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Preliminary assessment of the potential for the application of soil micromorphology to previously excavated Irish cave sites

Report for the Heritage Council (Grant No. 16267)

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An Chomhairle Oidhreachta
The Heritage Council

Summary
A preliminary study was carried out on the survival of *in situ* sediments from old cave excavations in Ireland, with the aim of assessing potential for soil micromorphological study of ancient use of caves and palaeoenvironmental history. The investigation comprised the development of a database of published excavated sites, the desk-based assessment of these as to their potential interest for soil micromorphological work, and the field-based assessment of a number of cave sites identified from the desk-top for survival of intact sediments. Specific recommendations are made regarding the caves assessed; in some cases there is already sufficient contextual information, and intact sections are available from which to sample, both in certain antiquarian excavations and in recent investigations.

The key results of the study are:

1) The published literature describes many primary and secondary deposits of interest recorded during the various excavations.
2) Although all the caves that could be entered were very empty in relation to their original state as described in that literature, several of those caves contained some preserved trenches or sections which would be ideal for further study.
3) In certain of these cases, however, linking the preserved sediment profiles to published descriptions, finds and dates requires a detailed study of field notebooks and drawings, which was beyond the remit of this small project.
4) The time and personnel needed for location, access, investigation and re-recording of cave sites in the field seriously limited the number of sites that could be visited, and a larger study focused explicitly on describing extant cave sediments is required to fully assess potential, even in the locales already visited during this preliminary investigation.

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Introduction

This pilot study examines the potential of known Irish archaeological and palaeoenvironmental caves for the application of soil micromorphology to ancient environmental history and cultural use of cave sites on the island. This project, the first stage of a full assessment process, focused on identifying sites of potential interest from the literature, and conducting non-intrusive assessment of the state of preservation and accessibility of cave sediments, through visits to selected sites.

Cave sites in Ireland have provided a wealth of information on palaeoenvironment and the palaeogeography of the island, particularly from the Pleistocene, from their abundant bone inclusions (e.g. Woodman *et al.* 1997), and their frequent speleothem formations (e.g. McDermott *et al.* 2001; Baker *et al.* 2000). They have also contributed enormously to our understanding of the Holocene, providing evidence of human occupation, use and perception of caves throughout prehistory and history (e.g. Dowd 1997; 2004; 2008), and of Holocene landscape history (e.g. Jones & McKeever 1987; Woodman *et al.* 1997). Despite a justified focus on the important bone and artefactual remains from the many caves investigated in Ireland since antiquarian times, there remains a relative poverty of relevant contextual information necessary to more fully discuss archaeological, palaeoenvironmental and depositional history, and local and regional environmental and landscape change. Much effort has recently been made to date cave remains such as bones, thereby establishing sequences of the presence/absence of particular vertebrates over time, and allowing better assessment of inferred environmental changes (e.g. Woodman *et al.* 1997; Woodman 2008; Searle 2008; McCormick 1999). Recent cave investigations (e.g. Dowd 2002; 2008; O'Drisceoil & Jennings 2004) have made concerted efforts to conduct more detailed palaeoenvironmental reconstruction, date sediments, and develop more complete understandings of cave contextual information regarding specific cave histories, and the lifestyles of prehistoric and historic people represented therein.

In the past two decades there has been a fluorescence of cave studies world-wide, linked with the development and application of a number of cave sediment-based approaches in environmental archaeology, and new approaches to the study of faunal and human populations. Regarding sediments, these are focused on understanding archaeological context, stratigraphic integrity of finds and dates, cave environments, and the various representations of the outside world found within cave deposits. A suite of approaches investigating depositional history, microfossil and microartefactual inclusions, sediment chemistry and dating have been successfully combined with more traditional approaches, such as the study of faunal, human and macrobotanical remains, creating a more complex understanding of human-environment interactions over long time scales, of human interest in and use of cave sites, and of palaeoclimate and environmental change (for example see Barker *et al.* 2002; 2007; Bird *et al.* 2007 regarding Asian caves). Soil micromorphology, as a method focused on contextual analysis and the depositional/post-depositional history of deposits and soils, has been usefully integrated into this suite of approaches, providing detailed information on local and larger-scale environmental change, and on cultural use-of-space in cave sites around the world (Goldberg 1979;

Courty *et al.* 1989; Karkanas *et al*. 2002; Schiegl *et al.* 1996; Shahack-Gross *et al.* 2004; Stephens 2005; Lewis 2007).

Irish cave sites, being mainly active today (with streams), and with relatively little in the way of guano deposits, have not tended to be a focus for such studies. This is despite the fact that they frequently contain datable speleothem layers separating and interspersed with artefact- and faunal-bearing layers of sediment, which is a very favourable situation for detailed investigation, providing an additional means of dating and contextualising materials. The caves of Ireland are frequently noted to contain sedimentary and archaeological deposits that are fundamentally secondary in nature, *i.e.* have been moved to their current positions from elsewhere, either from outside or within a cave system. This is a very different interpretative situation to that seen at caves in other parts of the world which contain deep guano stacks, where there are frequent 'primary' deposits, both natural and archaeological, as well as secondary or disturbed sediments, all in deep, well-preserved stratified sequences.

There is, however, great potential for environmental archaeological study from secondary sediments, and particularly where sequential build-up of such sediments can be demonstrated, even if these sequences are inverted. The study of secondary sediments is practically the norm in geoarchaeological landscape studies (e.g. of alluvial and colluvial deposits), and in studies of archaeological monuments and settlements (e.g. fills, mound/bank build-up etc.). Soil micromorphology is frequently used in archaeology expressly to investigate the original depositional environment of materials that are not in their original position, and provides information on issues such as location of origin, means of deposition, post-depositional alteration, integrity and preservation, as well as offering a means to explore micro-inclusions and micro-indicators of cultural alteration and disturbance. The interpretative value of the faunal, human and artefactual remains found as inclusions in cave sediments in Ireland is so high that there is merit in assessing extant deposits for their potential to provide more detailed contexts for the many finds, as well as for information within sediment profiles themselves on ancient environment. This premise is the basis for this study.

