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THE KILCORNEY DEPRESSION, CO. CLARE, IRELAND.

by

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ABSTRACT

The physical features of the depression, its surrounding area and associated caves are discussed. It is argued that the depression has been a focus of drainage for a long time having been formed as a border polje at or close to the boundary of the limestone and the shales no later than the early Midlandian Stage of the Pleistocene.

INTRODUCTION

The topography of the eastern part of the Burren of Co. Clare, that part commonly known as the High Burren, is dominated by closed depressions. Some, such as the Carran Depression and the Meggah Depression are of considerable size and are subject to intermittent flooding. These might be classified as Baselevel Poljes using the threefold classification of Ford and Williams (1989)[1]. The Kilcorney Depression, however, is not of this type. It has an extensive dry valley system associated with it and seems to more closely resemble Ford and Williams' Border Polje in type, although it is now approximately 1.5 km from the nearest outcrop of the Clare Shales. It is argued that this feature might be described as a Border Polje, which was formed when the water table was considerably higher and before the shale was stripped back by glacial action and is now largely fossil. This paper reviews the various items of field evidence, especially caves and surface stream channels both active and abandoned, in favour of this hypothesis.

FIELD WORK

Surface drainage channels

In 1983, Dr. Oliver Lloyd carried out a surface survey of the area around the main Kilcorney depression. The map on which Figure 1 is based is the result of this work and of analysis of aerial photographs of the area. It shows two significant sets of stream channels leading into the depression from the north (Kilcorney Glebe) and from the west.

Kilcorney Glebe

Owing to the dense thorn scrub which has grown up in this valley, it has not been examined in detail by the author. This account is therefore largely drawn from Tratman (1968).

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[1] Although the Castletown river, in the Carran depression, and its drainage to the Fergus springs is perched on relatively impermeable cherty limestones as much as 100 m above regional baselevel, this depression more closely resembles the baselevel polje than any other type. However, this anomaly does point to a potential flaw in Ford and Williams' simplified classification.

Kilcorney Glebe is much the shorter and steeper of the two valleys[2]. It is little more than 5-600 m in length and drops some 30 m in this distance. A short way down from its head Tratman described an old rising "feeding" a dry stream channel This channel cuts through a mound of hill moraine in the valley and has an indefinite end (Tratman, 1968). There are no records of flowing water having been seen in the channel. It was active after emplacement of the moraine, but the valley must predate the episode of glaciation which deposited the moraine.

The Western Valley System.

This is a much more extensive and more gently sloping feature. It has two heads each of which is associated with an embayment cut into the Clare shales (Figure 1). Both parts run eastwards. They then turn towards each other, before turning east again. Finally, the southern branch turns north again and they join shortly before reaching the depression proper, through a short cliffed gorge. In all, they drop about 30 - 40 m over a distance of 3 - 3.5 km.

In both of the branches old, abandoned dolines can be found. In the southern branch there is a low bedding cave, inhabited by badgers under the right wall. It has been penetrated for a short distance, but is solidly choked with large boulders. Immediately after the bedding cave, the valley floor rises by about 5 - 6 m and about half way up there is a large choked hollow, also on the left bank. The bedding cave and the choked depression would seem to be linked to a cave system that captured the drainage at this point and continued to function as the valley was further incised. Upstream of this point the valley is a significant feature about 8 m deep and 8 m wide. It is less distinct further upstream, near Lissylisheen castle, but it can be clearly seen again as the embayment into the current shale margin is approached.

The northern branch of this valley system is considerably smaller, averaging less than 2 m in depth and about 3 - 4 m in width. An old sink, much less distinctive than that in the southern branch, may be marked by a rise in the valley floor at one point. This valley system is limestone floored along its entire extent.

The Plateau Surface

To the west of the depression, a level plateau extends westwards to a distinct break of slope at the current edge of the Namurian Shales. This plateau surface has been dissected by both the western valley system and a number of small closed depressions, typically about 3 m deep and up to 10 m across. A couple of these, to the south of the southern arm of the valley system, are linked to that valley by short hanging gullies. To the east and north of the depression, the land surface and its drainage has been reorganised to a much greater extent into far more extensive closed depressions, such as the Meggah and Carron depressions.

The depression proper

The depression itself is semi-elliptical in shape, with an east-west axis of a little over a kilometre and a north-south one of about 500 m. To the west and to the north it is continuous depression side and there is no obvious stream channel into or out of the depression to either the

[2] Drew (1973) describes a series of depressions which stretch north from Kilcorney Glebe. He states that they indicate the presence of an ancient valley draining to the Kilcorney depression, via the Glensleade depression, along this line. However, they appear to the author to be linked only by virtue of their utilising the same fracture line.

