

## Report on the Animal Remains found in the Kilgreany Cave, Co. Waterford.

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### INTRODUCTION.

The following report has been furnished at the request of Mr. E. K. Tratman, B.D.S., who had charge of the recent excavations of a portion of the Kilgreany Cave.

The various animal remains submitted to me for examination were obtained at different levels in the section excavated. The whole collection sorts itself out readily into two distinct groups, *viz.*: (1) a Prehistoric Group containing domestic animals, and a few small wild forms, and (2) what I consider to be a Late-Pleistocene Group, consisting entirely of wild animals, some of which are extinct or not now inhabiting Ireland. The line of division between these two groups occurs immediately above the Lower Stalagmite.

Special interest is attached to the Lower Stalagmite—the lowest fossiliferous level—from the circumstance of the discovery therein of a human skull, and a skeleton of a middle-aged individual embedded in stalagmite (see report by Mr. Tratman). In addition to this discovery and the finding at the same level of the remains of fossil relatives of the Arctic Lemming, known previously from caves in the south and west of Ireland, another most important and interesting find made during the diggings is the skull of a field vole (*Microtus* cf. *arvalis*)—the first of its kind for the whole of Ireland. This discovery should prove a strong inducement for further investigations in this and other Irish caves.

### DESCRIPTION OF THE ANIMAL REMAINS.

The various remains are described below under two general headings:—

1. THE PREHISTORIC GROUP.
  - A. Surface to First Hearth.
  - B. First Hearth (Very Late Bronze Age).
  - C. Brown Earth and Stones Layer including the Second Hearth: D. (Neolithic or Early Bronze Age), divided into 1. First six inches, and 2, Below the first six inches to top of layer E.

## 2. THE LATE-PLISTOCENE GROUP.

E. Lower Stalagmite, subdivided into four sections, *viz.*

1. Topmost Layer.
2. Top Part.
3. Lower Part (including Third Hearth).
4. Crystalline Stalagmite (Barren).

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 1. THE PREHISTORIC GROUP.

## DOMESTIC ANIMALS.

The domestic animals represented are the ox, sheep, goat, pig, horse and dog. The remains of these animals agree very closely with others which I have had the privilege of reporting upon in recent years from many Pre Roman sites in England, especially those from the Glastonbury Lake Village (Prehistoric Iron Age),<sup>1</sup> and the somewhat earlier sites (Hallstatt and La Tène I) at All Cannings Cross, Wilts.; Fifield Bavant Down, S. Wilts.; Swallowcliffe Down, Wilts.; etc. They agree also with remains from Read's Cavern, near Burrington Combe, Somerset.<sup>2</sup>

## Ox.

Numerous bones, loose teeth, and fragmentary upper and lower jaws containing teeth, belong to small oxen. They represent young and old animals, and were found at all three levels A, B and C, but most abundantly at B—First Hearth. Many of the adult bones, including the metacarpals and metatarsals, have been split in the usual manner for the extraction of the marrow. Only one of the metatarsals is perfect; this was obtained at B, and measures: length, 215; mid-shaft, 24; distal condyles, 51-mm. A single calcaneum from the same level measures 128-mm. in length. There are also three broken horn-cores from B (one being of a bull), and one from C. Some further remains of the ox were found in a back chamber on a low level subject to floods in winter. Among other bones there is a perfect metacarpal which measures: length, 187; mid shaft, 28; distal condyles, 56-mm.

The above remains, on the whole, agree well with those of small celtic oxen (*Bos longifrons*) from Romano-British and earlier stations in England. The nearest representative among present-day cattle is probably the Kerry breed.

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<sup>1</sup> *The Glastonbury Lake Village*, Vol. II, 1917 (Animal Remains) pp. 641-672.  
<sup>2</sup> *The Early Iron Age Inhabited Site at All Cannings Cross Farm, Wiltshire*, by Mrs. Cunnington, Devizes, 1924. (Report on the Animal Remains, by J. Wilfrid Jackson, pp. 43-50 and Pl. 52).  
<sup>3</sup> *Wills. Archæol. and Nat. Hist. Mag.* Vol. XLII, 1924, pp. 492-3.  
<sup>4</sup> *Wills. Archæol. and Nat. Hist. Mag.* Vol. XLIII, 1925, pp. 90-93.  
<sup>5</sup> *Proc. Spelæol. Soc., Bristol.* Vol. 2, No. 1 (1922-23), pp. 55-58.

## SHEEP.

The remains of sheep are present among the bones from A, B and C, and are almost as abundant as those of the ox in B (First Hearth). All parts of the skeleton are represented and a good many of the bones and lower jaws belong to young animals. Some of the limb-bones are split or broken across, the breakage being ancient. There is only one fragment of skull, which is hornless; this was found in B, and is split down the middle as at the Glastonbury Lake Village and Read's Cavern. Four metacarpals from B measure, 110, 120, 124 and 131-mm. in length, and are slender in the shaft like those from Glastonbury and earlier stations. Two metatarsals from the same level are 134 and 142-mm. in length, and both are 11-mm. in diameter at the middle of the shaft. The above bones, together with the other small limb-bones, including the astragali and calcanea, seem to indicate a small breed of sheep not unlike that living to-day on Soay Island, near St. Kilda.