Desk-based assessment

A database of known relevant sites was drawn up, and sites reported to have deep or interesting sediments were short-listed for further assessment (Table 1). As a rule, soil micromorphology is a particularly useful approach for sediments composed primarily of fine sediments (sand-, silt- and clay-sized); this includes many types of archaeological deposit. The approach can be used on disturbed soils and sediments, with the caveat of limited interpretative power, as is the case for disturbed contexts in all archaeological investigations. Thin sections can also be studied from various speleothem deposits. The desk-based study therefore focused on sediment descriptions and discussions of depositional history provided in the literature.

Based on the published literature, many of the excavated Irish caves investigated are considered to have had at least some deposits appropriate for soil micromorphology at the

time of their excavation. However, for the aim of exploring cultural use of caves and palaeoenvironmental history, the caves were divided into those with high, medium or low potential. This ranking was based on the following described characteristics:

- depth and perceived integrity of sequence upon excavation
- presence/absence of comparative inclusions (e.g. artefacts, bones, dated materials)
- presence/absence of identified *in situ* features or 'culture layers' (e.g. hearths, layers of charcoal, 'surfaces')
- noted sediment disturbance; indicators of primary/secondary deposition
- descriptions of state of the excavations upon completion (e.g. 'cave entirely cleared out' = low; 'a large area was left' = high)
- availability of section drawings and trench plan locations
- occurrence of other palaeoenvironmental or dating studies (e.g. pollen, phytoliths, speleothem dating)
- notes on ease of access (due to time and personnel considerations)

On the basis of the desktop, a short-list was constructed (Table 1). It should be noted that the literature search at this stage of the study focused heavily on antiquarian investigations and a few major recent summaries, and should not be considered to be exhaustive by any means. A number of other caves of interest are included in the project database, but are not listed here; these are mainly caves which are listed simply as 'relict', have seen calcite dating, were excavated to bedrock, or are reported to be modified or 'souterrains' – these caves were not of high priority at this stage of the study.

Site visits

As there has been little published recent investigation discussing the survival of old trenches and sections in excavated cave sites, or the distribution of unexcavated sediments, the second phase of the pilot study comprised visiting a number of sites to see what sediments survive. The sites visited from the short-list (Figure 1; Table 2) were chosen on the basis of time constraints (proximity to each other, distance from Dublin), personal recommendations, and locations of recent cave investigations (for comparative purposes). Five regions were chosen: Fermanagh, South Clare, Sligo, Waterford and Cork. However, only four of these regions were visited, with Cork falling off the list due to unforeseen issues with site location in Fermanagh (see below). In all cases efforts were made to gain land owners' permission, and considerations such as environmental protection were taken into account. In addition, no caves with tight crawls, vertical drops, active streams, subject to flooding or which required climbing equipment were assessed, to ensure safety of the one- or two-person field teams. These issues are discussed further below, and are reflected in the 'accessibility issues' column of Table 2, which presents a list of sites targeted in each of the visited areas.

Table 1 Preliminary short-list of Irish cave sites with potential for soil micromorphology based on literature, by county[1]

Cave site name	County	NGR	Pre-visit ranking & reason
Ballintoy (6 caves)	Antrim	D 045 445; D 120 413	Medium – sediments marine & not high re. ranking, but *in situ* archaeological structures described
Portbraddan	Antrim	D 008 443	Low/medium – mostly gravels, but stratified archaeological deposits, including *in situ* hearths
Alice & Gwendoline (2 caves)	Clare	R 3225 7482	Low – mostly dug out; vicinity of other caves with high potential
Barntick/Cragmore	Clare	R 3266 7285	Medium – possibly lower layers of interest
Bats'	Clare	R 3266 7370	Medium/high – interesting sequences, with *in situ* archaeological deposits described
Catacombs	Clare	R 3210 7450	High – complex system, interesting sequences, including *in situ* archaeological deposits described
Elderbush	Clare	R 3233 7299	High – interesting sequences, including *in situ* archaeological deposits described
Glencurran	Clare	R 2734 9635	High – under current excavation; many interesting archaeological deposits
Robbers' Den	Clare	M 1097 0245	Medium – interesting archaeological deposits; recent excavation
Carrigtwohill (Old)	Cork	W 820 730	Medium – clay under speleothem
Castlepook	Cork	R 613 103	Low/medium; famous fauna caves; large grid system
Castletownroche 7 (Foley)	Cork	R 685 010	Medium-high – deep, stratified, speleothem 'sealed' deposits; faunal & human remains
Killavullen (4 caves)	Cork	W 648 997	Medium-high - 4 archaeological caves; stalagmite floor with embedded finds
Knockane Cross 1-4	Cork	W 9830 7425	Medium - several caves excavated; recent investigations
Marble Arch; Pollnagollum; Pollthanacarra	Fermanagh	H 121 344; H 1278 3386	Medium/low - palaeoenvironmental studies
Knockmore (15 caves)	Fermanagh	H 0844 5047; H 088 497; H 088 504	Medium-high – many excavated caves in one location; interesting archaeological deposits; various deposits

(continues on next page)

