Creag nan Uamh

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Highlights

Creag nan Uamh is of great importance for cave deposits and the fossil remains which they contain. Together these provide a record of environmental conditions and faunal changes dating back to the Ipswichian. The record of Late Devensian mammal faunas is particularly important, being the most detailed, diverse and best dated in Scotland.

Introduction

The white dolomite Creag nan Uamh ('Crag of the Caves') [NC 268 170] in Sutherland possesses three main caves, known locally as the 'Bone Caves', and a number of niches and rock-shelters (Young, 1988). Situated 45 m above the normally dry stream bed of the Allt nan Uamh, the Bone Caves (Badger Cave, Reindeer Cave and Bone Cave, from west to east) have wide, semicircular entrances and large entrance chambers. Both Badger Cave and Reindeer Cave have inner chambers largely choked with fine-grained sediments; Bone Cave possibly also has one, but access is prevented by deposits in the back of the entrance chamber.

The caves at Creag nan Uamh are of considerable interest for Quaternary research because of the paucity of cave sites with datable sediments in Scotland as a whole, as well as their position so far north. They have yielded a Late Devensian and Holocene fauna that shows how the area acted as a refuge for sub-arctic species at the end of the last glaciation (Peach and Horne, 1893b, 1917; Callender *et al.,* 1927; Cree, 1927; Ritchie, 1928; Lawson, 1981b, 1983, 1984). The stratigraphy that has been reconstructed may extend back to before the Ipswichian (Lawson, 1981a), and recent research suggests that the caves are an important archaeological site (Lawson and Bonsall, 1986a, 1986b; Morrison and Bonsall, 1989).

Description

Bone Cave was first excavated by B. N. Peach and J. Horne in 1889 (Peach and Horne, 1893b, 1917). They described a six-layered stratigraphy and were of the opinion that the deposits related to the '... Lateglacial time, or at least to a period before the final disappearance of local glaciers in that region' (Peach and Horne, 1917, p. 327).

Badger Cave and Reindeer Cave were excavated in 1926 by J. G. Callender, J E. Cree and J. Ritchie (Callender *et al.,* 1927; Cree, 1927; Ritchie, 1928; Lawson, 1981b). The results of work in Badger Cave were largely insignificant, but a more complicated stratigraphy in Reindeer Cave, together with rich faunal remains, prompted a reinvestigation of the deposits in Bone Cave in 1927 in order to correlate the stratigraphy of the two caves. However, this latter investigation uncovered largely undisturbed deposits with a stratigraphy somewhat different from that previously published, casting doubts on Peach and Horne's stratigraphic description (Lawson, 1981b, pp. 9 and 16).

The Creag nan Uamh caves are the truncated remains of large, high-level phreatic passages forming part of a cave system that once extended across the area now occupied by the Allt nan Uamh Valley (Lawson, 1983). Remnants of other abandoned phreatic passages occur at approximately the same altitude as the Bone Caves (330 m OD) in Allt nan Uamh Stream Cave and Uamh an Claonaite (entrances at [NC 2746 1713] and [NC 2709 1659], respectively), and these are possibly parts of the same former cave system. Uranium-series disequilibrium dating of a speleothem from Uamh an Claonaite gave an age of 122 ± 12 ka, indicating ice-free conditions at that time and placing the flowstone block in the Ipswichian (Lawson, 1981a). Three additional uranium-series dates of 181 +24/–18 ka, 143 +13/–16 ka and 192 +53/–39 ka, also from Uamh an Claonaite, indicate that part of the master cave system, at least, is considerably older (Lawson, 1983).

A recent survey of the caves showed that nearly all of the clastic deposits in the outer chambers were removed during the 1926 and 1927 excavations (Lawson, 1983). The only in *situ* deposits in outer Badger Cave are a series of yellow sands and silts occupying rock ledges on the western side. Much of the original silty sand in the inner chamber remains, overlain by breakdown slabs. Friable, red 'cave earth' comprising small dolomite splinters in a red or sandy-brown matrix containing numerous small faunal remains, especially amphibian bones, occupies ledges around the cave walls; in places it overlies or is indurated with flowstone.

