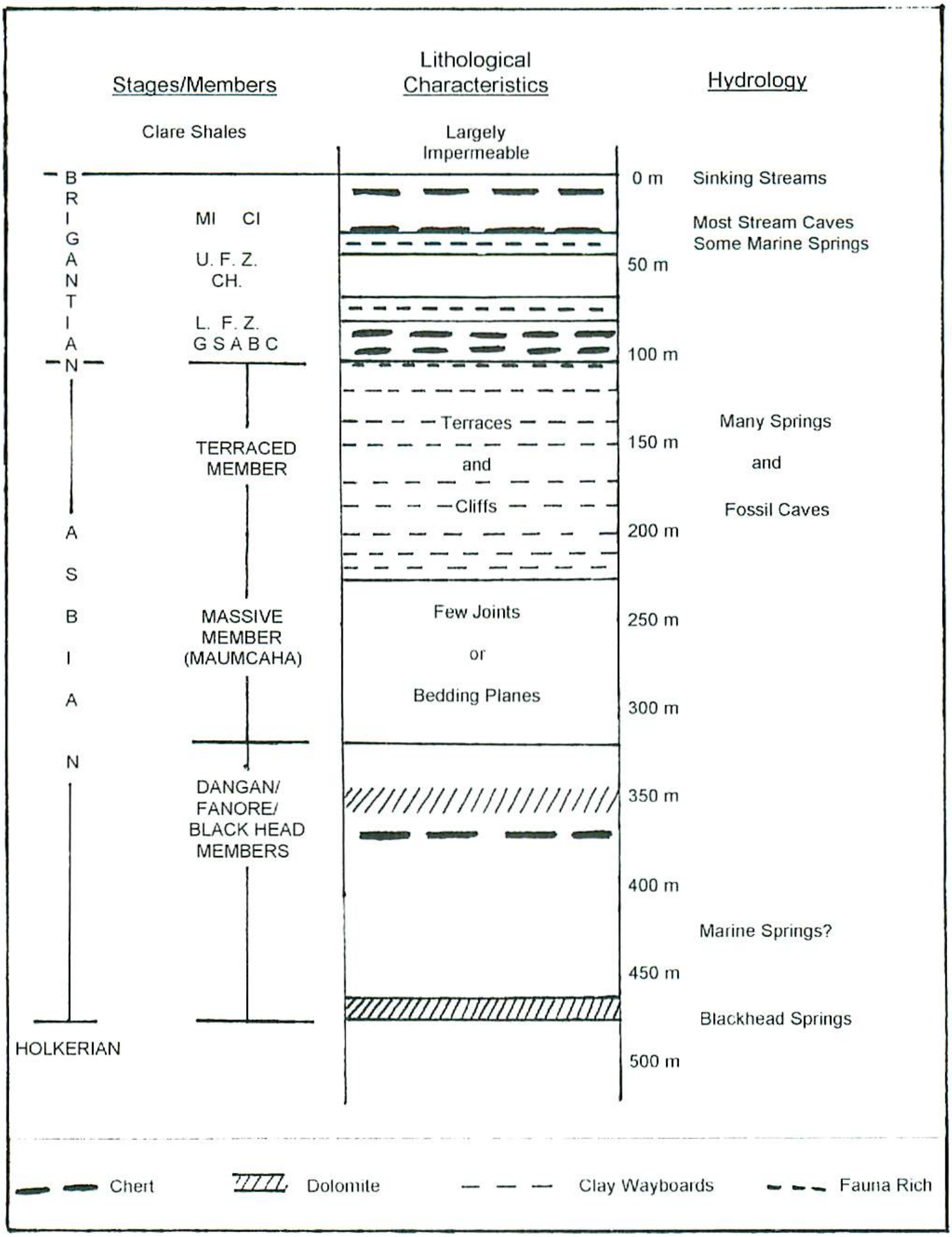

FIGURE 5. *Lithology of the Burren Limestones (modified from Drew, 1989)*

Prior to the exploration of this cave, no faulting had been observed in the area. Indeed Tratman (1969, p38) specifically stated that Corbel (1957) was incorrect in describing fault controlled passages as being found anywhere in Co. Clare, as he did for Poulnagollum. Poll na gCéim, however appears to have utilised a fault This fracture is parallel to the dominant north-south jointing, and no information is available for the degree or direction of movement, but evidence that movement has occurred can be seen in the large amount of fault breccia visible in the roof of the cave, especially beyond Sump 1, and by the presence of slickensides, seen between sumps three and four (C. Bunce, *pers. comm.*). The fault breccia is typically very broken, though in some areas it has been recemented by calcite, and occupies a zone from 0.5 to 2 m wide . This fault appears to be a major feature. It can be traced from the cave along the western edge of the Balliny depression to a large outcrop of vein calcite by the roadside, 4 km to the north (bearing 016°) of the cave entrance, and beyond this almost to the sea edge.

HYDROLOGY

The eventual resurgence of the Poll na gCéim stream is at present unknown. The sink B5 (Poll na Fhia) which is presumed to feed the inlet between the pitches and Sump 1 (Figure 3, Bunce and Judd, 1987), has been dye traced to the Upper Coolagh Valley Cave (Irish Diaries, 1958, Tratman, 1969). However as the resurgence for that cave (B6) is at about 190 m a.o.d. it is obviously not the resurgence for the main Poll na gCéim stream whose downstream termination is at about 60 m a.o.d.. This test needs to be repeated. A more likely outlet is the submarine resurgence S5, which if its existence can be conclusively proved, may well be the focus for all the drainage of this area that does not turn as far south as S3 (Figure 1).

The other possible candidate is in the area of S3. A spring of freshwater, rising from cracks in the sea bed and named the Sluggagh, was discovered off the coast near S3 in 1989 (Boycott *et al*, 1991) and seems to discharge a considerable flow. However S3 would seem to be higher in the geological sequence than the explored termination of the cave and water would then have to rise through the sequence to reach it. This problem would not apply to the other, shallower, caves on this hillside, if, as we have