Among the bones from B are three examples which are more robust than the remainder, *viz.* a humerus measuring 125-mm. from the head to condyles; a radius, 152 mm. (over all); and a femur, 141-mm. in length. These may indicate a larger breed of sheep, or may belong to goat.

## GOAT.

A horn-core and a broad metacarpal found in C appear to belong to goat. There is also a fragment of a horn-core from B which may belong to this animal.

## PIG.

The bones, teeth and jaws of the domestic pig occur among the remains from A, B and C, being very numerous in B. Both young and old animals are represented. The remains agree closely with those found at Glastonbury, All Cannings Cross, and other sites in Britain. They also resemble those of the turbarry pig (*Sus scrofa palustris*) from the Swiss Lake Dwellings. Unfortunately the remains are not perfect enough for measurements to be taken.

## HORSE.

The remains of this animal are not numerous. From A there are a second phalanx of the foot, a splint bone, and an upper molar. The First Hearth (B) yielded a complete metacarpal, four examples of phalanx I, one of phalanx II, and two of phalanx III (hoof-core); also an astragalus and several splint and other bones. The metacarpal measures: length, 202; mid-shaft, 30.5; distal condyles,

45-mm., and indicates a somewhat slender-limbed pony of about 12.2 hands. The hoof-cores are small and slightly hollow underneath. Horse remains were also found in a back chamber on a low level subject to winter floods. They comprise two metacarpals with splint-bones solidly attached and measure :

1. length, 204 ; mid-shaft, 29 ; distal condyles, 44-mm.
2. „ 206 ; „ 31 ; „ „ 46-mm.

Like the bone from B, these suggest a 12.5 hands pony of the type of *Equus agilis celticus*.

DOG.

A canine tooth, an incisor, a metatarsal, vertebræ, and some odd bones from A belong to dog. In the material from B there are many limb-bones in a somewhat broken condition. A tibia from this level is 185-mm. (over all) ; a radius is 155-mm. (over all) ; and three calcanea are 52, 46 and 43-mm. in length. The various bones suggest short-legged animals. There are two skulls, fragmentary lower jaws, and many loose teeth also from B. The two skulls have permitted the following measurements to be taken :—

	No. 1	No. 2
1. Length from occipital protuberance to tip of premaxillary	203-mm.	189-mm.
2. Length from occipital protuberance to centre of line joining post-orbital processes ... ..	101-mm.	96-mm.
3. Length from basion to alveolar point ... ..	180-mm.	165-mm.
4. Least width of frontals behind post-orbital processes ... ..	39-mm.	42.5 mm.
5. Maximum width between zygomatica ... ..	113-mm.	...
6. Maximum bi-orbital width ...	53-mm.	51.5-mm.
7. Minimum inter-orbital width ...	41-mm.	41-mm.
8. Length of tooth-row ... ..	71.5-mm.	65 mm.
9. Length of PM4, M1, M2 ... ..	40-mm.	37-mm.

The teeth in both the above skulls are very large, and in No. 1 are equal to those of a recent wolf in my collection, but in the latter the skull is considerably larger and has a high-standing occipital crest.

Among the lower jaws there is only one of which the length can be obtained : it measures 133-mm. from the condyle to the alveolar

point. The tooth-row in this jaw is 70.5-mm., and the first molar measures 21 x 8.7-mm. There are four loose first molars of large size, two measuring 24 x 10.5-mm., one, 25 x 10-mm., and one, 24 x 9.6 mm.

From C there are a few bones, vertebrae, loose teeth, and an imperfect lower jaw with large teeth, the first molar being as large as the loose teeth from B.

WILD ANIMALS.

The wild animals represented in the collection are wild boar, hare, rabbit, badger, otter, wild cat, brown rat, bats, birds, frog, land and marine mollusca.

WILD BOAR.

The remains from B (First Hearth) include several bones and teeth which belong undoubtedly to wild boar. Among them are two large astragali each 47-mm. in length; a radius with a full length of 182-mm.; the distal end of a split tibia; two split humeri (one very large); three large metacarpals; a large upper canine; two large lower canines; and four incisors. There are also three upper canines and a large astragalus from C, which belong to this animal.

HARE.

The remains of this animal are very numerous, and are present in the material from all three levels, A, B and C. Judging from the calcanea over thirty animals are represented in the bones from B and C. A great many of the long bones have been split so that very few measurements are obtainable. The following dimensions, however, may be useful. The bones are from B (First Hearth).

	<i>Extreme length</i>	<i>Minimum diam. shaft</i>
2 humeri (right and left) ... ..	100-mm.	
1 humerus ... ..	105-mm.	
1 radius ... ..	102-mm.	5.0-mm.
2 radii (right and left) ... ..	105-mm.	4.9-mm.
	106.5-mm.	4.8-mm.
2 tibiae ... ..	139-mm.	7.3-mm.
	145-mm.	8.0-mm.

