The Dungarvan Valley Caves Project: Second Interim Report

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Introduction

The 2006 issue of *Decies* included the first interim report from the Dungravan Valley Caves Project (Ó Drisceoil & Jennings 2006). This paper provides an update on the work that has been carried out since then and focuses in particular on one of the most important caves in the valley, Ballynamintra.

The Dungarvan Valley Caves Project

In England and Wales Palaeolithic archaeology has been documented since the seventeenth century and recent years have seen this record greatly augmented through the work of the *Ancient Human Occupation of Britain* project and the *Palaeolithic Settlement of Wales Research Project*. As a consequence Palaeolithic studies are now at the centre of British archaeological research. Ireland however provides a stark contrast: there is not a single stone tool or piece of modified bone that can with certainty be said to represent a human occupation of this island prior to 10,000 cal. BP, (before the present). Consequently the subject rarely features in archaeological discourse on this island, despite the fact that the origin of human settlement here is a question that is still far from resolved (Woodman 1986; 1998).

Explanations for the absence of an Irish Palaeolithic have traditionally centred on two tenets. Firstly that Ireland, being on the periphery of Ice Age Europe was simply a step too far for early human populations to reach and secondly, that if occupation had occurred here the destructive affects wrought by the Pleistocene glaciations would have destroyed any evidence that might have formerly existed. In many ways it is difficult to refute these arguments, for the simple fact is that thus far, apart from a handful of stray finds, reliable evidence has not been found.

Ireland however, shared largely the same conditions that made human settlement possible in much of Britain, many of the same species hunted by these populations were also present in this country and there was an intermittent land connection linking areas of human population in Wales with the east coast of Ireland. It is also a fact that over the course of just 1% of human evolution *Homo sapiens* colonised 75% of the surface of the planet. This relentless tide of human expansion extended the frontiers of settlement to such an extent that an unpopulated Ireland, being so close to an area of human occupation, represents something of an aberration. The absence of an Irish Palaeolithic is not therefore solely about when the first humans reached these shores, but rather is an issue with important implications for our understanding of the human species as coloniser.

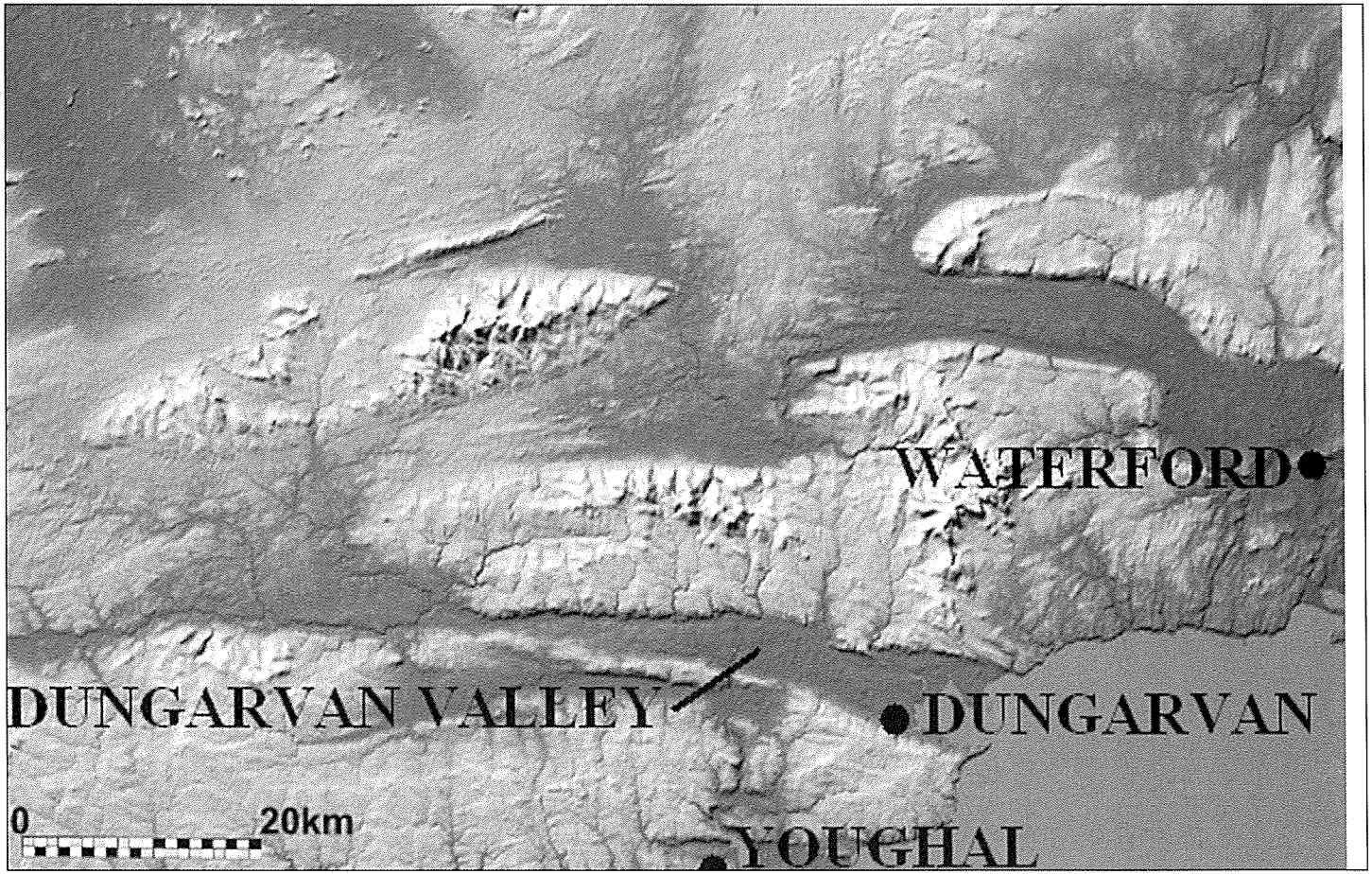

Figure 1: The Dungarvan valley is a well-defined triangle of ground shaped by its geology. The base of the valley is limestone and the surrounding uplands are predominantly sandstone.

The general acceptance of Mesolithic beginnings has resulted in a dearth of modern field research in the two types of location that have traditionally produced Palaeolithic material in other countries – caves and quarries. So, with a view to 'making a contribution through fieldwork to the questions surrounding the absence of evidence for an Irish Palaeolithic', the Dungarvan Valley Caves Project (DVCP) was set up in 2003 by the applicants. Now in its fifth year the project team has carried out a major review of the subject as well as surveying and carrying out excavations in a key area for Irish Pleistocene studies– the Dungarvan valley, Co. Waterford (O Drisceoil & Jennings 2006). The project has been supported by the Heritage Council archaeology grants scheme on two previous occasions (refs.13750 and 16268).

The Dungarvan valley is of critical importance largely because of its caves, which have produced thousands of bones of extinct glacial fauna (Figure 1). Indeed, of the *c.*700 caves recorded from Ireland there are only fourteen where the bones of Ice Age fauna have been positively identified (Table 1); five of these caves are in the Dungarvan Valley – Ballynameelagh, Shandon, Ballynamintra, Garret Morris and Kilgreany.