suggested, their drainage remains in the upper Brigantian limestone and drains to S3 at, or close to, the base of that formation. Only the deeper caves of the Asbian formation would then drain to S5. If this is the case, and it must be stressed that at present no water tracing evidence exists to support this theory, it may also mean that the present very immature routes taken by the Pollballiny and the Faunarooska streams near the ends of these caves represent relatively recent captures by the lower catchment from the upper. Unfortunately, tracing cave streams to these offshore resurgences is an extremely difficult task, especially in the case of S5, where diving has shown the seabed to be covered in sand with no indication of exactly where the flow emerges. For the present these ideas can therefore be no more than conjecture.

GEOMORPHOLOGY

Poll na gCéim is one of a series of caves that drains the western edge of the upland of Slieve Elva and Knockauns mountains (Figure 1). It differs from all the others, however, in two significant respects. Firstly its direction is almost entirely north east, whereas virtually all other known caves in the area drain to the south west, and secondly it can be followed to a considerably greater depth than any of the others. These characteristics are related and may be explained by the particular formation of this cave.

From the survey (Figure 4) it can be seen that the cave is largely linear in layout and that it runs parallel to the dominant 190 - 200° jointing of the area. It has not, however, simply utilised the joint network, but has utilised a fault. The fault zone accounts for the tall, narrow and steeply descending canyon portions of the cave. The low phreatic sections, the sumps and the canal beyond sump five, are perched phreatic passages formed where the passage has developed along the bedding rather than along the vertical fractures, and are of this form as the drainage is then against the dip, approximately 2° to 3° to the south west in this area. This can be seen particularly well at sump five, and the canal immediately beyond, where the drainage has left the main fracture zone at the start of the sump, and then returns to that line at the end of the canal, and the beginning of the next vadose section. The detailed location of the sumps is related to the presence of thin chert and clay bands towards the base of the Brigantian limestone, which impound water at the downstream end of each sump.

