Revisiting Alice and Gwendoline Cave, Co. Clare: new light on the 1902 excavations

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Abstract

Alice and Gwendoline Cave, Co. Clare, has produced the first evidence for human occupation on the island of Ireland during the Palaeolithic. A butchered brown bear patella discovered in the cave during excavations by the Committee Appointed to Explore Irish Caves in 1902 was recently dated by AMS to the Late Upper Palaeolithic (LUP) period. As part of current investigations into the cave, this paper presents hitherto unpublished data on the archaeological and palaeontological context of the antiquarian discoveries based on detailed analysis of an unpublished notebook related to the 1902 excavation. A GIS reconstruction of the original antiquarian grid system has facilitated a visualisation of the spatial distribution of artefacts, human bones and faunal remains found at the cave. This provides a more nuanced understanding of human activities at this multi-period site and highlights the role of natural formation processes at the cave, particularly with regard to the bones of extinct

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fauna. Preliminary results of a recent excavation inform our interpretation of the antiquarian data. The information extracted from the unpublished notebook provides an essential foundation for any future investigations of the site or any re-evaluation of material recovered there in 1902.

Introduction

Over the summers of 1902, 1903 and 1904, the Committee Appointed to Explore Irish Caves spent more than nine months excavating five caves outside Clarecastle village in Co. Clare, sites that subsequently became known as the Edenvale/Newhall complex (Fig. 1). The objective of the project was to recover extinct faunal remains and thereby enhance Ireland's zoological and palaeontological collections. An unintended consequence was the recovery of archaeological material from each of the five caves, representing activities ranging from Neolithic funerary practices to early medieval occupation (Dowd 2004; Dowd 2015). Two main documentary sources related to the excavations survive: the published report (Scharff *et al*. 1906) and an unpublished notebook (NMING:GLM10) belonging to Robert Francis Scharff, which is now held in the Natural History Division of the National Museum of Ireland (NMI). This paper presents a detailed examination of the unpublished notebook in relation to the first of the five excavated sites, Alice and Gwendoline Cave in Cahircalla Beg townland (SMR: CL041–060----; ITM: 532432 674752). Archaeological artefacts retrieved from the site, and now housed in the Irish Antiquities Division of the NMI,

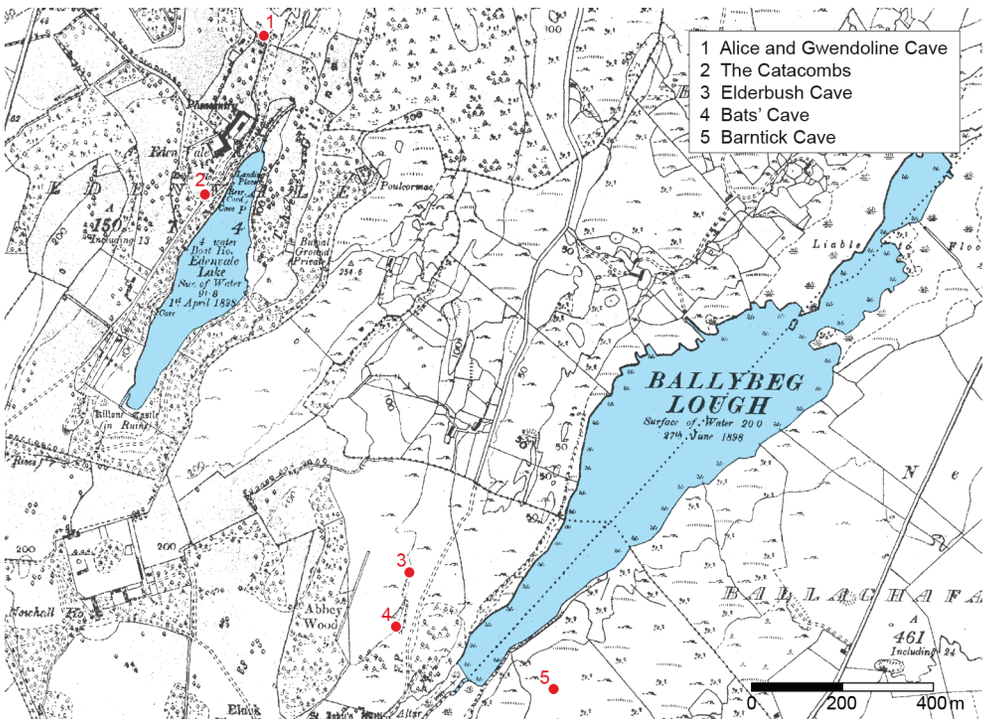


Fig. 1—Location map (Dowd 2015).

were also re-assessed. This cave has produced the first recorded evidence for human activity on the island of Ireland during the Upper Palaeolithic, dating to 10,860–10,641 cal BC (Dowd and Carden 2016).

The notebook contains a wealth of hitherto untapped information on the original context of the archaeological and palaeontological discoveries made in Alice and Gwendoline Cave in 1902. It also provides valuable insights into the antiquarian excavation, one that was of a remarkably high standard for the time. The nomenclature of the antiquarian grid system has been unlocked, which now enables researchers to plot the original findspots where artefacts and bones were discovered almost 120 years ago. A Geographical Information System (GIS) has been used to recreate the spatial distribution of material within the cave, allowing key areas of human activity to be identified and natural formation processes to be evaluated.

The Royal Irish Academy (RIA) has played a pivotal role in the exploration of Alice and Gwendoline Cave. Together with the British Association for the Advancement of Science, the RIA funded the 1902 excavation. In recent years, the RIA's Radiocarbon Dates Scheme has provided funding to date a human bone and two bear bones from the 1902 excavation, including the butchered bear patella that revealed a Late Upper Palaeolithic human presence (Dowd and Carden 2016). In 2019 the RIA funded an archaeological excavation (directed by M. Dowd) that re-evaluated the antiquarian investigation and the archaeological context of the earlier discoveries, the preliminary results of which are included here. The RIA archives also contain a number of previously unpublished sketches of the cave undertaken by Thomas Johnson Westropp in 1902, two of which are published here for the first time.

Background to the 1902 excavations in Alice and Gwendoline Cave

The modern discipline of geoarchaeology has its origins in the eighteenth and nineteenth centuries when specialists with expertise in the study of faunal remains, artefacts, prehistoric archaeology, geology and geosciences came together to carry out research on Pleistocene cave sites in Western Europe. The 1902 investigations at Alice and Gwendoline Cave typify this 'collaboration stage' in the development of geoarchaeology (Rapp and Hill 2006). A key moment in the development of geoarchaeology in Ireland occurred in 1899 when renowned Swiss zoologist Charles Immanuel Forsyth Major visited the Dublin Museum of Science and Art (subsequently the NMI) to examine its collections of extinct faunal remains. His trip inspired the formation of the Committee Appointed to Explore Irish Caves in 1901, with funding provided by the British Association for the Advancement of Science and the Fauna and Flora Committee of the Royal Irish Academy. The Committee's objective was 'the further exploration of Irish cave deposits' with the intention of expanding the collections of extinct faunal remains known from the island (Scharff *et al*. 1903, 171). The founding members were zoologist Robert Francis Scharff (employed at the Natural History Division, NMI, 1887–1922), archaeologist George Coffey (employed at the Irish Antiquities Division, NMI, 1897–1914), ornithologist Richard John Ussher, naturalist Robert Lloyd Praeger (employed at National Library of Ireland, 1893–1923) and geologist Grenville Arthur James

Cole (Professor of Geology at the Royal College of Science, Dublin, 1890–1924). The group was responsible for three important excavation programmes carried out between 1901 and 1908: excavation of five caves at Keshcorran, Co. Sligo (Scharff *et al.* 1903); five caves at Edenvale/Newhall, Co. Clare (Scharff *et al*. 1906); and Castlepook (or Mammoth) Cave, Co. Cork (Scharff *et al*. 1918).

The second campaign targeted a series of caves south-west of Ennis, Co. Clare. The first of these was Alice and Gwendoline Cave, 200m north of Edenvale House (constructed in the 1770s), and one of several caves on the Edenvale estate (Fig. 1). In 1902 Edenvale was occupied by Alice Julia Stacpoole (née Westropp), widow of Richard Stacpoole, and was owned by the eldest of their five children, Richard. Alice and Gwendoline Cave was first inspected by R.J. Ussher and R.F. Scharff in April 1902, having been made aware of its existence by Hugh Massy Westropp, brother of Mrs Stacpoole (Scharff *et al*. 1906, 4). The cave was deemed worthy of further investigation and an excavation by the Committee Appointed to Explore Irish Caves took place between 3 June and 2 July 1902 inclusive. The unpublished notebook records that the team worked a six-day week, taking Sundays off. Excavations were directed by Ussher accompanied by two staff from the NMI, James Michael Duffy and Robert Griffin (Scharff 1906, 2) (Pl. I). The NMI archives contain a letter dated 27 May 1902 to museum administrator H. Bantry White from R.F. Scharff 'requesting that Duffy and Griffin be sent to Clare to prepare specimens from the cave survey' (Nigel Monaghan pers.

Pl. I—Excavation of the Catacombs (1903?). L to R: Alice Julia Stacpoole of Edenvale House, Richard J. Ussher—excavation director, James Michael Duffy (NMI) pushing a wheelbarrow, and Robert Griffin (NMI) sieving (Robert Welch, courtesy of the National Museum of Ireland, NMINA:225).

comm.). Four women—Alice Jane and Gwendoline Clare Stacpoole (daughters of Mrs Stacpoole of Edenvale House), Primrose Neville and a Miss Parkinson—helped 'searching for relics' (Scharff 1906, 4), which presumably involved 'sifting' bags of sediment at the cave entrance to extract bones and artefacts. It is unclear whether other labourers assisted this team of three men and four women. The cave had originally been known as 'Bull-Paddock Cave' (Scharff *et al*. 1906, 66), but following the excavation was renamed in honour of the Stacpoole sisters. At post-excavation stage, R.F. Scharff reported on the faunal remains; Edwin T. Newton analysed the bird bones; Andrew Francis Dixon examined the human bones; G.A.J. Cole reported on the geology; and T.J. Westropp (half-brother of Alice Julia and Hugh Massy) completed several sketches of the cave (Fig. 2) and

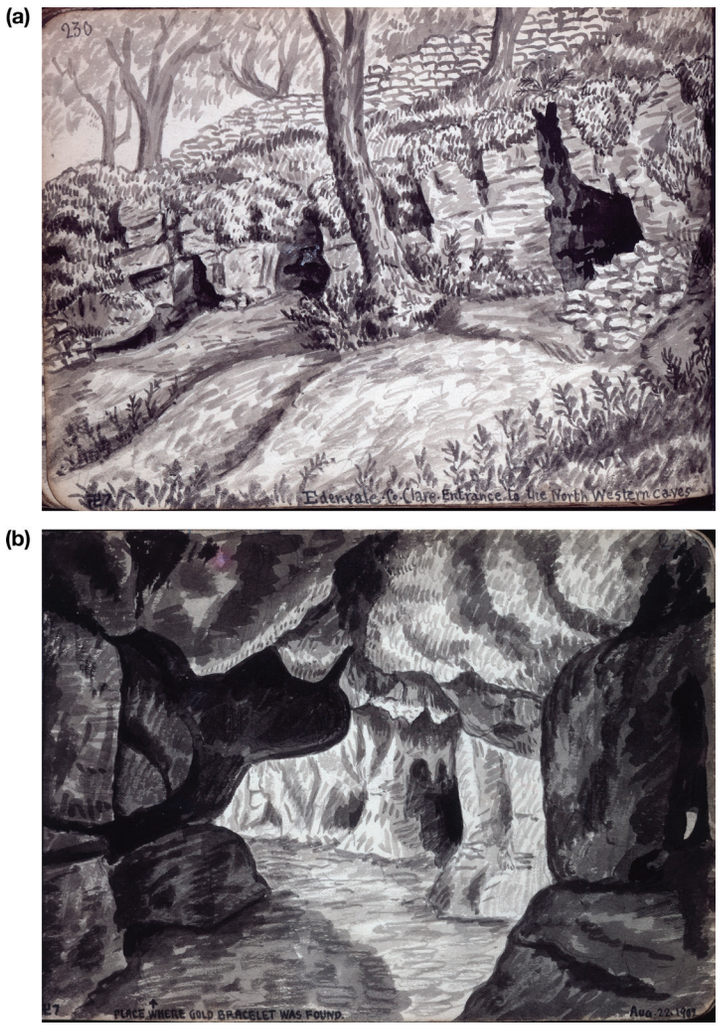


Fig. 2—Two of T.J. Westropp's sketches of Alice and Gwendoline Cave in 1902. (a) The entrances from the southeast (note the demesne wall overhead, now absent). (b) The area of the Alice Passage where the gold arm-ring was discovered, view from north facing the entrance (by permission of the Royal Irish Academy © RIA).

interpreted the archaeological material recovered (Scharff *et al*. 1906). A sauvastika—a left-facing variant of a swastika (Pl. II)—carved into the western wall of the Alice Passage was likely executed by Westropp at this time, as he frequently added this symbol to his illustrations (Manning 2008).

The 1902 grid system, methodology and stratification

During the 1902 excavation, the main cave passage was recorded as Edenvale No. 1 (later named Alice Passage), while a second passage to the west was called Edenvale No. 2 (later named Gwendoline Passage). Four smaller passages were identified as the Grotto, No. 3, Cross Gallery and Duffy Gallery (in honour of James Michael Duffy of the Natural History Division of the NMI). Well Meadow Cave No. 1 referred to an opening in the cave roof at the terminus of the Alice Passage that can be accessed from the field overhead. A survey line ran from 0ft at the entrance to 80ft at the terminus of the Alice Passage, and from 0ft at the opening of the Gwendoline Passage to 26ft at the junction with the Cross Gallery (Fig. 3). The 60ft point still survives on the eastern wall of the Alice Passage marked in red paint (Pl. II). Each excavation grid generally measured 2ft in length (i.e. from north to south) and was as wide as the cave passage. In very narrow parts of the cave, the grids were of greater length. Limited excavations took place a few feet outside the three main entrances to the system. For instance, the grid system extended 3m outside the entrance to Gwendoline Passage and 3.6m outside the opening to No. 3 Passage. Figure 4 illustrates the antiquarian grid system using data extracted from the notebook.

Pl. II—Alice Passage: the 60ft survey point from 1902 painted on the eastern wall, and a sauvastika carved into the western wall (Thorsten Kahlert).