Investigations in the valley between *c.*1860-1935 by Leith Adams, R.J. Ussher, H.L. Movius and E.K. Tratman brought to light the remains of the mammoth, giant deer, reindeer, horse, red deer, brown bear, the spotted hyena, arctic fox, Norway lemming, lynx, mountain hare and stoat. The preservation of the material probably had much to do with their location south of the limit of the last, Midlandian ice-sheet, which spared the region the devastating effects of this glacier. As well as the faunal remains, the cave at Kilgreany made international headlines when a human skeleton was found with the bones of giant deer. This was at the time famously declared by Sean Ó Riordáin as 'the first definite proof of the existence of Palaeolithic man in Ireland'. AMS radiocarbon dating of the bones was to later prove they were Neolithic (Molleson 1985-6).

Summary of fieldwork carried out by the Dungarvan Valley Caves Project 2003-2008

Survey

Twenty-eight caves were identified and twenty-two explored by the DVCP in the valley (Figure 2). These ranged from those in low-lying locations near the coast to those on the higher, rising ground inland to the west. The project has developed a partnership with Mr. Peter Ryder, speleologist, who carried out surveys of many of the valley's caves in the 1980s and 1990s. His expertise has allowed previously unexplored parts of the caves to be documented, and in the process new 'bone beds' have been discovered. A fully drawn survey of all known caves in the Dungarvan valley has now been completed and will be included in a forthcoming publication on the geology, palaeontology and archaeology of these sites.

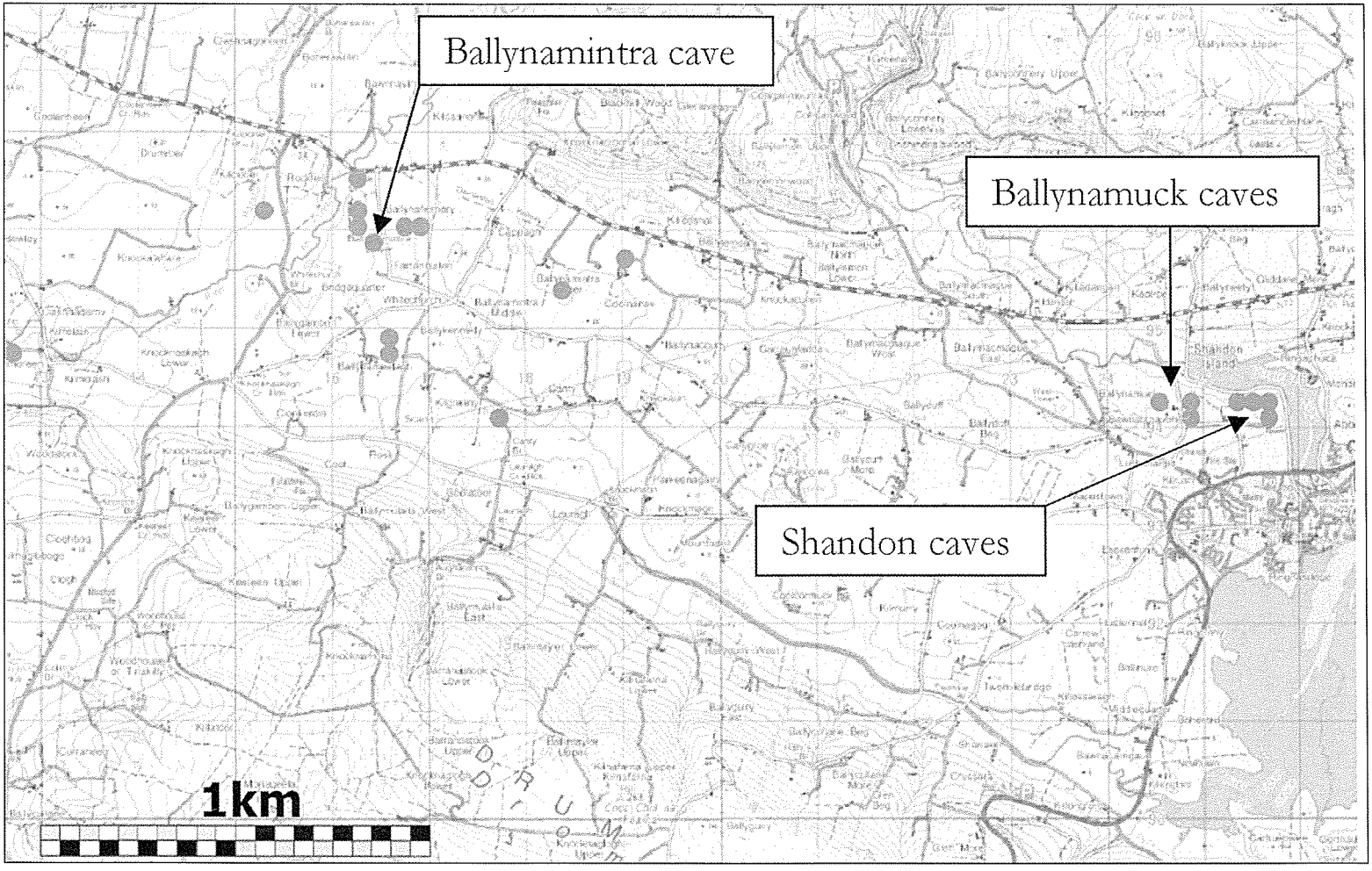

Figure 2: Cave locations in the Dungarvan valley.

Excavations at Ballynamuck caves 1 and 2

In 2006 excavations focussed on the low-lying sites and in particular the area around the famous Shandon cave, on the outskirts of Dungarvan town. Test-cuttings were excavated at two caves in Ballynamuck townland, the aim being to determine if the sites contained Pleistocene deposits that would be worthy of further study. Because of their topographical position close to the watertable, the sedimentary sequence within both caves was found to be largely waterlain / fluvioglacial - wet and inhospitable places that would not have been suitable for human occupation. Accordingly, no archaeological material was recovered from either cave.

However, the Heritage Council funded (ref. 13750) appraisal of the Ballynamuck cave strata by Dr. Simon Collcutt, an expert on cave sedimentology and the results of a series of Optically Stimulated Luminescence (OSL) dates identified that the excavated sediments were of Middle Pleistocene age, ranging from *c*.220,000-125,000 BP (before the present). These findings represent the first proof that material of such great age could survive within an Irish cave - it was formerly thought all such sediments had been removed by the Munsterian glaciation.

The importance of the Ballynamuck excavation results rest therefore in the possibility they provide that the *context* for a Lower-Middle Palaeolithic could survive in an Irish cave. Indeed, the Lower Palaeolithic has been identified as the epoch when humans were at their most populous and enduring in England and Wales. Another important implication from the work at Ballynamuck is that this site is unlikely to be unique and such early sediments could be more widespread in Irish caves than was previously thought. If a 'dry' cave containing Middle Pleistocene, non-waterlain sediments could be found this would be certainly worthy of significant investigation.