The cave can be classified as an vadose invasion cave (Ford and Williams, 1989) with perched paraphreatic sections caused by local structural controls. The position of the sink on the present Shale/Limestone boundary shows that it is a recent cave, probably post last glaciation, in origin. The present entrance is not an abandoned sink, away from the shale edge, but a section of canyon passage unroofed by collapse. It may be regarded as an vadose invasion cave, rather than a drawdown vadose cave as there is very little sign of any initial stage of phreatic development, except, of course, in the present paraphreatic sections. It must be said, however, that hardly any of the caves on the western, seaward facing, flank of the Burren show much of a phreatic stage. Even in the Doolin Cave System, for which a complete phreatic skeleton can be seen, more than 90% of the cave has been formed under vadose conditions.

In the light of recent work on cavern genesis (Lowe, 1992), it is worth restating Tratman's conclusion (Tratman, 1969) that the majority of the active stream caves in this area are quite young and have formed in their entirety since the end of the last glaciation. Caves that have older elements in their history, for example Poulnagollum where calcite deposits in the high canyons have been dated to 70,000 b.p. (Drew, 1993.), can be seen to be out of adjustment with the present hydrology (Collingridge, 1962), and any extended initiation period would surely have produced some comparable effect in the younger caves. No such lengthy initiation period is needed to explain the rapid genesis and development of a cave given the very favourable conditions of high relief, acid rich peaty water, and an open fracture to follow.

The unusual depth of this cave can also be related to utilisation of the fault. It is approximately 181 m deep, dropping to about 70 m a.o.d. The next deepest in this area is Faunarooska, at 94 m. More significant is the observation that, with the exception of Poll na gCéim, all the explored caves along this hillside seem to become impenetrable at approximately the same horizon in the geological sequence. The bottom of Faunarooska, at the