These measurements are less than those of the Late Pleistocene *Lepus variabilis anglicus* from Ightham, Kent, but agree closely with those of a specimen of *L. v. hibernicus* in the British Museum.<sup>6</sup>

<sup>6</sup> See Hinton, *Scient. Proc. Roy. Dublin Society*. Vol. XII, 1909, pp. 225-265

## RABBIT.

This rodent is represented by some bones and lower jaws from A ; by numerous remains from B ; and by two lower jaws from C.

## BADGER.

This animal is represented by a large portion of a skull and maxilla with two teeth found at the level of the First Hearth (B).

## OTTER.

Four bones from B belong to a small otter. These consist of a right and a left humerus each 79-mm. in length, and a right and left radius, 56-mm. long. They agree closely with the bones of a recent specimen (female) from Limerick in the National Museum of Ireland, in which the humerus measures 80-mm. and the radius 57.5-mm. in length.

## FOX.

Lower jaws, teeth, and a few broken bones and vertebræ of the common fox are present in material from the two levels B and C. They seem to indicate small animals. Three perfect bones from B measure : femur, 124 ; tibia, 130 ; humerus, 116-mm. (full length). Three calcanea, two from B, and one from C, are 29-mm. in length.

## WILD CAT.

From B there is a right maxilla with teeth, also a humerus. Among the material from C there is a left ramus of the lower jaw with teeth, and the distal end of a split radius. The above remains seem to agree best with the European Wild Cat (*Felis silvestris*). The lower jaw is comparable with the "*Felis ocreata*" from the Newhall caves, Co. Clare (Nat. Mus. Ire., N.H. 102, 85 and 118). It is rather shorter than the jaw of *F. silvestris* figured by Miller,<sup>7</sup> but the teeth agree in size. The three Newhall jaws are also shorter, and all four are shorter than a specimen of *F. silvestris* from the Glastonbury Lake Village.

## BROWN RAT.

A skull, several lower jaws, and a few limb bones from B belong to the brown rat (*Epinomys norvegicus*).

## LAND MOLLUSCA.

The following nine species of land shells are present in the collection :—

*Helix aspersa*. Four examples in A ; numerous in B ; one example in C.

*Helix nemoralis*. Many in all three layers ; most numerous in B (all banded).

<sup>7</sup> Miller, *Catalogue, Mammals of Western Europe*, 1912, pp. 457, etc.

- Pyramidula rotundata*. Odd examples in A, B and C.  
*Vitrea cellaria*. Three examples in A ; numerous in B and C ; many being of the *hibernica* form.  
*Vitrea nitidula*. A few in B and C.  
*Vitrea pura*. One example in B.  
*Hygromia hispida*. A few in B ; one in C.  
*Hygromia striolata*. One example only in A.  
*Clausilia bidentata*. A few examples of a small form in B.

#### MARINE MOLLUSCA.

The following species are represented :—

- Pecten maximus*. Fragments in B and C (top).  
*Ostrea edulis*. Fragments in B.  
*Mytilus edulis*. Fragments in B.  
*Cardium* and *Mactra*. Fragments in B.  
*Patella vulgata*. One in B.  
*Littorina littorea*. Eight in B.  
*Littorina obtusata*. One in B, and three examples artificially rubbed down for threading as beads in C (top). There was also a fish vertebra found with the latter which was also perhaps used as a bead.

In addition to the various species enumerated above from the Prehistoric levels of Kilgreany cave, the following derived specimens are present among the material examined. From C there is a loose upper and a lower molar of the Reindeer, both mineralized ; also two phalanges of Giant Irish Deer, both much worn.

#### 2. THE LATE PLEISTOCENE GROUP.

The following remains of wild animals are present in the material from the three sections (E1, 2 and 3) of the Lower Stalagmite ; the lowest section (E4) was barren of remains of any kind.

#### WILD BOAR.

This animal is represented among the remains from E1 by a large sacrum, a thoracic vertebra, and the distal end of a large split humerus. From the E2 level the remains are more numerous and consist of several large bones of the foot, an axis vertebra, two leg-bones (tibiæ), and several teeth, including a large lower canine and large upper molars. The most perfect of the tibiæ has a length of 251-mm. (over all), a mid-shaft diameter of 16-mm., and at the distal end is 39-mm. (over all). There are only a few remains from E3, as follows : the proximal ends of a split humerus and of a scapula ; also three milk-molars in stalagmite.

## GIANT DEER (IRISH ELK).

Three phalanges (one phal. I and two phal. II) from E1 belong to this animal. Bones of the same species are more abundant among the remains from E2, and comprise several footbones (phalanges, hoof-cores and cuboids), together with the proximal end of a scapula, the distal end of a radius, the distal end of a tibia, and some teeth. Both the radius and tibia are weathered and coated with a film of stalagmite. The tibia has evidently been split by man to obtain the marrow; it also shows some tooth marks as if gnawed by wolves. It agrees in size and state of splitting with a similar bone of "Irish Elk" found in the Ballynamintra Cave in 1879.<sup>8</sup>

From E3 there are three phalanges, a cuboid, a magnum, two large astragali, a large part of a split metatarsal, and a very large humerus. None of these shows any signs of gnawing. The humerus is of considerable interest on account of its size, it being quite as large as some of the bison humeri from Windy Knoll Fissure, Derbyshire, now housed in the Manchester Museum. It differs, however, from these and undoubtedly belongs to Giant Deer. The greatest length, over the proximal tuberosity, cannot be obtained owing to its damaged condition, but other dimensions are given below together with those of the largest humerus in the National Museum of Ireland, kindly furnished by Mr. A. W. Stelfox, M.R.I.A.