Ballynamintra cave

Ballynamintra cave, in the west of the Dungarvan valley, is best known as the first Irish cave where evidence for an Irish Palaeolithic was proposed (see below), though curiously it never excited the same attention as the nearby Kilgreany cave, where similar claims were made in 1928. To date Ballynamintra has been explored for a distance of 95m and comprises a 2.3m high x 3m wide oval tube that leads into a lower chamber from which two short extensions to the known passages extend (Figure 3). In 1878 Leith Adams and R.J. Ussher carried out a major excavation of the entrance passage, a summary of which is presented below (Adams *et al* 1881). In 1882 'a new chamber was cleared down to the level of the stalagmite floor' and beyond this 'a new series of chambers were discovered' (Ussher 1882). Subsequently the cave was revisited by E.K. Tratman 'to prove the stratification in the lower levels' (Tratman 1929, 111). Tratman dug trenches in the 'inner and lower' chamber but the only reported finds however were a 'few' arctic fox bones. In 1998 the speleologist Peter Ryder and colleagues explored the far reaches of the cave leading to the discovery of the 'White Forest Grotto' passage, a roof thickly hung with stalagmites. Until recently it was thought that the three archaeological

investigations had completely emptied the cave but intact stratigraphy has been identified there recently by the DVCP. In 2008 the Discovery Programme carried out a detailed laser scan of the upper section of Ballynamintra cave (funded under the 2008 Heritage Council archaeology grants scheme), mapping these sediments as well as the structure of the cave (Figures 4-7). This survey will provide the detailed base-map for all future investigations within the cave.

Laser scan survey of Ballynamintra cave

The survey

The cave is located on the side of a small hillock and is surrounded by a copse of trees. This dense tree coverage prevented Irish National Grid control being brought directly onto site, as it obscured the GPS signals. The solution was to establish two GPS control stations in an adjacent field (clear of trees) using the Trimble 5800 GPS receiver in VRS Now mode. VRS Now uses mobile communications (GPRS) to receive and apply corrections to GPS readings, enabling the user to reduce residuals to 10mm in Northing and Easting and 15mm in height. A Nikon Pulse Laser Station was set up over the station closest to the cave while a back sight target was set up over the other station. By setting up over a known station and back sighting onto another known station it was possible to establish the position of a third station at the mouth of the cave, with sightlines into the cave.

The Trimble Mensi GS101 Scanner was set up to record points at a resolution of 20mm at a distance of 10m.The first two scans were taken from the outside of the cave looking in. Four of the laser scanning targets were set up inside the cave. The first scan used all four targets while the second used three. Once the initial scans were complete and the position of the targets were deemed to be correct, the total station was set up over the third station and back sighted onto the closest station in the field. Using reflectorless mode Irish National Grid co-ordinates were recorded for the four targets in the cave. This control would be carried through the rest of the scans at the processing stage.

The scanner was then brought into the cave and using the four targets a 360-degree scan was taken. After the scan two of the targets were moved further into the cave and scanned into the project for use during the next scan. By the end of the first day a number of 360-degree scans had been completed in this manner and the second day would mostly be used to get into more complicated areas. The last act of the day was to move the targets onto secure tripods and scan them into the project. This was done to protect them from any animals using the cave during the night. That evening the data was processed to ensure that the scans were registering together. The residuals were found to be averaging out below 5mm. Notes were taken on areas that had not been picked up in the scans.

The following day the targets were checked to ensure that they had not been moved during the night. A number of scans were completed to pick up the rest of the detail of the cave. A laptop was brought to site so that the remaining scans could be processed on site before any equipment was removed. The residuals from

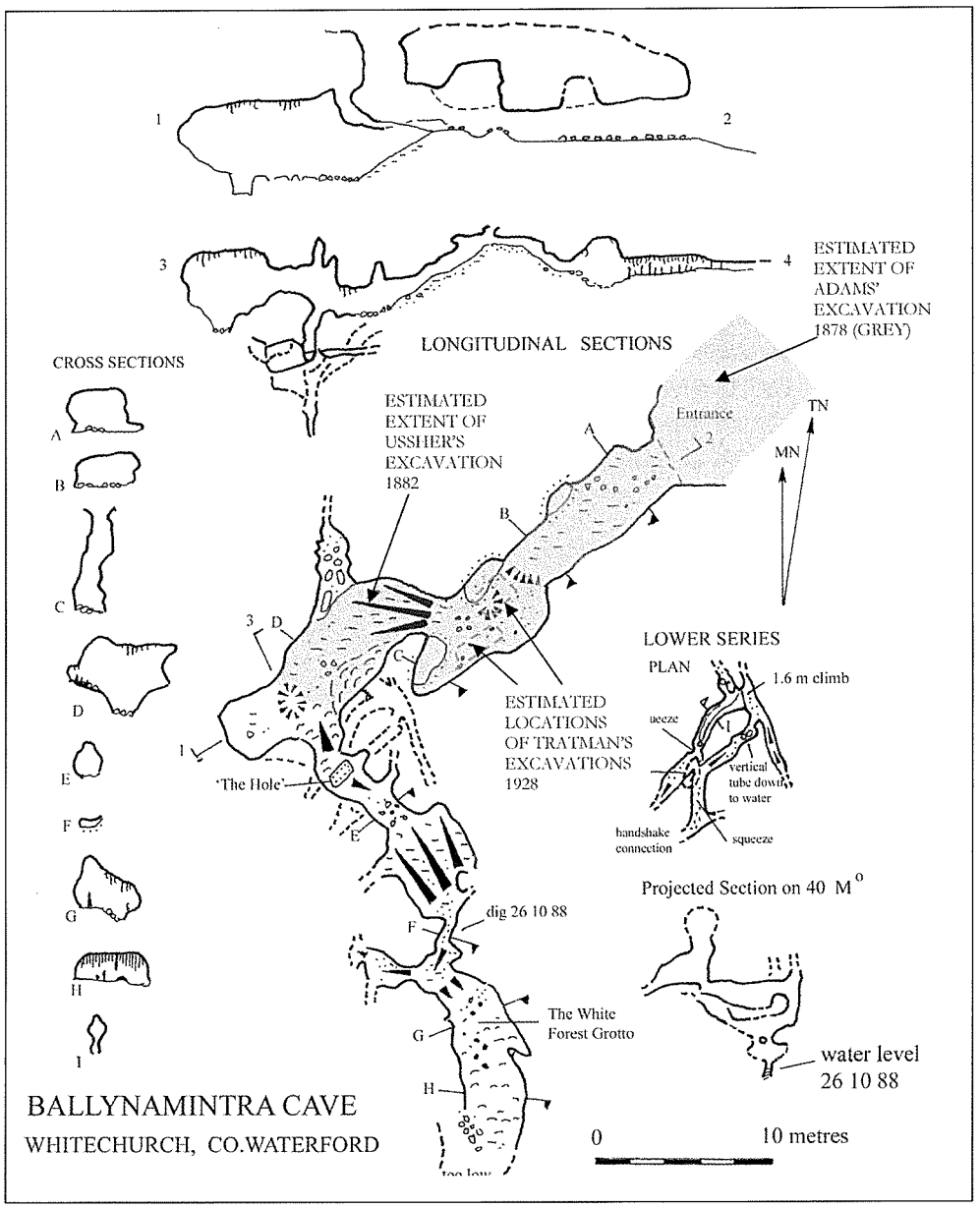

Figure 3: Survey drawing of Ballynamintra cave (courtesy of Peter Ryder, with additions by DVCP).

