THE ALVESTON BONE FISSURE GLOUCESTERSHIRE

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Part 1

By

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ABSTRACT

The Alveston Bone Fissure is the remnant of a cave system. Stalagmite was formed on the basal silt. Later boulder falls opened the roof of the cave to the surface and it became a pitfall for animals during the Eemian inter-glacial. The bone-bearing cone of dejection was truncated by erosion followed by deposition of thermoclastic scree, presumably of Weischelian age, and finally by post-glacial red loam. The site was mined for lead and quarried in the 1750s. Excavations were made in 1960-1963. A report on the soils forms part 2.

SITE AND HISTORY

The fissure is a remnant of a cave system in the ridge of carboniferous limestone which borders the Severn plain north of Bristol. It lies near the crest of the ridge at 230 ft. O.D. The upper part of the cave system and its contents have been removed by erosion, most of the remainder by mining and quarrying. The site has now been levelled and an electricity pylon stands about 10 yds. north of the fissure.

Lead mining took place in the 1750s (Catcott). The ore, "mixed with spar and grit", lay in narrow fissures; a much earlier shaft was found. In the fissure here described lead occurred as weathered ochreous nodules, white internally, most having a core of galena or enclosing galena between strata of heavy white matter, at first mistaken for baryta. They lay in ochreous earth together with weathered fragments of limestone and unweathered, unbraded teeth and bones.

The site was recorded by Davy (1933), and Jackson (1933) identified the fauna. The early finds and several hundredweight of breccia consisting chiefly of bones were destroyed in 1940

The cave system may have been drained WNW towards the present Severn by the fissure, here an open canyon only 5-6 ft. across but retaining traces of a wider shaft above. A phreatic passage ran underground at either end (Figs. 33, 34, 36; plate 15, 16). To the NE traces of chambers and fissures were visible between dumps of spoil. On the SW there had been at least two large phreatic chambers, now roofless. One opened into the fissure by a descending pipe partly sealed at its lower end by stalagmite (Figs. 33, 34, 36). It had been cleared of deposit saving a few inches of archaeologically-sterile purplish-red silt on its floor.

EXCAVATION

Fears for the safety of the site were aroused in 1960 by the Severn Bridge project. Excavation was carried out under the writer's direction until April 1963, when the site was buried without warning under many feet of earth and stones derived from road works. Work on the intact bone-bearing deposits had just been completed. The fissure had been cleared out or sounded to the depth of 30 ft. below its highest remaining point and 15 ft. below the floor of the quarry (plate 16). It had been hoped to follow the passages underground and to search the miners' spoil heaps.

On clearing away recent fill it was found that most of the bone-bearing deposit had already been removed. However, some remained intact and *in situ* in an expansion of the SW side of the fissure (perhaps the bottom of a relatively wide shaft,—Figs 33-36); some was in a bridge firmly cemented across the fissure by lime salts and some as masses cemented to the rock walls. From these it was possible to recontruct the stratification (Figs. 34-36). The plan (Fig. 33) shows the present lip of the fissure and top of its intact deposits at depths varying by as much as 15 ft., projected upon a horizontal plane; the empty chambers were not surveyed and their plan is approximate. None of the sections was complete and in Fig. 34 several longitudinal sections have been combined by projecting them upon the SSW wall; in Fig. 35 the transverse sections have been similarly combined. The findings are summarized in Fig. 36.

STRATIFICATION

(Figs. 34-36, plates 14-16)

A. Red surface loam. Absent around the fissure (presumably cleared away as overburden) but 2-3 ft. deep north and east of the workings.

B. Sharp (thermoclastic) limestone scree. The grey stones were brown externally and weathered. It lay directly upon the bedrock and the truncated deposit C in the fissure. It was at least 18 in. deep in parts, but only 4-6 in. remained around the fissure owing to clearance. Where intact it was barren archaeologically but two fragments of flint and a worked flake of Upper Palaeolithic type were found in it where not *in situ*.

C. Fallen deposits:

C.1 Yellow earth and stones. This was the chief bone-bearing deposit, forming a cone with an angle of rest of about 40° (plate 14); it was the base of a cone of dejection truncated horizontally at the level of the bedrock, where its junction with B was abrupt. Its remaining depth was 6-7 ft. Its fine element was the product of surface weathering, in the main, under warm or temperate conditions (Shackley, see Part 2). Its stones were weathered fragments of partly-decalcified limestone and nodules of lead ore. The bones and teeth of interglacial animals formed more than a quarter of some parts of the deposit. They were well preserved and neither weathered, abraded nor gnawed. Those

ALVESTON FISSURE. G.2. PLAN.