No in *situ* deposits remain in the entrance chamber of Reindeer Cave or in the fissure or shaft connecting it to the inner chamber. The 1926 excavations uncovered a gravel, rich in erratic lithologies, deposited by a stream that had entered the cave by way of the side passage from Bone Cave and then plunged down the shaft into the inner cave. This was overlain by an angular dolomite-rich gravel containing an arctic mammal fauna, which was in turn overlain by red 'cave earth'. Deposits in the inner cave appear to have been largely untouched since the 1927 excavation. A number of different strata are present. The lowest layer visible is a silty clay containing breakdown clasts which have been intensively weathered to form areas of grey clay. A lens of dark-stained gravel, 0.08–0.15 m thick, with a sharp, irregular upper surface, separates this layer from reddish-yellow silts (0.33 m thick) containing a few fallen roof-stones. A concentration of these angular dolomite cobbles separates the latter from an overlying stratum of structureless, pale-yellow silty-sand, 0.45 m thick. This layer is devoid of breakdown material. In places where the intervening marker-horizon of breakdown fragments is absent, the reddish-yellow silts merge imperceptibly into the pale-yellow silty sand, suggesting that they are all part of a single depositional unit. The whole profile is capped by slabs of dolomite breakdown. Clarification of the sedimentary history of this inner chamber is complicated by the presence of a band of bedded deposits, coarsening upwards from laminated sand to rounded pebbles in a silty sand matrix, which cuts through the other deposits on the eastern side of the chamber. The relationship between this gravel layer and the one found in the outer chamber and shaft in 1926 in not known.

In Bone Cave few of the original deposits remain *in situ.* In the passage connecting it with Reindeer Cave a section through cyclically bedded stream gravels occurs. They are not as well sorted nor as rounded as the gravels just described in the inner Reindeer Cave. Foreset bedding on the leeward side of a rock bar indicates that they were deposited by water flowing from Bone Cave to Reindeer Cave. These gravels most probably represent those described in 1927 (Lawson, 1981b) as also forming the lower gravel stratum in the outer Reindeer Cave. The gravel is capped by a thin flowstone layer and overlies yellow-brown clayey sediments occupying pockets in the cave floor. A brown silty mud containing amphibian bones occurs in the fissure on the eastern side of the cave; it is unlike other 'cave earths' in these caves, and probably represents the uppermost layers of the clay underlying red 'cave earth' described here in 1927. A cemented breccia at the cave entrance cannot be related to the former sedimentary fill as no evidence of the adjoining layers has been preserved.

Interpretation

(Figure 6.15) is an attempt to reconstruct the basic composite stratigraphy of the Creag nan Uamh caves. The relationship of the silts and sands to the 'cave earth' in the outer chamber of Badger Cave is entirely speculative; it assumes a correlation between these silts and sands and the yellow-brown silts of the inner cave, which is impossible to demonstrate in view of the disturbed nature of the latter. The silts of the inner recesses of Badger Cave also probably correlate with one or more of the fine-grained deposits in the inner Reindeer Cave; a smoke test in 1926 proved the two caves were linked (Lawson, 1981b), but no penetrable passages have yet been found.

Samples of sediment taken at the time of the 1926–7 excavations (and hitherto preserved in the Royal Museum of Scotland, Edinburgh), together with samples from the various litho-stratigraphic units still preserved in the cave have been analysed (Lawson, 1983) in order to ascertain their provenance and mode of deposition. Five radiocarbon dates have been obtained on selected faunal remains from two different layers in Reindeer Cave (Figure 6.15) (Lawson, 1984). Table 6.1 gives a composite faunal list after analysis of the material excavated in 1926–7. A synthesis of all the various evidence currently available allows the following stratigraphy to be proposed for the Creag nan Uamh caves.

The earliest deposit presently visible is the silty clay containing weathered breakdown material in the inner Reindeer Cave, which may correlate with the fine deposits occupying pockets in the floor of the outer chamber of Reindeer Cave

(silts and sands) and Bone Cave (silty clay). It may represent a 'wash' deposit, carried into the cave by groundwater percolating through the rock above. The intense weathering of this layer perhaps suggests that the deposit is the oldest in the caves. At least one stream channel extended over this material. The small grain size of this deposit implies low energy conditions, and the staining of the overlying gravel (possibly manganese) is similar to that which affects cave and peaty surface streams elsewhere in the area at present, suggesting an interglacial or interstadial origin for the chemical precipitation. The sharp, irregular contact with the overlying gravel layer reflects a break in sedimentation of unknown duration and subsequent erosion of these deposits.