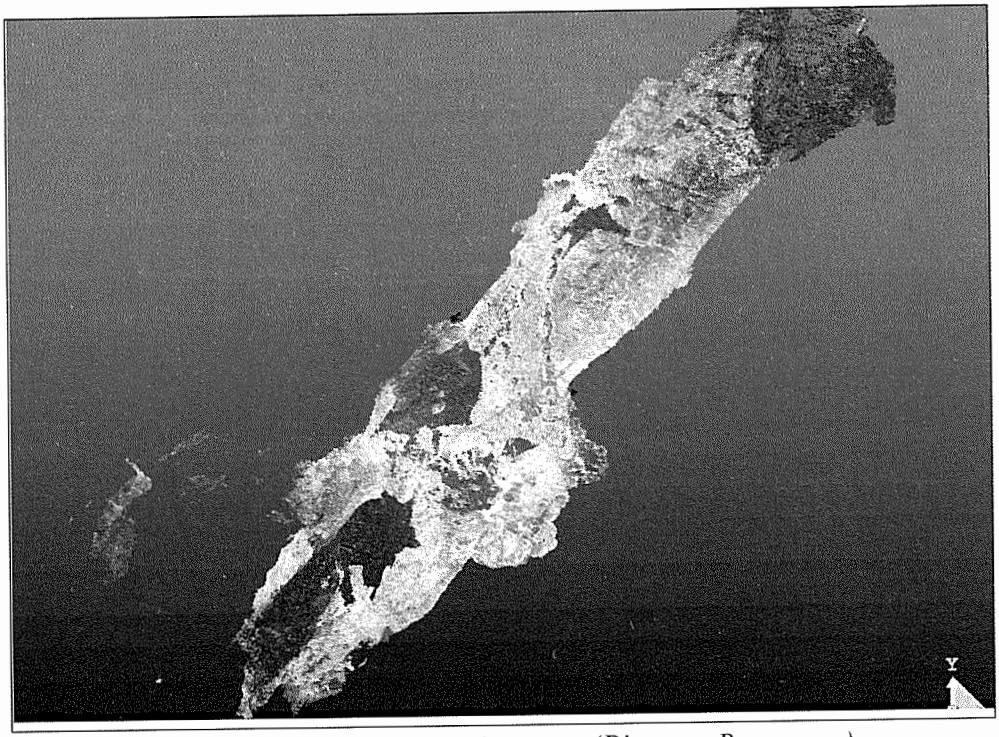

Figure 4: Laserscan plan view of Ballynamintra cave (Discovery Programme).

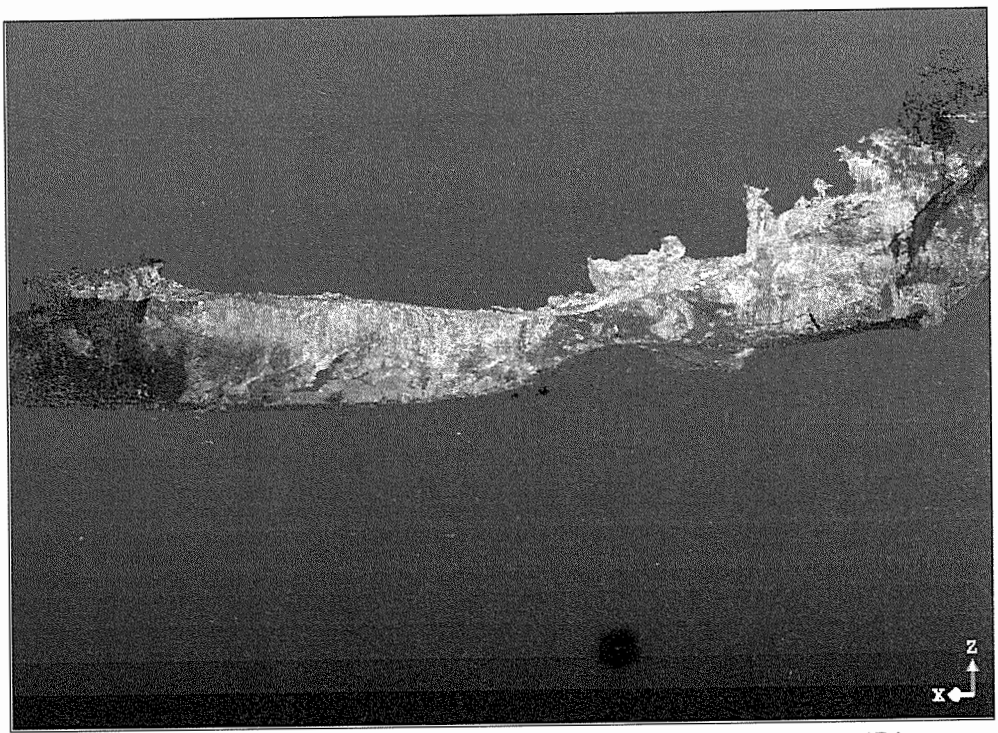

Figure 5: Laserscan south-east section through Ballynamintra cave (Discovery Programme).

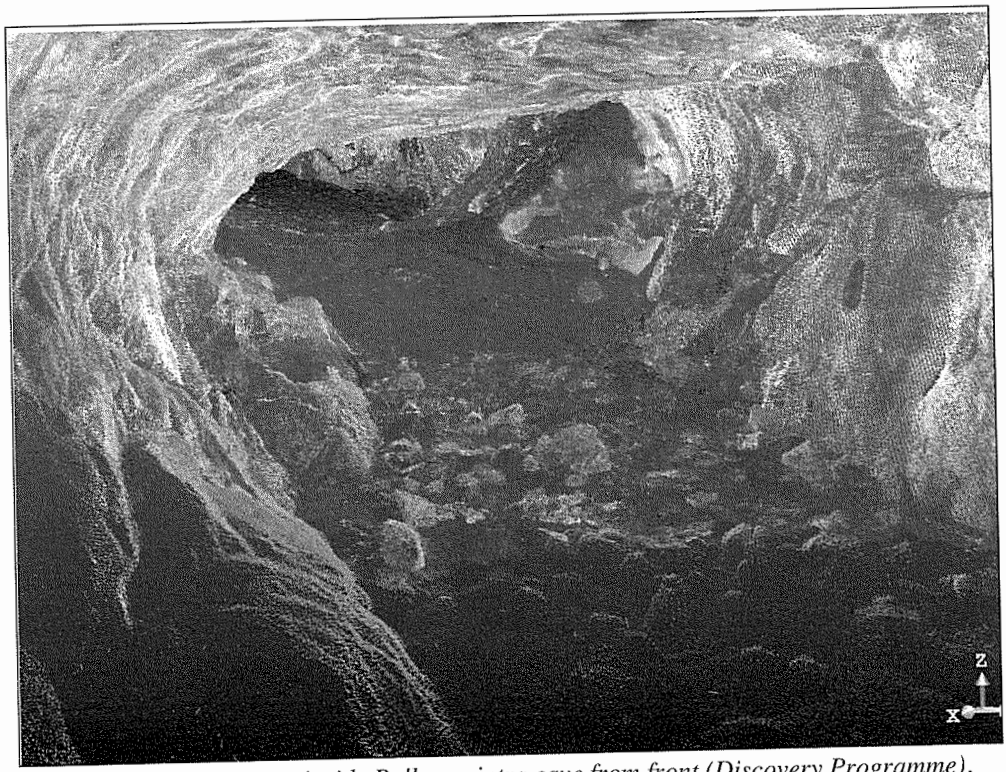

Figure 6: Laserscan view inside Ballynamintra cave from front (Discovery Programme).