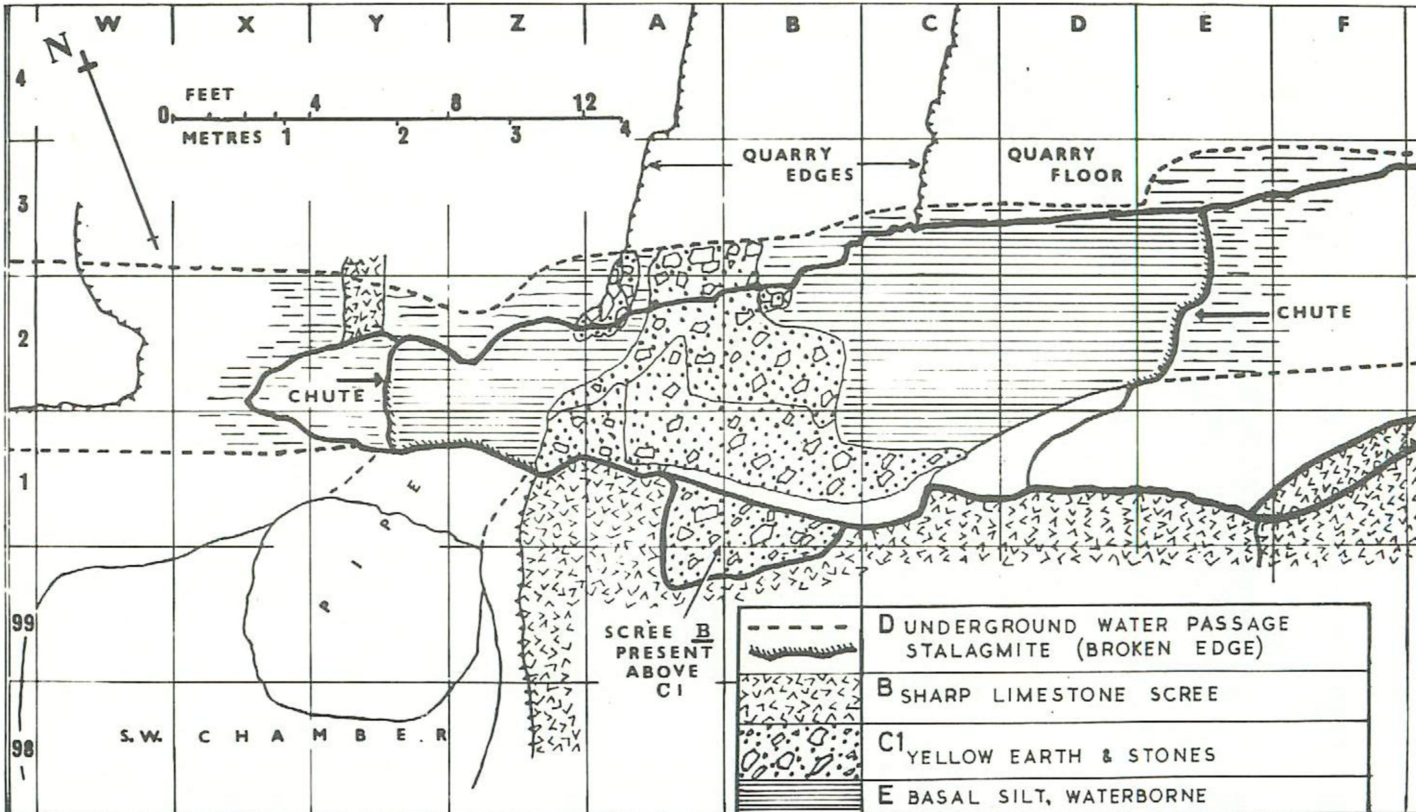

Fig. 33

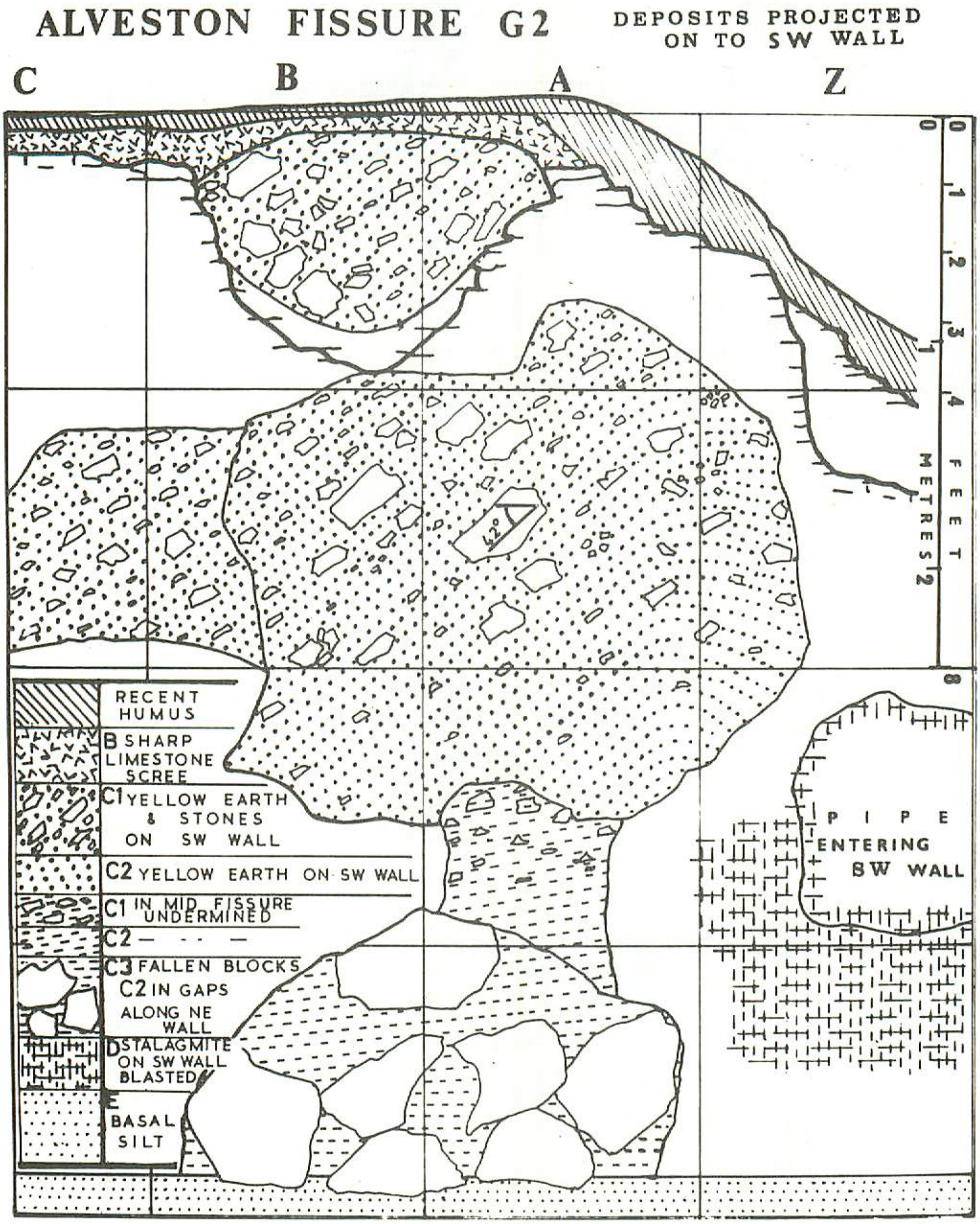

Fig. 34 Part of longitudinal sections projected on to SW wall. Only intact deposits shown.

