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AVELINE'S HOLE, BURRINGTON COMBE, NORTH SOMERSET: STRATIGRAPHY AND PROBLEMS

by

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ABSTRACT

The stratigraphy of the Late Quaternary deposits is described. There is similarity to the sequence at Gough's Cave, Cheddar. At both sites cave earth yielded late Upper Palaeolithic flint tools together with human and animal bones, and is succeeded by stalagmite which began to be formed around 9000 BP. The cave earth at Aveline's Hole was extensively reworked after its deposition, and the depths of finds does not offer information as to their relative ages.

INTRODUCTION

Excavations at Aveline's Hole in 1914 and 1919-1930 attracted considerable attention, principally on account of the human remains which were recovered. These were described in some detail by Professor Edward Fawcett and Sir Arthur Keith, but the major human finds were destroyed during an air raid in November 1940, together with the other material exhibited in the Society's museum and records of the excavations. Fortunately some finds, then considered of lesser importance, survived in storage and have been the subject of intensive studies reported in the present volume. As a final report was never written, the present contribution describes the stratigraphy of the Quaternary deposits which were excavated, and attempts to reconstruct their depositional history.

The majority of finds were recovered from the cave earth (layer 3, below) and there are associated problems: first, the relative depths recorded do not correspond with any cultural sequence (Jacobi, this volume), and second, with the exception of the double burial (Davies, 1925, p. 106), both human and animal bones were disarticulated and apparently scattered at random through the deposit. Possible reasons for this are discussed at some length below. The excavators made much of a 'rodent rift', near the entrance (Davies, 1924 p. 10). However, its relation to the main sequence is unclear and it did not yield any human bones or artefacts. This is not considered further here.

The discovery of the cave, in 1797, has been recounted by Davies (1921) and Schulting (this volume). It was named Aveline's Hole by W. Boyd Dawkins after W. T. Aveline, his teacher and colleague in the Geological Survey (Dawkins, 1865).

The cave is a single passage about 50 m long and of maximum cross-sectional area of perhaps 15 m^2, lying nearly east and west. A small side passage a few metres long branches off on the north side at the foot of the first section of the cave. As pointed out by Tratman (1963), the cave is a relict resurgence which originated as a large phreatic tube developed along the strike of the Burrington Oolite Formation of the Carboniferous Limestone, which here dips to the north at an angle of about 60º. The roof has been much modified by rock falls, but solutional features can be seen just east of the roof niche in the outer chamber (Tratman, 1963, p. 39, pl. 3). They indicate water flow in an upward, westerly direction. The inner part of the cave containing the rock engravings described by Mullan and Wilson (2005) is now protected by a gate.

The floor was originally covered by Quaternary sediments which also block the cave at the inner end. Rock floor has been exposed by the excavations in part of the outer chamber.

Archaeological finds were made in the outermost 25 m or so of the cave, known as the Outer Chamber. The floor slopes down from the entrance; according to Davies' survey (1923) the angle of slope averages 18º or 19º. The survey by Bristol Exploration Club, reproduced in this volume (Schulting, Figure 2, page 174). makes it steeper at about 25º. The BEC survey is probably the more accurate, but steepening will have resulted from the blasting of the inner part of the outer chamber in the late 1930s to remove a vertical drop which was considered dangerous,.

The cave had already been considerably disturbed by casual collectors when twentieth century work began with a relatively brief season in 1914 by the Bristol Spelaeological Research Society. In 1919 that society was refounded as the University of Bristol Spelaeological Society and work resumed in June of that year. Work continued until 1930 or 1931 (see Editorial, this volume) and gave rise to thirteen reports in the Society's Proceedings. The four by J. A. Davies, and the report of a lecture by him (Davies, 1923c) are the only ones which give any detail of the excavations, and after his last report (Davies, 1925) there were no more contemporary published accounts. There was a brief report to the British Association (Davies, 1923b). An equally brief editorial item in the journal *Nature* (Anon., 1922) was summarised from Davies (1921). E. K. Tratman, who was present at the excavations, gave some details (1963, pp. 37-39) and also wrote a summary (Tratman 1975b).