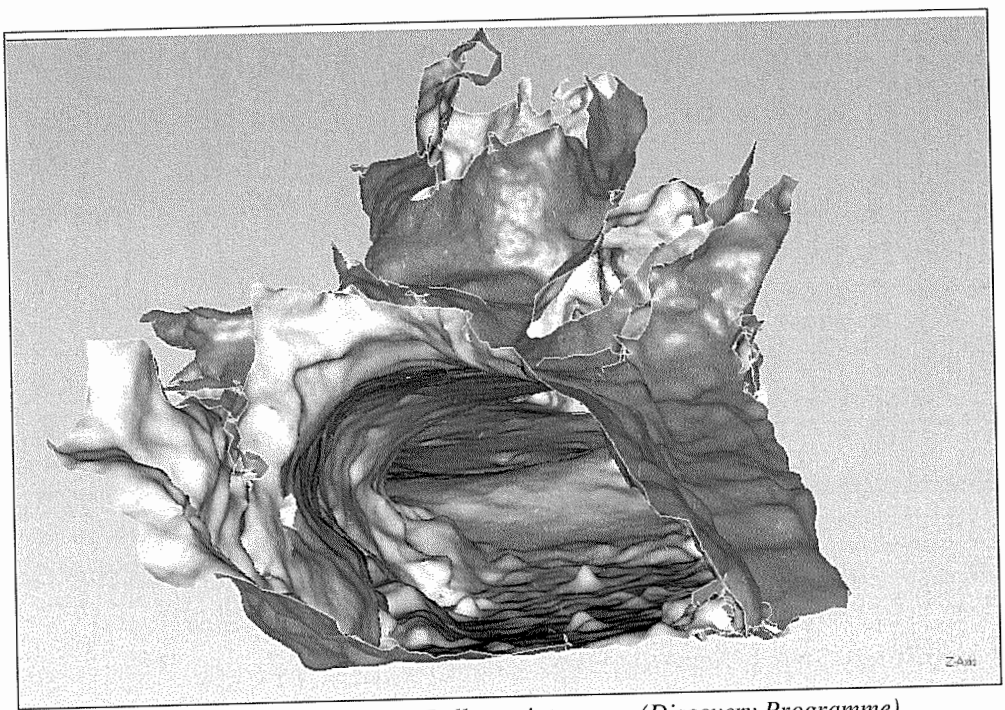

Figure 7: Laserscan mouth view into Ballynamintra cave (Discovery Programme).

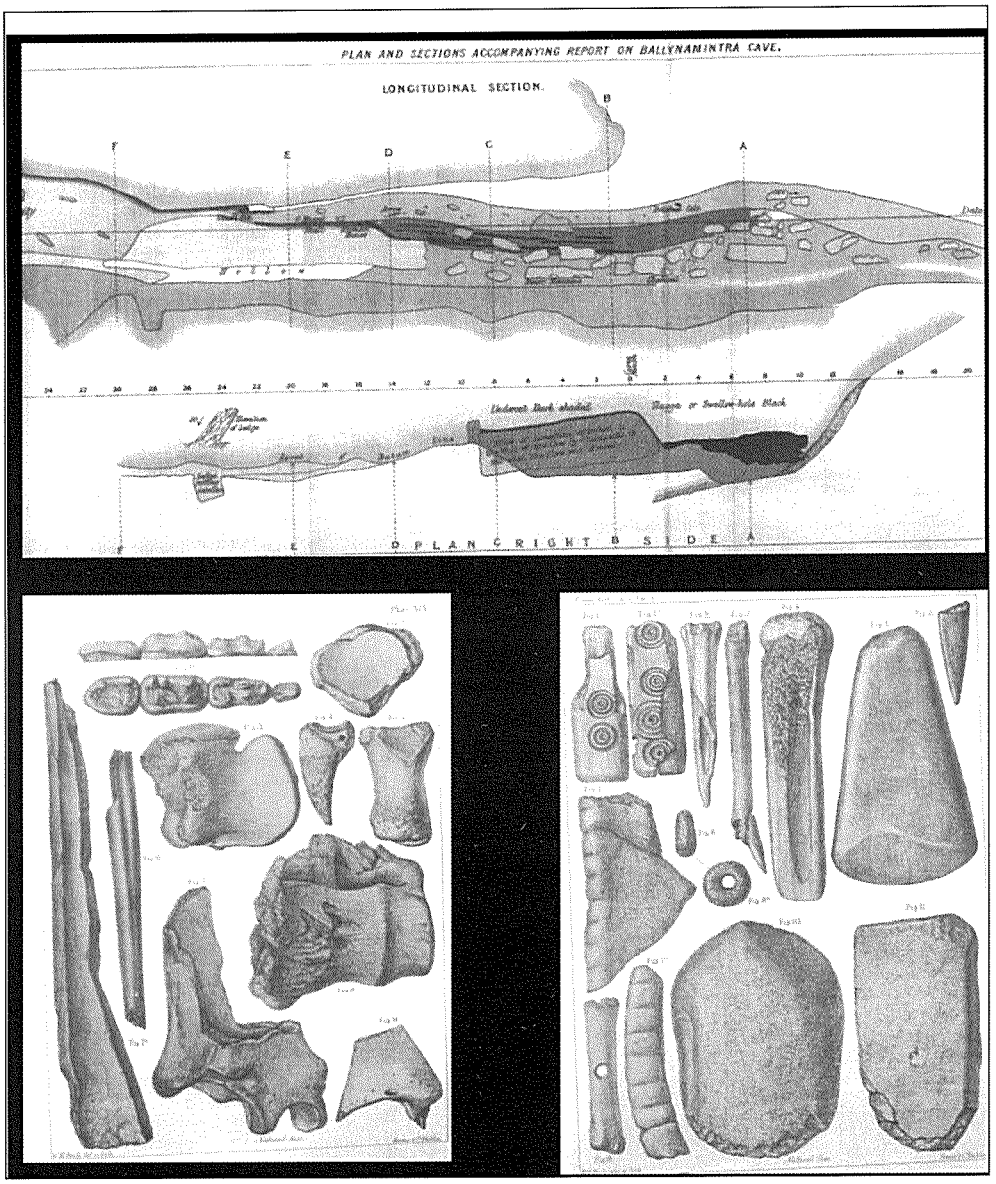

Figure 8: Section drawing, faunal remains and finds from the 1878 excavations at Ballynamintra (Adams et al 1881). All finds are currently in the National Museum of Ireland, the animal bones are housed in the Natural History Museum.

these scans came in below 2mm; the reason for the lower residuals on the second day was due to the fact that most of the scanning on that day was conducted at the back of the cave. This required less movement of targets and thus prevented errors from creeping up. The areas of shadow were confined to areas that we had accepted as impossible to record. By the end of the second day a total of fifteen scans from eleven set ups had been completed.