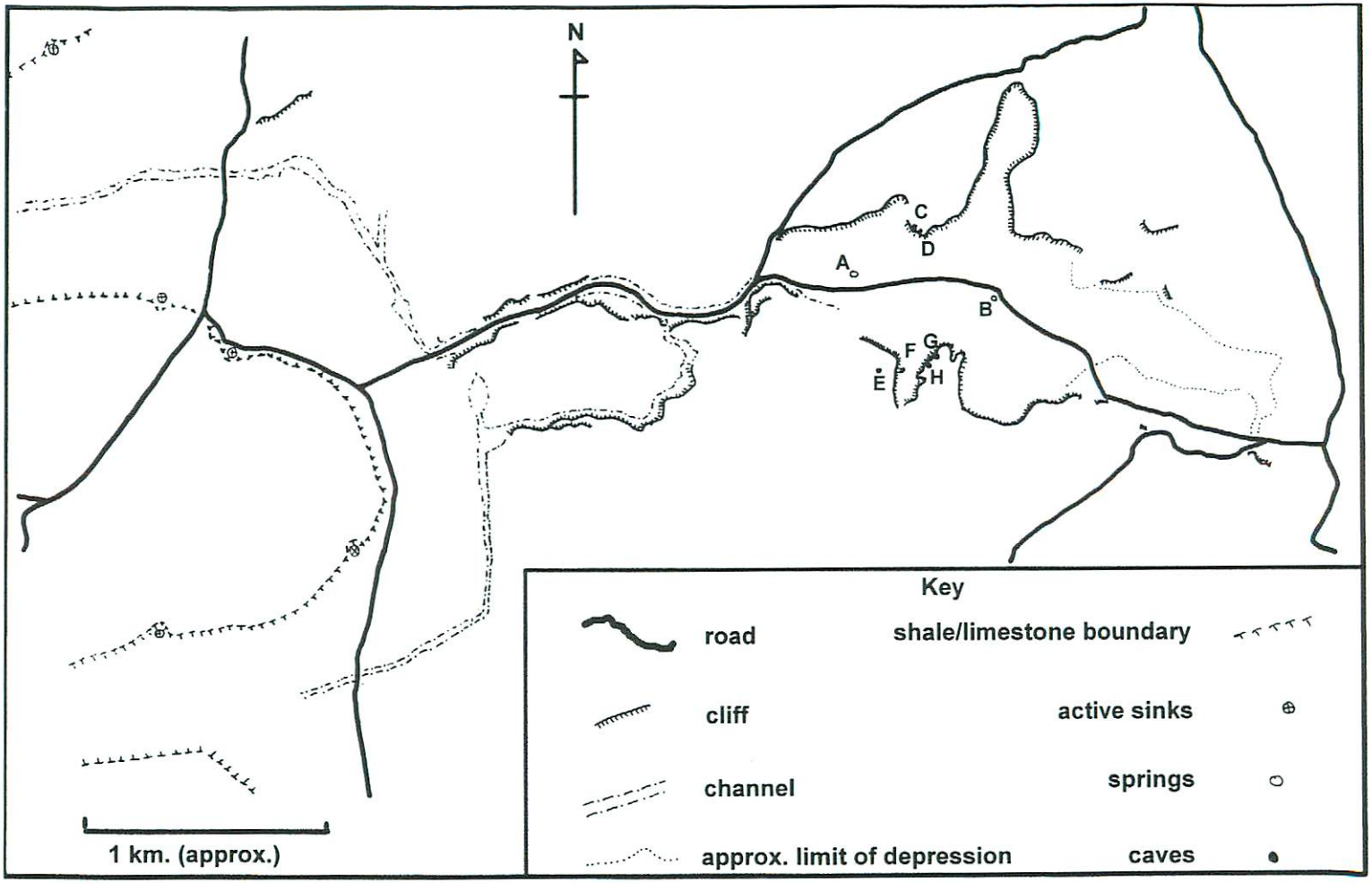

Figure 1. *Sketch map of the Kilcorney Depression showing surface drainage pattern and the position of the caves.*

south or the east. On its north and south sides, and to a lesser extent on the east, the depression is bounded by near-vertical cliff faces.