The overlying reddish-yellow silt and sand containing fallen roof-stones, which gives way vertically to structureless, pale-yellow silty sand, again implies low-energy conditions. It is thought that these sediments are the finer fractions of the surficial glacial deposits washed into the caves by way of fissures in the dolomite (Lawson, 1983). Deposition to the roof of the inner Reindeer Cave and Badger Cave, that is to levels higher than the present cave entrances, requires those entrances to have been blocked and the caves to have been flooded. In the absence of material evidence of such barriers, it is presumed that the cave entrances were blocked by glacier ice. The faunal assemblage obtained from the surface of this stratum of silt and silty sand is dominantly arctic or sub-arctic in character (Table 6.1). It implies that the land surface around the caves was free of glacier ice, although the climate was still cold and the possibility of glacier ice existing elsewhere in the area cannot be excluded. Two individual reindeer antler fragments yielded radiocarbon dates of 25,360 +810/−740 BP (SRR–2103) and 24,590 +790/−720 (SRR–2104) BP, and give a minimum age for the fine-grained deposits in the inner Reindeer Cave (Lawson, 1984). These dates correspond well with uranium-series disequi-librium dates on speleothem samples from other caves in the general area (Atkinson *et al.,* 1986), which suggests that this part of north-west Scotland experienced climatic conditions allowing groundwater recharge in a Middle Devensian interstadial approximately 38,000 to 26,000 BP, prior to the onset of full glacial conditions during the Late Devensian. A radiocarbon date of 8300 ± 190 BP (SRR–2105) on a leg bone of a juvenile reindeer from the same stratigraphic horizon shows that faunal material of a mixture of ages is present in the inner cave. This casts serious doubt on the reliability of a date of 18,040 ± 240 BP (SRR–1789) obtained from a bulked sample of antler fragments collected from this same level.

The stratigraphic relationships of the two main fluvially-deposited gravels are as yet incompletely understood. They are lithologically distinct, which can be attributed to different transport paths prior to deposition. The erratic-rich gravel in the outer cave was traced by the previous excavators from the entrance of Bone Cave, through the connecting passageway to Reindeer Cave; the exposed section through this gravel in the connecting passageway attests to water flowing in that direction. Both the lack of faunal material within it and its situation in the cave are consistent with meltwater drainage from glacier ice occupying the Allt nan Uamh Valley. In contrast, the higher percentage of dolomite clasts and the greater degree of roundness of the pebbles in the gravel that cuts through the sediments on the eastern side of the inner Reindeer Cave, suggest a longer transport route through a cave system prior to deposition. Imbrication of the pebbles, the position of the gravel close to the steeply sloping cave roof and wall and the limited spread of this material over the yellow silty sand, suggest that it was deposited by a stream entering the chamber from below under hydrostatic pressure, and hence probably under phreatic conditions. These gravels are therefore also attributed to a glacial phase, and are post-dated by the faunal remains in the inner Reindeer Cave noted above.

Table 6.1 Faunal assemblages from the Creag nan Uamh caves.

a. Surface of fine-grained deposits in the inner Reindeer Cave		
Carnivora	*Ursus arctos* L.	Brown bear
	Alopex lagopus (L.)	Arctic fox
	Lynx lynx (L.)	Northern lynx
	Canis lupus L.	Wolf
Artiodactyla	*Rangifer tarandus* L.	Reindeer
Rodentia	*Dicrostonyx torquatus* (Pallas)	Arctic/collared lemming
	Microtus cf. *agrestis* L.	Field vole
	Microtus cf. *oeconomus* (Pallas)	Northern vole
	Arvicola terrestris L.	Water vole
	Apodemus sylvaticus (L.)	Wood mouse