	<i>Length</i> (Head to distal condyles)	<i>Distal</i> Condyles	<i>Least</i> Circumference
Kilgreany	15 $\frac{1}{8}$ -ins. (383-mm.)	3 $\frac{7}{8}$ -ins. (98-mm.)	7 $\frac{9}{16}$ -ins. (192-mm.)
Nat. Mus. Ire.	15 $\frac{3}{8}$ -ins.	3 $\frac{5}{8}$ -ins.	8-ins.

The two astragali also agree in size with those of the Windy Knoll bison, but are distinctly cervine in character. One has a maximum length of 90-mm., and a width of 60-mm. One of the phalanges (phal. I) has a maximum length of 82-mm.

## REINDEER.

There are several remains of this animal from E2 and E3. From the first location there are two radii (right and left) of the same animal. Both are in good condition and measure: maximum length, 246; mid-shaft, 24; proximal end, 42-mm. Other bones from E2 consist of the proximal end of a large ulna, proximal end of a large radius (split and coated with stalagmite), shaft of humerus (both ends broken off in ancient times), a calcaneum (coated with stalagmite) and part of another, two astragali (maximum lengths,

<sup>8</sup> A. Leith Adams and others, *Scient. Trans. Roy. Dublin Soc.* Vol. I (Ser. II), April 1881, p. 200, pl. xiv, fig. 7.



48 and 48.3-mm.), five phalanges I, three hoof-cores, two vertebræ, and an upper and lower tooth. Some of the above bones are chocolate-stained.

From E3 there are vertebræ, a calcaneum, phalanges, split pieces of humerus and metacarpals, two teeth, an antler tine, and immature antler (coated in part with calcareous matter, and eroded chemically and gnawed in places).

#### Ox.

From E1 there is a large tibia with the following dimensions: length, 259; mid-shaft, 44; distal end (over all), 61-mm. It appears to indicate a larger ox than *Bos longifrons*, and agrees closely with similar large bones from an early site at Woodhenge, Wiltshire, a description of which is in the press.

From E2 there is the left ramus of the lower jaw with milk-teeth, and some permanent teeth, showing signs of wear, also a fragment of the left upper jaw containing M1 and M2, and three upper milk-molars of the same jaw. The latter is partly covered with calcareous matter, and all the above remains have an older and more mineralised appearance than those from the First Hearth.

#### BROWN BEAR.

This animal is represented by a right lower canine from E1; a left upper and a left lower first molar from E2; a left upper last molar and the crowns of a right upper M1 and right lower M1 from E3. From the last place there is also a tibia with both ends broken off. The above remains agree closely with the European brown bear (*Ursus arctos*), fossil and recent.

#### WOLF.

Remains of wolf occur in material from E2 and E3, but are not abundant. From E2 there are some vertebræ, two proximal ends of large scapulæ, parts of femora, of an ulna, and of a radius, four metatarsals, three canines, and four incisors. Most of the bones are yellow in colour, but a few are chocolate-stained and show white root-marks. From E3 there are some metacarpals and metatarsals, a large calcaneum (57-mm. long), a radius (maximum length, 197-mm.), ends of a humerus and scapula, the right ramus of a lower jaw containing most of the teeth (full tooth-row, 87-mm.; M1, 26 x 11-mm.), anterior portion of a larger left ramus, and several loose teeth, including a right lower first molar measuring 28.4 x 12.3-mm.

The above remains of jaws and teeth compare favourably with specimens from the Kesh caves, Shandon cave, Co. Waterford, Torbryan cave, Devon, and many other places.

## DOG. ?

There are a few odd bones from E2 which seem to belong to an animal in size between the above wolf and fox. They are too fragmentary for accurate determination. It is difficult to say if they are extraneous to this layer, but there is some calcareous matter adhering to some.

## FOX.

From E2 there are several bones and fragments of lower and upper jaws with teeth ; and from E3, a pelvic-bone, a calcaneum, and an astragalus, all comparable with the common fox.

## WILD CAT.

One right upper carnassial and a left upper carnassial with PM3 in fragment of jaw (length of the two teeth, 17-mm.) from E3, belong to this animal. The remains agree with the European wild cat (*Felis silvestris*).

## STOAT.

A loose lower canine from E3 appears to belong to the stoat (*Mustela erminea*).

## HARE.

From E2 there are many bones (some split), loose cheek teeth, and two lower jaws ; and from E3, a few split bones and teeth, all of which agree closely with the Irish hare from other caves in Ireland. The lengths of six calcanea range from 29.5 to 35-mm.