The floor of the central part of the depression is on two levels. There is a flat limestone surface to the north of the road at about 115 m AOD. South of the road, the floor of the depression slopes gradually south-east, the lowest point, at about 103 m AOD, being close to the mouth of the Cave of the Wild Horses (K1). The meadow here is floored by a considerable thickness of laminated alluvium as demonstrated by an attempt to bore for water. The bore hole was situated a few hundred metres north-west of the entrance to K1 and is said to have reached about 40 m AOD without striking solid rock. More exact data on this operation has not proved traceable and other drilling attempts apparently found a much thinner overburden. This evidence cannot therefore be relied upon. Immediately before the mouth of the cave is a meandering channel cut into the alluvium. This is about 2 m wide and 1 m deep. It does not run into the cave, but peters out about 10 m short of the cliff face. Another, shorter, channel, may be found slightly to the north. At several places in this meadow are circular depressions, in some of which clean washed stones may be found. These are connected to the subsurface drainage of the area, air is expelled through them when the water level is rising, and they also act as sink holes for flood water.

There are two risings in the depression. North of the road, at the northern extent of the meadow, is an intermittent rising where water comes up through alluvium near the base of a low cliff (R on Figure 1). This was identified as the major source of flood water by Coleman (1966) and by Tratman (1968). Just south of and below the road, approximately 175 m east of the ruins of Kilcorney church is a bedding plane spring, Tobar na nAingeal (B on Figure 1). Although a well-known site, it is marked as a holy well by Robinson (1977) and its water is said to be good for the eyes (O'Connell and Korff, 1991 p. 169). It is not mentioned in any previous accounts of the hydrology of the depression.

The Caves

A number of caves of varying extent are associated with the depression. Of these, only three opening within the depression and one opening to the plateau above have been explored to a significant extent. These are described below:

The Cave of the Wild Horses (K1)

This cave has been the subject of a number of publications over a long period of time (Baker and Kentish, 1913; Boycott *et al*, 1983; Hanna, 1968; Lucas, 1740; Wilson, 1965). Its overall layout is as shown in Figure 2. The cave consists of a series of sub-horizontal, down dip, passages linked by shafts. Virtually all the passages appear to be phreatic in nature. Most are irregularly shaped tubes of varying diameters with occasional enlargements along cross joints, of which the high aven in Lower Gour Passage is an exceptional example. The only exceptions to this pattern are the two avens, Main Aven and Eastern Series Aven, which are vadose invasion shafts channeling drainage from the plateau above (c.f. Mosquito Hole, below). The uppermost passages, especially, meander significantly, suggesting pressure flow. It has one trench, in the Upper Main Series, which has been identified as a vadose feature (Hanna, 1968), but this seems unlikely as the passage floor rises away from it at both ends and it may be that it is a paragenetic notch. There is little well defined scalloping to be found in the cave, but there is