b. Dolomite-rich, upper gravel unit, outer Reindeer Cave		
Carnivora	*Ursus arctos* L.	Brown bear
Artiodactyla	*Rangifer tarandus* L.	Reindeer
Rodentia	*Dicrostonyx torquatus* (Pallas)	Arctic/collared lemming
	Microtus gregalis (Pallas)	Tundra vole
	Microtus sp.	Vole
c. 'Cave earth' in Badger Cave (1), Reindeer Cave (2), Bone Cave (3)		
Insectivora	*Sorex araneus* L.	Common shrew (1)
	Sorex sp.	Shrew (2)
Primates	*Homo sapiens* L.	Man (1,2)
Carnivora	*Felis silvestris* Schreber	Wildcat (1)
	Mustela erminea L.	Stoat (3)
	Meles meles (L).	Badger (1)
	Canis lupus L.	Wolf (3)
	Vulpes vulpes (L).	Common fox (1,3)
	Ursus arctos L.	Brown bear (1,2,3)
Artiodactyla	*Sus* sp.	Pig (1)
	Cervus elaphus L.	Red deer (1,2)
	Capreolus capreolus (L.)	Roe deer (1)
	Rangifer tarandus L.	Reindeer (1,2,3)
	Ovis sp.	Sheep (1,2)
	Bos sp.	Ox (1,3)
Lagomorpha	*Oryctolagus cuniculus* (L.)	Rabbit (1,3)
	Lepus sp.	Hare (1)
Rodentia	*Arvicola terrestris* L.	Water vole (1)
	Microtus cf. agrestis L.	Field vole (1)
	Microtus oeconomus (Pallas)	Northern vole (1)
	Dicrostonyx torquatus (Pallas)	Arctic/collared lemming (2)

A variety of different unidentified bird species and fish, gastropods (including *Cepaea nemoralis* (L.) (2) and *Patella* sp. (2) and amphibians (mainly frogs and toads) were also retrieved from this layer (c). E.T. Newton (in Peach and Horne, 1917) identified the following additional species from Bone Cave, presumably from the 'cave earth' stratum of the revised stratigraphy: weasel (*Mustela nivalis* L.), otter (*Lutra lutra* (L.), rat vole (*Microtus ratticeps* (Keyserling and Blasius), bank vole (*Clethrionomys glareolus* (Schreber), ?chaffinch (*Fringilla coelebs* L.), barnacle goose (*Branta leucopsis* (Bechstein), ?mute swan (*Cygnus olor* (Gm), ?mallard (*Anas platyrhynchos* (L.), teal (*Anas crecca* L.), wigeon (*Anas penelope* L.), tufted duck (*Aythya fuligula* (L.), long-tailed duck (*Clangula hyemalis* (L.), eider duck (*Somateria mollissima* (L.), common scoter (*Melanitta nigra* (L.), ptarmigan (*Lagopus mutus* (Montin), red grouse (*Lagopus lagopus scoticus* (Latham), golden plover (*Pluvialis apricaria* (L.), grey plover (*Pluvialis squatarola* (L.), little auk (*Alle alle* (L.), puffin (*Fratercula arctica* (L.), frog (*Rana temporaria* L.), toad (*Bufo bufo* L.), natterjack toad (*Bufo calamita* (Laurenti), salmon or trout (*Salrno* sp.).

The upper gravel unit found in the outer chamber of Reindeer Cave represents extensive frost shattering and breakdown of the cave roof and walls. Why similar layers were not found in either Badger Cave or Bone Cave is unknown. This layer yielded a faunal assemblage of distinctly 'northern' character (Table 6.1). The tundra vole (*Microtus gregalis* (Pallas) is thought to have become extinct during the Lateglacial period (Bramwell, 1977; Stuart, 1982; A. Currant, unpublished data). A radiocarbon date of 10,080 ± 70 BP (SRR–1788) on reindeer antler fragments (Lawson, 1984), in accord with the cold-climate fauna, indicates a Loch Lomond Stadial age for the deposit. The caves lie outside the area affected by glacier ice at that time (Lawson, 1986). The faunal assemblage is peculiar in that over 830 shed reindeer antler burrs were excavated from the 0.5 m thick layer, but only two reindeer antler bones were unearthed. An analysis of the age and sex characteristics of the antler material suggests that Man may have been responsible for its introduction into the cave, which would make Reindeer Cave the oldest archaeological site yet found in Scotland (Lawson and Bonsall, 1986a, 1986b; Morrison and Bonsai, 1989).