UBSS EXCAVATIONS 1919-1930/31

The four reports by Davies record the removal from the cave of a total of 150 tonnes of deposit by 1925. If the average density of deposits is assumed to be 2.5 tonnes/m^3, this represents about 60 m^3. This would correspond to the removal of a layer just over one metre thick from the outer 21 m of the cave, and agrees well enough with the complete removal of layer 3 (see below) over this area. The outer chamber appears to have been 'cleaned out', there is now little sign of the deposits recorded by the excavators.

A black stripe about one centimetre wide on the north wall of the outer chamber may have been made by the UBSS excavators to mark the original surface level of the deposits. It has an irregular course but is perhaps on average about one metre above the very irregular, bouldery floor of the cave. A wider mark in white paint on the south wall is more difficult to interpret. Near the entrance it is about three metres above the present floor and follows a bedding plane between two limestone beds. A few metres inside the cave it drops to about one – two metres above the floor and moves to a slightly higher bedding plane. By comparison with the black stripe, it would be logical to read it as marking the original floor level on the south side, although there are no other indications that the deposits extended so far up the south wall near the entrance.

The survey of the cave by Davies (1923a, folder before p. 125; Figure 1 herewith), although dated March 1923 nearly 4 years after work started, shows a longitudinal section through the deposits as they were before excavation. According to this survey at about 12 m from the entrance (the opening of the roof niche) the original height of the cave above the surface of the deposits was only 0.6 m (longitudinal section) or 1.1 m (cross section CC). These heights seem to be too small.

The northern side of the outer chamber was excavated first. The right-hand picture of the frontispiece to *Proceedings* volume 1, no. 2, published about two years after work restarted, shows a surface of the cave earth, possibly as yet unexcavated, on the south side and an excavated area on the north, littered with angular pieces and boulders of limestone. Rock floor can be seen near the entrance (Schulting, this volume, Figure 6, page 180).

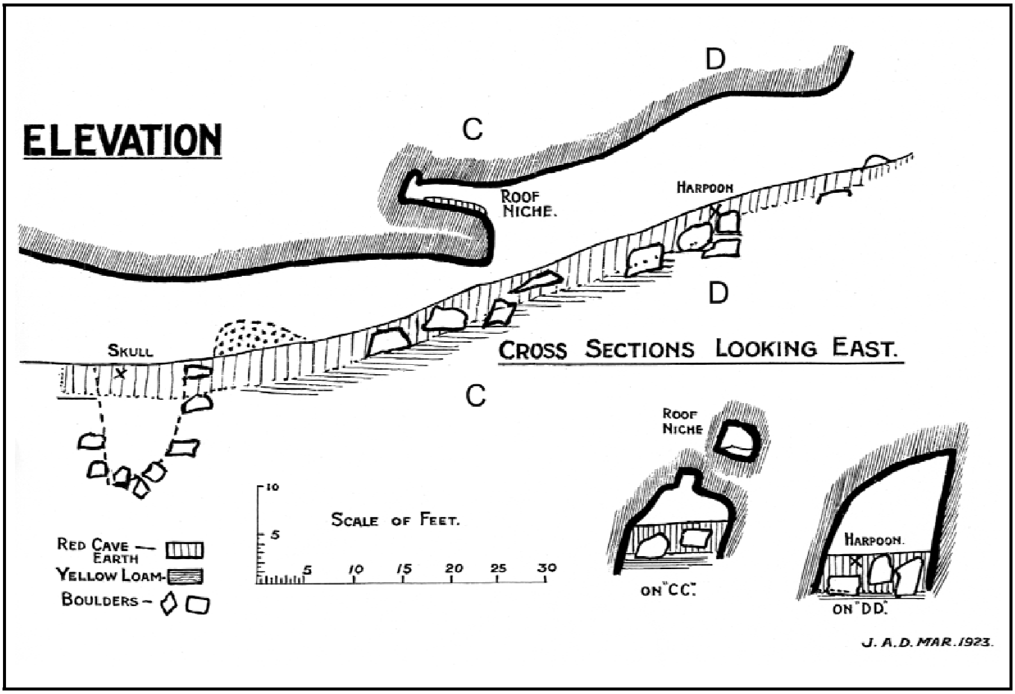

Figure 1. *Longitudinal section of the outer part of Aveline's Hole, modified from Davies (1923), showing the deposits before excavation.*

Finds were located by their distance from the cave mouth but this does not seem to have been recorded systematically until Davies' third report (1924). The exact position of the datum used is not now known. Depth was recorded by removing the cave earth (layer 3, below) in one-foot layers and marking finds accordingly. In view of the number of large (30 cm+) boulders in the cave earth, some of which remain on the floor of the outer chamber, it is difficult to know how accurately the layer system could have been maintained. The distribution of finds in the cave earth is discussed in a separate section below.