## RABBIT.

Among the bones from E2 there is a left upper maxilla with teeth belonging to the rabbit. It is encrusted with calcareous matter and seems to be contemporary with the layer. The remains of rabbit showing signs of antiquity have been met with in other Irish caves in Co. Clare, and in the Castlepook cave, Co. Cork. In England they have also been recorded from ancient cave deposits.

## FIELD MOUSE.

The remains of the field mouse (*Apodemus sylvaticus*) occur in material from E2 and E3. From the first layer there are four lower jaws, and from the second layer, one lower jaw and some limb-bones. As in the Kesh caves, they were associated at Kilgreany with the remains of the Arctic lemming. The bones of the field mouse were found in the Ballynamindra cave, but were erroneously labelled frog.

## FIELD VOLE.

One of the most important discoveries in the Kilgreany cave is that of the field vole—no voles having been hitherto recorded for Ireland, either recent or fossil. The remains consist solely of the greater part of the skull found at E2. All the teeth are unfortunately missing, but a close examination of the sockets suggests that the species is the Continental field vole (*Microtus arvalis*) or a close ally, and not the common field vole (*M. agrestis*).

## ARCTIC LEMMING.

A right and a left lower jaw from E2, and three right and two left lower jaws from E3, belong to fossil representatives of the Arctic lemming. The teeth appear to agree best with *Dicrostonyx henseli* Hinton, a species which has already been recorded from the Kesh caves, Co. Sligo, and the Doneraile or Castlepook cave, Co. Cork. The present constitutes the first record for Co. Waterford.

## BATS.

Among the small, slender bones from E2 are a few which seem to indicate the long-eared bat, but the identification is not certain.

## BIRDS.

A skull of a small avian species together with three bones from E2 are very close to thrush or blackbird. Several bones from E3 also suggest a similar species. From this last level there are in addition one or two larger and a few smaller bones which require further study.

## LAND MOLLUSCA.

The following five species occur among the remains from two levels in the Lower Stalagmite :

*Helix nemoralis*. E2 and E3, many large white shells with brown lips ; no banding ; some in stalagmite.

*Helix hortensis*. E2, one shell ; E3, three shells ; smaller than above, white all over including lips ; no banding.

*Pyramidula rotundata*. E2 and E3, one example and juvenile in each.

*Vitrea cellaria*. E2, two examples ; E3, six examples.

*Vitrea nitidula*. E3, two examples.

## CONCLUDING REMARKS.

The remains from the upper layers in the Kilgreany cave do not call for special comment. They can be dismissed as being very similar to those usually found associated together in Prehistoric and Romano-British refuse-heaps in Great Britain generally. They

represent the remains of domestic animals slaughtered for food, and include a number of wild animals, as the fox, badger, etc., who made use of the cave occasionally.

The remains obtained from the Lower Stalagmite are of greater importance and interest. The unfortunate absence of implements associated with the human remains found at this level deprives us of the much-desired evidence as to the precise date of the human occupation. We are compelled, therefore, to fall back upon the fauna of this level in the Kilgreany cave. This fauna is not a large one and there are several notable absentees such as mammoth and hyæna which have been found in other Irish caves, notably that of Castlepook, Co. Cork, and, nearer still, Shandon cave, Co. Waterford (mammoth only). The presence of mammoth remains in caves is almost invariably due to the hyæna who made use of such caves as dens in which to devour its victims at leisure.

The association of the giant Irish deer, reindeer, and Arctic lemming in the Lower Stalagmite at the Kilgreany cave seems to indicate very clearly a Late Pleistocene date for the deposit in question, and in England there would be no hesitation about the assemblage being of that date.

We can approach the subject best by ascertaining the date of appearance and disappearance of certain mammals in England. In this connection the late Middle Terrace of the Thames at Crayford is of extreme importance. It is now recognised as of Mousterian age from its contained implements. The period of the Mousterian industry is regarded as the tundra faunal stage linked with the Würm Glaciation of Penck (=Mecklenburgian of J. Geikie).

The importance of the Crayford Terrace lies in the fact that, so far as present evidence goes, it is here that we find the first great faunal break of the Pleistocene Period. In this Terrace are found associated together the remains of the true mammoth, woolly rhinoceros, musk-ox, reindeer, giant Irish deer, Arctic and Scandinavian lemmings, and other animals which now have a northern range. There is here, in fact, a typical tundra fauna which replaced the earlier "warm" fauna of Britain. Similar associations to Crayford are recorded from the same horizon in other places, including the St. Brelade cave, Jersey, where the fauna was associated with a Mousterian industry.

On the continent, the close of the Second Maximum of the Fourth (or Würm) Glaciation (regarded as Mousterian) is very definitely marked by the first-appearance of very numerous cold-loving rodents, especially of the banded or Arctic lemming, which constitute the

"Lower Rodent" layer in caves, etc. In early post-Glacial times (Aurignacian and Solutrean) there seems to have been an amelioration of climate, which was followed by a recurrence of a colder phase, represented by what is known as the Buhl advance, when the cold-loving rodents were again attracted by the suitable tundra-like conditions which prevailed. This fresh invasion, which constitutes the "Upper Rodent" layer of the continental caves, represents the final stage of extreme cold in Europe. It is correlated by most authorities with the Early Magdalenian period.