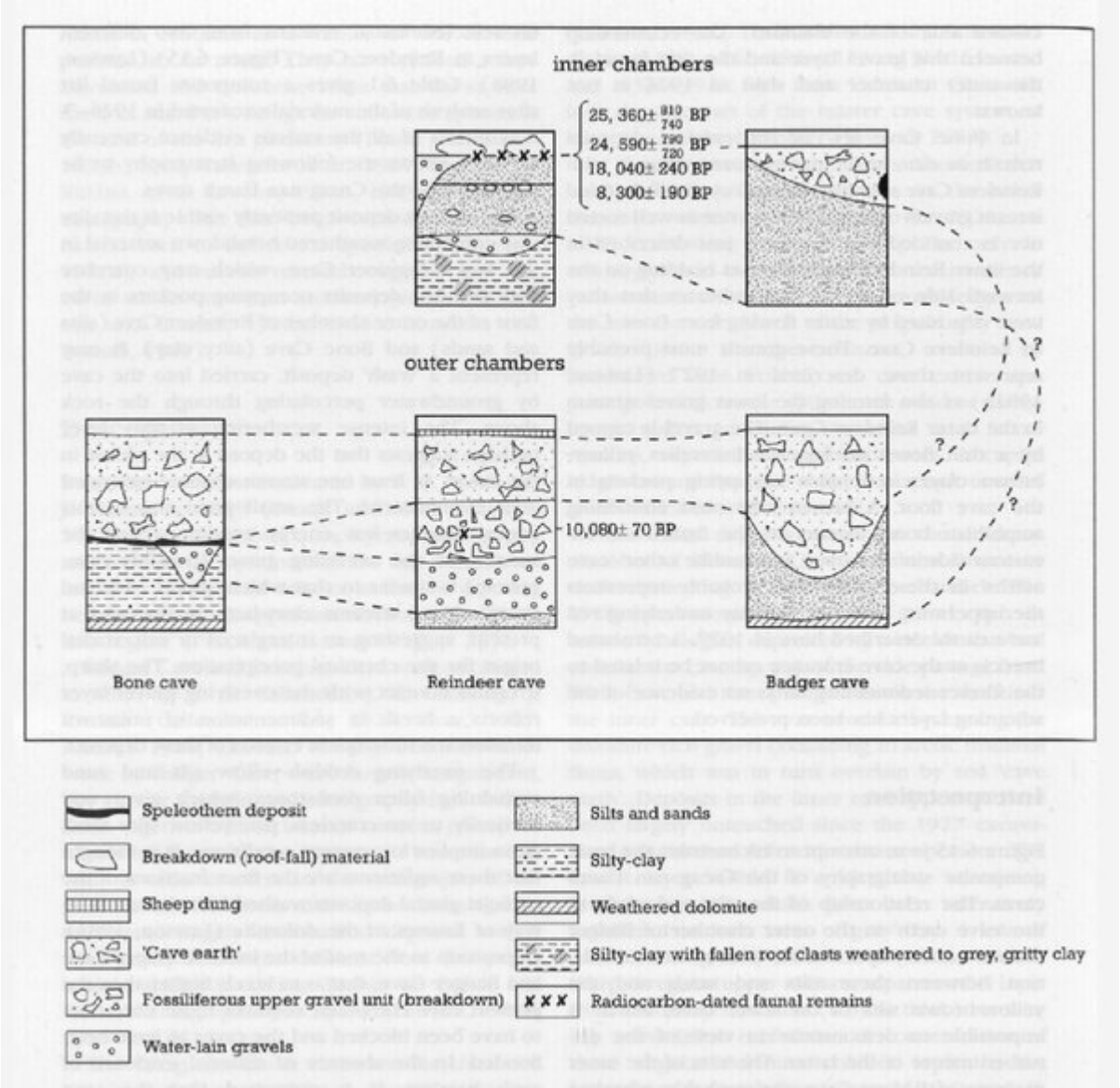
'Cave earth' comprises the uppermost deposits in the entrance chambers of all the caves, and includes varying amounts of small breakdown flakes in a red-brown silty matrix containing abundant faunal material. These sediments are clearly of Holocene age, but they do not appear to be actively forming at present. The presence of a thin flowstone deposit low down in this layer probably reflects a temporarily moister climatic regime. The 'cave earth' contains species that are still present in Scotland today (Table 6.1). Other species no longer present (for example, brown bear, wolf, and reindeer) probably owe their extinction to Man rather than to the changing Holocene climate. The location of the Creag nan Uamh caves helps to explain the presence of other animals usually associated with more northern climes, as a region so far north is likely to have remained a refuge area for many arctic species trapped there as climate ameliorated. This may account for the presence of arctic lemming (*Dicrostonyx torquatus* (Pallas)). The presence of *Cepaea nemoralis* (L.) is interesting as this land snail is no longer found farther north than southern Skye (Kerney and Cameron, 1979, distribution map 272). The numerous frog bones in these deposits are due to the death of many of these amphibians whilst aestivating in pockets of mud.