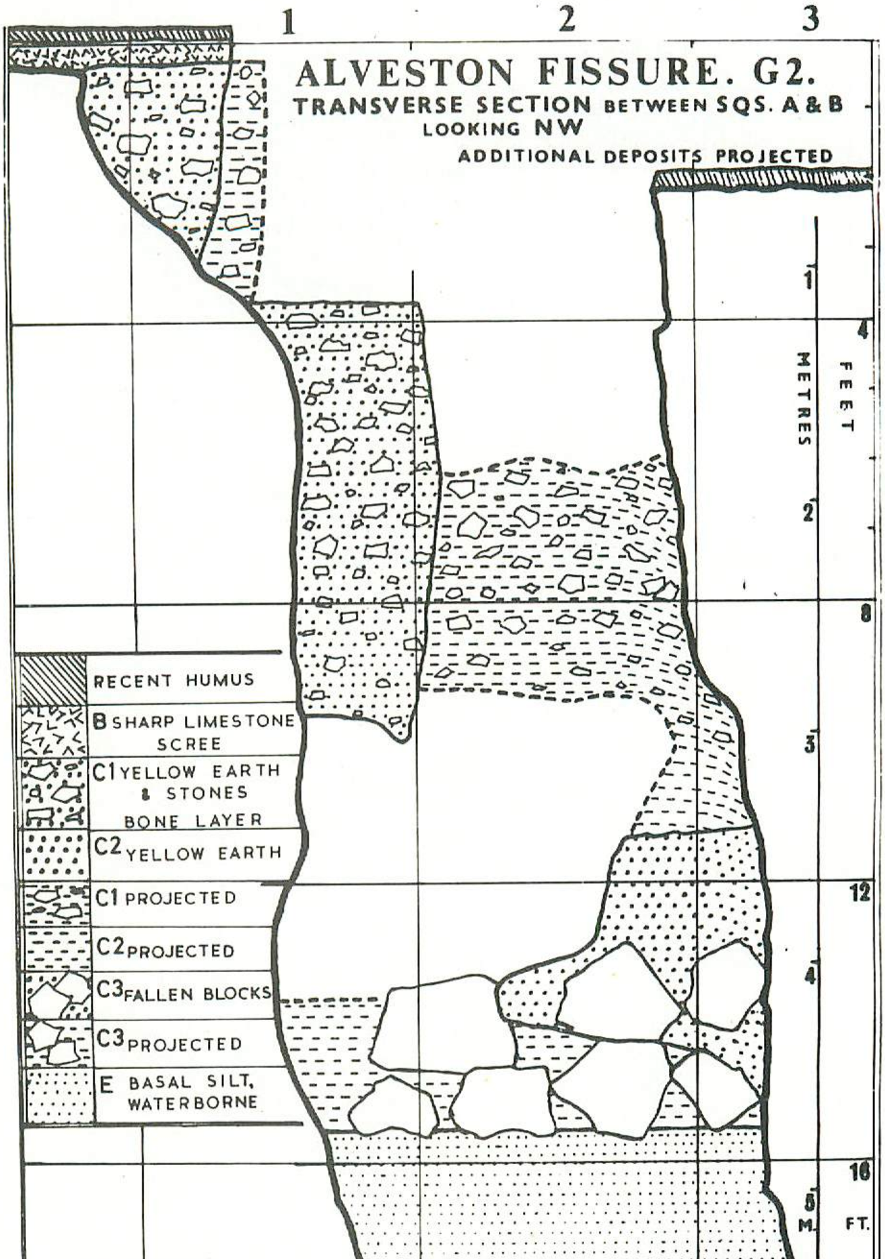
1
2
3
ALVESTON FISSURE. G2.
TRANSVERSE SECTION BETWEEN SQS. A & B
LOOKING NW
ADDITIONAL DEPOSITS PROJECTED
METRES
FEET
1
2
3
4
5
M.
4
8
12
16
FT.
RECENT HUMUS
B SHARP LIMESTONE SCREE
C1 YELLOW EARTH & STONES BONE LAYER
C2 YELLOW EARTH
C1 PROJECTED
C2 PROJECTED
C3 FALLEN BLOCKS
C3 PROJECTED
E BASAL SILT, WATERBORNE