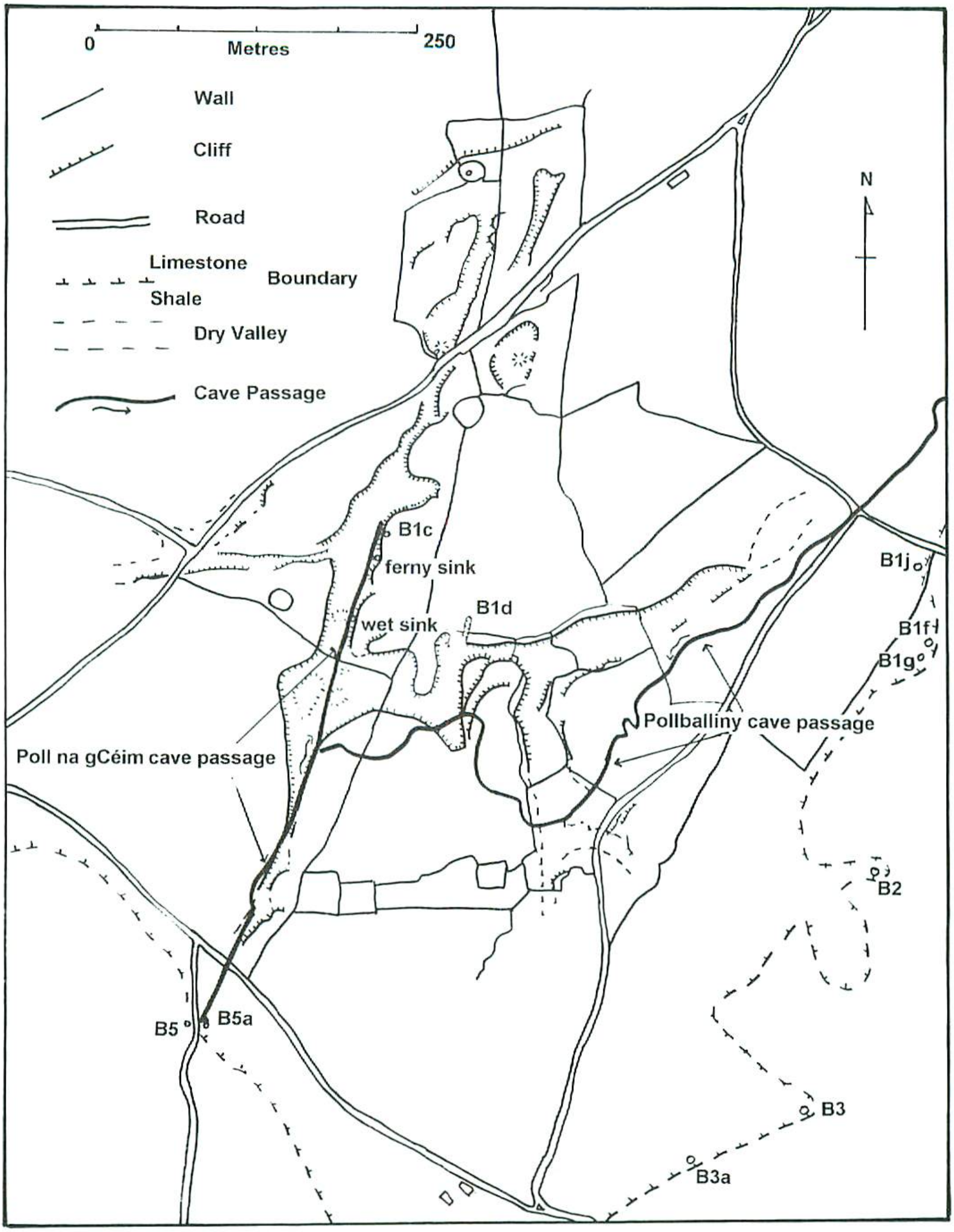

Figure 6. *Map of the Balliny Depression and underlying cave passages, showing basic geology*

northern end of the series, is at approximately 170 m a.o.d., and the bottom of Poulomega, at the southern end, at 140 m a.o.d. This height difference is consistent with the average observed dip in the area. All the other caves end at or above their predicted depths in this sequence. In most cases the explored ends are bedding plane sumps, indicative of their having reached local base level. It would seem, therefore, that there is a major aquiclude, possibly a thick chert horizon, to be found which has only been penetrated by the one significant fracture of the fault which guides Poll na gCéim. It is likely that this layer is close to, or at, the base of the Brigantian limestone (Figure 5). It has not yet been possible to observe this proposed horizon at outcrop.

This controlling bed may be further evidenced by the observation that the streams of the most southerly caves in this line, Poulnagree, Poll Ballynahown and Poulomega, all resurge well above regional base level (sea level), and flow over glacial till for a short distance before sinking again at below 55 m a.o.d. (Trudgill, 1971) This may however be the result of a local hydrological low caused by glacial erosion of the hillside in this area lowering the land surface to below the local water table (D.P. Drew, *pers comm.*). These observations are also consistent with the suggestions of Drew (1988) relating to the caves of the Upper Fergus River catchment further to the east. In this area all of the caves carrying sinking streams from the shale edge remain perched above the cherts of the Upper Faunal Zone of the Brigantian.

The explorers report some calcite and mud sediments high in the boulder chokes beyond sump five which they considered to be older than the present cave. This led to a suggestion that the cave had intercepted a much older passage, and that the choke was due to collapse at this junction. This is unlikely, given that chokes of this nature would be expected in a cave aligned along a fault zone, and these deposits, whilst likely to be older than the cave are probably mineral deposits associated with the fault. Higher upstream in the cave other minerals have been found associated with fault breccia including quartz and galena (Colin Bunce, *pers comm.*)

On the basis that the Pollballiny depression represented a very large fossil sink, Lloyd and Self (1982) hypothesised that the continuation of Pollballiny, when found, could prove to be enormous. It may be that Poll na gCéim will prove to be the best means of reaching that cave, as it is now very close to the line of Pollballiny and far below it. It would be unwise to draw too many conclusions, however, as the nature of other drainage routes beneath the postulated hydrologic barrier can only be speculative at present.