At the bottom (eastern) end of the outer chamber the excavators concluded that a 3 m deep shaft had been dug by nineteenth century excavators, giving rise to a spoil heap which extended from 16.8 to 21.3 m from datum, banked against the north wall. The spoil heap was removed, yielding many finds (Davies 1924, p. 5). Tratman (1963, p. 38) however wrote that "... the original explorers discovered a deep pit covered by rock slabs. The U.B.S.S. ... proved this to be a mass of jammed boulders, which collapsed and left a nearly sheer shaft, 16 ft. or more deep." He recorded that for safety reasons the west side of the shaft was blasted away. It is not very obvious where the material of the spoil heap came from.

STRATIGRAPHY

The sequence recorded by Davies is divided into five units:

5 Humus
4 Stalagmite floor
3 Red cave earth with limestone blocks
2 'Gravel' with rounded pebbles, impersistent
1 Laminated loam or silt

Layer 1 is described as "similar to the non-plastic finely stratified deposit of silt in the Inner Chamber" (Davies, 1921, p. 64); 'finely stratified yellow loam', fine lamination with more than ten layers to an inch thickness being emphasised (Davies, 1923a, p. 113); "a very fine stratified loam or silt of great thickness" (Davies, 1923c, p. 26). Two tonnes were examined or sieved in the hope of finding faunal remains which might date the layer, but it was completely barren (Davies, 1923a, p. 113). The layer is noted as of unknown thickness and Davies' longitudinal section (1923a, between pp. 124 and 125) shows it as underlying layer 3 from about 6 m to 20 m from the cave entrance. However, in the following season a trial trench dug between 9.1 and 10.7 m from datum reached apparent rock floor below 1.2 m of "limestone blocks in a matrix of light brown loam" "probably introduced by slowly moving water" though lamination is not mentioned. It had a "high content of disintegrating calcite crystals" and yielded a few bird and rodent bones including pika. The limestone blocks were angular and attributed to roof falls. Tratman (1963, p. 38) later recorded that "In the Outer Chamber [the silt] was found to cover and surround boulders and to extend right up to the entrance where it was bottomed and found to lie directly on the bed rock."

In a brief report to the British Association, Davies (1923b) described the sediment beneath the cave earth as "a deep layer of loess" but this interpretation does not appear elsewhere.

At the eastern end of the cave Dawkins (1865, p. 168) described the deposit which blocked the cave as "a fine, horizontally stratified silt, containing layers of fine sand." Tratman (1963, p. 38) recorded that "In the Inner Chamber the silt is laminated horizontally." Here, Dawkins and Ayshford Sanford sunk a 11.5 m deep [oblique] shaft. This is the final section of the cave in the BEC survey. It would have penetrated about 9 m thickness of the sediment, finding no remains except a horn core of sheep and a pig tooth. On account of the sheep Dawkins and Sanford supposed the sediment to be relatively recent, "after the extinction of the wild beasts of Wookey Hole Cavern" [i.e. the Hyaena Den, Wookey Hole]. However, Tratman (1963, p. 38) wrote that "U..B.S.S. excavations quite clearly demonstrated that either his [Dawkins'] dig was 'salted' or he failed to notice that he was excavating a disturbed deposit." The shaft had been back-filled, it is not known by whom, before the Society started work, but was subsequently reopened in the 1960s in an attempt to extend the cave.

Layer 2 was encountered only in one place, between 18.3 m and 19.8 m from datum, where Layer 3 rested on "a layer of rounded gravel" (Davies, 1925, p. 106). This was presumably the same as the "layer of sub-angular gravel and stones" noted in the same area a few pages later (Davies, 1925, p. 109). On the transverse section 18.3 m from datum (Davies, 1925, fig. 3, p. 109) 'gravel' is shown as 0.76 m thick, resting on large boulders. On the longitudinal section reproduced in this volume (Schulting, Figure 7a), but not on the earlier published one (Davies, 1925, Figure 4, p. 111), gravel is shown to a maximum thickness of about 1 m, if the drawing is to scale. It is cut off upslope by layer 3, and disappears off the diagram downslope at about 21.4 m from datum, the length shown being about 4.6 m. Elsewhere Layer 3 rested on Layer 1.