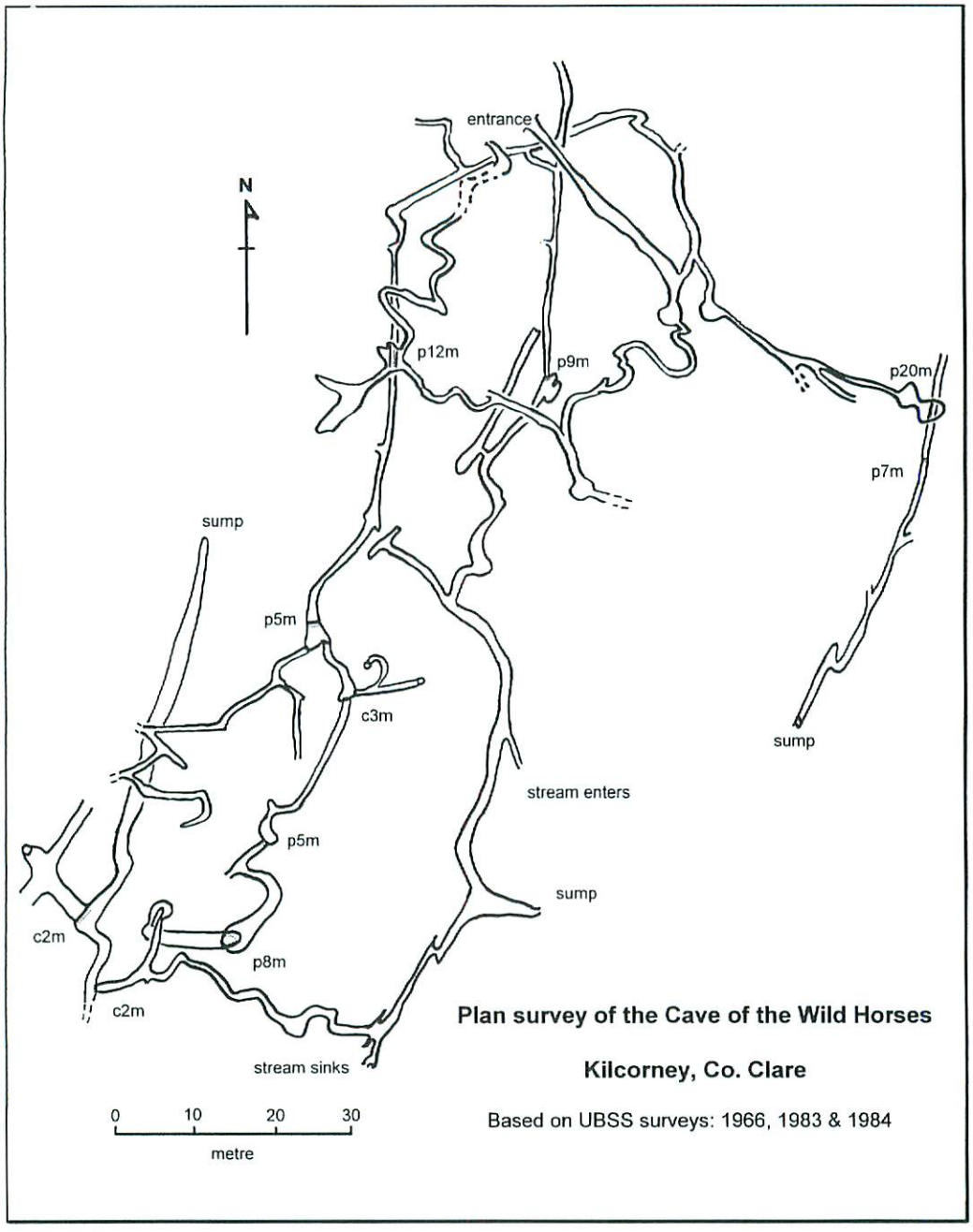

Figure 2. *Plan survey of the Cave of the Wild Horses.*

an excellent display of rinnenkarren at the foot of the pitch in Gour Passage (see Boycott *et al*, 1983 plate 15).

The cave contains considerable quantities of sediment. The major component is a thick, brown glutinous clay which can be found throughout most of the cave. A darker, less tenacious mud has also been identified in the entrance series (Tratman, 1968, pp. 132 & 212). Wilson (1965) believed that the cave may be losing mud at present. This may well be so, certainly the extent of the fill changes, as evidenced by the fact that passages of significant size were explored in July 1983 off Lower Gour Passage (Irish Diaries, 1983; Farr, 1983) that were simply not evident beneath the mud fill the previous March, when that passage was first explored (Boycott *et al*, 1983).