For many years I have had the privilege of handling many collections from English caves, and have been struck by the fact that the lemmings and other rodents occur in the West of England caves associated with a late (or developed) Aurignacian culture (Magdalenian in time). But it should be pointed out that they are accompanied in most cases with an abundance of pika—a close ally of which inhabits the Southern Districts of the Volga and the Ural Mountains, and Southern Siberia to the River Obi.

The same lemmings and other rodents, but without pika, have been recorded from Langwith cave, Derbyshire, and are turning up in numbers in the present diggings at the Creswell caves farther north, where they are associated with Aurignacian implements. Many years ago I recorded the same group of rodents (without pika) from the Dog Holes cave, Warton Crag, North Lancashire. Farther north, in Scotland, there is a record of Arctic lemming (*Dicrostonyx* sp.) having been found in a Pleistocene deposit at Corstorphine, west of Edinburgh.

We must now return to the consideration of the date of the arrival of the fauna with Arctic affinities into Ireland. In this connection it will be necessary to refer briefly to the recent and important paper by Professor J. K. Charlesworth on the Irish glaciation, and especially the Southern Irish End-Moraine. Like Osborn and others, he correlates this Moraine with the Newer Drift of England, and regards both as the equivalent of the Würm Glaciation of the Alps and the Upper Diluvium of Germany and adjacent countries. He also points out the fact that the previous Maximum Glaciation (? Riss) covered the whole of Ireland far to the south of the End-Moraine.

The area of the cave under discussion, together with other Co. Waterford caves and those of Co. Cork, lies to the south of the Southern Irish End-Moraine, and would, therefore, be ice-free and open for migrations by tundra-loving mammals, etc., for a considerable period after the retreat of the Maximum Glaciation. This gives us the

first possible time of entry into Ireland of the reindeer, giant Irish deer, lemmings, etc. It was certainly post-Maximum Glaciation, but how much before the Second Glaciation (if indeed it did precede it) is not known.

After their entry, these animals seem to have remained in Ireland for some considerable time. Lemmings and other forms have been recorded from the caves of Co. Clare and Co. Sligo which lie north of the End-Moraine, having in all probability followed the retreating ice-sheet which laid down this moraine. They doubtless found congenial habitats amid the tundra or barren-ground surrounding the borders of the ice-sheet. In England, in like manner, the lemmings seem to have migrated northwards, as their remains have been found in the area covered by the Newer Drift (for example, Dog Holes, North Lancashire, along with reindeer and giant Irish deer); they are also recorded for Scotland.

The reindeer, a typical Late Pleistocene mammal both in England and on the continent and appearing at Crayford in Mousterian times, has been met with in Irish caves along with the Arctic fox, Arctic and Scandinavian lemmings, giant Irish deer, etc., and in the marls underlying the extensive peat deposits of that country. This species and the others named above must, therefore, have reached Ireland before its severance from Great Britain, but they cannot be earlier than late Middle Terrace or Mousterian when they first appear in England.

Like the reindeer, the lemmings are typical Late Pleistocene animals. Two species of Arctic lemming seem to have existed. The remains of these were formerly referred to the existing Siberian species, *Dicrostonyx torquatus*, now inhabiting Russia east of the White Sea, and Siberia, but recent research by Mr. M. A. C. Hinton has resulted in the separation of the fossil remains into *Dicrostonyx gubielmi* and *D. henseli*. *Dicrostonyx gubielmi* makes its first appearance in the late Middle Terrace of the Thames along with other rodents, including the Scandinavian lemming (*Lemmus lemmus*). Its remains are found in caves of later date (West of England; Langwith; Creswell; Dog Holes; etc., also in the Kesh and Edenvale caves, Ireland), but its place appears to have been taken by *D. henseli* in later Pleistocene times (West of England; Langwith; Creswell; Ightham Fissures, Kent; Dog Holes; Castlepook, Co. Cork; also at Ponder's End, Lea Valley).

The Arctic lemming (recorded as *D. torquatus*) was first discovered in Ireland in 1901 in the Kesh caves, Co. Sligo, and was later (1905) found in the Edenvale Cave, Co. Clare. The Scandi-

navian lemming (*Lemmus lemmus*) was first discovered in Ireland in 1908 in Castlepook Cave, Co. Cork.<sup>9</sup>

As to the Continental field vole (*Microtus arvalis*), the remains of this rodent often accompany those of the lemmings, reindeer, etc., in the English caves. Cranial fragments from the Late Pleistocene deposit at Ightham Fissures, Kent, have been examined by Mr. Hinton, who finds that they are "apparently identical" with *Microtus arvalis arvalis* of Germany, etc.<sup>10</sup> This species apparently entered the British Isles somewhat later than the late Middle Terrace, as there is an absence of *arvalis*-like voles among the many microtine fossils from the Crayford deposit, which is a stage older than that of Ightham. It is thought that Ightham probably marks the date of the arrival of this species in Britain. Teeth belonging to the *arvalis*-group were found in the Lea Valley Arctic Bed at Ponder's End, together with mammoth, woolly rhinoceros, horse, reindeer and *Dicrostonyx henseli*.<sup>11</sup> Though deposited under cold climatic conditions when the southern part of England closely resembled the tundra of Northern Europe, this bed is not to be correlated with the major glaciation of the country, which occurred much earlier. There is some difficulty in correlating the Ponder's End Stage, but, according to Mr. S. H. Warren, "all that one can positively assert is that this is post-Mousterian and pre-Neolithic."<sup>12</sup>