A reassessment of the previous excavations in the caves, together with selective analysis of various *in situ* deposits, has allowed the construction of a lithostratigraphy covering a large part of the Late Quaternary. Radiocarbon dates indicate that the fine-grained sediment (silty clay, reddish-yellow silts and pale-yellow silty sand) of the inner Reindeer Cave, at least in part probably deposited beneath an ice-sheet, pre-dates a Middle Devensian interstadial; further work may show that the lowest stratum (silty clay with weathered clasts) dates from before the Ipswichian. Other stratigraphic units can be demonstrated to be of Lateglacial and Holocene age on sedimentological, geomorphological and faunal grounds. The faunal assemblages from these most recent deposits are unique in Scotland and are important in palaeobiological terms, showing how certain species with sub-arctic affinities survived into the Holocene in this remote part of northern Britain. The increasing evidence that the site is of considerable archaeological significance, being temporarily occupied by Late Upper Palaeolithic Man around 10,000 years ago, also adds to the importance of the Creag nan Uamh caves as a Quaternary site.

Conclusion

The unique assemblage of deposits and fossil animal remains preserved in the caves at Creag nan Uamh provides an important record of environmental conditions and changes in Scotland during at least the last 125,000 years. Particularly important is the detailed evidence for the range of sub-arctic mammalian species present in the area at the end of the last ice age (about 10,000 years ago).

References



(Figure 6.15) Diagrammatic reconstruction of the lithostratigraphy of the Creag nan Uamh caves, showing proposed relationships between certain of the layers (from Lawson, 1983).

(a) Surface of fine-grained deposits in the inner Reindeer Cave		
Carnivora	*Ursus arctos* L.	Brown bear
	Alopex lagopus (L.)	Arctic fox
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	Arvicola terrestris L.	Water vole
	Apodemus sylvaticus (L.)	Wood mouse
(b) Dolomite-rich, upper gravel unit, outer Reindeer Cave		
Carnivora	*Ursus arctos* L.	Brown bear
Artiodactyla	*Rangifer tarandus* L.	Reindeer
Rodentia	*Dicrostonyx torquatus* (Pallas)	Arctic/collared lemming
	Microtus gregalis (Pallas)	Tundra vole
	Microtus sp.	Vole
(c) 'Cave earth' in Badger Cave (1), Reindeer Cave (2), Bone Cave (3)		
Insectivora	*Sorex araneus* L.	Common shrew (1)
	Sorex sp.	Shrew (2)
Primates	*Homo sapiens* L.	Man (1,2)
Carnivora	*Felis silvestris* Schreber	Wildcat (1)
	Mustela erminea L.	Stoat (3)
	Meles meles (L.).	Badger (1)
	Canis lupus L.	Wolf (3)
	Vulpes vulpes (L.).	Common fox (1,3)
	Ursus arctos L.	Brown bear (1,2,3)
Artiodactyla	*Sus* sp.	Pig (1)
	Cervus elaphus L.	Red deer (1,2)
	Capreolus capreolus (L.)	Roe deer (1)
	Rangifer tarandus L.	Reindeer (1,2,3)
	Ovis sp.	Sheep (1,2)
	Bos sp.	Ox (1,3)
Lagomorpha	*Oryctolagus cuniculus* (L.)	Rabbit (1,3)
	Lepus sp.	Hare (1)
Rodentia	*Arvicola terrestris* L.	Water vole (1)
	Microtus cf. *agrestis* L.	Field vole (1)
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(Table 6.1) Faunal assemblages from the Creag nan Uamh caves.