There is no indication of either the composition or the size of the rounded elements, though the term gravel suggests that they were small. If the pebbles were of Old Red Sandstone then they were probably introduced through the entrance of the cave, perhaps during the deposition of the Burrington alluvial fan (Clayden and Findlay, 1960). Transport of Old Red Sandstone debris from swallets via unknown connecting links seem less likely, though not impossible. If the pebbles, or some of them, were of limestone they probably came in from outside. The Burrington fan included limestone as well as sandstone pebbles (Findlay, 1977). Layer 2 is discussed further in connection with Gough's Cave, below.

Layer 3 was plastic [i.e. clayey] red cave earth, with limestone blocks of varying sizes presumed to have fallen from the roof. The survey of the cave by Davies (Figure 1) shows the cave earth as about 0.6 m thick for the first 4.6 m from the entrance, thickening abruptly to about 1.15 m at the point where the harpoon was found, and maintaining this thickness to the bottom of the Outer Chamber, where it is about 1.2 m. Described as "at least three feet thick" by Davies (1921, p. 64), greater thicknesses were later recorded, e.g. up to 1.5 m between 18.3 m and 19.8 m from datum (Davies, 1925, p. 106), though a transverse section across the cave at 18.3 m (*ibid*. Figure 3, p. 109) shows from one to three feet, the latter thickness perhaps due to collapse of the underlying boulders. Balch (1937, p. 101) wrote that on his early visits to the cave, around 1890, "a descent of about twenty yards [about 18 m] brought one to a depression in the cave floor which had all the appearance of a subsidence; I concluded that it was at this point digging had been done, for there was no trace of such anywhere else …". Earlier digging here is not mentioned in UBSS reports, but if Balch was correct, the stratigraphy must be suspect.

No sedimentary description or analysis of the cave earth was attempted by the excavators. 'Cave earth' is an old imprecise term dating from the mid-19th century or earlier. It was often described as 'red' (i.e. reddish-brown) and tends to show little or no visible stratification. Dawkins (1874, p. 122) discussing cave earth at Victoria Cave, Yorkshire, noted that "Similar deposits, characterised by their red colour, are to be found in nearly all the caves of the south of England, in France, and southern Europe …" but did not offer further explanation. It can be added that the majority of these caves are in limestone. Macphail (this volume) reports that three samples from cavities in bones consisted of silt and clay with medium to coarse sand. He suggests that it was derived from the limestone soils of the Mendips.

Layer 4. The stalagmite layer is hardly described in the reports. Early nineteenth century accounts describe human skulls and bones encrusted with stalagmite. Fawcett (1920) described it as about 20 cm thick. Balch, who saw the cave before the excavations, noted (1937, p. 101, 102) that "Immediately beyond the depression [about 18 m from the entrance] one stepped up about thirty inches on to a broken off stalagmite floor …" This was the stalagmite shelf described by Davis as 15 to 45 cm thick and consisting largely of a cemented breccia of angular limestone blocks, between 16.8 m and 21.3 m from datum. The matrix varied from quite soft material to hard, crystalline calcite (Davies, 1924, p. 6). In his last report Davies (1925, p. 111) wrote, perhaps with some exaggeration, of the [former] "great stalagmite bosses and shelves …". At the present time very few traces of the former stalagmite floor can be seen and its original extent is uncertain. A cross section 21.3 m from datum (Davies, 1925, Figure 2, p. 105) shows a broken stalagmite floor extending across almost the whole width of the passage, sloping down from south to north. Tratman (1963, p. 38) wrote that it was "not quite continuous".

The stalagmite shelf was described as "full of human bones" some of which had been broken off by previous excavators (Davies, 1924, p. 6). At the inner end of the shelf, 21.3 m from datum, there were several pieces of skull, with a phalanx, about 10 cm below the surface, and the matrix included remains of insects, bats, birds, rodents and snails. Close by were a shattered human tibia, a young left femur and humerus, an adult femur in two halves and an ulna. A child's skull was found 15 cm below the surface. Human teeth, fragments of long bones, hand and foot bones, were found in stalagmite adhering to the cave wall (Davies, 1924, p. 10; see also Figure 1, p. 7).