[1] Citations used in this table: Adams 1879; Adams *et al.* 1881; Baldini *et al*. 2006; Bayley Butler *et al*. 1930; Boulger 1875; Brenan & Carte 1860; Bryce 1835; Chamberlain 2000; Coleman 1934, 1944, 1965; Coleman & Stelfox 1945; Condell 1985; Connolly & Coyne 2000; Cremin 1991; Dawkins 1874; Dowd 2002, 2004, 2008; Dowd & Corlett 2002; Drew & Huddart 1980; ESCR website; Evans 1910; Fogg 1993; Gwynn *et al*. 1940, 1942; Hardman 1875; Jackson 1933, 1936, 1938; Jackson & Gaffikin 1934; Jones & McKeever 1987; Leask 1934; Lindsay 2008; May 1934, 1943; Movius 1935; Mullan 2003; O'Drisceoil & Jennings 2004; O Floinn 1992; O'Kelly 1942; O'Shaughnessy 1994; Oldham 1981; Plunkett 1876, 1877, 1878, 1879, 1898; Ryder 1989; Scharff 1895, 1902, 1906; Scharff *et al*. 1903, 1905; Stelfox 1930; Thompson & Maloney 1993; Tratman 1929, 1937; Tratman *et al.* 1928; University of Bristol Spelæological (Caving) Society Website (www.ubbs.org.uk, accessed 2008); Ussher 1882, 1902; Wakeman 1866, 1896; Woodman *et al*. 1997; Woodman & O'Shaughnessey 2003.

Knockninny	Fermanagh	H 273 300	High – stratified deposits described; interesting archaeological deposits
Cloughermore	Kerry	Q 906 126	Medium – large passage; interesting archaeological deposits; recent studies
Dunmore	Kilkenny	S 50940 64950	Medium-high - interesting archaeological deposits, stratified sediment & speleothem sequences
Annagh	Limerick	16930 15810	Low (destroyed by quarrying?) - recent excavation
Grange Hill	Limerick	R 783 495	Medium - 4 entrances; uncertain survival
Killuragh	Limerick	R 643 407	Medium - recent investigations; test pits mentioned; secondary deposits
Red Cellar	Limerick	R 633 414	Low/medium - uncertain; faunal & human remains
Kesh 1-7	Sligo	G 706 121-3; G 707 118	High - interesting stratified sequences described
Knocknarea (9 caves)	Sligo	G 6190 3480; G 6170 3500	Medium-high - several archaeological caves in one locale
Mitchelstown (Old)	Tipperary	R 9245 1679	Medium; trial pits excavated (no finds)
Ballynahemery	Waterford	X 1659 9617	Medium/low - trial trench (no finds)
Ballynamintra 19	Waterford	X 1638 9485	Medium/high - stratigraphy described; interesting remains; calcite dating
Ballynamuck 1	Waterford	225004 094348	High - under current excavation
Ballynamuck 2	Waterford	224674 094482	High - under current excavation
Brothers & Oonaglour	Waterford	X 1565 9528	Medium & low - many interesting finds, some described as washed in; trial trenches mentioned; Oonaglour said often submerged
Carrigmurrish	Waterford	X 1689 9463	Medium/low – trial pits with clay under stalagmite (no finds)
Kilgreany	Waterford	X 1760 9432	Low (all cleared out?) - area of high ranking caves; recent reassessment
Shandon	Waterford	X 2573 9418	Medium/low - faunal studies

Limitations

Assessing cave sites is a time-consuming process which entails locating in the field caves corresponding to those cited in the literature (and eliminating caves that are not of interest – there were many caves in each area visited, most of which have no published archaeological or palaeoenvironmental value). Success at this varies with the quality of maps available, of details given by previous investigators, and of local knowledge of the landscape. Vegetation cover also proved difficult at times regarding cave visibility; for instance, all caves visited in South Clare were covered with overgrown thorny vegetation; indeed, one cave was not found despite knowing – and being at – its exact recorded location (see Table 2).