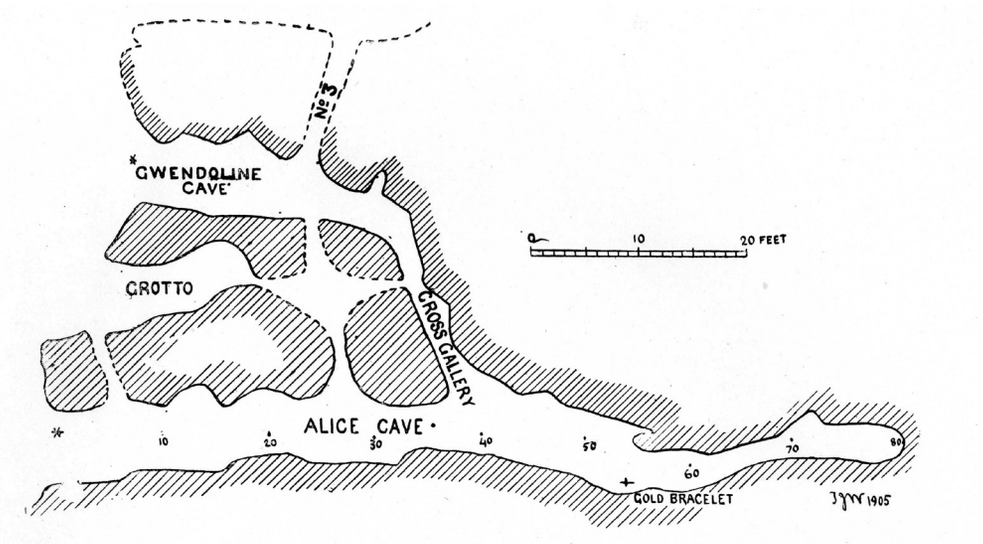


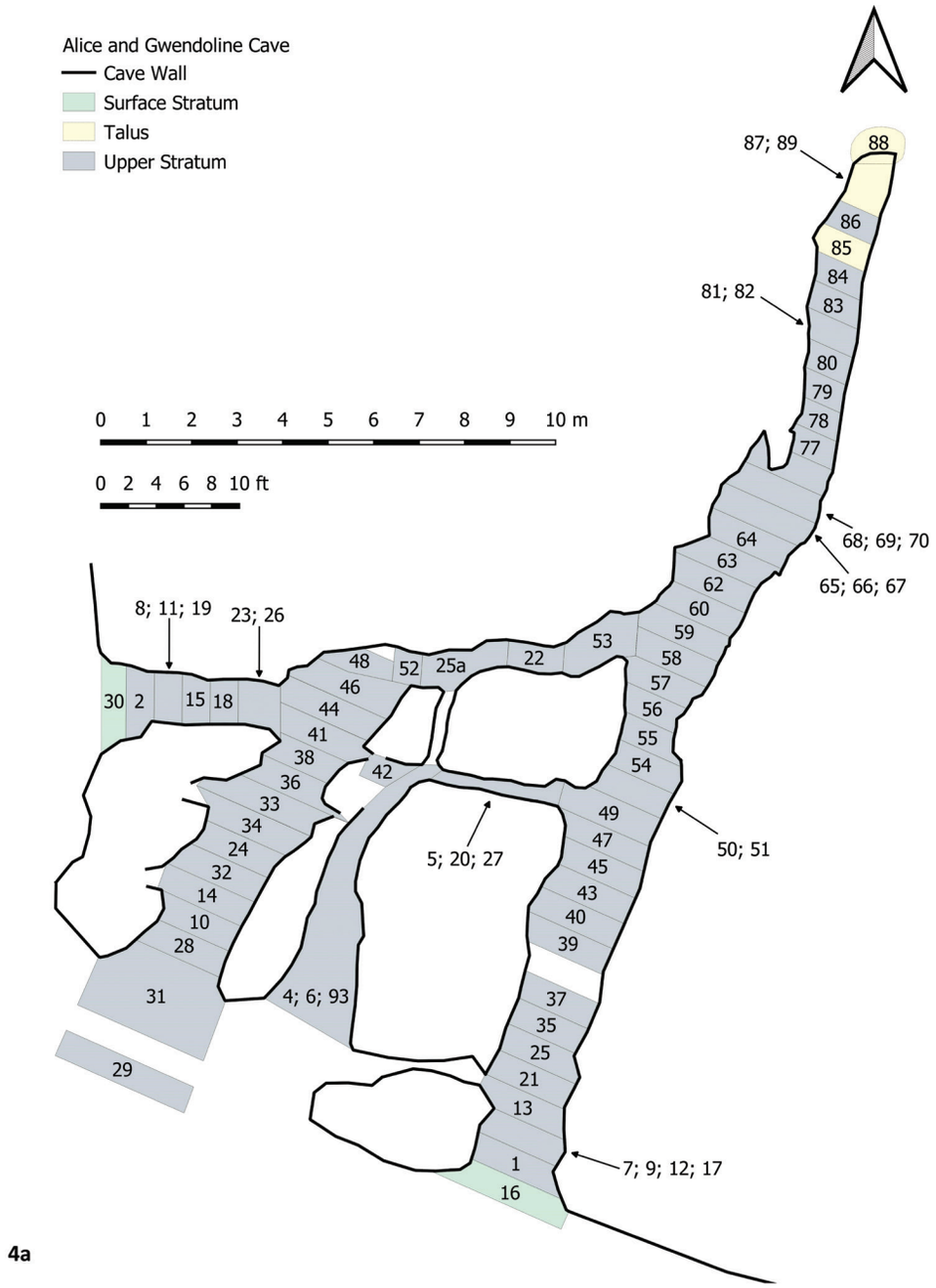
FIG. 3—1902 plan of Alice and Gwendoline Cave (Scharff *et al*. 1906, Pl. I).

Scharff (1906, 2–3) described the excavation methodology employed:

> *The procedure adopted in the work was, to carefully remove the surface layer of the cave-earth [...] The objects and implements found in every two feet [61cm] of earth, from the mouth of the cave inward, were then collected and transferred into a parcel or bag, which received a number [...] After the two feet of earth or clay had been searched through at the cave entrance, it was thrown out, and another two feet of earth was similarly inspected. After the surface-layer had been removed, the lower stratum was similarly dealt with. The bags were then forwarded to the National Museum, together with the notes on the more important objects found [...] Every object had then to be numbered, so that it might afterwards be possible to determine the exact position which it originally occupied in the cave, both vertically and horizontally.*

Each excavated bag or parcel of material was given a distinct code consisting of the letters 'EA' (Edenvale Alice?) followed by a number. There are 176 EA entries in the notebook associated with approximately 63 grids[1] located mainly inside the cave, with a few outside (Fig. 4). Some grids had multiple parcels of material, sometimes from the same stratum, thus these grids have several associated EA numbers. There is no correlation between the EA numbering system as it appears in the notebook and the chronological progress of the excavation. For instance, code EA1 relates to material excavated on the second day of the excavation (4 June 1902), but numbers EA111 and EA116, amongst others, were also assigned to bags of material recovered that same day (Appendix). Thirteen days were devoted to the excavation of the Alice Passage during which time 120 bags

1 Codes EA99 and EA129 were skipped; two bags of material were assigned EA24; and there was an EA25 and an EA25a.


Alice and Gwendoline Cave
Cave Wall
Surface Stratum
Talus
Upper Stratum
0 1 2 3 4 5 6 7 8 9 10 m
0 2 4 6 8 10 ft
87; 89
88
86
85
84
83
81; 82
80
79
78
77
68; 69; 70
65; 66; 67
64
63
62
60
59
58
57
56
55
54
53
22
25a
52
48
46
44
41
38
36
33
34
24
32
14
10
28
31
29
4; 6; 93
42
8; 11; 19
23; 26
30
2
15
18
5; 20; 27
49
47
45
43
40
39
50; 51
37
35
25
21
13
1
16
7; 9; 12; 17

4a

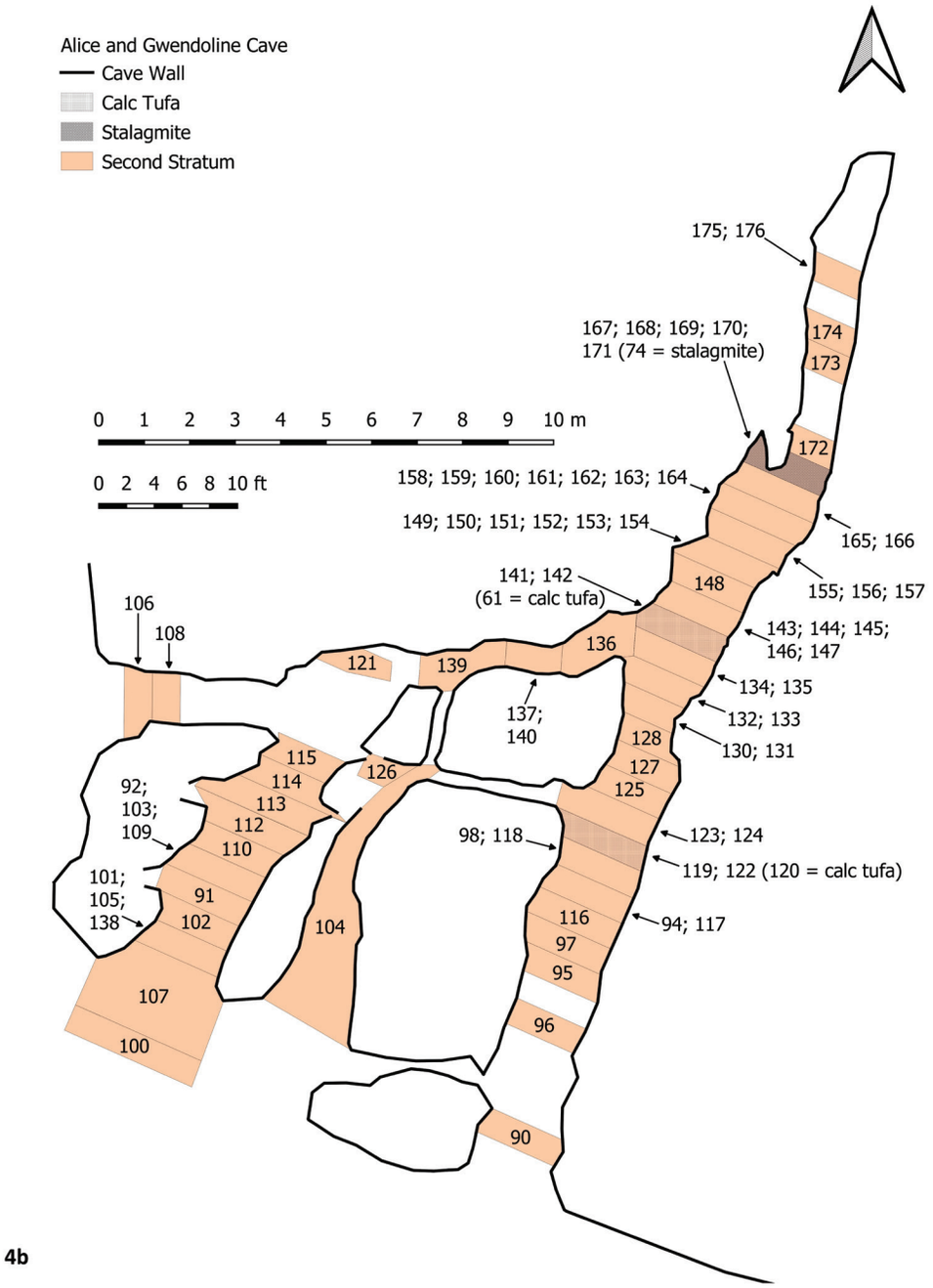


FIG. 4—2019 plan of Alice and Gwendoline Cave with the 1902 grid system superimposed and antiquarian EA code system indicated. The 'EA' prefix is not included; thus, for example, EA34 appears as 34. **4a** Grids that produced material from the Surface Stratum, Talus and Upper Stratum. **4b** Grids that produced material from the Second Stratum.

of material were recovered (i.e. 120 EA codes) from 40 grids, while the Gwendoline Passage was excavated over 5 days with the recovery of 22 bags of material (i.e. 22 EA codes) from 11 grids. Analysis of the notebook has allowed for the relationship between the grid system and the EA codes to be plotted for the first time (Fig. 4). Future researchers can now, at a glance, identify where in the cave a particular artefact or bone was recovered, and from which of the two main strata. The Appendix summarises the 176 EA entries in the notebook, listing the date excavated, the associated EA code(s), the relevant passage in the cave, the relevant grid (in feet, as per the notebook), and the stratum. The various fauna reported from that grid in the antiquarian study is also indicated; each number refers to the number of 'ticks' beside the relevant species in the notebook (see below).

The notebook recorded two strata in Alice and Gwendoline Cave: the 'Upper Stratum' and the 'clay of Second Stratum'. Some 88 bags (i.e. EA codes) reflect material from the Upper Stratum, with 86 bags related to the Second Stratum (Scharff *et al*. 1906, 25), which is consistent with what is recorded in the notebook. Occasionally, reference is made to a Surface Stratum, which comprised a disturbed stratum overlying the Upper Stratum, particularly in and around the entrances. Ussher (Scharff *et al*. 1906, 5) elaborated on the two main strata in the published report:

> *the upper one was of brown earth, with calcareous tufa here and there. Charcoal occurred in it frequently, with bones of the domestic animals so common in the ancient Irish settlements. There were also a few bones of Bear and Irish Elk in the first stratum; but the most unexpected discovery was that of the Arctic Lemming. The second stratum was of clay, often very tenacious, of an ochre tint, sometimes purplish, and often containing black patches. The upper portion of this stratum was less tenacious, being mixed with sand in places. Some charred or gnawed human bones are referred to this upper part. The animals most frequently represented in it were Bear and Reindeer; and the Irish Elk was met with in several places.*

The thickness of each stratum is not mentioned in the published report, but is recorded occasionally in the notebook. For instance, in the Alice Passage, the Second Stratum reached at least 36cm in thickness, but the depth of the Upper Stratum is not stated. In Gwendoline Passage the Upper Stratum measured 46cm thick immediately inside the entrance, while the Second Stratum was at least 30cm deep here. These figures are broadly consistent with colour changes visible on various areas of the cave walls at present, which indicate that prior to the 1902 excavation the cave floor was 60–75cm above the current floor level in the Alice Passage. In a pilot study on the potential of Irish caves for soil micromorphological analysis, Lewis (2008, 9) stated that Alice and Gwendoline Cave was 'filled with soil up to 20cm of the entrance roof' but this is incorrect; evidently the wrong cave was visited.

The 1902 team became aware from early on in the excavation that there was much evidence of stratigraphic disturbance at the site, particularly due to the activities of badgers: 'the Badger had mixed the strata in the caves to such an

extent as to greatly reduce the value of the scientific results obtained from this cave exploration' (Scharff *et al*. 1906, 42). Examples of disturbance included the occurrence of extinct faunal remains in the Second Stratum in association with rabbit bones (a more recent introduction to Ireland), and the presence of Arctic lemming (*Dicrostonyx torquatus*) remains in the Upper Stratum in association with iron fragments and modern debris. Furthermore, brown rat bones (*Rattus norvegicus*, attributed to the synonym '*Mus decumanus*' in the notebook) were recovered in units also containing remains of extinct fauna (Appendix), though brown rat has only been present in Ireland since the early eighteenth century (Yalden 1999, 183).

Mapping the 1902 archaeological and palaeontological material in a GIS

Mapping legacy data from excavations can aid the understanding of archaeological archives, the process of historic excavations, and environmental conditions (Allison 2008). GIS is dependent on accurately located georeferenced data, typically derived from a total station or GNSS. Whilst such technology was unavailable in 1902, the notebook contains a wealth of non-digital data. The value of using GIS for legacy data derived from caves was demonstrated by Mihai and colleagues' (2010) spatial distribution of bear remains from Pengelly's 1858–80 unpublished excavations at Kent Caverns, England. The similarly confined geographic environment of Alice and Gwendoline Cave, and the small scale of the 60cm grids, represent a unique opportunity to visualise legacy data. The notebook was used to populate a GIS to visualise the 1902 material. The location of each grid was reconstructed within the GIS and attributes for all variables recorded in the notebook were defined, visualising the distribution of strata (its properties and depth), artefacts, human bone and faunal remains, as well as evidence for burning or charring within the cave.