Fig. 35

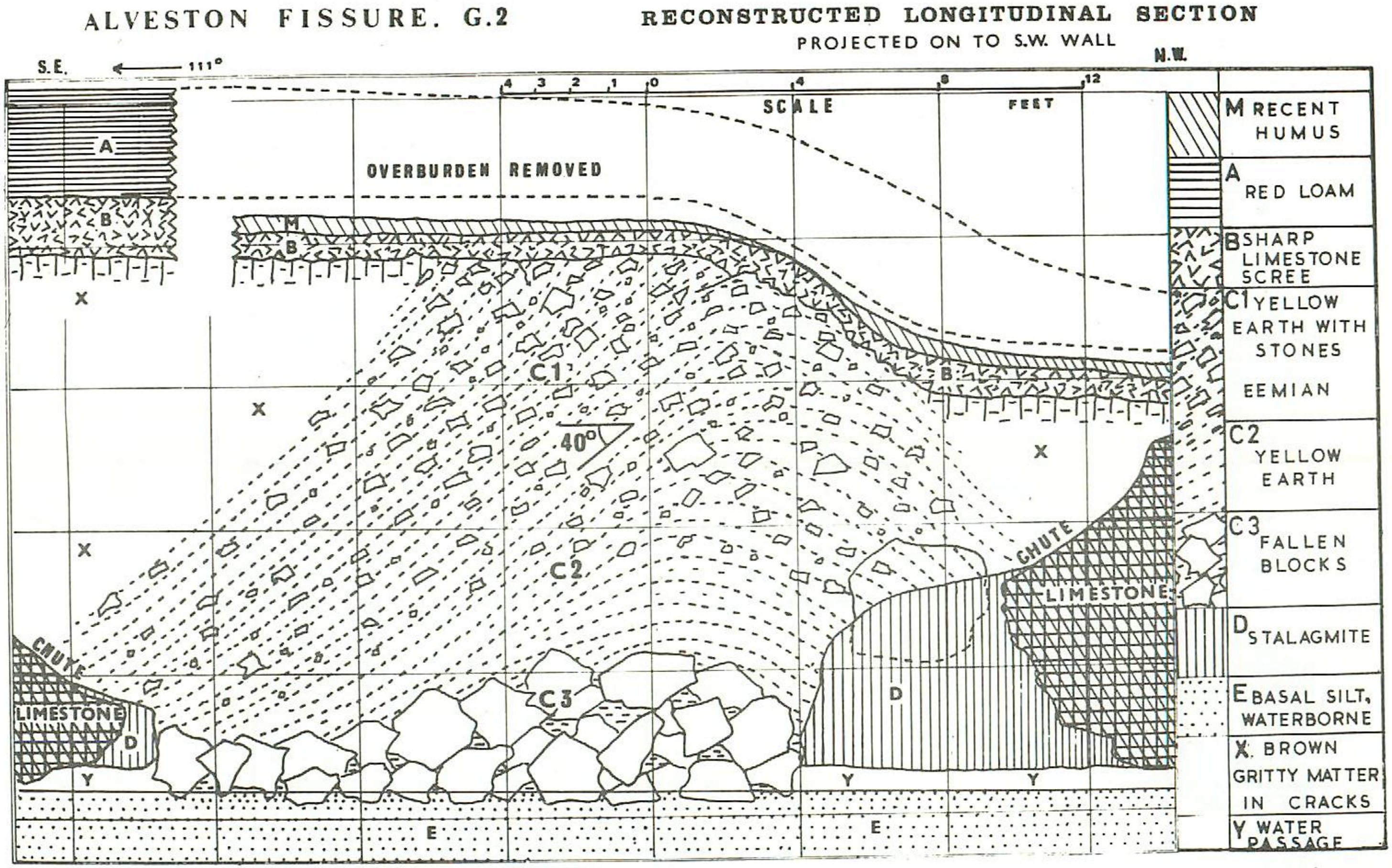

Fig. 36 The squares have sides of 4 ft.

recognizable as belonging to the same individual lay in the same stratum, often not far apart and in several cases still in anatomical relationship (e.g. a foreleg and foot of ox or bison, a hind foot of rhinoceros). Unfortunately only a few bones from each individual were present in the remnants of the layer. A few scraps of much weathered bone were also present, presumably derived from the surface together with the weathering products.

In the upper two feet or more of C1 many stones and bones were shattered with minimal displacement of their fragments, as if by frost action after C1 had been formed. At all depths much of the matrix was firmly cemented by lime salts and blocks of such material were abundant in the miners' spoil. Towards the base of the layer, stones, lead nodules and bones became gradually less abundant, the stones smaller and a fine weathering product formed under cold conditions was present, (Shackley—sample 9).

C2. Yellow earth. This was usually cemented by lime. It filled the interstices between the boulders of C3 and was as much as 3 ft. thick above them. There was little evidence for cryoclastic processes so presumably it was the product of a temperate climate. It yielded only a few bones of hare, smaller rodents and very small snail shells; none was weathered or abraded.

C3. Limestone blocks. Some of these weighed several hundredweight. Where they were *in situ* the lowest rested upon the silt E. They were not encrusted with stalagmite but many were cemented together and to the sides of the fissure by the lime rich deposit C2.

D. Stalagmite. This had formed local floors or shelves below the pipe and below the chutes where the rock closed over the passage. It lay between the fallen deposits and the silt E. Below the pipe the stalagmite may have reached a thickness of 2-3 ft. but had been blasted through.

E. Brown non-plastic silt. This had no visible stratification and thus was probably deposited in very still water; its top sloped slightly downwards to the WNW. Its depth was shown to exceed 15 ft. by excavating an old sounding. It was sterile archaeologically.

DISCUSSION

The fine silt E was water-deposited in part of a cave system represented by the fissure. It was succeeded by massive deposition of stalagmite, which appears as shelves (Fig. 33). The rock falls (C3) need have no special significance. They occured after the stalagmite shelves had formed for the blocks were not encrusted with stalagmite. The few exceptions had single encrusted faces, which, presumably, had formed part of a roof or wall. The falls may have been associated with the breaking through of the fissure to the surface.

Above and around the fallen blocks was the silt C2 formed by weathering of the Carboniferous Limestone. There was little evidence of cryoclastic processes involved (Shackley p. 150). C2 yielded only a few bones of hare and some shells of very small snails.

TABLE 1

FAUNA

(The following were present only in layer C1 unless otherwise stated)

Carnivora		
Felis leo spelaea	Cave lion	At least three individuals; includes nearly complete ulna
Crocuta crocuta	Cave hyena	Several individuals
Canis lupus	Wolf	At least two individuals
(*Meles meles*)	Badger	? one individual: in spoil, probably recent
Proboscidae		
Loxodon antiquus	Straight-tusked elephant?	Not mammoth. Limb bones from two individuals
Perissodactyla		
Dicerorhinus hemitoechus	Steppe rhinoceros	At least two individuals. Includes part of horn
Artiodactyla		
Bos sp.	Ox or bison	Abundant
Cervus elaphus	Red deer	? Three individuals
Dama dama	Fallow deer	Very abundant
(*Sus scrofa*)	Pig	One individual. Probably recent
Rodentia		
	Small voles	Not abundant. Present in both C1 and C2. Mainly unidentifiable pieces.
Sorex cf. minutus	Shrew	Rare
Microtus agrestis	Field vole	
Clethrionomys (?) *sp.*	Bank vole (?)	
Lagomorpha		
Lepus sp.	Hare	Rare. Present in both C1 and C2
Mollusca		
		Not common. All very small. Present in C1 and C2. Awaiting identification