The presence of an *arvalis*-like vole in Ireland is of some considerable interest as indicating a late land-connection between that country and some part of Great Britain. This connection, however, must have been severed before the numerous other small mammals found in the English caves had time to cross to Ireland. As is well known, there is a notable absence in the Irish caves of such animals as the pika.

With regard to the giant Irish deer, there appears to be good evidence that it did not long survive, if at all, the last cold phase which is generally regarded as of early Magdalenian date. This animal was undoubtedly a prairie-dweller, and not an inhabitant of the forests, as its immense antlers would prevent progress through thickly wooded country. Its remains have been found in several Irish caves, and are remarkably abundant in lake-marls below thick peat in many parts of Ireland. It seems to have become extinct immediately before the forest period.

<sup>9</sup> Professor Charlesworth's reference (*Q.J.G.S.*, 1928, p. 320) to the discovery of Arctic and Scandinavian lemmings in Shandon Cave, Co. Waterford, as early as 1875 (1876) must be an error in copying, as Adams makes no mention of the same. He especially notes the absence of Irish Elk, though this is included by Professor Charlesworth along with the hyæna—another animal unknown in Ireland until 1904.

<sup>10</sup> Barrett-Hamilton, *Hist. Brit. Mammals*, Pt. XVI, 1914, pp. 467-8

<sup>11</sup> *Quart. Journ. Geol. Soc.*, LXXI, 1916, p. 174.

<sup>12</sup> *Quart. Journ. Geol. Soc.*, LXVIII, 1912, pp. 219 and 224.

A study of Dr. Erdtman's researches on the late Quaternary history of the Irish forests is instructive.<sup>13</sup> He finds that the microfossils, especially pollen grains, of the peat and lacustrine deposits, give indications of changes of climate at different periods. The period with which we are most concerned is the Marl-period when the giant Irish deer was so abundant. Erdtman considers this to have been a period of sub-arctic climate (at least in its earlier phase) with scanty tree growth, the birch and willow dominating. It began somewhat earlier than and continued into the *Ancylus* Lake stage of Sweden. This appears to have been a period of high land-level, and it seems probable that the Peat-Bed at Belfast now submerged some 28 feet below high-tide level accumulated at this stage. It is interesting to note that Dr. Praeger records the presence of "Irish Elk," red deer, and wild boar, in this Peat-Bed.<sup>14</sup>

Erdtman's conclusions appear to be strongly corroborated by the evidence afforded from the study of a typical section of the Bog of Ballybetagh, Co. Dublin, described by W. Williams, in 1881.<sup>15</sup> The section he gives shows the *Megaceros* clay to be overlain by a greyish clay with mineral debris from granitic hills brought down by frost, ice, and rain, during the last cold period.

Mr. A. W. Stelfox<sup>16</sup> has recently referred to this interesting section and records *Salix herbacea* from the flaky peat overlying the bed containing the bones of the great Irish deer. He suggests that this animal lived during a comparatively mild period, and that the peat with *Salix herbacea* may be contemporaneous with one of the re-advances of the ice.

The presence of *Salix herbacea*, among other Arctic plants, was a special feature of the Ponder's End deposit in the Lea Valley, and it is interesting to note that Dr. F. J. Lewis<sup>17</sup> sums up the evidence as indicating a late Glacial age for the remains, "a period" he says "at any rate considerably later than the retreat of the general ice-sheet of the main glacial stages." He considers the find as tending to confirm evidence pointing to widespread Arctic conditions from other sources in the north of England.

In the face of all the evidence, there appears to me to be strong reasons for regarding the fauna, together with associated human remains, found in the Lower Stalagmite of the Kilgreany cave as of Late Pleistocene date. But it remains for future discoveries to define more precisely the stage of Late Palaeolithic culture attained.

<sup>13</sup> *The Irish Naturalists' Journal*, Vol. I, No. 12, July, 1927, p. 242.