The authors created the GIS by transcribing, digitising and critically reviewing the notebook (MD). The database was collated and prepared using QGIS (3.12.1-București) to create shapefiles for each 2ft long excavated grid across the width of the cave, in turn creating distribution plots and spatial analyses, all of which were integrated into a modern digital basemap of the cave floor (JB), that was acquired from a composite terrestrial Lidar and structure from motion survey carried out in 2019 (TK). A mixture of original attributes (the EA code for each excavated bag or parcel of material; stratigraphic terminology; and grid location distance from the cave entrance in imperial units) and modern attributes (artefact classification; dating evidence), were applied to polygon shapefiles using the EA code location as a spatial reference. The strata recorded in 1902 were created as unique polygons within the grid system. Centroid point shapefiles were created from the polygon layers to generate spatial distributions. Point location maps were created for artefacts and species recovered, and frequency proportional maps were created for extinct faunal remains. While GIS is more commonly used for archaeological landscape analysis, the analytical component can also be applied to a localised 'sitescape'. This involves mapping individual artefacts as if they were 'sites' in the 'landscape' of, for example, a prehistoric

structure (Constantinidis 2001). In this case, the GIS mapped all of the details recorded in Scharff's notebook (i.e. the strata, faunal assemblage, human bones, artefacts, heat-altered deposits, etc.) within the 'cavescape'. This has facilitated a spatial analysis of the 1902 archaeological data, with some key caveats:

- The 1902 data were never intended to be used in this way.
- The use of 'best-fit' for the site grids was required due to the absence of accurate 1902 georeferencing data. This means the mapping has an accuracy or 'fuzziness' of ±0.30m (1ft) along the cave passage when compared to the modern Irish Transverse Mercator coordinate system.
- The modern mapping found that the accuracy of the 1902 plan (Fig. 3) was very high, although it decreased slightly as the surveyors progressed deeper into the cave. The first 10ft of Alice Passage were accurate to within 0.2 inches, whereas the final 10ft, located beyond a dog-leg style turn off the main transect, were accurate to within 8 inches.
- An assumption is made that the 1902 data can be trusted. As discussed above and below, this is justifiable given the evidence that the excavation and its archive are of a very high quality for the time.
- Of the 176 EA codes, only two parcels of excavated material (EA111 Second Stratum and EA3 Surface Stratum) were recorded in insufficient detail by Scharff. These cannot be attributed to any specific location within the Alice and Gwendoline Cave passages, and therefore were excluded from the GIS.

Such caveats are not unique to this study. The use of legacy data will always require compromises as the modern researcher critiques and evaluates the usefulness of older data sources. Nevertheless, the GIS analysis allows sophisticated questions to be asked of the archive and facilitates integration of these data with current and future analyses of the cave environment.

Assessing archaeological and palaeontological material from the 1902 excavations

By disentangling the EA codes and grid system employed in 1902 (Fig. 4), it is now possible to revisit archaeological and palaeontological material. Here, we reassess the human bones, artefacts and extinct fauna. Using data presented in the Appendix and Figure 4, researchers could create similar distribution maps for other fauna discovered at the site, such as domesticates (cattle, sheep, pig, dog, cat etc.) and wild animals (pine marten, badger, hare, mouse etc.). It is important to stress that the Appendix relates to identifications made in 1902. While the taxonomic nomenclature of the reported fauna has been updated here, some misidentifications are to be expected (see further below).

Human bone assemblage

Nine EA entries in the notebook record the discovery of human bones, located almost exclusively in No. 3 Passage and scattered across the length of Gwendoline Passage (Fig. 5). Though the total number of human bones recovered was not stated, Dixon (Scharff *et al.* 1906, 62–3) described the assemblage as derived

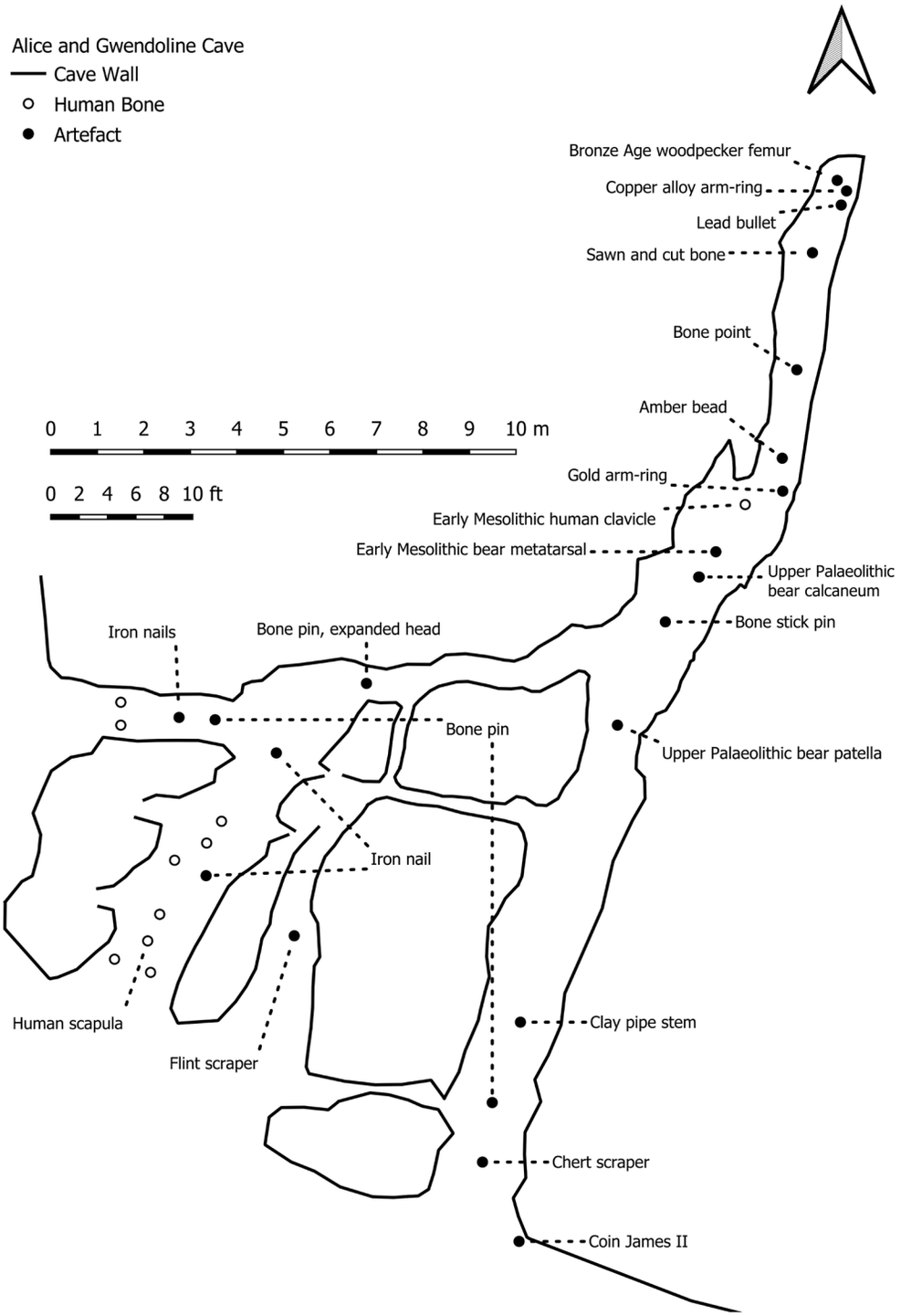


FIG. 5—Distribution of human bone, artefacts and dated animal bones based on data from the unpublished notebook and published report. Each artefact has been located in the centre of the relevant EA grid, unless the notebook or report gave additional locational details.

from one adult represented primarily by small skeletal elements: carpal and metacarpal bones, phalanges 'of the hand and foot', an incisor and fragments of a vertebra, sacrum, clavicle, humerus, ulna, cuboid and rib. In the absence of modern osteoarchaeological analysis, the 1902 identifications are not certain though it should be noted that Fibiger (2016) found a concordance between the antiquarian identifications of human bones from the other caves in the Edenvale/Newhall complex and those that survive in the NMI collections.

Unfortunately, almost all the human bones from Alice and Gwendoline Cave have been lost and only two have been located in recent years. One of these, a fragment of a human clavicle (EA166), is not recorded in the notebook and, unlike the other human bones, was recovered midway along the Alice Passage in the Second Stratum. It was analysed in 2005 as part of the Human Remains from Irish Caves Project and comprised an adult left clavicular diaphysis fragment. It displayed areas of dark staining, surface erosion and cracking/flaking, and exhibited breaks that appear to have occurred after a considerable post-mortem interval (Fibiger 2016, 17). In 2007 this bone was dated to the Early Mesolithic (8828±34BP; 8200–7756 cal BC; Table 1). An Early Mesolithic bear metatarsal (EA64) was found nearby in the Upper Stratum. The only other possible human bone from the cave that can be located at present is the glenoid of a right adult scapula (EA102) that displays evidence of burning (Lynch 2020). It was one of several bones from Gwendoline Passage and was listed as human and charred in the notebook. This bone can only be identified as 'possibly human' because the morphology of the joint surface is somewhat unusual: it is slightly convex whereas a flat or concave shape would be expected of the human glenoid. Furthermore, the exposed edges of bone, broken post-mortem, are slightly more robust than would be expected for a human scapula (Lynch 2020). It has not been dated. Currently, then, little can be concluded from the human remains. It is quite possible that the missing human bones may yet be found amongst the NMI's unsorted animal bone collections.

Artefact distribution

Over twenty artefacts were recovered during excavations in 1902, the majority from the Upper Stratum in the Alice Passage (Table 2; Fig. 5). Many of these cannot be located at present and do not appear to have been deposited in the NMI in 1907. For instance, a flint scraper, chert scraper, whetstones and some bone pins are missing. Other artefacts were likely discarded due to their relatively recent date and perceived unimportance, such as a lead bullet, an animal trap, iron nails, iron fragments and glass. The assemblage reflects multi-period activities at Alice and Gwendoline Cave, from prehistory (scrapers) through to the early medieval (arm-rings) and post-medieval (clay pipe fragment) periods.

Few of the artefacts from Alice and Gwendoline Cave can be closely dated and thus the precise nature of activities represented by this archaeological assemblage is difficult to determine. Several of the artefacts, such as the whetstones, worked bone and bone pins, point towards use of the cave for short-term

Table 1—Radiocarbon dates from Alice and Gwendoline Cave.

Lab code	*Date discovered Trench & Grid Context*	*Species, element, ID**	*$\delta^{13}C$*	*$\delta^{15}C$*	*C:N ratio*	*Collagen yield %*	*Radiocarbon age (BP)*	*Calibrated radiocarbon date (2 δ) cal BC ***	*Calibrated radiocarbon date (2 δ) cal BP (years before present, where present is 1950)*
UBA-41820	12.08.2019 Tr. 1, G.4C C.1003	Large mammal Long bone shaft fragment (19E381:95)	−19.4	8.8	3.19	4.90	11061±41	11144-10942 (0.938) 10910-10899 (0.016)	13092-12891 (0.984)
UBA-20194	09.06.1902 Alice Passage (EA131) Second Stratum	Brown bear (*Ursus arctos*) Right patella (NMIAD: 2020:12; E1028:1	−19.97	6.51	3.28	7.30	10798±71	10941-10911 (0.032) 10898-10729 (0.923)	12846-12678 (0.969)
OxA-29358		NMING: F23919) (Dowd and Carden 2016)					10850±50	10935-10916 (0.031) 10894-10778 (0.923)	12842-12727 (0.972)
UBA-6700	12.06.1902 Alice Passage (EA150) Second Stratum	Brown bear (*Ursus arctos*) Right calcaneum (NMING: F21750) (Edwards *et al.* 2011)	−19.91	6.15			10495±51	10731-10425 (0.770) 10409-10373 (0.049) 10360-10303 (0.067) 10287-10226 (0.064)	12679-12433 (0.800)
OXA-3702	21+26.06.1902 Gwendoline Passage (EA14+EA41) Upper Stratum & (EA101) Second Stratum	Arctic lemming (*Dicrostonyx torquatus*) Three different mandibles (NMING: F21138.1-3) (Woodman *et al.* 1997)	−19.8				10000±80	9859-9837 (0.017) 9807-9301 (0.937)	11755-11249 (0.983)
UBA-41821	14.08.2019 Tr. 2, G.2D C.2011	Goose (*Anser* sp.) Sternum fragment (19E381:99)	−21.9	4.6	3.20	3.80	9728±40	9291-9130 (0.906) 8976-8938 (0.049)	11239-11080 (0.951)

(*Continued*)

Table 1—Radiocarbon dates from Alice and Gwendoline Cave.

Lab code	*Date discovered Trench & Grid Context*	*Species, element, ID**	*$\delta^{13}C$*	*$\delta^{15}C$*	*C:N ratio*	*Collagen yield %*	*Radiocarbon age (BP)*	*Calibrated radiocarbon date (2 δ) cal BC ***	*Calibrated radiocarbon date (2 δ) cal BP (years before present, where present is 1950)*
UBA-20196	12.06.1902 Alice Passage (EA64) Upper Stratum	Brown bear (*Ursus arctos*) Metatarsal IV (NMING: F23920 NMIAD: 2020:13; E1028:2) (Dowd and Carden 2016)	−21.35	0.63	3.27	2.60	8919±64	8278-7937 (0.891) 7911-7829 (0.064)	10226-9885 (0.932)
UBA-8151	14.06.1902 Alice Passage (EA166) Second Stratum	Human, adult Left clavicle (No NMI reg. no.)	−26.3				8828±34	8197-8111 (0.192) 8094-8071 (0.032) 8066-8037 (0.050) 8015-7751 (0.680)	10145-9700 (0.999)
UBA-6693	03.06.1902 Terminus of Alice Passage (EA87) Talus material	Great Spotted woodpecker (*Dendrocopos major*) Femur (NMING: F21520) (Monaghan 2016)					3750±35	2286-2247 (0.110) 2236-2110 (0.596) 2105-2036 (0.248)	4234-3984 (0.999)
UBA-41819	13.08.2019 Tr.1, G.4C C.1006	Duck (*Anas platyrhynchos*) Left coracoid (19E381:97)	−22.4	10.0	3.17	4.70	2079±31	175-25 cal BC (0.888) 20 cal BC - 8 cal AD (0.067)	2123-1974 (0.930)
UBA-41822	14.08.2019 Tr. 2, G.6C C.2009	Ash twig (6 yrs old) charcoal					18±18	1703-1722 cal AD (0.260) 1815-1835 cal AD (0.254) 1890-1909 cal AD (0.441)	

*Identification numbers for bones discovered in 1902 were attributed by the National Museum of Ireland, some of which relate to sequencing in the Natural History Division and others to the Irish Antiquities Division. During their history in the NMI, some bones have been given more than one ID number, all of which are presented here to prevent confusion with numbering in previous publications.

**The conventional radiocarbon ages were calibrated using OxCal v4.4.2 software (Bronk Ramsey 2020).

Table 2—Artefacts recovered from the 1902 excavations in Alice and Gwendoline Cave (after Dowd 2004).