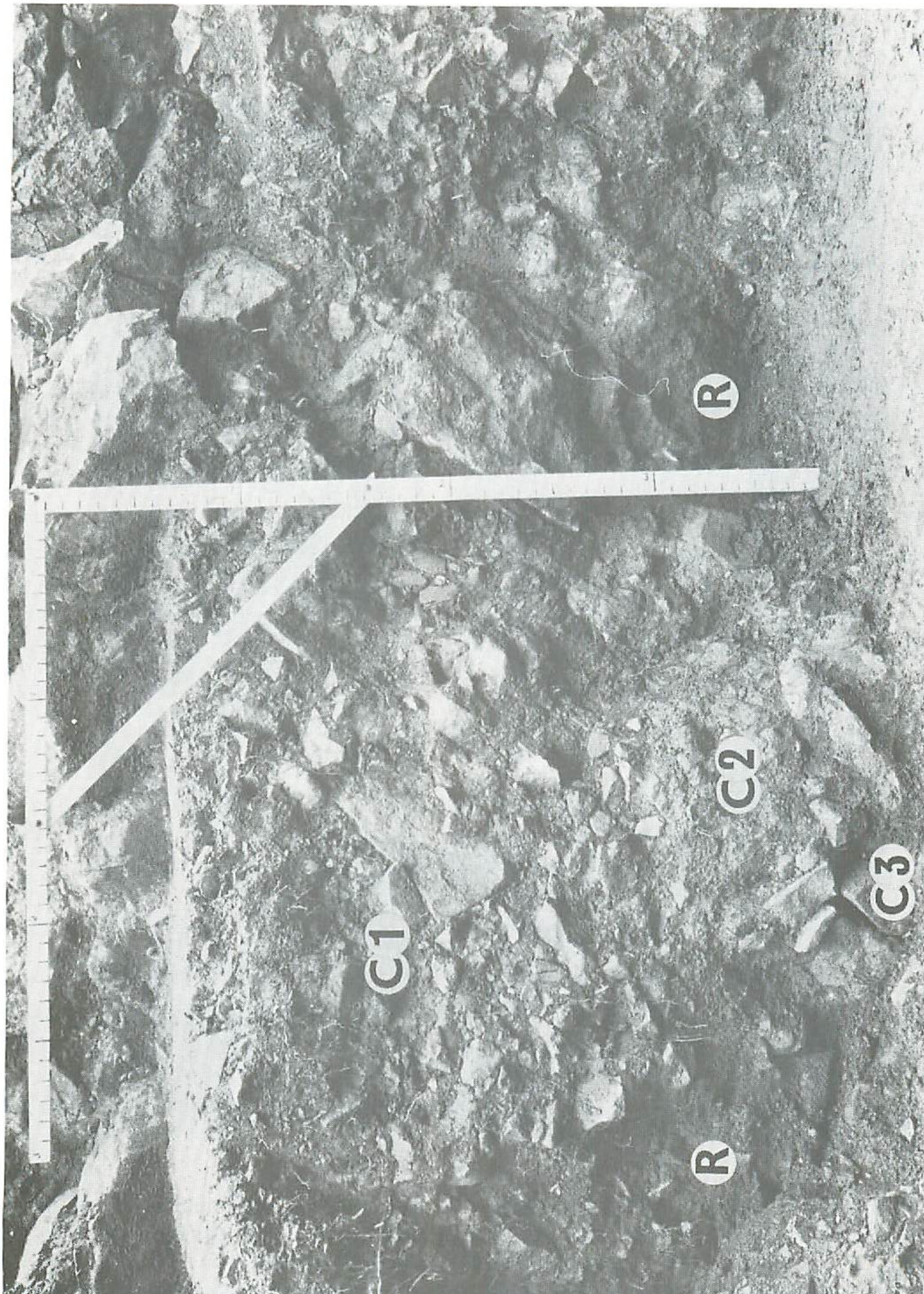

Plate 14. Intact deposits adherent to SW wall. C1-C3, cone of dejection with reverse slope on right. R, Miners' fill. Frame 3 × 4 ft.

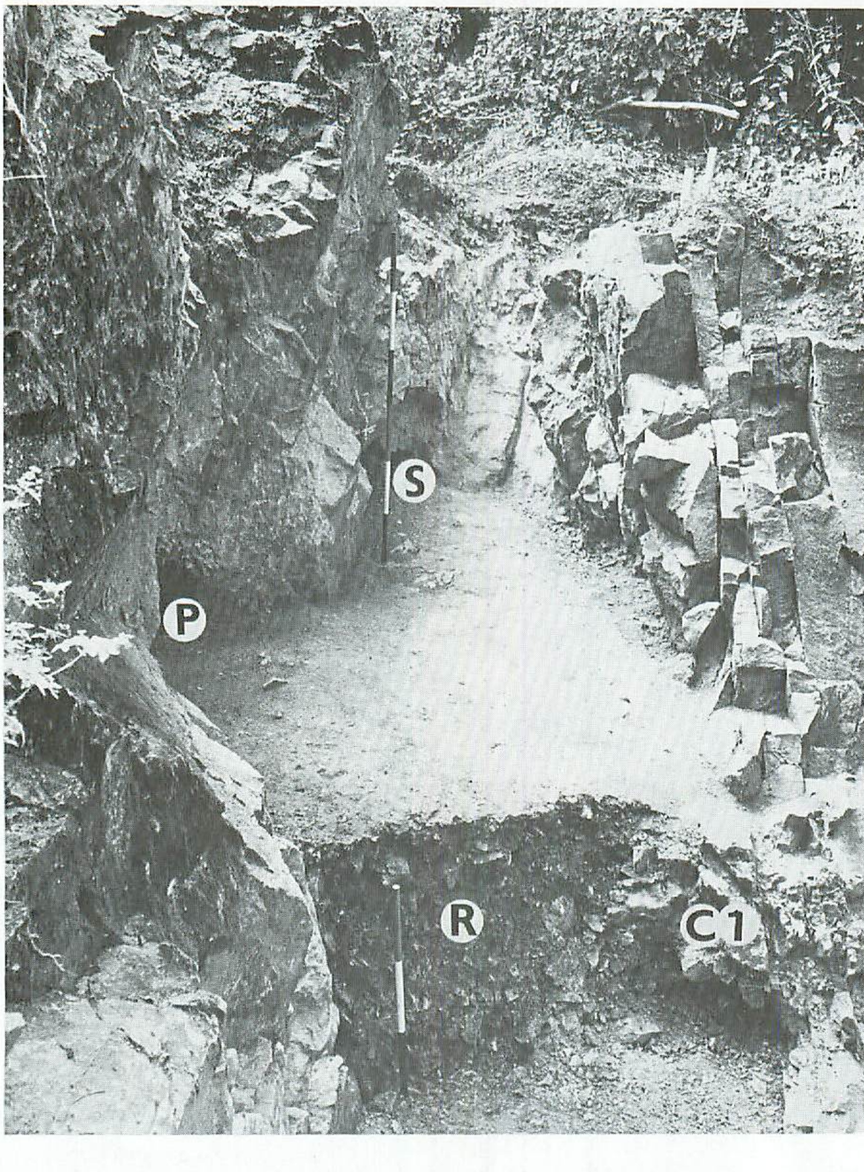

Plate 15. Excavations looking NW. C1, intact yellow earth and stones cemented to NE wall. P, entering pipe. S, exit passage for water. The measures are 6 ft. and 3 ft.