The processing stage

Trimble Realworks Survey 5.1 was used to process the data. As noted earlier, the individual scans registered together with residuals between 1-5mm. The survey was geo-referenced using the coordinates established for three of the four initial targets with sub-mm residuals. The point cloud contained points representing the targets used during the survey; these points were isolated and removed from the point cloud. The point cloud was then exported as an ASCII file. This file was imported into a modelling software package, Geomagic Studio 9, and a surface model of the data was created. Section views of the central passage of the cave were created and extracted as Tiff images.

Equipment

Trimble Mensi GS101 terrestrial laser scanner
Trimble 5800 GPS (operating with VRSNOW correction service)
Nikon NPL 332 Pulse Laser total station

Software

Trimbe Pointscape – controlling the scanner in the field
Trimble Realworks – processing scan data
Geomagic 9 – surface modelling

The stratigraphic sequence at Ballynamintra

Prior to Adams' excavations the cave was filled almost to the roof, a depth of 1.9m of sediment was recorded at the cave entrance (Adams *et al* 1881) (Figure 8). According to Adams the archaeological material ceased once a distance of 6.9m inside the cave from the entrance had been reached. They also noted that the cave has been shortened quite considerably as Adams was able to trace its extent beyond the present entrance for at least 12.9m. Adams identified five basic stratigraphic units over the limestone floor of the cave and he maintained a record of the faunal remains and artefacts that each produced. How accurate this was exactly is not entirely clear though subsequent radiocarbon dating of bones from the cave appeared to correlate in a broad sense with his interpretation of the stratigraphic sequence (see Table 2).

The fauna from Ballynamintra cave

Approximately 1,500 animal bones were retrieved from Ballynamintra cave during Adams' excavations (Adams *et al* 1881, table p. 206) and Tratman (1929) recorded that bones of the arctic fox were retained. Whether or not Ussher kept any bones is not known. Adams went into considerable detail regarding the faunal remains in his published report, cataloguing and identifying each fragment. About a third of the assemblage would appear to be of Pleistocene age and of the seven radiocarbon dates available from the cave, five produced such dates (Woodman *et al* 1997) (Table 3). The dates also demonstrated that a certain amount of reworking had taken place in Units 2 and 3 though Unit 4, the stalagmitic floor, was consistently Middle Midlandian in date and probably fairly undisturbed. This fauna represents a classic 'Mammoth-steppe' (Pin Hole) assemblage (Currant & Jacobi 2001) and may indicate the use of Ballynamintra as a spotted hyena den at the time. The two radiocarbon dates on giant deer indicate a Late Glacial 'Woodgrange' interstadial horizon.

The artefacts from Ballynamintra cave

The artefacts from Ballynamintra have been examined by Marion Dowd who identified forty-nine individual items in the assemblage (Dowd 2004) (Table 4). There are very few chronologically diagnostic objects though with certainty there is Neolithic and Early Medieval activity represented; there may be Bronze Age and Medieval (M. Dowd pers. comm.). The polished stone axe (E969:149) could be Neolithic though a Late Mesolithic or Early Bronze Age date is also a possibility. The three bone points (E969:154, 155 and 158) would not be out of place in an Early Medieval context though could also be prehistoric. Likewise the amber bead (E969:157) could be Bronze Age or Early Medieval in date. The 'bone toggle' or 'buzz bone' is an item generally dated to the Early Medieval period though their function is disputed – they may have been utilised as children's toys, or perhaps as musical instruments and it has also been suggested they were used as buttons. An Early Medieval date is quite secure for the decorated knife-handle (E969:151). Lastly, the age of the possible bone harpoon (E969:153) from Unit 1 is a particularly interesting question.

The cave, based on similarly assemblages from other caves, may have been used for short-term occupation in the Early Medieval period but it is also possible the material could have entered from a settlement overhead via the opening(s) in the cave roof. Marion Dowd's examination of the hammerstones indicated many of them may be of natural derivation, though nevertheless they must have been brought into the cave. The surviving pottery sherd (E969:150) from Ballynamintra cave is probably Late Bronze Age in date based on the fabric and shape and the fact that similar pottery has been recovered from Rathgall, Co. Wicklow. However, the decoration on this sherd is reminiscent of a Middle Neolithic globular bowl and therefore, such a date cannot be entirely discounted (Helen Roche pers. comm.).

The human remains from Ballynamintra cave

The surviving assemblage of human bones from Ballynamintra cave was examined by osteoarchaeologist Linda Fibiger in 2005 as part of the Human Remains from Irish Caves Project (Dowd *et al* 2006). The total number of human bones and bone fragments present was fifty, the minimum number of individuals present was three, two adults/adolescents, one juvenile. The majority of remains appeared to belong to adult or late adolescent individuals (epiphyseal fusion; size/robusticity; dental development). The only juvenile remains present were two metatarsals, representing an individual less than ten years of age (size, epiphyseal fusion).

Adams was quite clear in the Ballynamintra report that 'the human remains, implements, and charcoal-bed found with the remains of the Irish elk in the grey earth [Unit 2], were deposited there contemporaneously with them...' (Adams *et al* 1881, 221). However, the dating of a human radius from Unit 2 to 3020-2580 cal. BC appears to have settled this argument and Ballynamintra may now be included as an instance of an Irish cave where funerary activities, perhaps token deposition, was undertaken in the Late Neolithic (Dowd 2008; Dowd *et al* 2006).

Proposed further fieldwork at Ballynamintra

Ballynamintra is one of the most significant cave-sites in Ireland, both from an archaeological and palaeontological perspective. A key reason for this is the expertise and care with which Adams and Ussher conducted and published their excavation of the site. The renowned archaeologist H.L. Movius, whose work at Abri Patud in the Dordogne valley redefined Palaeolithic cave-archaeology, cited their work as a 'classic' example of cave excavation (Movius 1935, 254).

From a palaeontological perspective Ballynamintra is critically important. It is one of just two Irish sites (with Castlepook) where faunal remains of Midlandian and Late Glacial date have been discovered and it is one of just four caves (Shandon, Castlepook and Foley caves being the other three) that has fauna belonging to a period earlier than the Last Glacial Maximum. The recovery of the fauna from archetypal cave sediments - grey earths and tufa, sandy earths and possible debris flows (with shattered stalagmitic floors) and breccias - is also significant. These deposits appear to have been quite well preserved as a consequence of the cave's high altitude and position within a relatively isolated ridge of limestone, probably long divorced from any wider subterranean drainage system; without sufficient catchment, flushing could not occur. Indeed today Ballynamintra is one of only six Irish caves where sediments that pre-date the Last Glacial Maximum are thought to survive, the others being Castlepook and Foley cave, Co. Cork, Crag cave, Co. Kerry and the two Ballynamuck caves, near Dungarvan.

The basic stratigraphic sequence at Ballynamintra is fairly well understood as a consequence of the high quality of the Victorian excavations and the Quaternary Fauna Project's dating programme. However, it is evident from the published excavation report that the cave's sedimentological sequence is of much greater complexity than that described; the lithostratigraphy and likely lithogenesis of the sequence is not known, nor are the ages of many of the excavated units.