Artefact	*NMI (IAD) reg.*	*Area of cave*	*Stratum*	*Grid*
Artefacts from Alice and Gwendoline Cave in the Irish Antiquities Division of the NMI				
Gold arm-ring	RIA1902:110	Alice Passage	Upper Stratum	EA71
Copper alloy arm-ring	RIA1907:6	Alice Passage	Talus	EA177
Amber bead	RIA1907:5	Alice Passage	Second Stratum	EA172
Bone pin	RIA1907:2	Cross Gallery	Upper Stratum	EA52
Bone pin, fragment	RIA1907:3	Alice Passage	Upper Stratum	EA60
Bone point	RIA1907:1	Alice Passage	Second Stratum	EA173
Clay pipe stem	? RIA1907.39.5	Alice Passage	Upper Stratum	EA37
Lead bullet	? RIA1907.39.14	Alice Passage	Surface	EA87+89
Glass (modern)	? RIA1907:39.21	Alice Passage	Upper Stratum	EA16
Iron nails	? RIA1907.39.6-12	No. 3 Passage	Upper Stratum	EA18
Iron nail	? RIA1907.39.6-12	Gwendoline Passage	Upper Stratum	EA24
Iron nail	? RIA1907.39.6-12	Gwendoline Passage	Upper Stratum	EA41
Large mammal bone, butchered	RIA1907:8	Alice Passage	Upper Stratum	EA21
Animal bones, some butchered	RIA1907:39.28	Various	Various	EA92, EA 101 etc.
Artefacts from Alice and Gwendoline Cave - current location unknown				
Flint scraper	Never deposited in NMI	Grotto	Upper Stratum	EA6
Chert scraper	Never deposited in NMI	Alice Passage	Upper Stratum	EA17
Bone pin	Possibly in NHD, NMI	No. 3 Passage	Upper Stratum	EA26
Worked bone splinter	Possibly in NHD, NMI	Gwendoline Passage	Upper Stratum	EA33
Tooth ground at root	RIA1907:4	Alice Passage	Second Stratum	EA157
'Several' whetstones	Never deposited in NMI	Unknown	Unknown	Unknown
Coin James II	RIA1907:7	Crevice at entrance	Surface	EA16
Amorphous iron	Never deposited in NMI	Grotto	Upper Stratum	EA6
Iron animal trap	Never deposited in NMI	Gwendoline Passage	Upper Stratum	EA36

occupation and/or shelter at unknown periods in time. The distribution of material close to the entrances of Alice Passage and Gwendoline Passage is consistent with use of caves for shelter or short-term occupation, with activities focussed in the outermost areas where natural light is present and there is free circulation of air (Dowd 2015). Some of the post-medieval and modern finds, such as the clay pipe fragment and glass, probably indicate visitors to the cave. A coin of James II found in a crevice outside the entrance to the Alice Passage may have been deposited there by one such visitor in the late seventeenth century. The cave is also likely to have been visited at various times by occupants of nearby Edenvale House. The lead bullet and animal trap probably reflect hunting in the demesne.

Two Hiberno-Scandinavian arm-rings (Fig. 6) were recovered from different locations at the terminus of the Alice Passage, a significant distance from most other signs of human activity. The gold arm-ring is a rare find in Ireland, with only three other examples known, while the copper alloy arm-ring is the only example of its kind in the country and was likely manufactured in the late ninth or early tenth century (Sheehan 2000, 34–5; Sheehan 2016, 163). The arm-rings may reflect early medieval use of the cave as a hideaway for the concealment of valuables that were subsequently never retrieved (Sheehan 2000; Dowd 2015, 193). An alternative reading is that one or both of these prestigious items reflect ritual deposition (Sheehan 2016, 175). A very weathered and damaged amber bead was found approximately 90cm north of the gold arm-ring. Its elongated and flattened barrel shape is unlike Irish Bronze Age or Iron Age examples, suggesting it may be contemporaneous with the Hiberno-Scandinavian material rather than being of late prehistoric origin (Lisa Moloney pers. comm.).

Charcoal, burnt earth, burnt stone, charred bone

Indirect evidence of human activity is represented by the abundance of charcoal, charred bone, burnt earth and burnt stone noted in the notebook. Burnt earth and burnt stone were recorded from the outermost sections of Alice Passage, Gwendoline Passage and No. 3 Passage, almost exclusively from the Surface Stratum and Upper Stratum. This distribution, primarily in the outermost 2.5m of the respective passages, suggests that fires were lit at the entrances, which is consistent

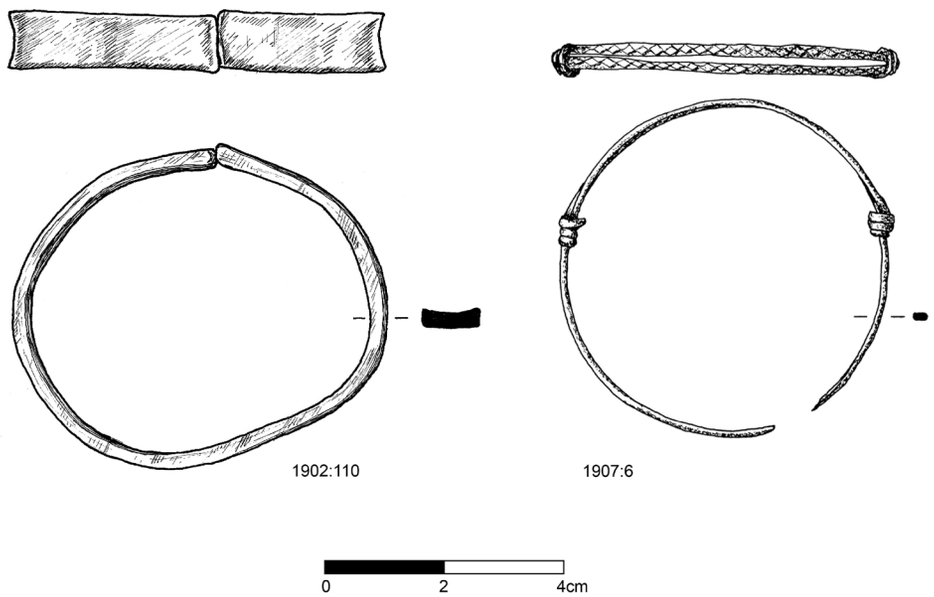


Fig. 6—Gold arm-ring and bronze coiled arm-ring found at the terminus of the Alice Passage (by Malgorzata Kryczka in Dowd 2015).

with the use of caves for short-term occupation and shelter in many time periods. Charred bone was recorded from eight parcels of material, with a distinct concentration in Gwendoline Passage where it occurred in both main strata. The presence of potentially charred human bone was recorded in the notebook for entry EA102, which correlates with the possibly burnt human glenoid that survives in the NMI collections (Lynch 2020). In the Alice Passage, charred bone was recorded from the Second Stratum in two grids. The identification of charred material in the 1902 notebook, as per all other identifications, would need to be verified by modern reanalysis. For instance, manganese staining of bone and stone was noted during the 2019 excavation and could easily be mistaken for burning or charring. The numerous references to the recovery of charcoal during the antiquarian investigations provide a more reliable indicator of burning.

Charcoal occurred in all areas of the cave and in both strata. The notebook records the presence of charcoal in 44 EA entries, some of which occurred embedded in tufa (EA49) and stalagmite (EA166) in the Alice Passage. Significant quantities of charcoal entered the terminus of Alice Passage via the talus of material that had entered through the cave roof opening. A comment in the notebook that charcoal from EA69 was 'kept' suggests that all other charcoal was discarded, it did not receive any specialist attention in the publication, and no charcoal samples from the cave could be located in the NMI collections. Charcoal indicates the presence of fires and/or use of wooden torches in the cave probably at multiple occasions in the past. Some of these likely relate to short-term occupation of the cave.

Marine resources

A small quantity of seashells and fish bones may also have entered the cave via anthropogenic agency. A single Common European limpet (*Patella vulgata*) shell (EA58) was recovered from the Upper Stratum in the Alice Passage. The pharyngeal plate of a wrasse (*Labrus* sp.) (EA87) entered the cave via the roof opening at the terminus of the Alice Passage. A second fish bone (EA86) may derive from the same species, and a third fish bone of unidentified species was also retrieved (Scharff *et al*. 1906, 23–4).

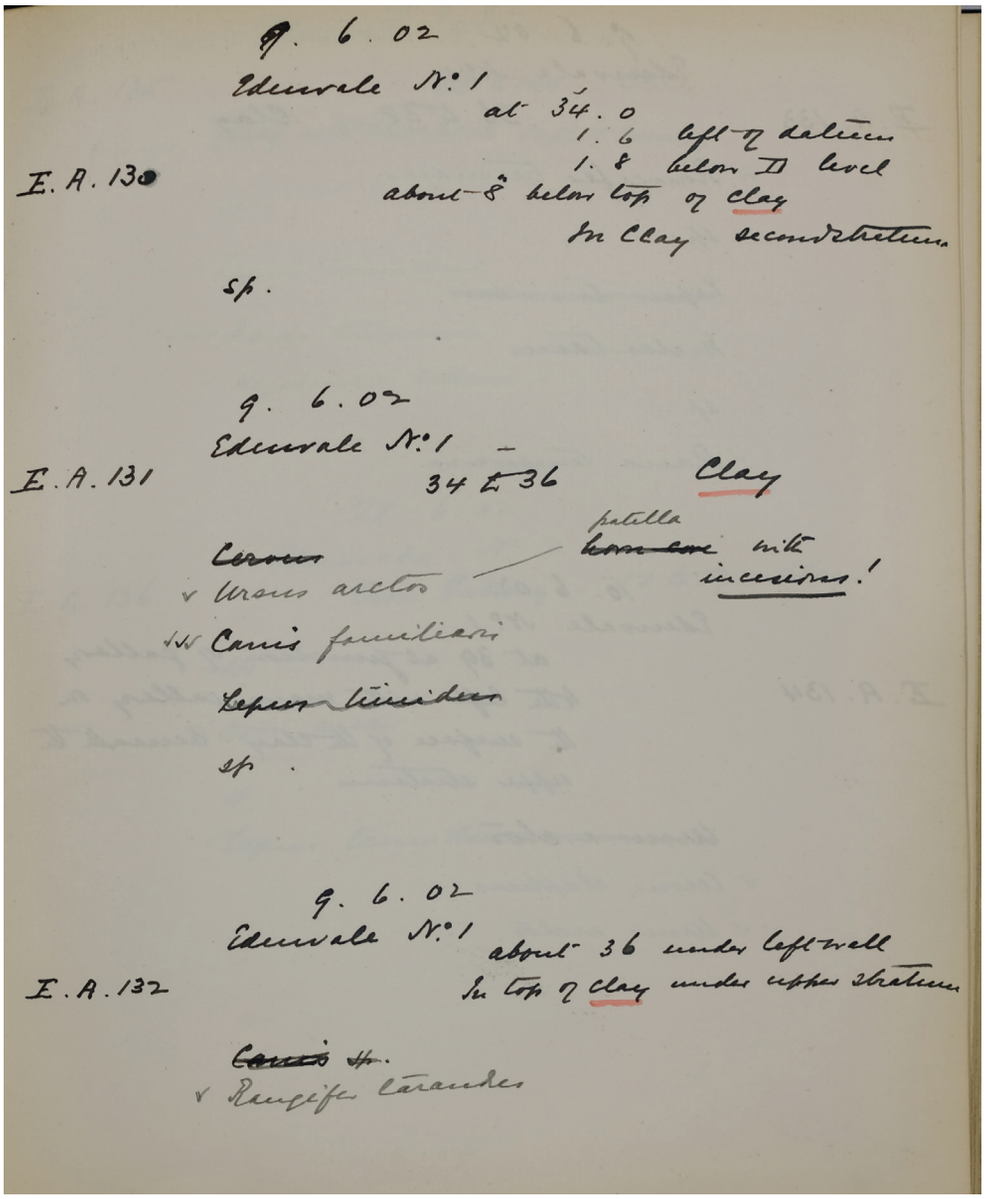
Faunal assemblage

The most significant outstanding issue regarding the 1902 excavations in Alice and Gwendoline Cave is the vast assemblage of faunal remains. Scharff, who examined the faunal assemblage, reported that 'Altogether, Mr. Ussher sent about 50,000 bones from the Edenvale Caves [Alice and Gwendoline Cave and the Catacombs Cave]...to the Museum' (Scharff *et al*. 1906, 2–3). If 50,000 animal bones were recovered from the two caves, a generous estimate of some 10,000–15,000 animal bones might be attributed to Alice and Gwendoline Cave considering that the Catacombs was a much larger cave system and was excavated over seventeen weeks in 1902 and 1903, compared to four weeks at Alice and Gwendoline. Regrettably, the Alice and Gwendoline Cave faunal assemblage in

the NMI has not yet been fully sorted, bagged, labelled or consolidated. As of early 2021, the 1902 faunal assemblage is divided between three buildings and multiple different boxes and bags; bones from different species are intermixed; and in multiple instances, bones from Alice and Gwendoline Cave are mixed with bones from other sites. These not insignificant issues have been highlighted previously (Dowd 2004; Carden and Lewis 2010). Until the essential work of sorting, identifying, cataloguing, re-bagging and unifying the assemblage has been completed, the total number of bones recovered from Alice and Gwendoline Cave in 1902 will not be known.

Scharff's notebook provides some detail on the relative frequency of species found throughout the cave. Each EA entry is followed by the species found therein, accompanied by 'ticks' (Pl. III). On first examination, each tick might appear to represent the number of bones per species per parcel of material. This is supported by the fact that the first entries in the notebook attempt to list each bone per species, which correlates with the number of ticks. Overall, the notebook indicates the recovery of 1,322 bones representing 24 species (not including fish, bird and human) (Appendix). In some cases this correlates with what survives in the NMI collections. For instance, the notebook lists ten pine marten (*Martes martes*, listed as '*Mustela martes*' in the notebook) 'ticks' from ten parcels of material (i.e. ten EA codes), and in 2020 nine pine marten bones from the site could be located in the NMI. However, this figure of 1,322 'ticks' falls far short of the estimated 10,000–15,000 bones and does not always correlate with the number of bones surviving in the NMI collections. For example, there are 21 Arctic lemming (*Dicrostonyx torquatus*) bones and teeth with twelve different EA codes in the NMI collections (an additional Arctic lemming bone was 'sent to Cork' in 1912), but the notebook records thirteen ticks (not 21) from thirteen parcels of material. The EA codes in the notebook correlate with the NMI records and thus in this instance each tick would seem to represent the 'presence' of Arctic lemming in thirteen parcels but not the exact number of elements.

What remains unclear is why there are multiple ticks beside some species in certain EA entries. To take one example, the notebook has 94 ticks for bear (*Ursus arctos*) across 55 EA entries. EA163 has eight ticks for bear, while EA166 and EA168 each have five ticks for bear. Does this indicate eighteen bear bones from these three parcels of material? It clearly cannot represent eighteen individual bears. One possibility is that bones that were considered more important, specifically those of extinct fauna, were carefully counted, but species considered less interesting or likely modern—such as rabbit (*Oryctolagus cuniculus*, listed as '*Lepus cuniculus*' in the notebook) or frog (*Rana temporaria*)—were not recorded in detail but their presence was noted. This is supported to some extent by entries in the notebook. For example, entry EA13 notes that *Canis familiaris* and '*Lepus cuniculus*' were 'abundant' but receive just eight and five ticks respectively. Similarly, entry EA14 notes rabbit and frog as 'abundant' but these are accompanied by just six and three ticks respectively.