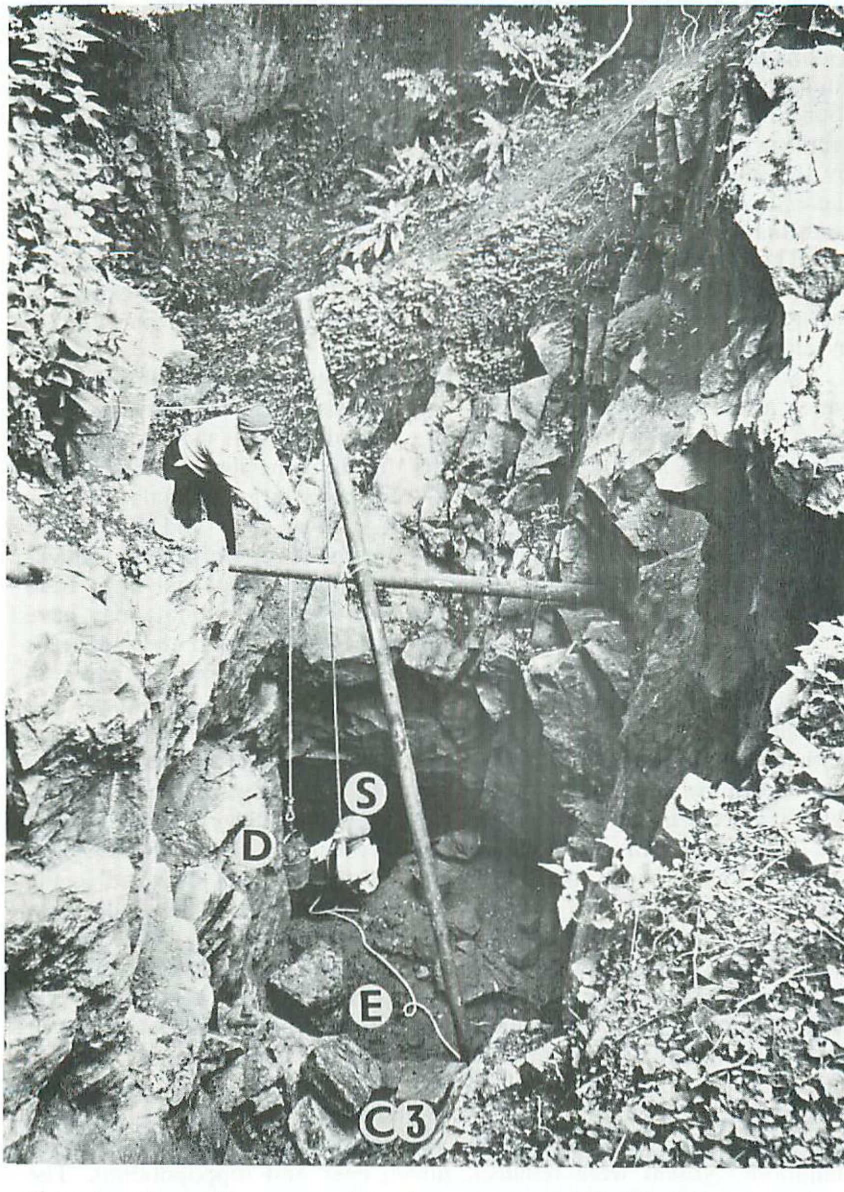

Plate 16. Excavations at a late stage, looking SE. C3, fallen boulders. D, remains of stalagmite shelf. E, basal silt. S, underground water passage. The figure is standing on the quarry floor, which is 15 ft. below present top of fissure.

Upwards C2 merged gradually into the stonier layer C1, which contained abundant remains of a 'warm' (Eemian) fauna including steppe rhinoceros and fallow deer. Near the base of C1, however, was a 'fine-textured scree' (soil sample 9) formed under 'severe climatic conditions' (Shackley, p. 151) but associated with the same 'warm' fauna found in all other parts of the layer. The granulometric findings would seem to indicate a climatic sequence somewhat earlier than that shown by the faunal remains, and apparently including a colder phase before the end of the Eemian. Clearly this very tentative suggestion must await confirmation at larger and less ransacked sites.

The limestone fragments in C1 were weathered externally but neither they nor the bones were abraded or rolled. The original thickness of the layer could not be determined, for the upper part had been removed by erosion.

Some bones in C1 retained their anatomical relationship. Those which appeared to be of the same individual lay on the same horizon. All conformed with the angle of rest of the deposit. It would seem that they were derived from animals which fell into the fissure when it was wide enough and deep enough to trap both large animals such as elephant and rhinoceros and agile ones such as deer and wolf. Such pitfalls appear to have existed at the Dream Cave, Derbyshire, (Buckland, 1823) and Joint Mitnor, Devon, (Sutcliffe, 1960), and have been suspected at other sites. In other cases, however, the animals may have been killed or drowned at a drinking place, from which their remains were washed into a shaft before all their flesh had decayed. At Alveston this would not explain the high proportion of predators and formidable animals such as elephant and rhinoceros—(these beasts were neither very young nor old). That the deposit had not been stream-laid was shown by its angle of rest (about 40°) and the presence side by side of objects of all sizes and weights, including heavy lead nodules.

The bones had not been gnawed. Presumably their fall had been sufficient to kill or disable the hyaenas. They were not drowned in the shaft for the deposit had not been re-arranged by water. It would seem that erosion had removed the top of the cone of dejection (Fig. 36) and that the material of the cone had completely filled the shaft for none of layer B had entered. The probability is that many feet of the top of the limestone ridge, including the top of the pitfall, had been removed by erosion before the thermoclastic scree B was deposited.