Figure 1: Caves visited in the pilot study and discussed in the text

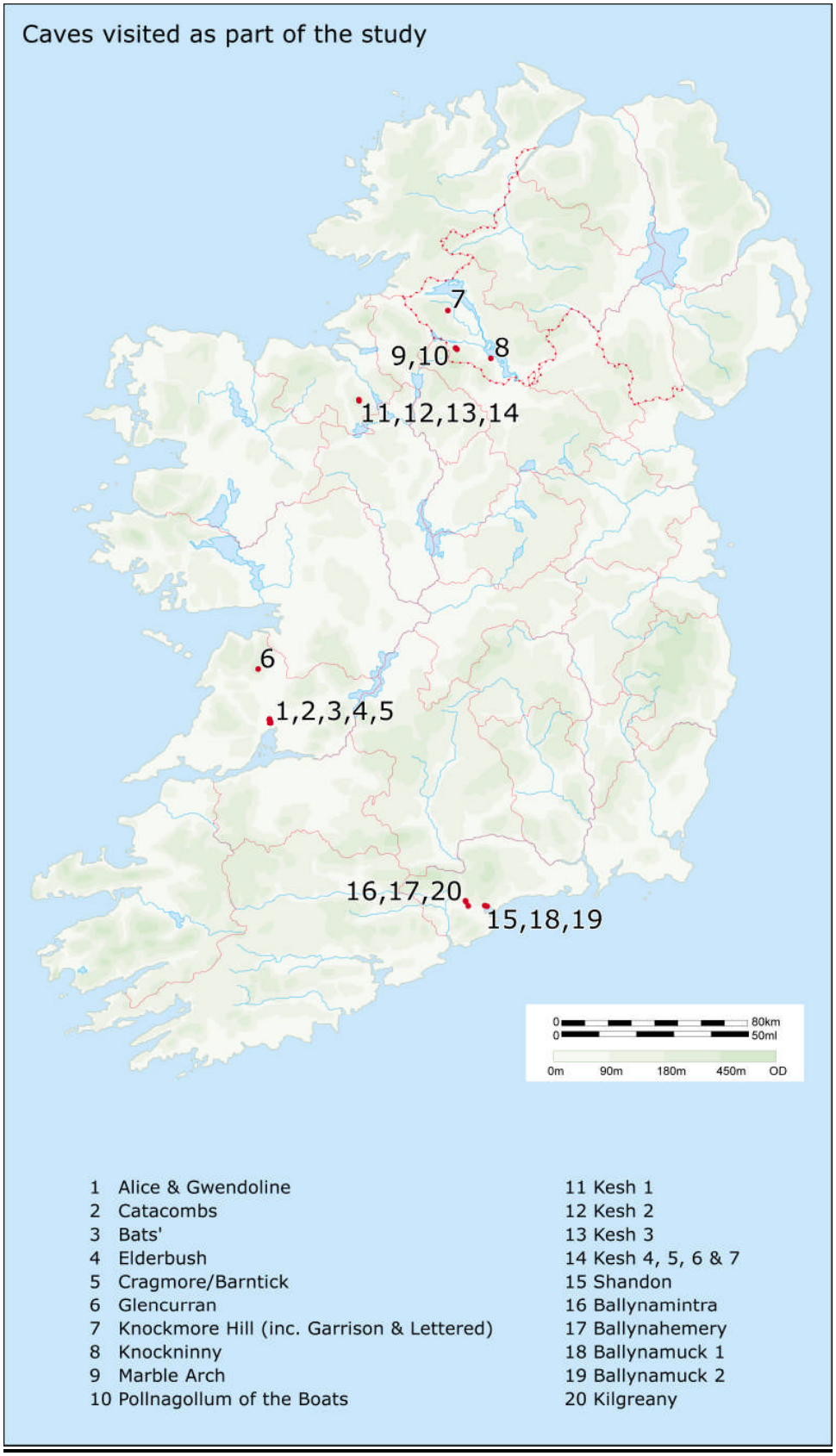


Table 2 Cave sites visited during the preliminary assessment phase

Site name	County	Accessibility issues
Knockninny Cave	Fermanagh	None
Knockmore Hill (15 caves)	Fermanagh	Site location and identification very problematic (see text)
Marble Arch Cave	Fermanagh	None; access to Pollnagollum of the Boats impossible without swimming
Kesh Cave 1	Sligo	None
Kesh Cave 2	Sligo	None
Kesh Cave 3	Sligo	None
Kesh Cave 4	Sligo	None
Kesh Cave 5	Sligo	None
Kesh Cave 6	Sligo	None
Kesh Cave 7	Sligo	None
Shandon Cave	Waterford	None; interior not accessed – downslope through narrow crawl over loose sediment
Ballynamintra Cave	Waterford	None; deepest passages not accessed
Ballynahemery Cave	Waterford	Not accessed; land owner not available for permission
Ballynamuck Cave 1	Waterford	Located, but not accessed; temporarily closed off due to ongoing excavations; site already known to have potential (under excavation by C. O'Drisceoil)
Ballynamuck Cave 2	Waterford	Not accessed; site already known to have potential (under excavation by C. O'Drisceoil)
Kilgreany Cave	Waterford	Not accessed; quarry owner could not be contacted; site thought to have low potential
Bats' Cave	Clare	Located, but not accessed; site closed due to hibernating bats
Catacombs	Clare	Not accessed; site closed due to hibernating bats
Alice Cave	Clare	Located, but not accessed; site filled with soil up to 20cm of entrance roof
Gwendoline Cave	Clare	Located, but not accessed; site filled with soil up to 30cm of entrance roof
Elderbush Cave	Clare	None
Barntick/Cragmore Cave	Clare	None known, but cave could not be found despite using GPS and a long search.
Glencurran Cave	Clare	Locked; site already known to have potential; will be accessed with site director (M. Dowd) in early December 2008

Although cave location was not normally problematic, in the case of Knockmore, Fermanagh, it proved impossible to find the targeted caves. The excavator of this set of reported 15 archaeological caves did not produce a map of cave location, despite several publications on the caves (Plunkett 1876; 1878; 1879; 1898), and his field notes have never been found (Lindsay 2008). Early large-scale OS maps show some caves, but not all, and it is clear based on the recent survey of the caves of Fermanagh (Jones *et al.* 1997) that many of these are active caves or pots (see Lindsay 2008 for a discussion of the difficulties of matching Plunkett's cave sites to the known caves). The recent caving survey has produced detailed maps of the many caves on the hill, with their grid references, but has little topographical information or other landmarks, and is also at a very small scale. Local knowledge was also difficult to access, with the hill apparently abandoned for occupation, and little information forthcoming from landowners. Finally, the sheer size of the hill, its microtopography and ground cover made it extremely difficult to locate specific caves on the ground. This situation also limited Lindsay's recent study (2008 & pers. comm.). For this project, a list was drawn up of likely archaeological caves based on Plunkett's publications, Lindsay's dissertation and the recent caving survey (all *op. cit.*) – these comprise a number of caves listed as relict (no stream), including some which may fit some of Plunkett's sparse location notes and cave descriptions, and using the NGR coordinates given by Jones *et al.* (1997). None of these particular caves were located during the visits. Knockmore is discussed further below.

Although there were a few issues regarding locating land owners, and closed caves (see Table 2), the only major limitation in the field-based assessment was that of perceived risk to personal safety. Many of the caves visited were deemed to be partially or wholly inaccessible due to backfilling, the need to carry out crawls on slopes of loose sediments, vertical climbs, and the possibility of getting lost or stuck in the deeper passages. The field teams always comprised only two people (only one person in the case of Keshcorran), mobile phone access was variable, and it was difficult to predict how long it would take to find, enter, explore and record the various caves on any given day's agenda; i.e. it would have been difficult for others to judge if we were missing until the end of any given day, and where exactly on our itinerary we would be at any given time. This situation would be improved by increasing the basic team to at least three people (one of whom would stay outside at each cave site), or having dedicated check-in times with a third party throughout the day. This limited our ability to fully explore potential areas of certain caves.