Pl. III—Series of entries from the notebook, including the discovery of the butchered bear patella (Chris Stimpson).

To compound these issues, the notebook records instances where unknown quantities of frog, rabbit and pig (*Sus scrofa*) bones were 'thrown out'. Though the reason for the discard of these bones was not stated, it was presumably because of the abundance of these remains and/or the assumption that they were of relatively recent date. The notebook also records that two sets of animal bones were 'sent away', perhaps for display or as comparative samples or to add to existing

zoological collections. On 18 January 1912, 26 bones were 'sent to Cork' (Cork University Museum), including 6 frog, 5 bear, 5 dog, 4 pig, 2 giant deer (*Megaloceros giganteus*, listed as '*Cervus giganteus*' in the notebook), 1 Arctic lemming, 1 horse (*Equus ferus caballus*), 1 cat (listed as '*Felis domestica*' in the notebook) and 1 lesser horseshoe bat (*Rhinolophus hipposideros*). In June 1907, 34 bones were sent to Liverpool Museum (now World Museum) including 8 bird, 7 *Canis* sp., 4 rabbit, 4 hare (*Lepus timidus*), 2 bear, 2 cat, 2 pig, 1 horse, 1 badger (*Meles meles,* listed as '*Meles taxus*' in the notebook), 1 giant deer, 1 sheep (*Ovis aries*) and 1 goat (*Capra hircus*). It appears that these two sub-collections were never returned to the NMI.

Figure 7 illustrates the distribution of the 1322 animal bones documented in the notebook as a heatmap. Generally, the majority of the faunal remains were recovered distributed along the length of Alice Passage, though with a distinct absence of material along a 6m stretch of the passage, beginning approximately 4m inside the entrance. In contrast, a concentration of faunal remains occurred in the most spacious part of the cave, some 14m inside the entrance of the Alice Passage. Some 26 parcels of material were recovered from these grids, suggesting a greater volume of sediment here. The general paucity of animal bones in Gwendoline Passage contrasts with the concentration of human bones here.

In 2010, 871 bones from the 1902 excavations in Alice and Gwendoline Cave were reanalysed (Carden and Lewis 2010, 21–3, 97–112). The 702 identifiable bones included 'fox sp.'[2] (177), 'hare sp.' (176), 'dog/wolf/fox' (145), rabbit (75), dog (29), 'bear sp.' (19), horse (15), badger (13), pig/wild boar (8), 'cat sp.' (8), pine marten (4), 'lemming sp.' (2) and cattle (*Bos taurus*; 1). A further 169 bone fragments were categorised as unidentifiable. This project was an important first step in the reanalysis of the faunal remains from the 1902 excavations, and the analysed bones were sorted, catalogued and rebagged by species. Occasional misidentifications in the original 1902 analysis were also highlighted (Carden and Lewis 2010, 29).

In cave contexts it can be nearly impossible to distinguish between animal bones that relate to human activities and those that represent natural processes (see Dowd 2015, 65–7; Stimpson 2016). The primary distinguishing factor is where animal bones show signs of working and/or display cutmarks or butchery marks. Bones that exhibit burning or charring may reflect human food preparation, but it is also possible that bones naturally introduced into a cave may be accidentally scorched by fires associated with human occupation or shelter at much later periods. The notebook refers to the presence of 'artificially split bones' in at least 41 EA entries, related primarily to material from the Upper Stratum. Butchered and sawn bone and antler was particularly common in the

2 Specimens assigned to fox were listed as 'Vulpes alopex' throughout the notebook, which is not a valid taxonomic name. *Canis alopex* is a taxonomic synonym for the red fox, *Vulpes vulpes*. Confusingly, however, *Alopex lagopus* is the Arctic fox, which has a similar post cranial osteology to the red fox (e.g. Monchot and Grendron 2010).

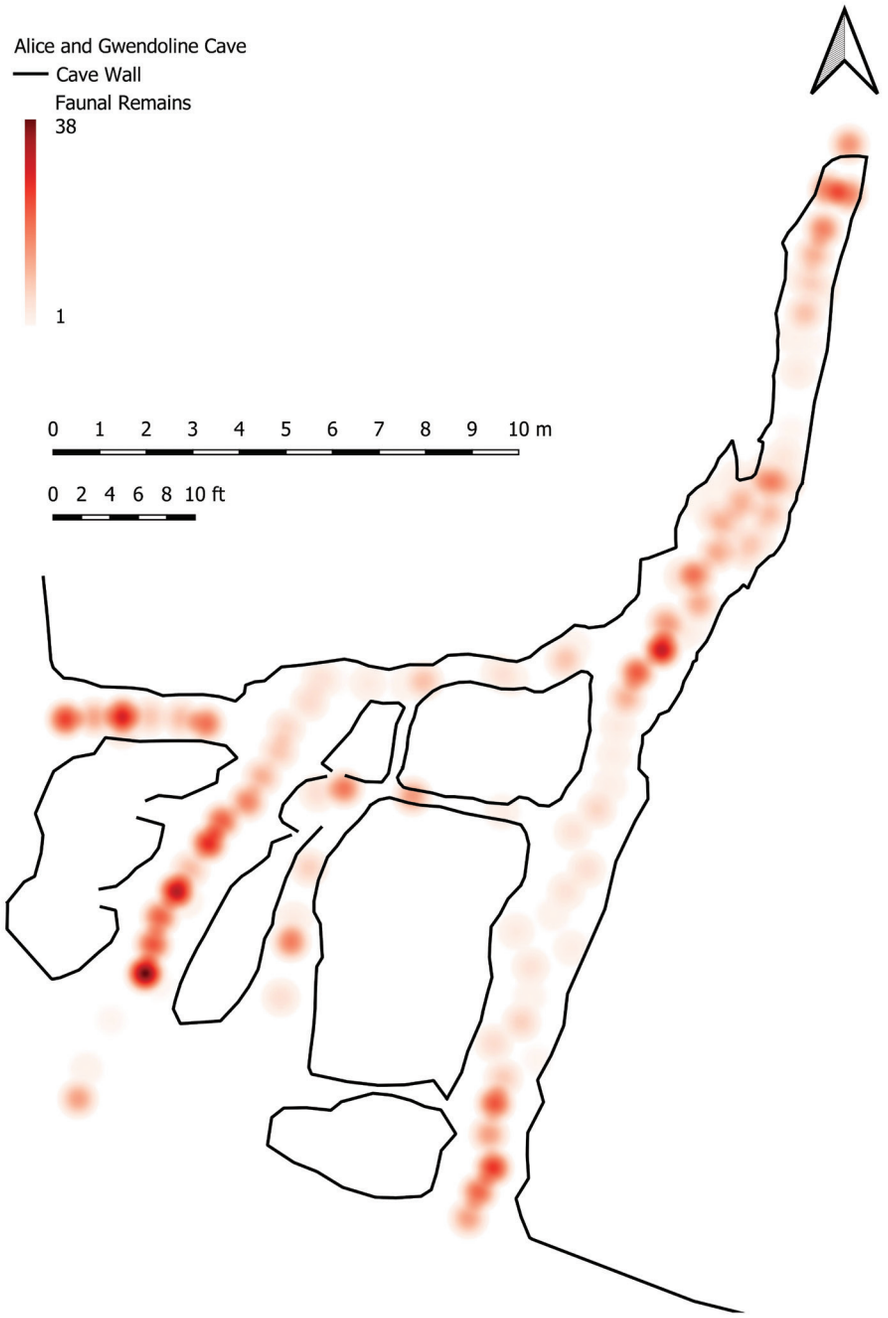


FIG. 7—Distribution of faunal remains based on data from the unpublished notebook. Distribution is presented as a heatmap based on the frequency of bone discovered per EA grid unit. The 2ft wide excavation grid is shown overlaying the heatmap.

talus material that had entered the terminus of Alice Passage via the cave roof opening, and also occurred at and outside the Alice entrance and the Gwendoline entrance. However, until detailed modern analysis of the full faunal collection has been completed, the tally of humanly modified animal bones from the site is not known. Many of the 'artificially split' bones reported in 1902 probably reflect trampling or natural breakage, for instance. In their 2010 partial study of the assemblage, Carden and Lewis (2010, 21) identified 31 bones from the site with possible signs of anthropogenic agency (e.g., butchery, burning, scorching), notably hare, fox and bear bones. The dates of these instances of human activities (presumably butchery and food preparation) are unknown. One exception is the aforementioned brown bear patella, listed in the notebook as 'patella with incisions' (Pl. III), which relates to Late Upper Palaeolithic hunter gatherer butchery of a bear carcass and the extraction of tendons probably for use as binding materials (Dowd and Carden 2016). The patella and two other bones—a large mammal bone fragment with cutmarks and a burnt mammal rib fragment—are housed in the Irish Antiquities Division of the NMI, though all other butchered animal bones from the cave are housed in the Natural History Division. The perceived distinction between what is considered archaeological and what is deemed palaeontological can have damaging repercussions for the long-term curation and interpretation of faunal assemblages from caves and can result in unequal treatment of these assemblages within museums.

Extinct faunal remains

The notebook provides information not contained in the published report on the remains of the four extinct species that were recovered from the site: bear, Arctic lemming, giant deer and reindeer (Appendix). Scharff noted the frequent discovery of reindeer bones together with those of bear and giant deer, which he suggested 'would seem to point to their having inhabited Ireland at the same time' (Scharff *et al*. 1906, 30). The span of dates, however, indicates a period of more than two millennia (Table 1). Modern reanalysis of the extinct faunal remains from Alice and Gwendoline Cave is essential, but the identifications made by Scharff in the early twentieth century are generally quite robust.

Bear (*Ursus arctos*) At least 94 bear bones were recovered from Alice and Gwendoline Cave, nineteen of which have been re-examined in recent times (Carden and Lewis 2010). Two bear bones, almost certainly from two different bears, have been dated to the Late Upper Palaeolithic, while a third bear bone has indicated an Early Mesolithic date (Table 1). Figure 8 illustrates a distinct concentration of bear bones from the Second Stratum approximately 14–18m inside the entrance, midway along the Alice Passage where the cave is most spacious. The findspots of the Late Upper Palaeolithic butchered bear patella and bear calcaneum, as well as the Early Mesolithic bear metatarsal, are indicated. Polishing (still visible today) 4.5m inside the entrance on the west wall of the Alice Passage led Ussher to surmise it was caused 'by the rubbing of passing

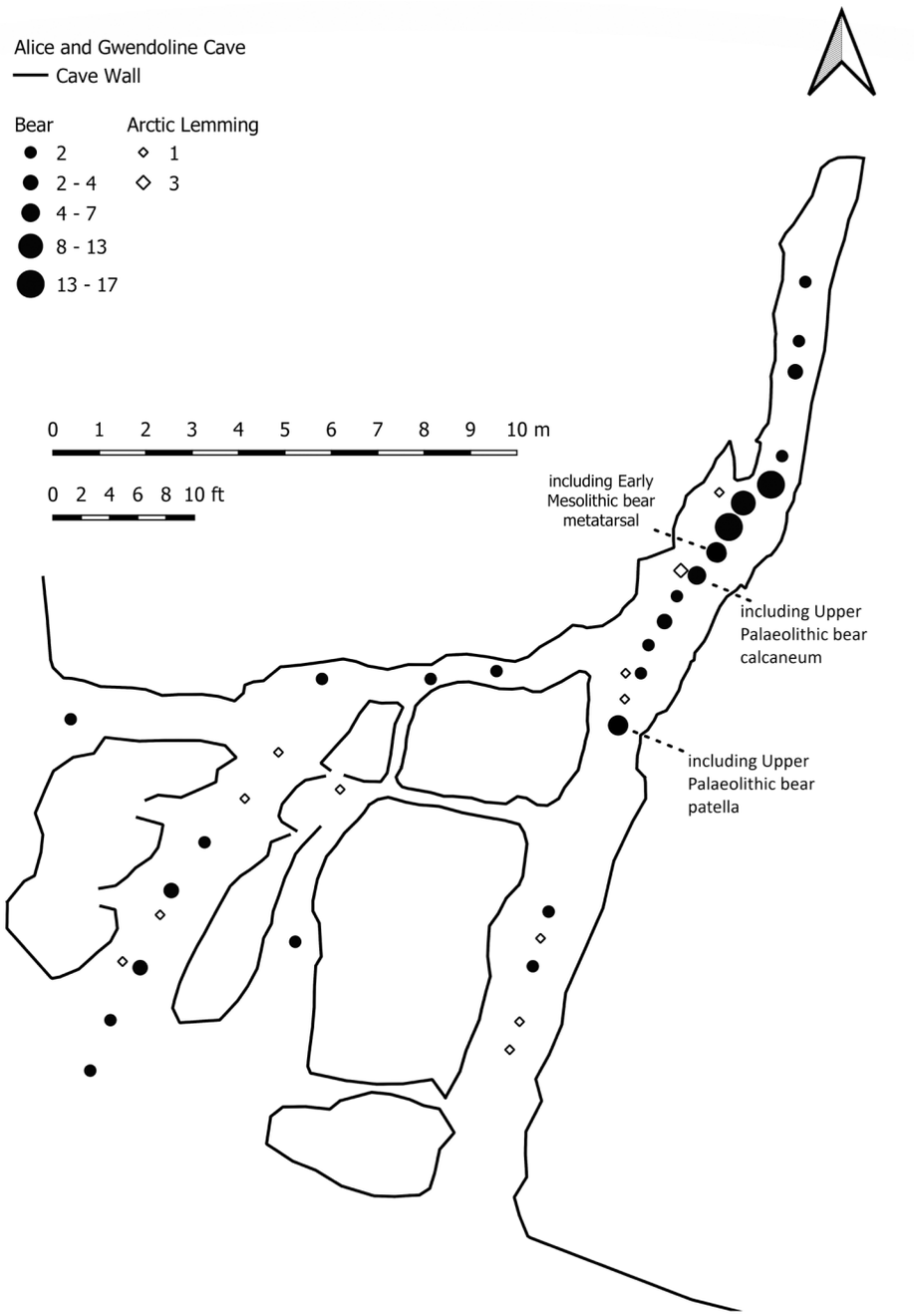


FIG. 8—Distribution of Arctic lemming (*Dicrostonyx torquatus*) and bear (*Ursus arctos*) bones based on data from the notebook. Distribution is presented as symbol proportional data based on the frequency of bone discovered per EA grid unit.

animals', a phenomenon known as *Bärenschliff* that may relate to bear occupation of the cave (Scharff *et al*. 1906, 4). The recovery of adult and juvenile bear bones from the Alice Passage might suggest that the cave had been used as a hibernaculum. However, if this passage was largely choked with sediment,

the polishing on the cave wall may have been caused by smaller mammals such as badgers. A number of bear bones were also scattered through Gwendoline Passage.

Arctic lemming (*Dicrostonyx torquatus*) Figure 8 illustrates the distribution of the 21 Arctic lemming bones found in the cave, two of which were examined in recent years (Carden and Lewis 2010). Unlike the other extinct species, Arctic lemming occurred in Gwendoline Passage as well as in Alice Passage. One Arctic lemming bone was sent to Cork University Museum in 1912. The Irish Quaternary Fauna Project obtained a single date (10,000±80 BP) from three Arctic lemming mandibles from the Second Stratum of Gwendoline Passage (Woodman *et al*. 1997, 137). This date must be considered of limited value given that it derived from bones of three different individuals.