The carnivores were lion, hyaena and wolf. A large bovid was abundant and fallow deer even more abundant. The steppe rhinocerous was present but not the woolly rhinoceros. The elephant was not mammoth. Absent were reindeer, horse, bear and hippopotamus. The nearest parallel would seem to be the Hyaena layer in Torbryan Cave, Devon (Sutcliffe and Zeuner, 1962), which is ascribed to the Last Interglacial (Eemian) period; at Tornewton, however, hippopotamus and bear were found in the Eemian layer. In conversation, Sutcliffe compared the Alveston fauna with the Last Interglacial at Joint Mitnor Cave, Devon (Sutcliffe 1960), where the conditions of deposition were similar to those at Alveston: he thought that Alveston was probably a little later owing to the absence of hippopotamus; although the absence of this animal may be due to the small size of the collection or to the hilltop site where its remains could not be expected unless brought by predators. It seems possible that the fauna of C2 and the sharp scree near the base of C1 represent a cold phase which could have led to the extinction of the hippopotamus. The presence of hare indicates relatively open country.

The sharp limestone scree B was probably a product of the last (Weichselian) glaciation. Where intact it was barren archaeologically, but three fragments of imported flint were found in miners' spoil. All bore a dense white patina; one was part of a flake of Upper Palaeolithic type having one long edge blunted by retouch, the other damaged as if by use. These were the only remains left by man (other than modern) found on the site.

The thermoclastic scree rested directly upon bedrock and on the deposit C1 in the fissure, which was truncated to the same level. Abrupt transition between such deposits and earlier layers apparently truncated by erosion has been observed at Mendip sites, e.g. the Bridged Pot Shelter in Ebbor Gorge (McBurney, 1959, 263-4) and the Badger Hole and Hyaena Den, Wookey Hole (Tratman, Donovan and Campbell, 1971). Its presence at Alveston supports the view that the splitting of bones and stones *in situ* in the upper part of C1 was caused by frost; it was certainly not due to man, animals or pressure.

CONCLUSIONS

The Alveston Bone Fissure is a remnant of an ancient cave system. Stalagmite was deposited above the deep deposit of basal silt. After roof falls of rock the fissure became open to the surface and received weathering products in which only a few bones of hare, small rodents and small snails were found.

During the Eemian interglacial period it was a natural pitfall for animals. It became completely filled with their remains and the weathering products which included many more and larger stones than the earlier ones; in some parts the bones made up 25% or more of the deposit. Animals typical of the period such as steppe rhinoceros (*hemitoechus*) and fallow deer were present, together with *Bos sp.*, an elephant, cave lion, hyaena and wolf. The absence of hippopotamus may indicate a date late in the Eemian and the granulometric findings tend to suggest a relatively cold phase before the end of the period.

There followed a period of erosion during which the upper part of the limestone ridge, cave system, fissure and its contents were removed. This ended with the deposition of a thermoclastic scree provisionally ascribed to the final cold phase of the Weichselian glaciation. No faunal remains were found in this deposit. A post-glacial red loam was laid down over the whole.

Despite lead mining and quarrying sufficient of the several deposits remained *in situ* to enable the stratification to be worked out.

ACKNOWLEDGEMENTS

My thanks are due to Mr. G. Northover for permission to excavate the site and for kindly presenting the finds to the University of Bristol Spelaeological Society.

I am greatly indebted also to Dr. A. J. Sutcliffe and Dr. R. J. G. Savage for identifying the larger animal remains, to Dr. G. B. Corbett for identifying the rodents and to Miss M. Shackley for examining and reporting on the soil samples.

Without the help of my wife and of Mr. and Mrs. H. Masterman this rescue dig would not have been completed before the site was buried. The latter have done much work on the bones.

My special thanks are due to Dr. E. K. Tratman for his help in the preparation of this report.

DISPOSAL

All the material and the catalogue are in the University of Bristol Spelaeological Society's Museum.

PART 2

SEDIMENT SAMPLES FROM THE ALVESTON BONE FISSURE, GLOUCESTERSHIRE

By

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The samples were numbered 1-14, from the top downwards, and had been assigned by the excavator to the following stratigraphic divisions:

Samples 14-12 (Layer C2)
Samples 11- 4 (Layer C1)
Samples 3- 1 (Layer B)

It was hoped that the analyses would provide additional information about the palaeo-environment of the cave deposits, and perhaps some corroborations for the climatic divisions postulated on faunal grounds.

ANALYTICAL PROCEDURE

The colour of the deposits was examined, and measured using a Munsell chart. The presence of included material such as charcoal, bone, mineral particles or archaeological material was also noted, and the shape and angularity of the pebbles was described. In addition all samples were subjected to a detailed particle-size analysis by dry-sieving through a nest of 21 American Standard sieves, mechanically shaken and spaced at intervals from 0.06-16 mm, on the logarithmic ø scale. For these methods see Shackley (1972).

RESULTS

The colour descriptions of the samples are summarised in Fig. 37, and are seen to be all within the Munsell category 10 YR (yellowish-brown), although there are variations of hue and chroma from 10 YR 7.4 (very pale brown) to 10 YR 5.8 (yellowish-brown).

Sample	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Original division	*Layer C2*			← *Layer C1* →								*Layer B*		
Phases 1-3	*Phase 1*			← *Phase 2* →								*Phase 3*		
Colour (Munsell)	← *10YR* → 6·6	6·8	7·4	← *10 YR* → 5·8	5·8	7·4	6·6	5·8	6·4	5·6	5·8	*10YR* ← 7·4 →		
Notes.	*Transitional deposit.*			*Complex deposit series forming main dejection cone. Much animal bone.*								*Clean scree. (thermoclastic.)*		

Fig. 37 Main divisions within the cave sediments.

All samples contained fragments of metallic lead, and samples 11-4 contained a number of small bones (Fig. 37). There was an appreciable degree of variation in the roundness of the pebbles, those of samples 3-1 being very angular. The coarse pebbles of samples 8-4 were much more rounded, and showed signs of chemical solution.