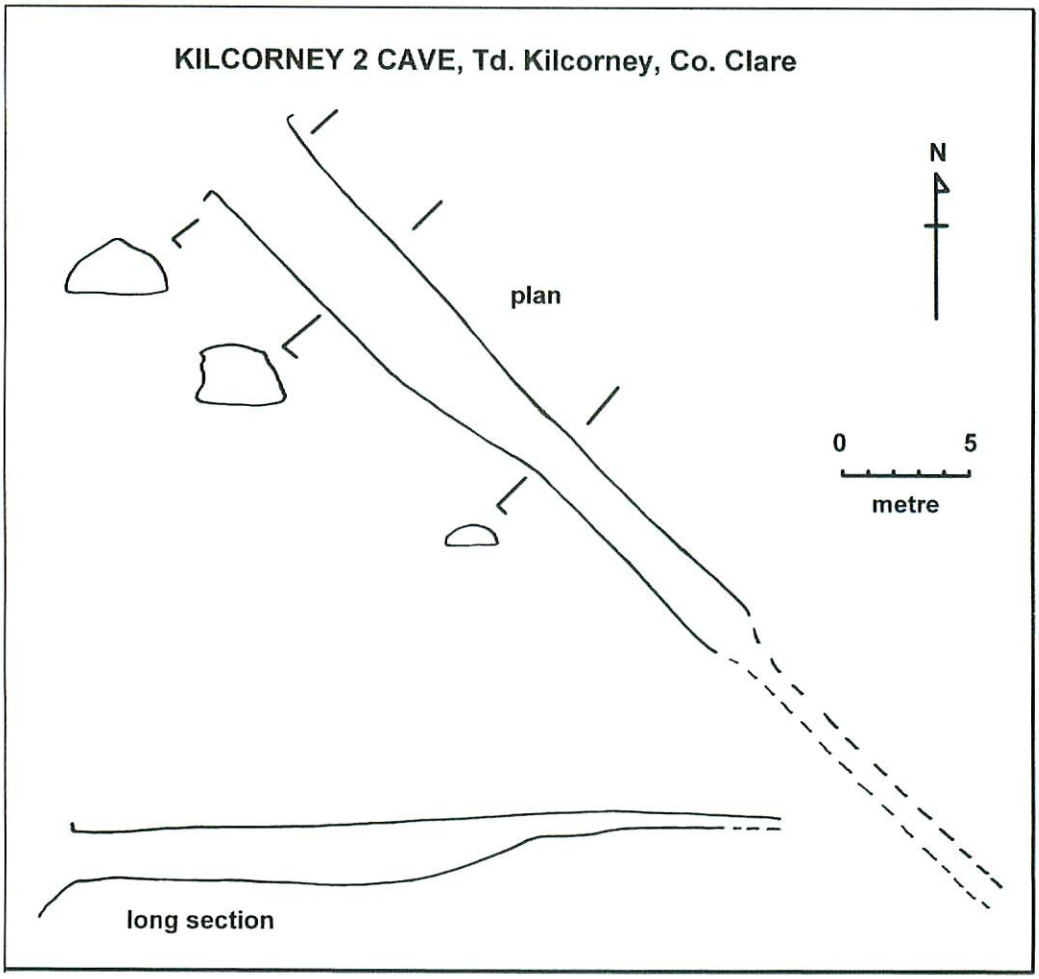

Figure 3. *Plan Survey of K2 Cave.*

Kilcorney 2 (K2)

The entrance to this cave is located roughly half way up the east wall of the gully running south from K1 at an altitude of 116 m, that is 13 m above K1. The cave is a single phreatic tube, 4 m wide by 2 m high, with a small meandering half-tube in the roof; running at a bearing of 133° for about 40 m. After 10 m the floor rises, over a mud fill, and the final 15 m of passage requires crawling over this fill. (Figures 3 and 4). There are a number of small tubes to the right (south west) of K2 which soon become too tight to follow. The sediment fill is a secondarily-deposited glacially derived mud (Tratman, 1968, pp. 132 & 212). It is hard-packed. Scalloping shows that the water flow in this cave was to the south east, that is into the cave.

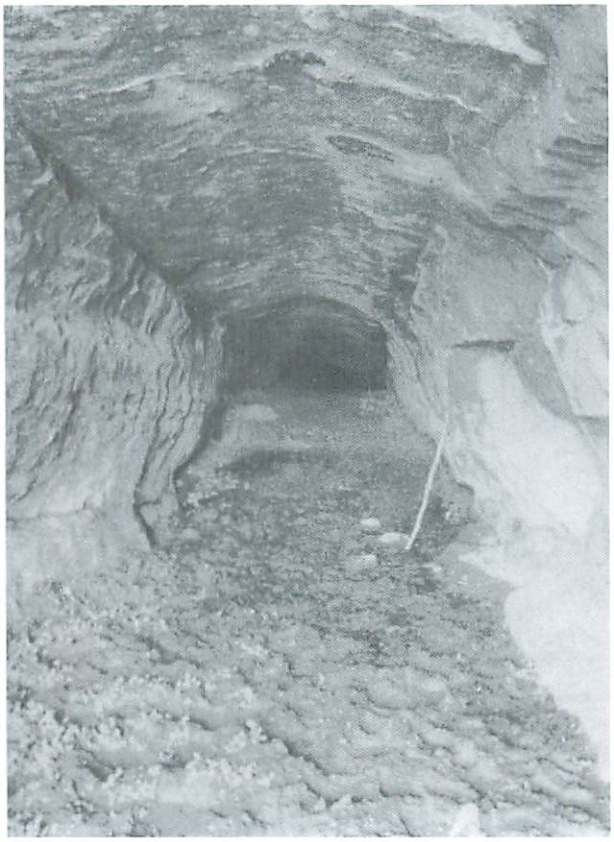

Figure 4. *Looking into K2 Cave.*
Photo: J.K. Pitts

Kilcorney 4 (K4)

Kilcorney 4 (Figure 5) is found in the north wall of the depression (Figure 1). It is a phreatic passage, about 26 m long and heading roughly north into the hillside. It is choked with hard packed mud similar to that found in K2 but containing well rounded limestone pebbles. Scalloping indicates flow towards the south, outwards; but a sample of mud taken in 1984 was said by Lloyd (*pers. comm.*) to show well marked current bedding indicating flow to the north, that is into the cave. Both observations, of course, may have been correct, but pertain to different periods. At the same level as K4 and a few metres to the west is K5, an 8 m long phreatic rift also ending in a mud choke.

Mosquito Hole (K3b)

The entrance to this cave is to be found on the plateau surface west of the gully which runs south from K1. It consists of a small entrance leading to a 10 m deep pitch into a chamber formed on an east-west joint. The floor of the chamber is of boulders (Lumley, 1982). It is likely to have been formed by vadose water percolating down from the plateau surface in the same manner as the avens in the Cave of the Wild Horses.