Giant deer (*Megaloceros giganteus*) The notebook lists the recovery of at least 24 giant deer bones in the cave, none of which were examined by Carden and Lewis (2010). One giant deer bone (EA93) was sent to Liverpool Museum in 1902 and two giant deer bones (EA148, EA162) were sent to Cork University Museum in 1912. Scharff *et al*. (1906, 28) noted that most of the giant deer remains were fragmentary and 'much-blackened'. The notebook recorded a giant deer bone from EA122 as 'apparently artificially split!' but this would need to be verified by modern zooarchaeological analysis. All but one of the giant deer bones occurred scattered along the Alice Passage, with a distinct concentration of at least seventeen bones within a 0.90m stretch of the most spacious part of the cave (Fig. 9). At least six giant deer bones (EA166) occurred together at a depth of 28cm in the Second Stratum. The distribution of giant deer bones was broadly similar to that of bear.

Reindeer (*Rangifer tarandus*) The notebook records the discovery of twelve reindeer bones, none of which were examined by Carden and Lewis (2010). One reindeer bone (EA162) was sent to Cork University Museum in 1912. Scharff *et al.* (1906, 30) noted that all but two of the reindeer bones were 'dark in colour [...] which indicate great antiquity'. He added that the remains were well preserved and none 'show clearly that the Reindeer had been used as food' by humans (Scharff *et al.* 1906, 30). The reindeer bones are far more randomly dispersed throughout the cave, along the length of the Alice Passage, but also in No.3 Passage and the Cross Gallery (Fig. 9).

The concentration of bones of extinct megafauna, animals that would have been too large to enter the cave alive, almost certainly represent the introduction of disarticulated bones into Alice Passage from aboveground via the opening in the cave roof at the termination of the Alice Passage, and by other natural formation processes such as scavenging. Similarly, the Late Upper Palaeolithic bear patella plausibly relates to human activities on the plateau overhead, being subsequently washed or carried into the cave by natural formation processes.

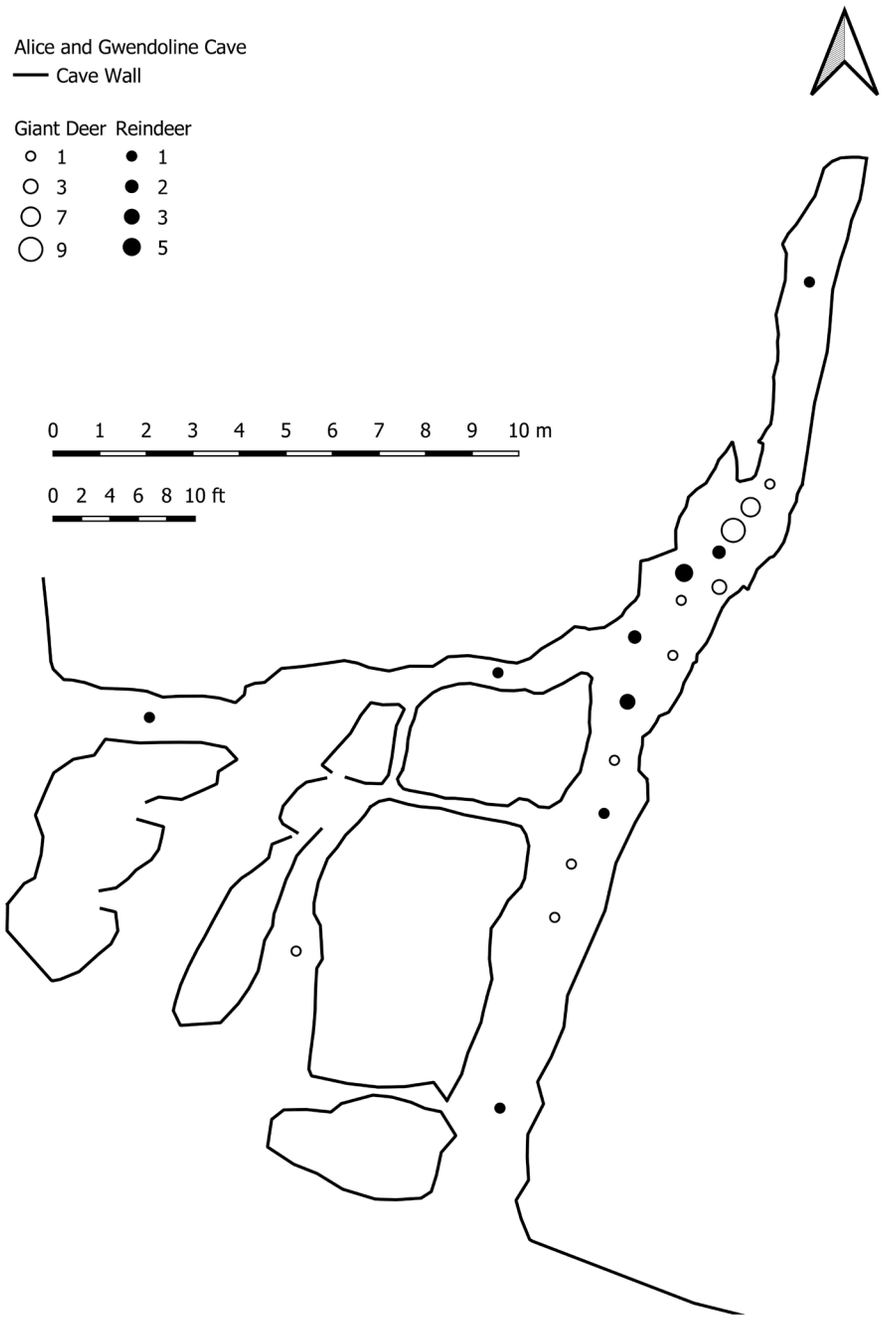


FIG. 9—Distribution of giant deer (*Megaloceros giganteus*) and reindeer (*Rangifer tarandus*) bones based on data from the notebook. Distribution is presented as symbol proportional data based on the frequency of bone discovered per EA grid unit.

Excavations in 2019 (Licence 19E381)

In 2019 a two-week excavation took place in the cave (Dowd 2020). Two trenches were opened in the Alice Passage with the objective of assessing the extent of *in situ* deposits within the cave and investigating the archaeological and palaeontological context of the LUP butchered bear patella (Fig. 10). A detailed account of the excavation is beyond the scope of this paper, but the preliminary findings summarised here complement the 1902 data.

Overall, 77 animal bones were recovered including young cattle (*Bos taurus*); cat, most likely domestic (*Felis* cf. *catus*); dog (*Canis familiaris*), likely associated with greyhound skeletons recently dumped into the cave via the roof opening at the terminus of the Alice Passage; rodents; small passerines (likely thrushes—Turdidae); and frog (*Rana temporaria*) (Stimpson 2019). The majority of this material is relatively modern (with some exceptions) and reflects ongoing 'middening' from the local farm, the activities of carnivores and owls, and possibly the independent activities of amphibians (frogs). Also included in this small assemblage, however, was a LUP fragment of a large mammal; a LUP goose (*Anser* sp.); and an Early Iron Age duck (*Anas platyrhynchos*) (Pl. IV) (Table 1). Studies of Pleistocene fauna tend to focus on megafauna and thus the LUP goose is a noteworthy contribution to our knowledge of wild fowl at this time. Geese and ducks would have been valuable resources for prehistoric communities, not only for food but also for feathers and eggs.

A magnetic susceptibility survey identified several areas of burning in the Alice Passage and subsequent excavation revealed that at least one of these is modern and post-dates the 1902 excavation (Table 1). An assemblage of 69 pieces of limestone and siltstone/shale that may have been struck or retouched was also retrieved (Ballin 2019). None of the pieces are convincing, however, and more likely represent natural pieces of stone that were shattered and experienced edge damage as a consequence of natural cave formation processes. No definite artefacts were recovered.

The most significant outcome of the 2019 excavation was in establishing that the antiquarian team was extremely thorough in the removal of archaeological and palaeontological strata from the cave. Virtually none of the so-called 'Upper Stratum' and 'Second Stratum' removed in 1902 survived, with the exception of a few small pockets of material trapped in niches in the cave walls. For instance, two strata were encountered in Trench 2 trapped between a slab of stone and the cave wall, *in situ* deposits that had been removed elsewhere by the 1902 team. This surviving column of material measured 0.65m in height, but covered an area just 10cm by 12cm. The lowest stratum was a loose yellowish brown silty clay consolidated into a soft breccia with inclusions of calcite fragments; it produced the LUP goose bone. Overlying this was a yellowish white solidified calcite-rich deposit with some loose soil and limestone fragments.

The strata removed in 1902 reached a depth of 60–75cm as revealed by staining on the cave walls as well as the aforementioned block of deposits sandwiched between the cave wall and the stone slab in Trench 2. It appears that the 1902 excavations ceased when faunal remains were no longer being discovered. However, in the Alice Passage *in situ* sediments survive though these appear

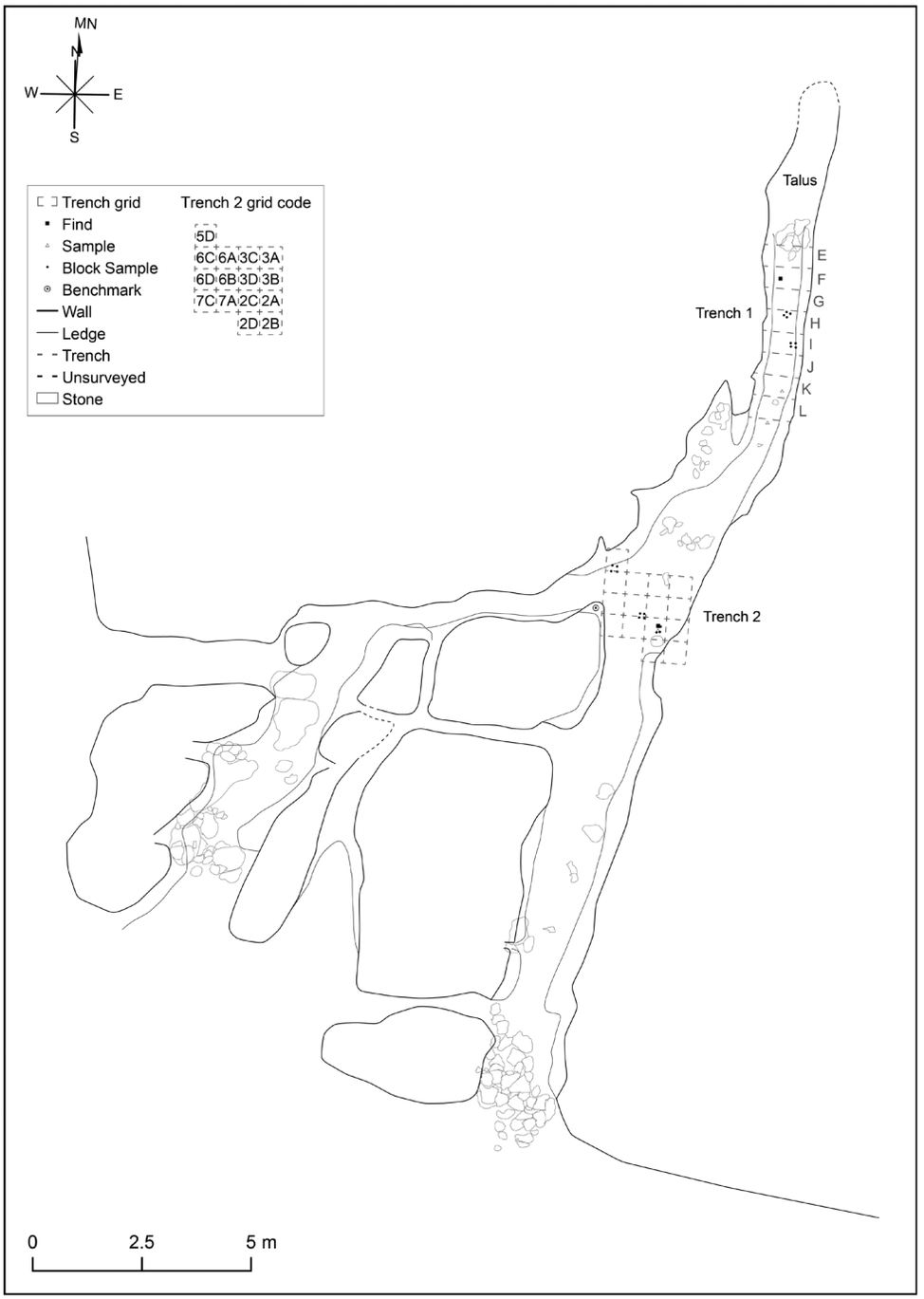
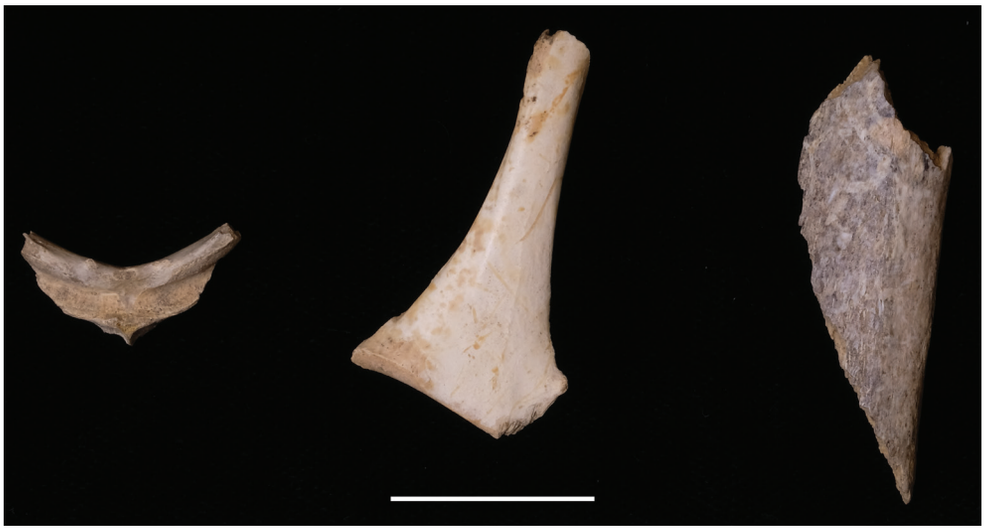


Fig. 10—Location of 2019 excavation trenches.

to be largely sterile. In Trench 1, two *in situ* strata were identified below the level of the 1902 excavation: a loose orangey-yellow coarse sand that was exposed but not excavated, overlain by a firm mid-pinkish brown sand clay (max. 12cm thick). In Trench 2, the deepest stratum excavated in 2019 was a sterile



Pl. IV—Dated bird and animal bones from the 2019 excavation. Left to right: LUP goose (*Anser* sp.) sternum (19E381:99); Iron Age large duck (*Anas platyrhynchos*) left coracoid (19E381:97); LUP unidentified large mammal long bone shaft fragment (19E381:95) (20mm scale) (Chris Stimpson).

yellowish-brown silty clay with abundant calcite and manganese deposition (20cm thick). A core revealed that this was not the basal deposit in the cave and that further deposits exist here to a depth of at least 20cm (David Drew and Colin Bunce pers. comm.).