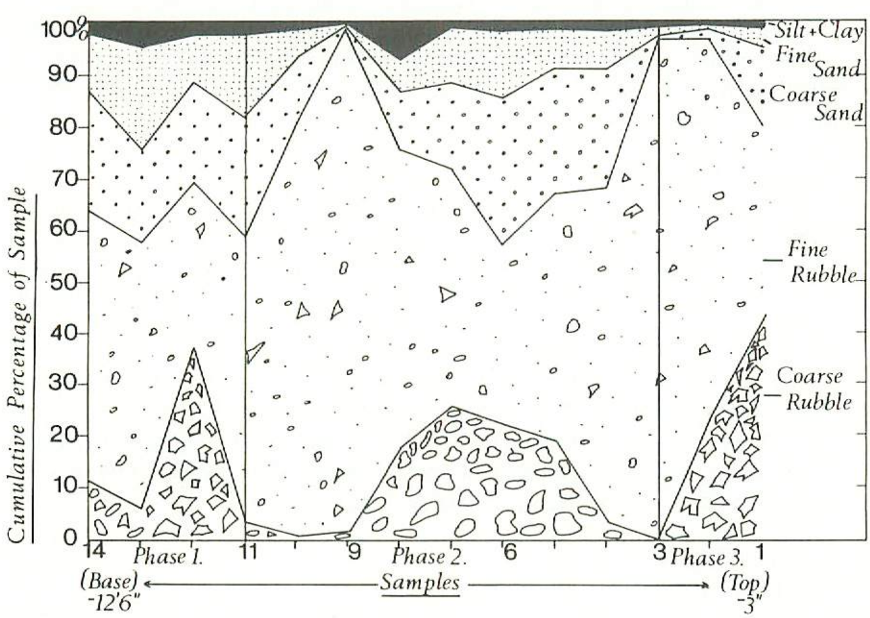

Fig. 38 Results of mechanical analysis of the cave sediments.

The results of the particle-size distribution analysis are summarized in Fig. 38. It can be seen that the grain size composition of the samples is very variable, even though the 21 size classes used have been condensed into the following main divisions:

(1) Coarse rubble (pebble diameter 16 mm)
(2) Fine rubble (pebble diameter 1-16 mm)
(3) Coarse sand (0.25-1 mm)
(4) Fine sand (0.06-0.25 mm)
(5) Silt and clay (0.06 mm)

Samples 14-12. C2.

These three samples were taken from the lowest part of the deposits, with the exception of the basal silts, and consisted partly of chemical residue weathered from the Carboniferous Limestone, and partly of macroscopic pieces from the same source. The composition of the three samples was very similar, the weathering products being combined with water-transported silt, waterworn limestone pebbles, some small stalagmite fragments and a number of metallic lead nodules. There was little evidence for cryoclastic processes and the samples contained an average of 40% sands and clays.

Samples 11-10. C1.

These samples were taken from near the base of the cone of dejection, and are composed of fine material possibly derived from outside the fissure. They have a very small coarse fraction (less than 3%), which is composed of large fragments that are all chemically weathered. The weathered fine sand grains are often present as agglomerations, cemented together by calcium carbonate, and there are appreciable quantities of fine lead nodules.

Sample 9. C1.

This sample is markedly different in composition from those immediately above and below it, and consists of a very clean thermoclastic scree, rather fine-textured and virtually free from sand or silt. The component particles are very angular, and of a size range 1-16 mm.

Samples 8-7. C1.

These samples, deposited immediately above the thermoclastic screes, are composed of the fine-grained products of chemical weathering. There is a marked increase in the amount of sand and silt present in the samples, and a decrease in the amount of fine rubble. The deposit includes a few well-worn limestone pebbles.

Samples 6-4. C.1.

These form the highest part of the cone of dejection. They show an increase in fine rubble and sand, and a decrease in waterworn material. The lead nodules in the sample were particularly well-rounded, and the deposit contained a number of small bones.

Samples 3-1. **B.**

These three samples were uniformly composed of very angular thermoclastic scree, identical with Sample 9, and also containing very little fine material. There was no evidence for chemical solution.

With the exception of the thermoclastic screes the sediments represented are the products of the combination of a number of erosion and weathering processes. This could invalidate more sophisticated data-manipulations by techniques intended for strictly *in situ* deposits (Shackley 1972).

CONCLUSIONS

Samples 14-12 are likely to have been deposited during the initial stages of the formation of the system, combining material eroded and weathered from the limestone walls with fragments of stalagmite and fine-grained material that probably entered the fissure via solution passages. These three samples are therefore of mixed character, and are likely to have formed over a considerable period of time, under variable climatic conditions.

After the collapse of the cave roof, leaving the fissure open to the air, the basal deposits would have become mixed with large blocks derived from the roof fall (Layer C3 in Figs. 34-36). The sediments deposited after the collapse are likely to reflect prevalent climatic conditions. The next layer to be deposited consisted of fine-grained material showing evidence of chemical weathering, and is likely to be the result of solution of the walls of the fissure combined with some wind-blown material and other sediments derived from outside the fissure. A period of damp temperate conditions seems likely.

The deposit of thermoclastic scree represented by Sample 9 is the product of physical weathering under severe climatic conditions. Succeeding this cold period there appears to have been another temperate episode, represented by Samples 8-7, when conditions were similar to those existing during the formation of Samples 11-10. Samples 6-4 form the highest part of the cone of dejection, and show signs of having accumulated under similar, although slightly drier, conditions. The exact climatic regime responsible cannot be accurately determined, but there is nothing in the sediment analyses inconsistent with the faunal evidence for deposition in the Ipswichian (Eemian) interglacial. If so the scree, Sample 9, was formed during a brief cold period within this interglacial, such as that recorded in the Camp Century Greenland ice core with an age of about 89,000 years. (Johnsen *et al.* 1972). (I am indebted to Mr. A. M. ApSimon for this suggestion). If Sample 9 was formed thus it indicates that the rate of accumulation within the deposit was extremely slow.

The thermoclastic scree (Samples 3-1) which caps the deposits can only be a product of cold conditions, probably during the Weichselian glaciation. The red loam (not sampled) was presumably a post-glacial soil.

ACKNOWLEDGEMENTS

The writer would like to thank Mr. A. M. ApSimon and Dr. D. P. S. Peacock for their help and criticism, and the Geology Department of Southampton University for providing laboratory facilities.

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