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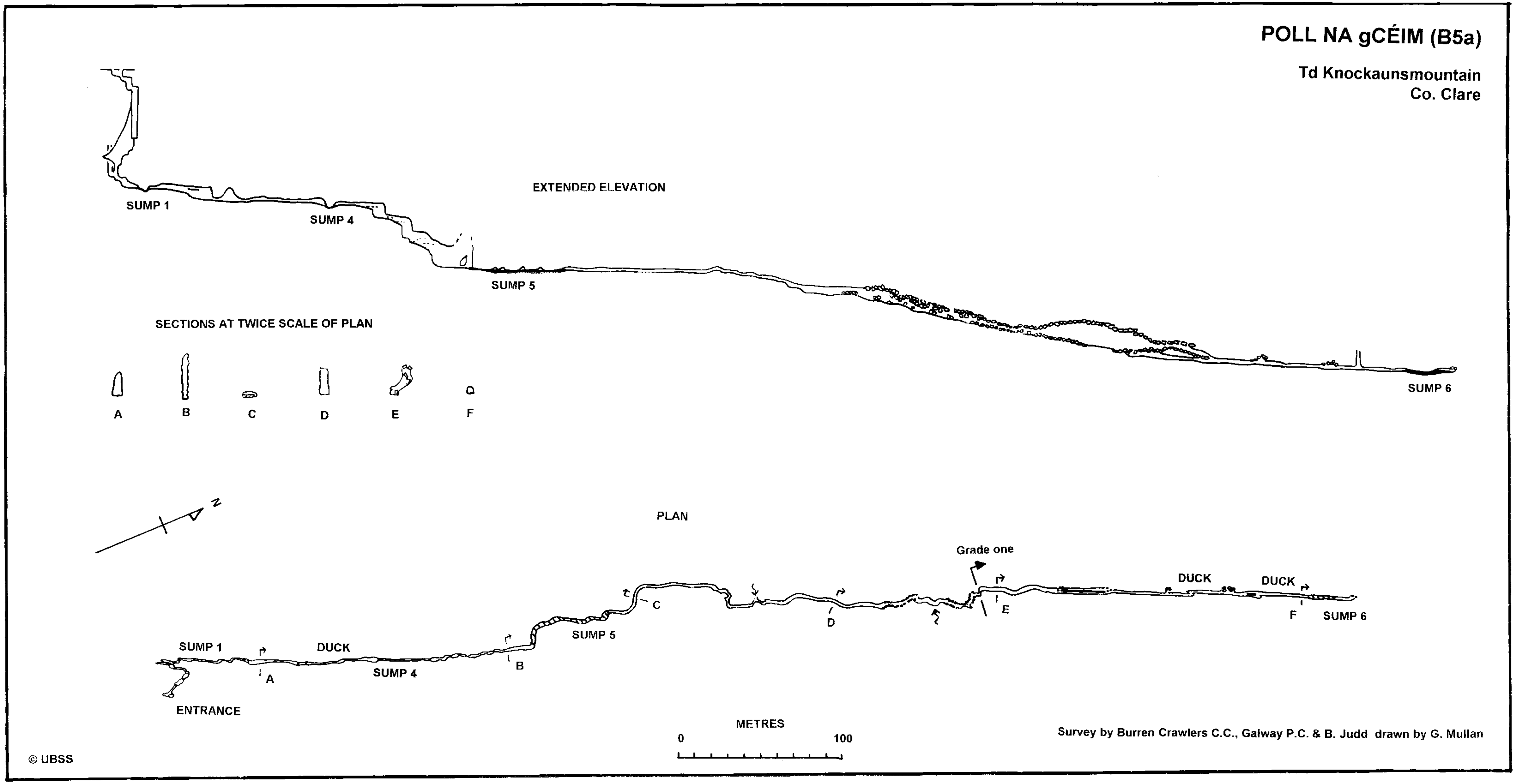

Figure 4. *Survey of Poll na gCéim*