Davies (1925, p. 110) thought that the cave mouth had been blocked by a rock fall in very late Palaeolithic times, because no later artefacts or fauna had been found, and that the "stalagmite grew apace".

Layer 5. The first report (Davies, 1921, p. 64) described a layer of humus, from 1 cm to 30 cm thick, which completely covered the cave floor. This was interpreted as material washed in from the road and the implication was that it had been introduced since the rediscovery of the cave, and covered the cave floor as it had been left by early collectors. However Rutter (1829, p. 117) described the human skeletons found by the original discoverers as being "surrounded by black mould".

LOCAL CORRELATION OF THE STRATIGRAPHICAL SEQUENCE

The sequence of deposits shows strong similarity to that at Gough's Cave, Cheddar, about 5 km from Aveline's Hole. About 30 m from the entrance of Gough's Cave, Donovan (1955) recorded:

Stalagmite
Cave earth and breccia
Conglomerate
Laminated (fine) sand
Coarse sand

Both Gough's Cave and Aveline's Hole are relict resurgence caves which occupy similar sites. Both caves originated by solution below the water table, later drained as water level in the Mendip Carboniferous Limestone fell, and later still exposed to the air by downward erosion of (now) dry valleys. The entrance Aveline's Hole is about at road level, and faces west. The entrance to Gough's Cave is slightly lower than road level and faces north-west. At Aveline's Tratman (1963, p. 37) recorded that the rock floor was shown by the excavations to continue its upward slope [i.e. west of the cave mouth] for another 3 m towards the road. In both cases the levels of the rock floors of the valleys are unknown.

After the caves had been drained of permanent water fill, periodic flooding could have left the laminated deposits recorded as the earliest layer seen in both caves. Stanton (1986) has described how, when Gough's Cave was finally breached by torrential streams in Cheddar Gorge, "A mass of coarse streamborne debris would have entered the cave through the hole in its roof and formed a lenticular deposit … This was the 'Conglomerate' described by Donovan (1955)." The conglomerate as originally seen was a thin layer 30 m inside the cave. Later excavations at the cave entrance revealed the top of the conglomerate at a higher level (Donovan, 1972, Figure 16). In 1989 about 1 m thickness of conglomerate was exposed near the Cheddar Man fissure, with sand above and below.

While it is not possible to argue that Aveline's Hole and Gough's Cave were breached simultaneously, it is likely that the exposure of both of them resulted from the same episode of rapid lowering of the Mendip valley floors, during a climatic regime which rendered the underground drainage unable to carry all the runoff. In lithostratigraphical terms, at least, the Gough's conglomerate and Aveline's layer 2 can be correlated and regarded as contemporary.

Cave Earth. The only sedimentological study of this deposit, at Gough's Cave, is by Collcutt (1986), who summarised earlier ideas about its formation. He concluded that: "The Cave Earth/Breccia unit is an accretionary wedge of creep and sheetwash sediments derived from up-slope (and ultimately from the Gorge outside), with a local input of limestone debris and carbonate precipitates." Similar material is deposited at the present day when the cave floods. If deposition was contemporary with occupation, by humans or animals, the absence of obvious stratification is explained. On this view bioturbation is essential for the formation of 'cave earth'. Back flooding like that at Gough's Cave may have occurred at Aveline's Hole. At many other Mendip sites, however, flooding is an improbable source of sediment, though washing in of surface soil material could have taken place at some of them.

Stalagmite. The change from cave earth accumulation to stalagmite in both caves resulted from a change of climate to a warm, humid regime with humus-rich soils facilitating carbonate deposition (Smart and Stanton, 1974, citing Thompson, 1971). As the control was external, it can probably be regarded as simultaneous at both Aveline's Hole and Gough's Cave, though local circumstances may also have influenced dripstone accumulation.

CHRONOLOGY OF THE AVELINE'S HOLE AND GOUGH'S CAVE SEQUENCES

The laminated silts of layer 1 are interpreted as deposited from slowly moving water, as the excavators believed. They belong to the Slackwater Facies of Bosch and White (2004) "fine-grained clays and silts transported … as suspended load." "[Floodwaters] become ponded during which time all or a portion of the suspended load has time to settle out." The lamination implies periodic deposition, possibly seasonal.