Due to time constraints, it was at no time possible to re-map or re-describe in detail any cave visited, although trench and section locations found were noted on existing plans from publications, and basic field descriptions were made. All caves entered were examined both regarding the potential for soil micromorphology sampling from earlier excavation trenches, and potential if future intrusive investigations were conducted. Despite the limitations mentioned, the small subsample of caves that was successfully entered did regularly produce remains demonstrating that there is potential for future investigation through soil micromorphology and other sediment-based approaches.

Field assessments

Kesh Caves, Sligo

The Kesh Caves saw major excavations in 1901 (Scharff 1902; Scharff *et al.* 1903; Ussher 1902) and 1929 (Bayley Butler *et al.* 1930), producing numerous archaeological and faunal remains, dating mainly from the Neolithic/Early Bronze Age on into historic times. The site is known as a site for Lughnasa celebrations, and the caves are located high up the side of a large limestone hill. All are relict, easily found and easily accessible. They are described here by number, which is correlated with the lettering system given to the entrances and the names given to the caves during excavation in the text below. The caves to the centre and south of the cliff held much more obvious potential, primarily because a number of these have seen previous excavation, and the upper sediment sequences were still visible in a number of places within them.

Kesh Cave 1 is a small cave 5m long. It has one entrance (A), was very small and somewhat difficult to access. No sediments deemed worthy of sampling were seen.

Kesh Cave 2 (Principal Cave) is a small network of passages with five entrances (B, C, D, E & F). Entrances E-F enter into one main chamber, with an active drip line running along its centre. The mouth floor slopes down from back to front, with shallow modern cave sediments overlying a layer influenced by calcium carbonate formation (tufa/speleothem or possibly breccia layer). This area is connected to entrances B, C and D by side tunnels with little headroom, which had to be crawled through. These side tunnels show little sign of disturbance. The mouths and main chambers in B, C and D showed strong influence by water dripping and run-through, with mainly flat floors of reddish-brown cave sediments with zones of gravel, which held no obvious sediments of interest for soil micromorphology sampling. In entrance E there was a small block of sediment upstanding, comprising c. 30cm of soft calcareous deposits over a hard travertine layer, over layers of greyish brown earth and travertine (Figure 2). This has yet to be linked to any of the reported excavations.

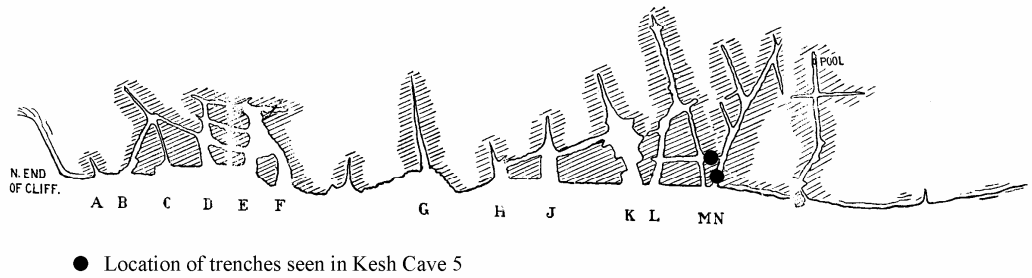
Kesh Cave 3 (Entrance G) revealed no sediments deemed worthy of sampling without further excavation.

Kesh Cave 4 (Coffey Cave) is a small network of passages with three entrances (H, J & K). Entrance J has a large, very wet entrance area with exposed gravel on the surface. Entrance K also had a gravelly and rocky surface in a flat entrance area; in this cave it appears that a great deal of sediment may have washed out to the slope below, although some zones of potential build up were seen. Gwynn *et al.* (1940) also noted that most of the Kesh cave mouths showed flushing through by water. This cave would require renewed intrusive investigation for any micromorphological study.

Figure 2 An upstanding block of intact sediment in Kesh Cave 2, entrance E

Kesh Cave 5 is a further network of passages with three entrances (L, M & N). Bayley Butler *et al.* (1930) describe a number of trenches, including one excavated between entrances M and N (Figure 3), running the length of cross-gallery B; this trench was dug for the purpose of draining off water from entrance N. The entirety of this trench is well preserved (Figure 4a), revealing a sequence of thin calcareous layers overlying and within a dark greyish brown clayey sediment, overlying a thick layer of calcareous speleothem deposit, which becomes more solid with depth. The latter may be (but this remains to be confirmed through detailed study of the archives) at the same part of the sequence as the uppermost exposed deposit in a small rectangular trench found inside entrance N (Figure 4b). This partially backfilled trench may be a trench excavated by Bayley Butler in his 1929 excavations (Gwynn *et al.* 1940). It revealed a well-preserved upper section of soft calcareous sediment (c. 25-30cm thick) overlying brown clayey sediment (Figure 4c). Black charcoal fragments and flecks were visible, but without cleaning the section it is not clear if these were within the deposit or simply lying on the surface. These deposits could be sampled for soil micromorphology study; it would be interesting to dig out some of the backfill and clean, record and sample from the entirety of the upper profile. Occasional lumps of upstanding profiles were also found in other parts of Cave 5 including in Cave L; these were primarily composed of soft calcareous sediment, and may relate to the excavation described by Gwynn *et al.* (1940), although no direct correlation was made with specific trenches.