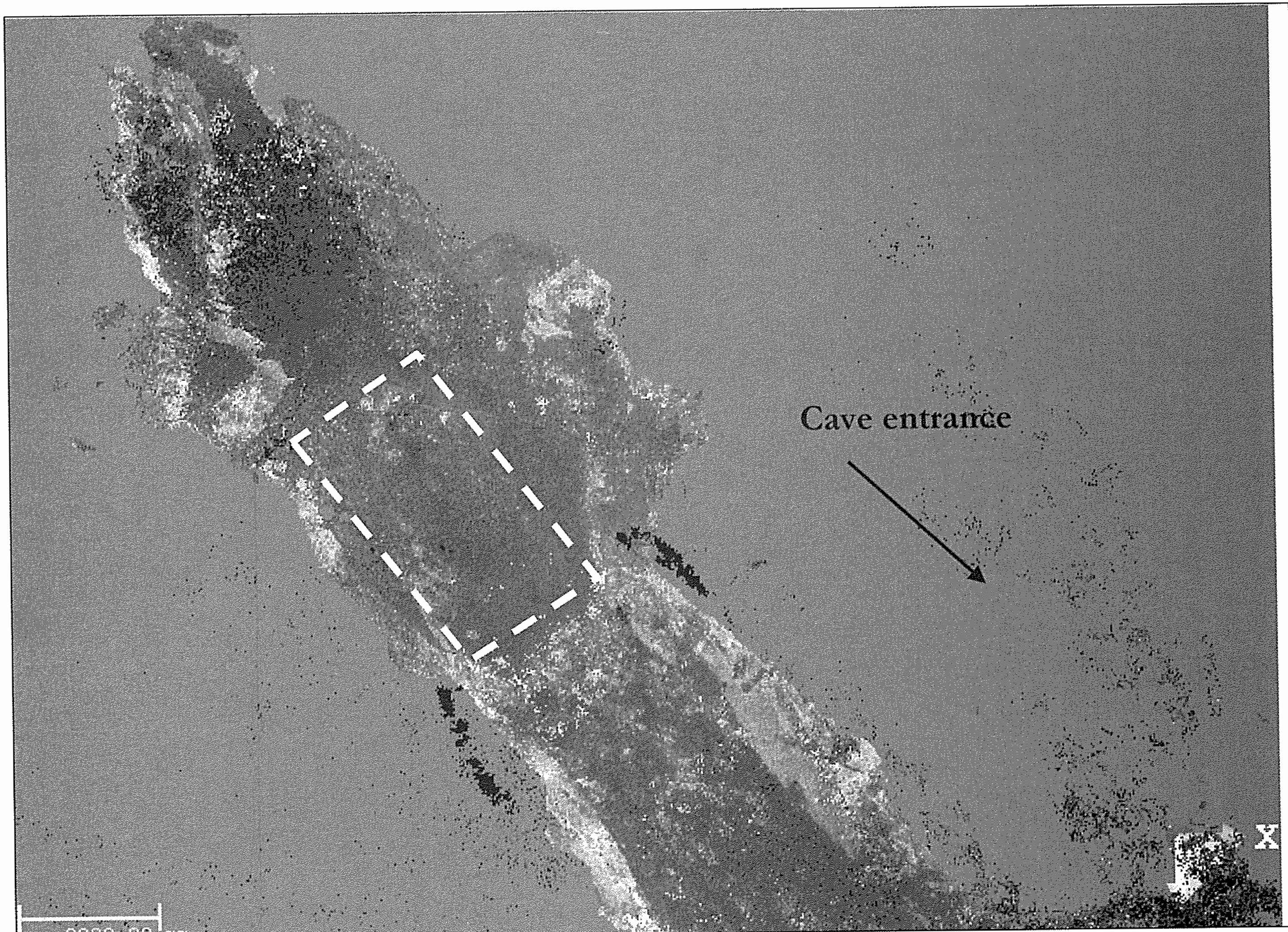

Figure 9: Proposed location of archaeological cutting at Ballynamintra cave (Discovery Programme).

Techniques to address these very matters were used to good effect at the Ballynamuck caves and it would be beneficial to bring a similar methodology to bear on Ballynamintra. The critical reason why such studies are carried out is to allow for the prediction of the likely locations, broad types and survival states of a variety of Late Pleistocene deposits, and by extension the potential for the discovery of Palaeolithic archaeology. For these reasons it is proposed to undertake a new phase of fieldwork at Ballynamintra.This is also a matter of urgency for it is apparent that some of the cave's standing sediments are under threat from erosion

Research strategy

It is proposed to re-open, under archaeological excavation licence, a previously excavated cutting that is visible in the rear of the cave's entrance passage (Figure 9) and sample from its standing sections. This will ensure minimal disturbance to existing Pleistocene deposits

The fieldwork aims to:

* Comprehensively describe the standing sediments exposed by the removal of backfill from the previously excavated sondage
* Definitively establish which of the previous excavations in the cave the sondage relates to
* Link if possible the standing sections to published excavation reports
* Take dating samples of the key sedimentary divisions from the standing sections
* Take palaeoenvironmental samples from the standing sections including pollen, phytoliths, charcoal, herpetofauna and small and large mammalian fauna
* Assess whether the cave sediments are suitable for micro-tephrachronological analysis

Methodology

The following steps will be undertaken:

Sedimentary Appraisal

A detailed lithostratigraphic analysis of the exposed section-stratigraphy will be undertaken by Dr. Simon Collcutt, a leading authority on cave sedimentology.

Dating of the sequence

Once units have been defined by the sedimentary appraisal a range of dating techniques will be utilised to provide a chronology on the excavated sequence. AMS radiocarbon dating will be suitable for the upper units while it is more likely that Uranium Series Dating would provide a chronology if the stalagmitic floor of Adams is located, (Unit 4). Optically Stimulated Luminescence may be more suitable for dating the upper sediment and the underlying basal gravel, Unit 5, if encountered.

Analysis of fauna, microvertebrates, phytoliths, pollen, charcoals

A column-sample through the stratigraphic sections will be excavated and retained for sieving in the laboratory (1mm mesh size) to provide material for analysis of the above materials.

All cave deposits will be recorded by laser scanning and integrated into the 3d cave model

Intended outcomes

* To provide using modern analytical methods a detailed account of sediment deposition in this part of Ballynamintra cave
* To assess whether these sediments can be linked to the six divisions of Adams (1881)
* To provide new evidence concerning the environment of Ballynamintra cave during the late Pleistocene
* To date faunal material from secure chronological contexts
* To devise a preservation strategy of the existing standing deposits to ensure their long term survival
* To establish whether a new excavation programme at the cave is warranted

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Site	Reference(s)
Ballynamintra 1	Ussher 1878-9; Ussher and Adams 1879; Ussher 1881a; Ussher 1881b; Adams et al. 1881; Tratman et al. 1929
Ballynameelagh 1 Castlepook, Co. Cork	Adams et al. 1881, 180, Plate X Scharff et al 1918
Dunmore, Co. Kilkenny	Coleman 1965, 73-5
Edenvale, Co. Clare	Scharff et al 1906
Foley Cave, Co. Cork	Gwynn et al 1942
Garrat Morris, Co. Waterford	Adams et al. 1881
Keshcorran, Co. Sligo	Scharff et al 1903; Gwynn et al 1940
Kilgreany Cave, Co. Waterford	Adams et al. 1881, 180, Plate X; Tratman 1930; Tratman et al. 1929; Tratman 1937; Mahr 1937; Movius 1935; Movius 1942; O Riordain 1931; Molleson 1985-6; Dowd 2002
Killavullen, Co. Cork	Coleman 1947
Killuragh Cave, Co. Limerick	O'Shaughnessy 1994
Poll na mBear, Co. Leitrim	Simms and Monaghan 2000
Polldonin, Co. Sligo	McShea and McShea 1969
Red Cellar Cave, Co. Limerick	Leask 1938
Shandon 1, Co. Waterford	Brenan and Carte 1859; Adams 1876; Boulger 1876; Adams et al. 1881