The 2019 excavations also revealed that sediments had entered the cave via the roof opening at the terminus of the Alice Passage. Immediately beneath the opening, the excavated strata reached a thickness of 34cm in the northern end of Trench 1 but petered out to 4cm in the southern end. Relatively deep water channels along this section of the passage also clarified the role of water in washing sediments and bones into the cave from outside, as well as transporting material from the terminus of the Alice Passage further south. Indeed, during the 2019 excavation summer rains caused low level flooding in this part of the cave illustrating the likely impact of outside weather conditions on the formation of sediments, the mixing of strata, and the dispersal of palaeontological and archaeological material over millennia.

Discussion

The 1902 excavations in Alice and Gwendoline Cave resulted in the recovery of a diverse array of palaeontological and archaeological material including approximately 10,000–15,000 animal bones, 20 artefacts and 12 human bones. Re-analysis of elements of the assemblage, combined with new data from the 2019 excavations, provide a clearer understanding of how the cave was used through time. In particular, there is a concentration of Late Upper Palaeolithic

and Early Mesolithic material in the cave, but virtually no later Mesolithic, Neolithic, Bronze Age and Iron Age material. Of the ten radiocarbon dates, five derive from the Late Upper Palaeolithic (Table 1). This bias cannot be attributed to a selective sampling strategy or period-specific research focus as, apart from the Arctic lemming, the three other LUP bones were of species not exclusively related to the period. The oldest specimen, for instance, is a long bone shaft fragment from an unidentified large mammal. It was recovered in 2019 and selected for dating because of the possibility that it may have been burnt. Because the fragment could not be identified to species, there was no prior clue as to its date. Similarly, a well preserved large goose sternum fragment found in 2019 could have been from any period, including modern, yet returned a date at the end of the LUP. Furthermore, the LUP butchered bear patella was initially selected for dating because of the rarity of evidence for interactions between humans and bears in prehistoric Ireland (Dowd 2016). There was no prior indication that it would be so early in date, as bear was present in Ireland until at least the Middle Bronze Age (Monaghan 2017). Another bear bone was dated by Edwards *et al.* (2011) as part of a genetic study; the date is significantly different to that from the butchered patella as to indicate two different bears. The three lemming mandibles were recovered from the Gwendoline Passage and may indicate the original presence of lemming burrows in this part of the cave. The four other LUP elements were located in the innermost section of the Alice Passage. The butchered bear patella has been interpreted as relating to dismemberment of a carcass by LUP hunter gatherers (Dowd and Carden 2016), though this has been disputed by Tune (2020). The potentially burnt LUP large mammal shaft fragment provides further tentative evidence of human activities at this time, though should be treated with caution as the discolouration may be the consequence of manganese staining. These two bones, the second LUP bear and the LUP goose sternum, were probably washed into the cave through the opening at the end of the Alice Passage from the limestone plateau aboveground. If so, the best chance of finding further evidence for LUP human activities is to investigate the area *above* the cave in the vicinity of the surface opening.

A human clavicle and a butchered bear bone present intriguing evidence of human activities at the cave at the very onset of the Mesolithic (Table 1). The human clavicle is significant considering that human bone of Mesolithic date is rare in Ireland and to date has only been recorded from seven locations on the island (Meiklejohn and Woodman 2012). Of note is the relative proximity of Alice and Gwendoline Cave to Hermitage, Co. Limerick, where cremated human remains of Early and Late Mesolithic date were recovered from burial pits on the bank of the River Shannon (Collins and Coyne 2003; Collins 2009), and Killuragh Cave in the same county where unburnt disarticulated human bones, also of Early and Late Mesolithic date, were retrieved (Woodman *et al*. 2018). The single bone from Alice and Gwendoline Cave should not necessarily be interpreted as indicative of ritual or funerary processes. As this bone was isolated from other human bones at the site, it may not be directly related to the human

bones from the Gwendoline Passage and No. 3 Passage. The Early Mesolithic bear metatarsal was discovered close to the Early Mesolithic human clavicle towards the end of the Alice Passage, suggesting that these bones may have washed into the cave from aboveground. However, human occupation of the cave during the LUP and/or the Early Mesolithic cannot be discounted. The very early dates for both the human clavicle and the butchered bear metatarsal should be noted: they pre-date Mount Sandel and the 8000 cal BC conventional start date for the Irish Mesolithic.

Following the very beginning of the Early Mesolithic there appears to be a drop-off in human and animal activities at the cave, potentially through to the twentieth century. It is plausible that the cave became choked with sediments from the ground surface overhead during the LUP and into the Early Mesolithic, essentially blocking the Alice Passage and rendering the site unusable for human activities. The cave thus acted as a trap for early prehistoric sediments and bones. Though the Gwendoline Passage is much smaller in size, at least twelve human bones were found here. Dowd (2008; 2015) conjectured that these may reflect Neolithic or Bronze Age excarnation practices based on the small size of the assemblage, the exclusive presence of small skeletal elements, and the similarities between this assemblage and dated Neolithic human bone assemblages from adjacent caves in the Edenvale area. A flint scraper from the Grotto and a chert scraper found close to the main entrance of Alice Passage may tentatively relate to these human bones considering the close association between scrapers (both convex and concave) and Neolithic human bones in Irish cave contexts (Dowd 2015, chapter 5). It is possible that the Gwendoline Passage was more accessible or spacious in prehistory than the Alice Passage. Indeed, the 1902 discovery of modern iron nails and an iron animal trap in the Gwendoline Passage supports this theory. The Early Bronze Age great spotted woodpecker femur (Monaghan 2016) from the talus material at the end of the Alice Passage, and the Early Iron Age duck bone from Trench 1 in the same area, evidently entered the cave from aboveground through the roof opening (Table 1).

The two Hiberno-Scandinavian arm-rings and the amber bead from the end of the Alice Passage indicate human activity at the cave in the latter part of the early medieval period. The gold penannular arm-ring 'lay at no great depth between small stones, with a small slab laid overhead' (Scharff *et al*. 1906, 68). The copper alloy coiled annular arm-ring was found in the talus of material that had entered the terminus of the Alice Passage through the opening in the cave roof. Ussher (Scharff *et al*. 1906, 5) conjectured that it 'had plainly been thrown in from some settlement above the cave, the latter having been used as an ash-pit'. It is difficult to envisage how two such prestige items could have been discarded or lost or washed into the cave from a site overhead. Hiberno-Scandinavian artefacts and hoards from Cloghermore Cave, Co. Kerry, Glencurran Cave, Co. Clare, and Dunmore Cave, Co. Kilkenny, have been interpreted as representing votive deposits or gravegoods accompanying burials or the concealment of wealth (Dowd 2015, chapter 8). In a similar vein, it is more plausible that

the arm-rings from Alice and Gwendoline Cave were deliberately and carefully deposited, though the motives for doing so are unknown. The antiquarian description of the find circumstances of the gold arm-ring suggest it was carefully placed on the cave floor amongst stones and protected with a slab. It is possible that the person or people who deposited these arm-rings entered the cave from the opening in the cave roof at the end of the Alice Passage rather than through the main cave entrance.

Conclusion

The reassessment of legacy data from antiquarian excavations, in tandem with modern scientific analyses of the material recovered during such investigations, has the potential to return rich dividends. Such studies can provide new insights into the original contexts and spatial locations of palaeontological and archaeological material at sites that were excavated at a time when the focus was on recovering artefacts and bones rather than examining stratigraphy or natural and cultural formation processes. For instance, reassessment of the 1928 and 1934 excavations at Kilgreany Cave, Co. Waterford, revealed that different areas of the cave were used for Neolithic burial, early medieval occupation and post-medieval shelter (Dowd 2002). Similarly, a re-evaluation of archives related to the 1911 excavation of passage tombs within the Carrowkeel complex, Co. Sligo has allowed for a reconstruction of the original context and distribution of Neolithic human remains within the tombs (Meehan and Hensey 2018).

Alice and Gwendoline Cave is a key site in understanding Ireland's early human occupation. Consequently, maximising the information contained within the unpublished antiquarian excavation records is vital to any further study of this site. The data we have extracted from the unpublished notebook and visualised using GIS provides a foundation for future archaeological excavations at the site and will be crucial to all further reassessments of material recovered during the 1902 campaign. This is especially significant considering that some of the artefacts, almost all of the charcoal, and many of the faunal remains recovered in 1902 cannot be located at present. Furthermore, while the archaeological material from the site has been reassessed in recent years (e.g. Dowd 2004; Fibiger 2016; Sheehan 2016), and a portion of the faunal assemblage has been re-examined (Carden and Lewis 2010), the full collection of animal bones has yet to be sorted and unified as an assemblage.

Our reassessment of the 1902 data, combined with results of a two-week excavation in the cave in 2019, lead us to conclude that the Alice Passage had become choked with sediment by the beginning of the Mesolithic effectively blocking the cave and rendering it largely unusable. Material clearly entered the cave from aboveground via the opening in the cave roof at the terminus of the Alice Passage, bringing with it bones of now-extinct mega-fauna and archaeological objects. GIS has demonstrated that the majority of extinct faunal remains are confined to the deeper parts of the Alice Passage, the area closest to the roof opening. Further palaeontological and archaeological material and sediments

may well survive on the limestone plateau above the cave. There is some evidence to suggest that Gwendoline Passage, though currently quite small and restricted, was accessible to some degree in prehistory. The human bones and scrapers found in this area may represent Neolithic or Bronze Age funerary practices, though this is far from certain. The Hiberno-Scandinavian arm-rings appear to have been carefully placed in the cave, though access at this time may also have been via the opening in the cave roof.

Our study highlights the wealth of information that has yet to be extrapolated from the four other caves in the Edenvale/Newhall complex that were excavated by the Committee Appointed to Explore Irish Caves, and indeed similar antiquarian investigations where documentary records survive. In terms of Irish palaeontological collections, identifying the locations within sites where specific bones were discovered provides important contextual data and is a significant influencing factor in where to locate future excavation trenches, particularly with regard to caves. This type of data, for instance, is largely absent from the Irish Quaternary Fauna Project, the largest dating programme of Irish extinct faunal remains yet undertaken (Woodman *et al*. 1997). With detailed analysis, antiquarian excavation archives have much to reveal about sites and associated assemblages of artefacts and bones allowing for a deeper understanding and new interpretations of past human and animal activities.

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Appendix: Data extracted from R.F. Scharff's unpublished notebook

Date in 1902	EA code	Area of Cave	Grid	Stratum	Lesser horseshoe bat (*Rhinolophus hipposideros*)	Polecat (*Mustela putorius*)	Human (*Homo sapiens*)	Bear (*Ursus arctos*)	Arctic lemming (*Dicrostonyx torquatus*)	Reindeer (*Rangifer tarandus*)	Red deer (*Cervus elaphus*)	Giant deer (*Megaloceros giganteus*)
03.06.02	3			Su								
	16	AP	Outside	Su							2	
	88	AP	Talus	Su								
	87 + 89	AP	76-80ft	Su	1	2						
04.06.02	1	AP	0-2ft	US								
	7	AP	2-4ft	US								
	9	AP	2-4ft	US								
	12	AP	2-4ft	US								
	17	AP	2-4ft	US								
	13	AP	4-6ft	US								
	21	AP	6-8ft	US						1		
	25	AP	8-10ft	US							1	
	90	AP	2-4ft	SS								
	111	AP		SS								
05.06.02	35	AP	10-12ft	US					1			
	37	AP	12-14ft	US					1			
	39	AP	16-18ft	US				1			1	
	40	AP	18-20ft	US					1			
	96	AP	10-12ft	SS								
	95	AP	12-16ft	SS								
	97	AP	16-18ft	SS								
	116	AP	18-20ft	SS								

Hedgehog (*Erinaceus europaeus*)	Pine marten (*Martes martes*)	Fox (*Vulpes vulpes*)	Badger (*Meles meles*)	Cattle (*Bos taurus*)	Sheep (*Ovis aries*)	Sheep/goat (*Ovis aries*/*Capra hircus*)	Goat (*Capra hircus*)	Pig (*Sus scrofa*)	Dog (*Canis familiaris*)	Cat (*Felis catus*)	Horse (*Equus ferus caballus*)	Rabbit (*Oryctolagus cuniculus*)	Hare (*Lepus timidus*)	Frog (*Rana temporaria*)	Brown rat (*Rattus norvegicus*)	Wood mouse (*Apodemus sylvaticus*)	Bird
											3						
				2		1		2	4		1	5			1		x
				2				2	10			6	1				
	1	8	1	1	2	5	1	11	10			3	5			1	x
				8				3	9		1	5		1	2		
								1	3								
									2				4		1		x
														1	6		x
		1						1	8		3	1		1	4		
				1					8		2	5		3			
		1		2	2	1		7	7		1	4		4	2		x
					3	1		2	1		1		1	1			x
						2		3				1	1				x
						2		1				5		1			x
						1						1		1	1		x
								1				2					x
												1					
												1		1			
													1	2			x

(*Continued*)

Date in 1902	EA code	Area of Cave	Grid	Stratum	Lesser horseshoe bat (*Rhinolophus hipposideros*)	Polecat (*Mustela putorius*)	Human (*Homo sapiens*)	Bear (*Ursus arctos*)	Arctic lemming (*Dicrostonyx torquatus*)	Reindeer (*Rangifer tarandus*)	Red deer (*Cervus elaphus*)	Giant deer (*Megaloceros giganteus*)
06.06.02	43	AP	20-22ft	US								
	45	AP	22-24ft	US							1	
	117	AP	20ft	SS				1				
	94	AP	21ft	SS								1
	118	AP	22ft	SS							1	
07.06.02	47	AP	24-26ft	US								
	49	AP	26-28ft	US							1	
	51	AP	28-30ft	US							1	
	98	AP	22-24ft	SS								
	119	AP	24-26ft	SS								
	120	AP	24-26ft	CT								
	122	AP	25-26ft	SS								1
	123	AP	27ft	SS								
	124	AP	26-28ft	SS								
09.06.02	50	AP	27-30ft	US								
	54	AP	30-32ft	US								
	55	AP	32-34ft	US								
	56	AP	34-36ft	US								
	57	AP	36-38ft	US					1			
	125	AP	28-30ft	SS						1		
	127	AP	30-32ft	SS								
	128	AP	32-34ft	SS								1
	130	AP	34ft	SS								
	131	AP	34-36ft	SS				1				

Hedgehog (*Erinaceus europaeus*)	Pine marten (*Martes martes*)	Fox (*Vulpes vulpes*)	Badger (*Meles meles*)	Cattle (*Bos taurus*)	Sheep (*Ovis aries*)	Sheep/goat (*Ovis aries/Capra hircus*)	Goat (*Capra hircus*)	Pig (*Sus scrofa*)	Dog (*Canis familiaris*)	Cat (*Felis catus*)	Horse (*Equus ferus cabalhus*)	Rabbit (*Oryctolagus cuniculus*)	Hare (*Lepus timidus*)	Frog (*Rana temporaria*)	Brown rat (*Rattus norvegicus*)	Wood mouse (*Apodemus sylvaticus*)	Bird
												1					
								1				2					x
				1				4				1					
	1	1		2								1					x
	1	1						1				1	1				
			1														
																	x
												1	1				
								1				1					x
		1						1									x
									6			3		1	1		
																	x
								1									x
									3								

(*Continued*)