<u>Figure 3 Location of preserved trenches seen in Kesh Cave 5, indicated on part of Scharff *et al.*'s (1903) plan of cave locations (for scale see Scharff *et al.* 1903)</u>



All of these profiles could easily be cleaned back, recorded and sampled for soil micromorphology study; the general sequence agrees with Scharff *et al.*'s (1903) descriptions of the upper layers in the excavated caves: shallow surface layer overlying stalagmite, overlying brown earth. The sequence in the entrance N trench also agrees very well with the profiles described in the internal part of entrance L: a stalagmite floor of varying thickness overlying a layer of 'brown earth' (Gwynn *et al.* 1940). The calcareous layer was noted by the excavators to contain faunal remains brought in by predators, and some charcoal. Underlying the stalagmite layer were layers with charcoal, bones of field mouse, bear and Arctic lemming, along with more recent bones (cat, sheep, rabbit) interpreted as intrusive (*ibid.*). This upper profile overlay clays, sands and gravels (as also described in the other caves by Scharff *et al.* 1903). Since the deposits found in Cave 5 can be related to described deposits with datable inclusions (charcoal, bones, calcite deposits), the two sets of trenches noted here have excellent potential for future soil micromorphological study.

Kesh Cave 6 (entrance O) is one long passage ending in a pool. No deposits of interest were noted. Kesh Cave 7 (Plunkett Cave) is another grid of passages with three entrances (P, Q & R). Although listed as being at the same altitude as the other caves in the literature, it is in fact several metres above the others as well as some distance around the hill, and was slightly difficult to find. This cave showed a disturbed floor, with frequent shallow wet depressions (similar to those seen next to the trench in Cave 5 in Figure 2b), and was obviously very disturbed. No upstanding profiles or trench outlines were located in the entrances; the deeper passage was not investigated.

Figure 4 Deposits in Kesh Cave 5

4a. Drainage trench in cross-gallery B between entrances M and N (gallery is c. 0.9m in height)

4b Partially backfilled excavation trench (c. 0.8 x 1.3m) in entrance N of Kesh Cave 5

4c Detail of the exposed section in the trench in entrance N, showing calcareous layer (c. 20-25cm thick) over brown clayey sediment.

Dungarvan, Waterford

A number of caves were visited in the area north and west of Dungarvan, Co. Waterford. These caves were easily located and have easy access (where open). It is known that two caves have medium to high potential for soil micromorphological study – these are the two Ballynamuck Caves currently undergoing excavation by C. Ó Drisceoil. These were blocked for entry, and the Ballynahemery and Kilgreany Caves were inaccessible pending access permission. Although it is ranked at low potential (Table 1), Kilgreany will be visited in December 2008 with M. Dowd, the current excavation director. Two caves were entered in the area: Ballynamintra (Cave 19) and Shandon Cave. At Shandon Cave, the entire mouth appears dug out, and access to the rest of the cave entailed a low crawl over what appeared to be loose backfill; efforts to access more of the cave were soon abandoned. No deposits of interest were seen.

Ballynamintra

In the 1881 published description of the Ballynamintra Cave (Adams *et al.* 1881), the following general sedimentary sequence was noted: brown earth (18-24 inches thick) over a grey layer of 'earth and calcareous Tufa' (14-20 inches thick), over a layer of 'pale sandy earth' (no thickness given - p. 183). These layers contained charcoal, artefacts, bones and pebbles of limestone and sandstone. Underlying this sequence was a stalagmite floor (12-42 inches thick), sometimes broken, with faunal remains. This overlay a layer of gravel with faunal remains which lay on the rock floor of the cave (*ibid*.).

Only spoil was seen up to c. 12m in from the mouth of the cave, but after passing through a few tunnels and chambers, in an internal chamber immediately underneath a large flowstone formation, we located an excavation trench, two sides of which remain intact. This trench shows up to 40cm of flowstone cut through, overlying c. 30cm of brown clay with calcareous inclusions, over a 1cm thick layer of unidentified dark brown clayey material, over 50cm (exposed) of brown clay with occasional layers of fine gravels (Figure 5). This profile does not match any of those described in the early reports, in which the speleothem layer is stated to overlie fine gravels, although there are areas in the outer parts of the cave where Ussher describes brown or grey fine sediment infiltrating or filling in hollows in the speleothem (Adams *et al*.1881). As can be seen from Figure 5, this explanation does not necessarily fit with an intact, sealed and apparently stratified series of deposits. The location is obviously a trench edge, and cannot easily be explained away as one of the zones of broken up speleothem described in the outer parts of the cave (*ibid*.). Further investigation of the literature is required to identify this trench and sequence.

However, even if it were a secondary deposit, this profile could immediately be sampled for soil micromorphological study. In particular, the nature of the thin dark brown layer (Figure 5b) could be identified in thin section. Options for its origin may include: illuviated amorphous organic matter, a brief phase of guano deposition, micro-comminuted charcoal, amorphous iron and/or manganese staining. As contextual information is currently lacking, and since this was the only intact sediment profile located, any sampling would need to be undertaken with great care regarding preservation for future research, and only after additional desk-based investigation.

Figure 5 Trench cutting located in Ballynamintra Cave 19, with intact sediments

5a At the base of a flowstone formation, there is a clear trench (two sides visible) cut through a deposit of hard speleothem layers, and overlying a thick deposit of brown clay and fine gravels.

5b Just above the location of the matchbox a thin layer of black material is seen in between two layers of brown clayey sediment. The nature of this layer could be assessed through soil micromorphological study.

Knockninny, Knockmore & Marble Arch, near Enniskillen, Fermanagh

Knockninny

The archaeological cave on Knockninny was easily reached with permission and directions from the local farmer. It is located partly up the southwest side of Knockninny Hill, and is a short passage running through the rock, with two entrances. The cave was excavated by Plunkett (1877), who describes five layers in the East entrance: an upper layer of small angular limestone pebbles covering the whole surface; a second layer of black 'mould' with some charcoal, human and animal bones; a third layer of brown compact sediment with interpreted fired limestone fragments, pottery, human and animal bones; a fourth layer of yellow clay (with 'veins of brown earth') with charcoal, human and animal remains; and a lowest layer of gravel covered by yellow sandy clay, in which he found two lithics, human and animal bones, and charcoal. The deposits in the west entrance followed a similar sequence, which may represent the Mesolithic/Neolithic through the Bronze Age (Dowd 2004).