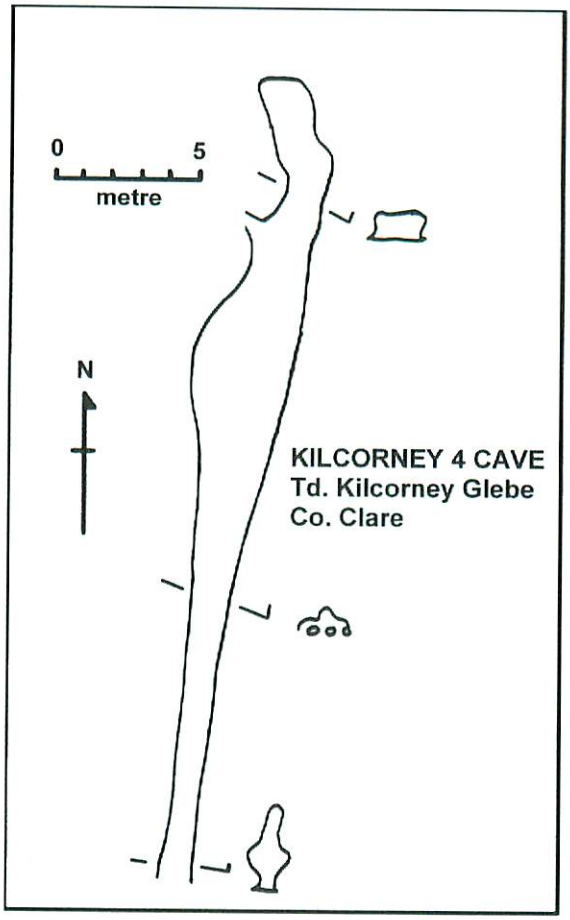

Figure 5. *Plan Survey of K4 Cave*

Other Caves

A number of small phreatic remnants are also to be found in the depression. The longest of these is K6, a moonmilk coated rift some 14 m long found under the 115 m terrace below the entrance of K4. K3 is a choked arch to the west of K2 and at the same level (116 m AOD).

GEOLOGICAL SETTING

The outline geology of this area has been described by Drew (1988,) and will not be repeated here. The lithology of the limestone is as shown in Figure 6. The most important point to note about geological controls upon cave development is that the vast majority of the penetrable caves carrying sinking streams today are perched above the cherts of the Upper Faunal Zone (UFZ) for their explored lengths and that the majority of springs in the Fergus valley, including the Fergus River Cave are developed above the cherts of the Lower Faunal Zone (LFZ).