Date in 1902	EA code	Area of Cave	Grid	Stratum	Lesser horseshoe bat (*Rhinolophus hipposideros*)	Polecat (*Mustela putorius*)	Human (*Homo sapiens*)	Bear (*Ursus arctos*)	Arctic lemming (*Dicrostonyx torquatus*)	Reindeer (*Rangifer tarandus*)	Red deer (*Cervus elaphus*)	Giant deer (*Megaloceros giganteus*)
	132	AP	36ft	SS						1		
	133	AP	36-38ft	SS						2		
10.06.02	58	AP	38-40ft	US					1		1	
	59	AP	40-42ft	US							2	
	60	AP	42-44ft	US	1						1	
	134	AP	39ft	SS				1			1	
	135	AP	38-40ft	SS								
	141	AP	40-42ft	SS				1	1	1	2	1
	142	AP	41ft	SS				1				
11.06.02	61	AP	41.6ft	CT						1		
	62	AP	44-46ft	US								
	143	AP	42-44ft	SS								
	144	AP	43ft	SS				1				
	145	AP	43ft	SS								
	146	AP	42-44ft	SS				1				
	147	AP	42.2ft	SS				1				
	148	AP	44-46ft	SS				1			1	1
12.06.02	63	AP	46-48ft	US	1			4			1	
	64	AP	48-50ft	US				3				
	149	AP	46-48ft	SS				1	1		1	1
	150	AP	46.3ft	SS				1				
	151	AP	46.4ft	SS								
	152	AP	46.9ft	SS				1				
	153	AP	47ft	SS								

Hedgehog (*Erinaceus europaeus*)	Pine marten (*Martes martes*)	Fox (*Vulpes vulpes*)	Badger (*Meles meles*)	Cattle (*Bos taurus*)	Sheep (*Ovis aries*)	Sheep/goat (*Ovis aries/Capra hircus*)	Goat (*Capra hircus*)	Pig (*Sus scrofa*)	Dog (*Canis familiaris*)	Cat (*Felis catus*)	Horse (*Equus ferus cabalhus*)	Rabbit (*Oryctolagus cuniculus*)	Hare (*Lepus timidus*)	Frog (*Rana temporaria*)	Brown rat (*Rattus norvegicus*)	Wood mouse (*Apodemus sylvaticus*)	Bird
														1			
		1	1					1	6	1		2	3	4	2	1	x
1	1	3						2	4		1	2	3	4	2	1	x
	1							2	3	1		4		3	1	1	x
													1	4			
									2			5		4			x
				3				1				1		7			x
													1	1		1	x
													1	1			x
		1						3	1			4		5			x
												1		5			x
		1												4			x
																	x

(*Continued*)

Date in 1902	EA code	Area of Cave	Grid	Stratum	Lesser horseshoe bat (*Rhinolophus hipposideros*)	Polecat (*Mustela putorius*)	Human (*Homo sapiens*)	Bear (*Ursus arctos*)	Arctic lemming (*Dicrostonyx torquatus*)	Reindeer (*Rangifer tarandus*)	Red deer (*Cervus elaphus*)	Giant deer (*Megaloceros giganteus*)
	154	AP	47.5ft	SS								
	155	AP	48.8ft	SS				1				
	156	AP	49.4ft	SS				2				
	157	AP	48-50ft	SS				1		2		
13.06.02	65	AP	50-52ft	US							2	
	66	AP	50-52ft	US				1				
	67	AP	50-52ft	US				1				
	68	AP	53ft	CV				1				
	69	AP	52-54ft	US	1			4			1	1
	70	AP	52-54ft	US				1				
	158	AP	50ft	SS				1				
	159	AP	50-52ft	SS								
	160	AP	51ft	SS				1				
	161	AP	51ft	SS							2	1
	162	AP	51-52ft	SS				3				3
	163	AP	51.6ft	SS				8				
	164	AP	51-52ft	SS								5
	165	AP	52.6ft	SS				2				
	167	AP	54ft	SS								1
	168	AP	54ft	SS				5				
	169	AP	54ft	SS				1				
14.06.02	71	AP	54ft	US				2				
	72	AP	54-56ft	US				1				
	73+76	AP	54-56ft	US				1			1	

Hedgehog (*Erinaceus europaeus*)	Pine marten (*Martes martes*)	Fox (*Vulpes vulpes*)	Badger (*Meles meles*)	Cattle (*Bos taurus*)	Sheep (*Ovis aries*)	Sheep/goat (*Ovis aries/Capra hircus*)	Goat (*Capra hircus*)	Pig (*Sus scrofa*)	Dog (*Canis familiaris*)	Cat (*Felis catus*)	Horse (*Equus ferus cabalhus*)	Rabbit (*Oryctolagus cuniculus*)	Hare (*Lepus timidus*)	Frog (*Rana temporaria*)	Brown rat (*Rattus norvegicus*)	Wood mouse (*Apodemus sylvaticus*)	Bird
																	x
													2				x
		4		1					1			1		1			
								1									
		2						1	1				1	1			x
																	x
					1												
													1				
				2													
		1											1				
													6				
		6															x

(*Continued*)

Date in 1902	EA code	Area of Cave	Grid	Stratum	Lesser horseshoe bat (*Rhinolophus hipposideros*)	Polecat (*Mustela putorius*)	Human (*Homo sapiens*)	Bear (*Ursus arctos*)	Arctic lemming (*Dicrostonyx torquatus*)	Reindeer (*Rangifer tarandus*)	Red deer (*Cervus elaphus*)	Giant deer (*Megaloceros giganteus*)
	75	AP	54-56ft	US								
	77	AP	56-58ft	US								
	78	AP	58-60ft	US								
	166	AP	52 -54ft	SS	1			5	1		1	6
	171	AP	54-56ft	SS				1				
	172	AP	56-58ft	SS				2				
16.06.02	74	AP	55ft	ST	1			3				
	79	AP	60-62ft	US								
	80	AP	63-64ft	US				1				
	81	AP	64-66ft	US								
	82	AP	65ft	US				1				
	170	AP	55ft	SS				3				
	173	AP	62-64ft	SS				2				
	174	AP	64-66ft	SS								
17.06.02	83	AP	66-68ft	US								
	84	AP	68-70ft	US								
	85	AP	70-72ft	T								
	86	AP	72-74ft	US	1							
	175	AP	68ft	SS				1				
	176	AP	68-70ft	SS				1		1		
20.06.02	29	GP	-10-0ft outside	US								
	31	GP	-3.6ft	US								
	100	GP	-6ft	SS				1				
	107	GP	-2ft	SS				1				

Hedgehog (*Erinaceus europaeus*)	Pine marten (*Martes martes*)	Fox (*Vulpes vulpes*)	Badger (*Meles meles*)	Cattle (*Bos taurus*)	Sheep (*Ovis aries*)	Sheep/goat (*Ovis aries/Capra hircus*)	Goat (*Capra hircus*)	Pig (*Sus scrofa*)	Dog (*Canis familiaris*)	Cat (*Felis catus*)	Horse (*Equus ferus cabalhus*)	Rabbit (*Oryctolagus cuniculus*)	Hare (*Lepus timidus*)	Frog (*Rana temporaria*)	Brown rat (*Rattus norvegicus*)	Wood mouse (*Apodemus sylvaticus*)	Bird
		2												1			
												1					
														3			x
																	x
									1					1			
																	x
														1			x
				1				6	2		1	2	1				x
								1	1			3		2		1	
				3				4	6			1		1		1	x
		4	1	2		1		7	2		2	2		1		1	x
												1					
		2			3		1	4				2	6	1			X
		1															

(*Continued*)

Date in 1902	EA code	Area of Cave	Grid	Stratum	Lesser horseshoe bat (*Rhinolophus hipposideros*)	Polecat (*Mustela putorius*)	Human (*Homo sapiens*)	Bear (*Ursus arctos*)	Arctic lemming (*Dicrostonyx torquatus*)	Reindeer (*Rangifer tarandus*)	Red deer (*Cervus elaphus*)	Giant deer (*Megaloceros giganteus*)
21.06.02	10	GP	2-4ft	US								
	14	GP	4-6ft	US			x		1		1	
	19	No. 3	2-4ft	US								
	28	GP	0-2ft	US			x					
	32	GP	6-8ft	US				2				
	91	GP	4-6ft	SS								
	92	GP	6-8ft	SS								
	101	GP	0-2ft	SS			x	2	1		1	
	102	GP	2-4ft	SS			x					
	105	GP	0-2ft	SS				2				
23.06.02	24	GP	8-10ft	US								
	24	GP	8-10ft	US			x					
	33	GP	12-14ft	US			x					
	34	GP	10-12ft	US			x				1	
	36	GP	14-16ft	US		1			1		1	
	103	GP	6-8ft	SS								
	109	GP	6-8ft	SS				1				
24.06.02	110	GP	8-10ft	SS								
	112	GP	10-12ft	SS				2				
	113	GP	12-14ft	SS								
	30	No. 3	-12ft outside	Su				1				
25.06.02	2	No. 3	0-2ft	US							1	
	8	No. 3	2-4ft	US			x					

Hedgehog (*Erinaceus europaeus*)	Pine marten (*Martes martes*)	Fox (*Vulpes vulpes*)	Badger (*Meles meles*)	Cattle (*Bos taurus*)	Sheep (*Ovis aries*)	Sheep/goat (*Ovis aries/Capra hircus*)	Goat (*Capra hircus*)	Pig (*Sus scrofa*)	Dog (*Canis familiaris*)	Cat (*Felis catus*)	Horse (*Equus ferus caballus*)	Rabbit (*Oryctolagus cuniculus*)	Hare (*Lepus timidus*)	Frog (*Rana temporaria*)	Brown rat (*Rattus norvegicus*)	Wood mouse (*Apodemus sylvaticus*)	Bird
	1	5	1		3	1		2	1			6	7	1			X
	1	4	1		1			4	3			6	3	3			X
		4		1	1	1		3				1	3	5		1	x
	1	5			2	1		3	3			5	13	2			
		7		2	1			4	8			7	1	6			x
		1												1			x
								1					2	1			x
		3						2				6	2	1			x
		1						1				1	1				
		1															
		3	2					4	9			3					x
		1										3	3	6			x
		3				2		3	10			7	1				x
	1	3						2	12			6	1	4			x
1		1			2			1	6			8					x
		1						1				2					
														2			
													1				x
		1						1				3	1	1			x
									2			1		1			x
	1	4	1		3	1		4	4	3		6	5		2		x
		3			1	1		1				5	3	1			x
		1						1				1		6			x

(*Continued*)

Date in 1902	EA code	Area of Cave	Grid	Stratum	Lesser horseshoe bat (*Rhinolophus hipposideros*)	Polecat (*Mustela putorius*)	Human (*Homo sapiens*)	Bear (*Ursus arctos*)	Arctic lemming (*Dicrostonyx torquatus*)	Reindeer (*Rangifer tarandus*)	Red deer (*Cervus elaphus*)	Giant deer (*Megaloceros giganteus*)
	11	No. 3	2-4ft	US			x					
	15	No. 3	4-6ft	US						1		
	18	No. 3	6-8ft	US								
	23	No. 3	8-11ft	US								
	26	No. 3	8-11ft	US		1						
	38	GP	16-18ft	US								
	106	No. 3	0-2ft	SS								
	108	No. 3	2-4ft	SS							1	
	114	GP	14-16ft	SS								
	115	GP	16-18ft	SS								
26.06.02	41	GP	18-20ft	US					1			
	44	GP	20-22ft	US								
	46	GP	22-24ft	US								
	48	GP	24-26ft	US							1	
	52	GP		US								
	121	GP	24-26ft	SS				1				
	138	GP		SS							1	
27.06.02	22	CG	8-12ft	US								
	25a	CG	3-8ft	US							1	
	137	CG	10.6ft	SS								
	139	CG	3-8ft	SS				1				
	140	CG	9ft	SS				1		1		
28.06.02	6	GO		US							1	
	53	CG	12-17ft	US							1	
	136	CG	12-17ft	SS								

Hedgehog (*Erinaceus europaeus*)	Pine marten (*Martes martes*)	Fox (*Vulpes vulpes*)	Badger (*Meles meles*)	Cattle (*Bos taurus*)	Sheep (*Ovis aries*)	Sheep/goat (*Ovis aries/Capra hircus*)	Goat (*Capra hircus*)	Pig (*Sus scrofa*)	Dog (*Canis familiaris*)	Cat (*Felis catus*)	Horse (*Equus ferus cabalhus*)	Rabbit (*Oryctolagus cuniculus*)	Hare (*Lepus timidus*)	Frog (*Rana temporaria*)	Brown rat (*Rattus norvegicus*)	Wood mouse (*Apodemus sylvaticus*)	Bird
1		2	3					1	2			4	4				1
								3	1			3	1	3			x
					1			1	4			4	3	1			x
					1			1	2	1		7	3	1			x
		1						1	2	1		1		4			x
		1							6			5	1	2			x
		1											1				
														2			
														1			x
								3	3			4		1			x
		1			1	1		1	1			1		1	1	1	x
		1				3		2		1		1					x
		1										4					x
					1		1					1		1			x
																	x
			1		1			2				1					
		1				1		3	1			4	1	1			X
		1															x
		1															
		5		1	1	1		6			3	7					x
						1		4	1			1	3	1			x
					1								1				

(*Continued*)

Date in 1902	EA code	Area of Cave	Grid	Stratum	Lesser horseshoe bat (*Rhinolophus hipposideros*)	Polecat (*Mustela putorius*)	Human (*Homo sapiens*)	Bear (*Ursus arctos*)	Arctic lemming (*Dicrostonyx torquatus*)	Reindeer (*Rangifer tarandus*)	Red deer (*Cervus elaphus*)	Giant deer (*Megaloceros giganteus*)
01.07.02	4	GO		US								
	5	GO		US								
	20	GO		US								
	42	DG		US					1		2	
	93	GO	CV					2			1	1
	104	GO		SS								
02.07.02	126	DG		SS								
	27	AP		US								
					7	**4**		**94**	**13**	**12**	**39**	**24**

AP – Alice Passage
CG – Cross Gallery
CT – Calc Tufa
CV – Crevice with material
DG – Duffy Gallery
GO – Grotto
GP – Gwendoline Passage
No. 3 – No. 3 Passage
SS – Second Stratum
ST – Stalagmite
Su – Superficial Stratum (overlying Upper Stratum)
T – Talus of material introduced from outside
US – Upper Stratum

Hedgehog (*Erinaceus europaeus*)	Pine marten (*Martes martes*)	Fox (*Vulpes vulpes*)	Badger (*Meles meles*)	Cattle (*Bos taurus*)	Sheep (*Ovis aries*)	Sheep/goat (*Ovis aries/Capra hircus*)	Goat (*Capra hircus*)	Pig (*Sus scrofa*)	Dog (*Canis familiaris*)	Cat (*Felis catus*)	Horse (*Equus ferus cabalhus*)	Rabbit (*Oryctolagus cuniculus*)	Hare (*Lepus timidus*)	Frog (*Rana temporaria*)	Brown rat (*Rattus norvegicus*)	Wood mouse (*Apodemus sylvaticus*)	Bird
								3				2	3	2			x
								1	2		1	6					x
		2		1	3		2	1				9	3	1		1	
									1				2				
		1										1	2				
												6		1			
								1				1		1			
3	**10**	**112**	**13**	**36**	**35**	**28**	**5**	**148**	**185**	**8**	**20**	**233**	**117**	**138**	**26**	**11**	