The cave is very narrow, but upon entry a clear change is seen in the cave floor in both entries, marking the edge of Plunkett's excavations: about one third of the way in from both entrances, the floor changes from a dark brown silty soil (possible backfill) to a densely packed angular limestone cobble layer embedded in the surface layer (Figure 6).

Figure 6 Inside Knockninny Cave

Backfill meets the intact upper layer of angular stones inside Knockninny Cave at one end Plunkett's trench. A similar boundary is seen at the other side of the central narrow area of the cave.

This layer of angular stones, and the measurements of the two proposed trench edges exactly correspond with Plunkett's (1877) excavation description. While there are no exposed profiles for immediate sampling, it is clear from the literature that there is high potential at Knockninny for soil micromorphological investigations if the backfill were removed from one or the other entrance to expose the intact profile. It would be very important to try to obtain datable materials from these profiles, particularly the charcoal mentioned by Plunkett (*ibid.*) in most of the layers.

Marble Arch

The archaeological area at Marble Arch Caves could not be visited without diving gear, but the show cave was visited, courtesy of the Geopark. In the main cave system open for visitors there are a number of fluvial and speleothem deposits with possible potential for archaeological research, particularly sediment-based studies of pollen or other inclusions, and dating. These include mainly well-sorted sand and clay deposits, and those with particular potential would be the sediments located in currently dry streambeds and as banks along water courses. Pollen was previously found in two organic layers in a sand and gravel bank in one part of the system, thought deposited by floodwaters, and to date to between 7500-3500 yr. B.P. (Jones & McKeever 1987); a phytolith study from Pollnagollum of the Boats showed local plant types around that doline (Thompson & Maloney 1993), and the same area (Pollthanacarra) contained three human skeletons, one of which has been radiocarbon dated to c. 4650 yr. BP (Dowd 2004, citing Doughty 1995). The cave has also seen dating of speleothems to 70,000 ya (ESCR website). The nature of the organic layers reported by Jones & McKeever (1987) is not clearly described, but they record a well-stratified sequence of flooding deposits; it would be very interesting if further studies were carried out of this type to learn more about the organic deposits found in the cave system. Soil micromorphological potential from such sequences is uncertain but probably low.

Knockmore

Knockmore has been described briefly above regarding issues of cave identification. In her recent survey, Lindsay (2008) found eight caves, none of which definitely match the descriptions made by Plunkett (1876; 1878; 1879; 1898). At Lettered Cave, Lindsay recorded evidence of possible undercutting of one of the walls; this cave was suggested to have been partly 'constructed' by Wakeman (1866), and Lindsay states that it could not be determined whether this undercutting was evidence of an excavation or of such modification (*op. cit.*).

Garrison Cave did contain deposits with archaeological materials in them (primarily charcoal), and that appear from Lindsay's description to have been dug through at some time. In this large cave Lindsay (2008) describes broken stalagmite floors, above which are 'large pieces of charcoal, some…embedded in the wall (in calcite) deposits…0.5m from the floor' (p. 38-39). This is a classic description of the remains of a cave excavation, with a thin layer of deposit being left on the cave wall, and I have seen several examples of this in excavated caves in Southeast Asia. As Lindsay suggests

(*ibid.*), it would be very useful to look more closely at this cave and this deposit, and to take charcoal samples for dating. It seems likely that this cave is one of those excavated by Plunkett, although whether it is one of those described in his papers is still uncertain.

The two visits to Knockmore Hill by this project further demonstrated how desperately a detailed georeferenced topographical map is needed in order to assess these caves, as discussed above. Both Lindsay's and this assessment have concluded that the hill is a large job; I estimate that it would require a team of four people at least four-five days to both survey the hill for relict caves, and then explore and record those caves for their archaeological potential and the preservation of previously investigated trenches. Linking these to Plunkett's excavations is a bit of a logic problem that could be solved if a systematic ground survey were conducted. That level of work was unfortunately financially beyond the remit of this project.

Given the type of backfilling seen at Plunkett's site at Knockninny, which appears to have preserved intact his trench outlines, and the fact that the locations of most of the 15+ archaeological caves on Knockmore have yet to be rediscovered, and are probably therefore relatively undisturbed, it seems that this hill has enormous potential for additional studies. One further trip, to meet with Lindsay and at least visit (and record the exact locations of) her caves, is already costed within this project for the first week of December 2008. The large amount of work needed to fully assess the Knockmore caves will require additional funding.

South Clare – Ennis region

Attempts were made to visit a number of caves in the region (Table 2), but of those listed only one could be entered (Elderbush Cave). As anticipated, Alice and Gwendoline Caves were small and appeared to be filled with backfill (Dowd 2004). Bats' Cave and Catacombs could not be entered due to hibernating bats at the time chosen for visiting. Unfortunately, the Barntick/Cragmore Cave could not be located, despite having known co-ordinates; we spent a long time searching around the recorded location through a very overgrown thorny area, but to no avail. This cave, along with Bats' Cave and Catacombs, were held to have medium to high potential, and all should be re-visited for assessment. The other site targeted for a visit at this stage in Clare is located further north – Glencurran Cave is currently under excavation by M. Dowd, and will be visited with her in early December 2008 as part of this pilot project.