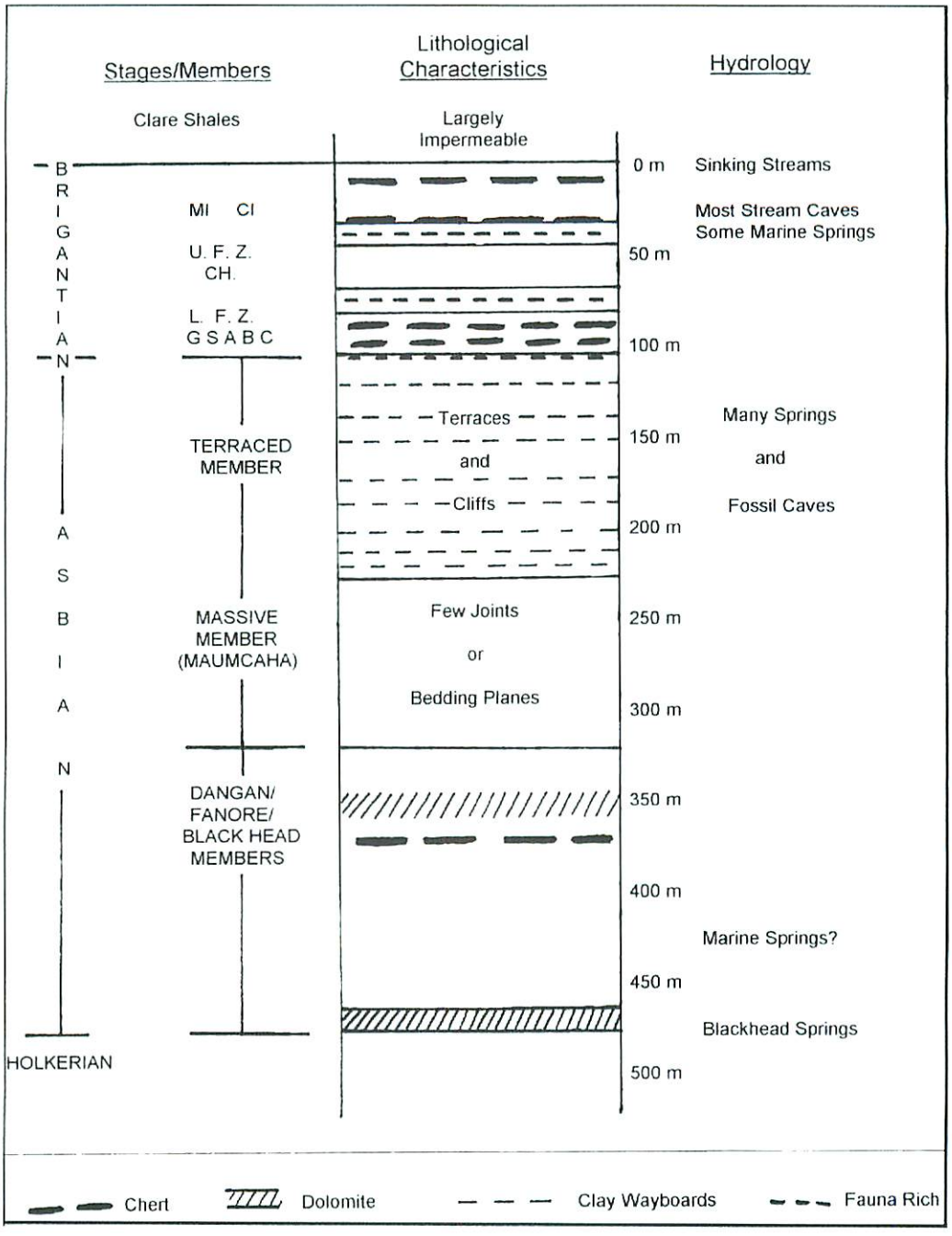

Figure 6. *Lithology of the Burren Limestones (modified from Drew, 1989).*

DISCUSSION

The earliest stage of drainage in this area for which there is evidence is represented by the caves K2 and K5, which may represent original down-dip conduits draining water from the north to the south east, when the surface stood at about 120 - 130 m OD or higher. These caves were subsequently truncated by the development of the depression and blocked by stream lain deposits of reworked boulder clay. Like the active stream caves of today, they are developed above the Upper Faunal Zone cherts.

Subsequently, the floor of the depression has been eroded down to below 100 m OD. Intermediate stages in this process are evidenced by such remnant caves as K6, just below the 115 m terrace. As there are no indications of "overflow" channels out of the depression, it must be the case that during this time all the water flowing into the depression left via caves and especially through the Cave of the Wild Horses. It seems that this cave was formed entirely under phreatic conditions. There is no obvious structural control on the position of the various passages, but the shafts between upper and lower parts of the cave, the main pitch, Eastern Series pitch and Gour Passage pitch and also the large aven in Lower Gour Passage are all passing between approximately the same levels and may mark descents from beds above the Upper Faunal Zone to beds above the Lower Faunal Zone. Prior to the cave being abandoned, it was subject to the influx of a significant amount of sediment, the thick, brown glutinous clay. Latterly much sediment has been washed out of the cave by the actions of secondary streams, notably those that flow through Gour Passage and the Eastern Series. This process is still continuing and it may be that variations in the position and extent of the fill are responsible for some of the variations noted in the pattern of flooding in the cave and the depression. This variation has been observed underground, between trips only a few months apart, as noted above.

This cave was functional prior to the Glenavy Stadial of the Midlandian, as a stalagmite from a small roof tube in Upper Main Series, near Pitch Chamber, gave a date of 41,000 ± 6,800 yr. (D.P. Drew, *pers. comm.*), which dates to the Hollymount Cold Phase (Coxon, 1993); equivalent in time to the Upton-warren Interstadial of the English Devensian Glaciation. It had apparently been abandoned at this time, allowing calcite deposition, but was rejuvenated at a later date, as attested by the re-solution of calcite having occurred at a number of points in the upper passages.