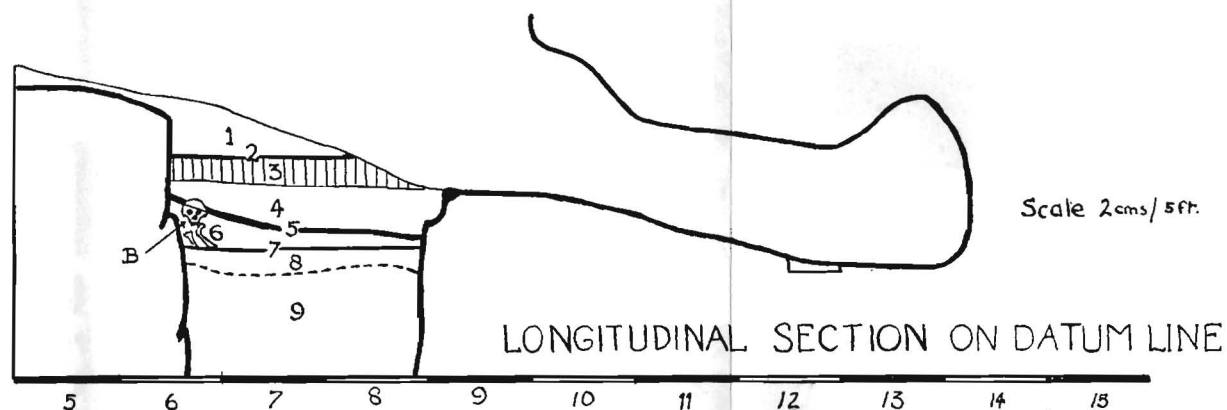
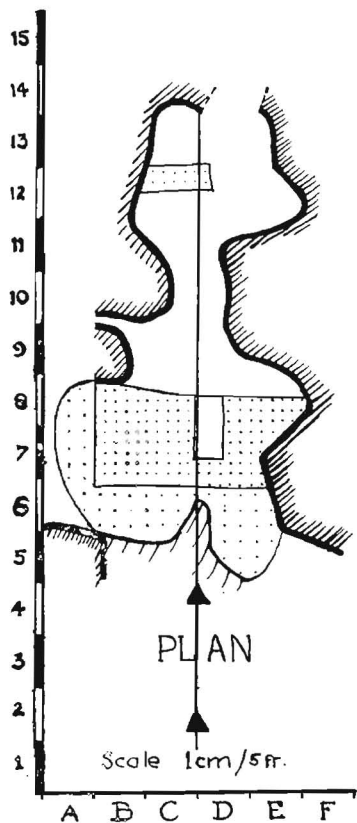
<sup>14</sup> *Proc. Roy. Irish Acad.*, Vol. XXV, Sect. C, No. 6, Dec. 1904, p. 149.

<sup>15</sup> *Geol. Mag.*, 1881, p. 7 (reprint).

<sup>16</sup> *Nature*, May, 28th, 1927, p. 781.

<sup>17</sup> *Quart. Journ. Geol. Soc.*, LXVIII, 1912, p. 230.

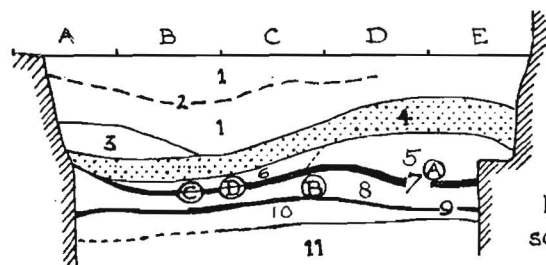




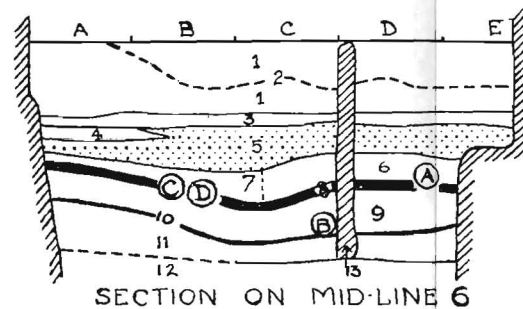
- 1 Quarry debris
- 2 Surface spoil from old roof
- 3 1<sup>st</sup> Hearth
- 4 Brown earth & stones
- 5 2<sup>nd</sup> Hearth

- 6 Tufaceous stalagmite
- 7 3<sup>rd</sup> Hearth
- 8 Hard crystalline stalagmite & stones
- 9 Stones
- B. Skeleton 'B'

# KILGREANY.



- 1 Quarry debris
- 2 Probable height of roof
- 3 Upper stalagmite
- 4 1<sup>st</sup> Hearth
- 5 Brown earth & stones
- 6 Stones & little brown earth
- 7 2<sup>nd</sup> Hearth
- 8 Tufaceous stalagmite
- 9 3<sup>rd</sup> Hearth
- 10 Hard crystalline stalagmite
- 11 Loose stones.



- 1 Quarry debris
  - 2 Approx. height of roof
  - 3 Tufaceous stalagmite [fallen roof]
  - 4 Tufaceous stalagmite floor
  - 5 1<sup>st</sup> Hearth
  - 6 Brown earth & stones
  - 7 Loose stones & little brown earth
  - 8 2<sup>nd</sup> Hearth
  - 9 Tufaceous stalagmite, stones & yellow rubble
  - 10 5<sup>th</sup> Hearth
  - 11 Crystalline stalagmite
  - 12 Loose angular stones & air spaces
  - 13 Lime stone wall of cave
- (A) skeleton 'A'  
(B) " " 'B'  
(C) skeleton 'C'  
(D) " " 'D'