<u>Elderbush Cave</u>

Elderbush Cave excavations are described by Scharff *et al*. (1906). It is located in the same escarpment as Bats' Cave, and overlooks a path leading to a holy well site. The excavations describe sediments in the main cave (Elk Gallery) as loose brown earth (5ft deep) with included a charcoal seam (2ft below surface); while the main upper layer was thought to be disturbed in places, the description of a layer of charcoal suggests a possible intact surface, series of hearths, or archaeological midden layer. One gallery was said to also contain pink-brown clay at the base of the profile (*ibid*.). The cave

excavations produced faunal and human remains, including a pelvic bone dated to c. 4800 yr. BP, charcoal, a perforated shell and boar tooth, and a few lithics (Dowd 2004).

The cave has a large and easily visible entrance (once the correct part of the brush-covered escarpment was explored), with two smaller caves/entrances recorded nearby (not explored). Although the entrance passage (Elk Gallery) appears completely dug out to rock, the cross-passages and interior areas contain sediment; mostly this does not look very promising, and it seemed that some of it was spoil, while other areas appeared to be natural infills of small side tunnels. However, in the main cross-passage to the right off the Elk Gallery, sediment profiles remain adhered to the cave walls (Figure 7). In some places these 'sections' appear thick enough to take block samples for soil micromorphology. One particularly good profile (Figure 7c) is obviously cut through and must be an old trench edge. The profile shows a series of calcite speleothem layers overlying brown clay. This section could easily be studied micromorphologically, and appears to match the following description (Scharff *et al.* 1906): '…a bed of hard stalagmite…in layers (over)…a pinky-brown clay…in the innermost gallery to the right'. These deposits were not noted to have produced any finds (*ibid.*).

Conclusions

Although small-scale, this project has positively demonstrated that several of the archaeological caves explored do contain undisturbed *in situ* deposits (whether secondary or primary remains uncertain), which could be investigated for further archaeological, dating and palaeoenvironmental information, and which are appropriate for soil micromorphological study.

In general regarding the literature review, the need for more extensive study to develop the background contextual information needed for sediment-based approaches has been noted above. As an additional comment, at several places in the literature archaeological finds are reported from 'midden deposits', which are described as infills in passages and cracks in caves. This type of material is not noted to be well stratified, but it is reasonable to assume that as sediments plug and fill in these holes over time, stratified records could remain. While these are normally disturbed materials from the surface or other parts of a cave system, they can be re-deposited in a progressive fashion, particularly where a plug is created. It is unclear to me what precautions, if any, have been taken during recent caving exploratory digging to ensure that such infills are excavated with the advice of archaeologists or sedimentologists regarding the potential to identify depositional stratigraphy (even if reversed) of the archaeological and palaeoenvironmental record held within them. With regard to deposits flushing in from the surface in particular, a stratified plug could contain interesting information on the history of the local landscape in addition to the more obvious artefactual finds.

Figure 7 Sediment sections in the right cross-passage at Elderbush Cave

7a Multiple layers of a speleothem deposit, 3-25cm thick in total, overlying intact brown clay sediment

7b A second location of the same sequence

7c A third location, showing potential width of remaining deposit, which is sufficiently wide to take block samples from

In terms of potential for soil micromorphology, several of the excavated caves entered contained intact and easily identifiable old trenches or profiles; indeed some trenches were already open and could be cleaned, recorded and sampled in one day. It was rather surprising to find that even easily accessible caves, such as those at Keshcorran, contained obvious trenches and sections in good conditions of preservation. Other caves would require excavation of backfill for further assessment, and before recording and sampling from old sections. For instance, at Knockninny, where the antiquarian trench edges are visible from the surface, exposing the trench sections through removing the old backfill from one side of the cave would be a relatively simple job.

Other caves visited which were not clearly archaeological also contain substantial sedimentary deposits which could be further investigated, at least for palaeoenvironmental evidence (e.g. the active parts of the cave system at Marble Arch). Further application of OSL and U-series dating methods, and re-sampling of preserved sections for radiocarbon dating, could provide a comparative dating framework contexualising the faunal remains and interpreted Pleistocene-Holocene environments from the sediment record. In particular, dating speleothem layers found within and between earth-based sediments would be of great interest; a project doing exactly this has begun dating such deposits in archaeological sites in Southeast Asia, exploring the impact of the Last Glacial Maximum and other climate changes on the region, and also providing dates and information on stratigraphic integrity for overlying and underlying archaeological deposits (Lewis *et al.* 2008).

The general recommendations of the pilot study are that a larger-scale assessment be carried out, with provision for personnel to assist with desk-based and field-based research (including some extensive mapping and recording). A larger project would allow more complete exploration of cave systems for sediment profiles and old trenches, and a much deeper understanding of the excavations and the published sedimentary sequences, and the finds and dates directly associated with them. This should aim at developing the contextual integrity necessary for interpretation using soil micromorphological and other sediment-based approaches. A full re-assessment of many more archaeological and palaeoenvironmental cave sites is required to realize the potential for Irish cave archaeology of the application of soil micromorphology or other sediment-based approaches. This preliminary study has shown that it is definitely worth carrying out a larger assessment of this kind.

Despite recent efforts in new excavations, little work has yet been done to further contextualize and add comparative sedimentary data to the masses of palaeoenvironmental (primarily bone) material found from antiquarian cave investigations. Since the bone archive is a key set of primary data regarding the prehistory of Ireland, and provides a large part of the story of the environmental history of the island, the reinvestigation of caves throughout the island should remain a very high priority for archaeology and palaeoecology. Most previous field investigations were carried out before radiocarbon dating, and before the invention or application of most of the currently standard approaches to investigating and dating cave sediments (e.g. OSL &

U-series dating, isotopic studies of speleothems, micro-fossil approaches, geochemical analytical approaches, soil micromorphology). Since at least some intact cave sediments can be seen to survive from old excavations, and in good condition, it seems particularly important to use these to provide additional contextual information for the faunal assemblages, to develop more detailed local cave histories, explore variations in these in different parts of the island, and to get an even more detailed sense of the human use of caves in prehistory and history.

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