Thus the Kilcorney depression was acting as focus of drainage before at least the last sub-stage of the Midlandian glaciation in this area.. It is possible, therefore, that it was situated at the then shale limestone boundary and received its water directly from the Namurian Shales as do the caves of the western Burren today. That is, it was formed as a border polje with an active swallet as its downstream outlet. A similar origin has been postulated for the Balliny depression on the western slopes of Slieve Elva (Mullan, 1995). This premise is supported by the observation that the limestone surface to the east and north of the depression, as evidenced by the greater reorganisation of its karst surface, has been subjected to sub-aerial weathering for a much longer time than that to the west and south. However, the evident maturity of the western valley system requires that to have been active and cutting into the surface of the limestone for a relatively longer period of time than that required simply for the establishment of underground drainage in the immediate post-glacial period. In the area immediately to the east, the Gort Lowlands, despite the water level remaining close to the ground surface, underground drainage appears to have developed rapidly without allowing time for the development of surface erosion features, but it may be that in the Burren lithological variations within the limestone are

relatively more important and perched water-tables have been more significant as is currently the case in the Carron depression (see footnote 1 above).

If water was going underground at this point, then where was its destination? Water from this area now resurges to the South East in the Fergus River, notably at Elmvale rising and its associated springs (Drew, 1988, 1990). This was probably also the original resurgence area. The Fergus River Cave, which is now only intermittently active, is certainly of about the same age. A good stalagmite date has been obtained of 42,600 yr. (+2,500 -2,400 yr.) and a less reliable one of >350,000 yr. from material in that cave (D.P. Drew, *pers. comm.*). This would seem to indicate that the present drainage pattern in this area is of considerable antiquity.

Putting these points together, the Kilcorney depression would seem originally to have formed no later than pre- or early Midlandian times at or close to the then shale edge. Given the impoverished nature of the Irish Pleistocene record, it would be considerably difficult to determine an upper age limit for this process. As the depression developed, the western valley system developed to feed it, possibly originally on shale but certainly cutting into the limestone at a time when the water table was very close to, if not at, the surface. Throughout this period, the drainage from the depression was underground, through the Cave of the Wild Horses.

The result of the ensuing glacial advance was to fossilise the system, both by beheading its catchment by eroding away the overlying shales and by lowering the water table through erosion in the Upper Fergus valley. After the ice retreated, surface drainage was re-established for a time in the valley systems described above, until new underground drainage routes developed at a lower level. This was a three stage process. In the first stage, the water continued to flow on the surface all the way to the depression, in the second it was captured about half way along this valley system at the abandoned swallets described above. The third stage is the present situation where the depression is subject only to occasional flooding. It is also possible that this process had started before the glacial episode which simply caused its completion. Evidence for this might be found by excavating in the abandoned swallets.

FLOODING IN THE DEPRESSION

It is said that if a bottle of water is filled from a flood in the Kilcorney depression and kept corked, then the level of water in the bottle will fall as the flood waters recede. One day a farmer's wife used the water from such a bottle in her bread making but when the flood was over the bread turned back to dry flour and yeast[3].

Although the area now has an established underground drainage, the depression is still liable to extensive flooding, perhaps two to four times each year. Despite comments that it now floods more frequently than it used to, this frequency is quoted with remarkable consistency in accounts as far back as the eighteenth century (Lucas 1740; Hodge, 1952; Wilson, 1965). None the less the floods can still be a trap to the unwary and at least one death has occurred here.

There is no doubt that the flood waters issue from the Cave of the Wild Horses; numerous observations have been made which confirm this, including alarming accounts of hearing the water rise whilst rigging the first pitch (Sheena Stoddard, *pers. comm.*). Although others have stated that the water first appears at the intermittent rising north of the road, in the only published account which takes this line (Coleman, 1966) it is obvious that the flood was well established before the observer reached the depression. This rising is no more than a seepage spring, typical of many in the High Burren. The well, Tobar na nAingeal, is of the same sort. It

[3] I am indebted Mrs. Susan Johnson of Kilcorney for this story.

is sufficiently reliable to feed a water trough in relatively dry conditions, as in early May 1998, but has never been implicated as a source of flood water.

The source of the floodwater must be the active streamways beneath the explored cave. The depression is close to the drainage lines from swallets on Poulacapple hill to the risings in the Fergus river and it would be surprising if there were not connections between the two. That the water is capable of backing up by a height of over 70 m indicates either that the flow routes downstream of here are still poorly developed or, more likely given the age of the caves postulated above, that their outlets are constricted, probably by sediment chokes. If, as conjectured by Wilson (1965), the explored cave is losing mud, then it may be that more of it has found its way into the active streamways, eventually to be washed away.

One odd feature of these floods is that independent observers have related them to wind direction rather than the amount of rainfall. Hodge (1952) recorded that they only occurred when "there is a N.W. wind." and in 1998, Johnson stated that they occur when there are "Westerly winds veering and getting caught into a spiral before settling into a pattern – S.W. to N.E." (Susan Johnson, *pers. comm.*). Unfortunately these observations are not sufficiently precise to devise a causal relationship, but this apparent phenomenon is mentioned here in the hope that this will stimulate further study.

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