Table 1: Table of Irish cave-sites that have produced Pleistocene fauna

Unit	Description	Finds	Human	Fauna
1	Brown earth, 0.6m thick. Charcoal 'everywhere' though disappeared 6.9m from the entrance.	'Polished celt', Flat amber bead, Bone harpoon, Carved perforated bone, Bone point. Bone chisel, Knife handle, Several sandstones – ground point, 2 striking stones.	Human skull.	Rabbit, hare, goat, ox, fox, pig, red-deer, dog, marten, horse, hedgehog, birds, bear, giant deer.
2	'Grey earth with calcerous tufa'. 0.5m thick. Two blocked avens ascended towards the surface in the passage and there was a concentration of occupation material underneath that nearest the entrance. Bones were clustered in crevices in the rock.. The human remains were in a 'calcerous tufa'. Abundant charcoal was recorded, including an 'old floor or hearth'.	Pointed metacarpal of goat', 'Rude stone implements', 'chipped hammer stones' and 'Worn lumps of sandstone'. Crevice produced a bone chisel of ox, a knife handle and a 'rude celt'.	Human bone in calcerous tufa – 0.75m from roof level. Fragmentary human remains found inside the cave at '16 feet from the cave mouth'.	Giant Deer (min. 5 indi viduals), Wolf, Bear in brec cias, Ox, Red deer and Pig, Rabbit, Goat, Fox, Wolf, Badger, Marten, Hare.
3	Pale sandy earth, extended 4.2m into the cave and rested on top of Unit 5 in places.	The only find was a possible rubber stone.	Human finger bone (possibly from unit 2).	Bear, Hare, Pig, Rabbit, Wolf, Deer, Ox, Giant Deer.
4	Stalagmite floor, 1.05m thick. This continued over the gravel (Unit 5) for a distance of 4.8 outside the entrance (Adams et al 1881, 184). The stalagmitic floor sloped 'rapidly upwards' to a much higher level from	The unit produced 'no trace of man'.	None	Articulated bear, deer, reindeer, frog. No bones were found in the unbroken floor.

	7.8m into the cave. The stalagmite was 'found in every part of the cave' though sometimes shattered. Unit extended unbroken from wall to wall from 3.6m into the cave from the entrance.			
5	Gravel.This unit lay directly on the limestone floor was uniform in character and contained no bones of human material. The gravel was a mixture of brown sand and old red sandstone. It was devoid of limestone.	None	None	None
6	Limestone floor. Swallow holes were recorded on the right near the entrance.	None	None	None

Table 2: Summary table of stratigraphic sequence recorded at Ballynamintra cave by Adams et al (1881)

Species	Specimen	Location	Lab No.	Date in radiocarbon years	Reference
Megalacorous Giganteus	Ulna F21166	Unit 2	OxA-4249	11,110±110 BP	Woodman et al 1997
Homo Sapiens, Human	Radius E968	Unit 2	OxA-4250	4230±75 BP	Woodman et al 1997
Lepus timidus, Irish Hare	Tibia F21167	Unit 3	OxA-4251	1500±65 BP	Woodman et al 1997
Ursus arctos, Brown Bear	Calcaneum F21168	Unit 4	OxA-4252	35,570±1100 BP	Woodman et al 1997
Rangifer tarandus, Reindeer	Metatarsal F21169	Unit 4	OxA-4253	33,630±790 BP	Woodman et al 1997
Cervus elaphus Red Deer	Upper Molar F21170	Unit 4	OxA-4336	27,730±380 BP	Woodman et al 1997
Megalacorous Giganteus	Not stated[1]	Not stated	KIA25446	11,567±42 BP	Lister et al 2005

Table 3: Radiocarbon dates from Ballynamintra cave

1 The stratigraphic position of the sample was not recorded in the published account.

Artefact	Reg. no.	Location in cave	Unit	Habitat
Polished stone axe	E969:149	6.7m	1	D8:9
Whetstone (?)	None	10.4m	Crevice	Unknown
Whetstone (?)	None	1.2m	1	Unknown
29 hammerstones	None	Various locations – mainly unrecorded	4 from C.1 21 from C.2	Beggars Bush
3 grinding or rubbing stones	None	Various locations	1 and 2	Unknown
3 burnt stones	None	Various locations	2	Unknown
Amber bead	E969:157	5.5m	1	D8:9
Decorated knife handle	E969:151	10.4m	Crevice	D8:9
Bone toggle	E969:152	11.6m	1	D8:9
Pronged bone object	E969:153	11.6m	1	D8:9
Bone point	E969:154	Unknown	1	D8:9
Bone point	E969:155	Unknown	2	D8:9
Bone point	E969:158	Unknown	1?	D8:9
Worked bone	E969:156	10.4m	Crevice	D8:9
Pottery sherd (LBA?)	E969:150	Unknown	1 or 2	D8:9
Pottery sherd	None	Unknown	Unknown	Unknown

Table 4: Artefacts from Ballynamintra cave (Dowd 2004)

1 In column 3, figures relate to distance from the original cave entrance to the interior unless otherwise stated

Plate 1: Obverse, bust of Gallienus.

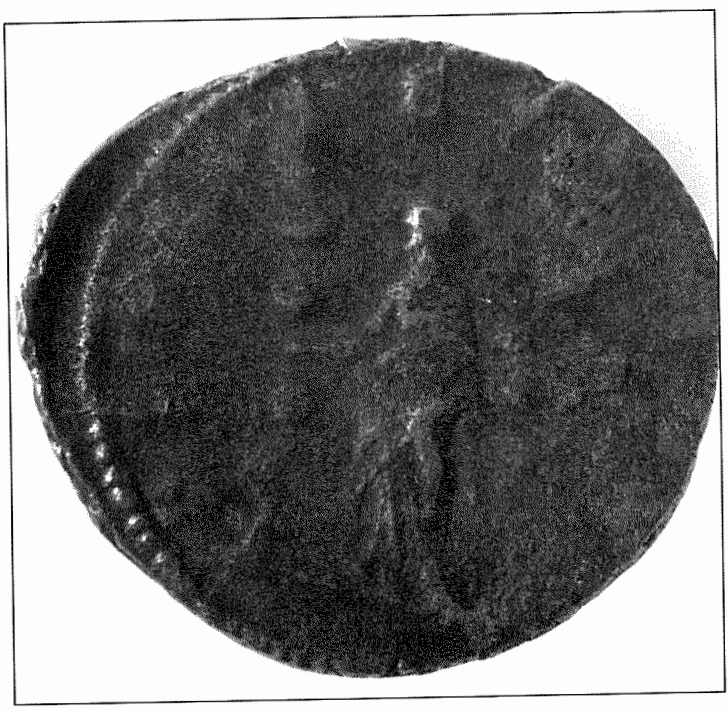

Plate 2: Reverse.