The sediment is uncontaminated with local soil material and accumulated before the cave was open to the air. The inner end of Aveline's Hole was originally choked with layer 1 material in which Dawkins and Sanford dug their shaft. The situation is closely paralleled at Gough's Cave where about 6 m of laminated silty clay accumulated in the Boulder Chamber at the end of the cave (Stanton, 1965, Figure 2).

There has been no geomorphological study of Aveline's Hole and the age of the cave is unknown. It has been assumed that it acted as a rising after Burrington Combe had been excavated to near its present depth (e.g. Tratman, 1963). As such it would have been a misfit because the volume of underground drainage in the area has never been large. Perhaps, as underground drainage found lower levels to the present risings, periodic flooding deposited layer 1.

There is no intrinsic evidence for dating the deposit. As it was deposited when underground drainage was active, this would suggest an interglacial or interstadial age. It is clearly earlier than the flint industry, dated to the early part of the late glacial interstadial (Jacobi, this volume), so one is looking to an earlier interstadial or even the Last Interglacial (Oxygen isotope stage 5e).

A section at Bourne (ST 483 598) (Findlay 1977) in the proximal part of the Burrington alluvial fan (Clayden and Findlay, 1960) yielded information on the later history of that deposit. Gravel deposition was followed by two phases of soil formation alternating with frost-induced structures. The first was intense cryoturbation, the second was ice wedge formation. These two cold spells agree well enough with the two generations of structures formed by ground ice in Britain noted by Briffa and Atkinson (1997, p. 92) and attributed by them to the period of cold climate before 13000 bp (i.e. the last glaciation proper) and the Younger Dryas respectively. The second episode of soil formation at Bourne would then date from the Late Glacial Interstadial (or Bølling – Allerød), the first perhaps the positive excursion of $\delta^{18}O$ in the Greenland ice cores before the Heinrich 1 episode, about 16 kyr BP. On this interpretation deposition of the alluvial fan ended before the end of the last glacial, at latest about 19 or 20 kyr BP, and the formation of Burrington Combe in its present form would have been completed during the main part of the Devensian glaciation.

The remains of Layer 2 in Aveline's Hole are thin and restricted in extent, and the conglomerate in Gough's Cave is not very impressive either. It is reasonably certain that the pebbles were washed in from outside, and derived from the debris carried down the valley which formed the alluvial fan at its mouth. In both G.B. Cave and Longwood Swallet phases of clastic fill are assigned to glacial episodes (Ford, 1964; Atkinson, 1967). The mouth of Aveline's Hole lies on a spur forming the core of a meander convex to the west, so that if the stream followed the outside of the curve only a limited amount of gravel might have been carried into the cave.

This phase ended, at latest, with the beginning of the Late Glacial Interstadial, or Bølling/Allerød episode, at about 13 kyr BP. Cave earth began to accumulate, by whatever mechanism. Cave earth accumulation was ended by advent of the Younger Dryas cold phase, which may have contributed to the disturbance of layer 3 discussed below.

The change from cave earth accumulation to stalagmite deposition resulted from a change from climate with severe winter frosts to a warm, humid regime with humus-rich soils facilitating stalagmite deposition (Smart and Stanton, 1974, citing Thompson, 1971). As the control was external it can be regarded as simultaneous at both Aveline's Hole and Gough's Cave.

Holocene stalagmite deposits are conventionally attributed to the Atlantic climatic phase, characterised as warm and wet, which is variously dated, perhaps c. 7000–5000 BP (Briffa and Atkinson, 1997). 'Cheddar Man' at Gough's has radiocarbon dates of 9100 ± 100 and 9080 ± 150 yr BP (Burleigh, 1986). This was a burial into the upper part of the cave earth, and bears traces of stalagmite (Donovan, 1955; Tratman 1975a). Cave earth accumulation at Gough's had therefore ended and stalagmite formation begun by about 9000 BP. A human skull from Aveline's encrusted with stalagmite has been radiocarbon dated at 8100 ±50 yr BP (Burleigh, 1986) These ages are consistent with the beginning of stalagmite formation at about 9000 BP. A short sharp cold event at about 8200 BP has been claimed (Alley *et al.*, 1997) which may have interrupted deposition.

The time span represented by the stalagmite is uncertain. CO_2 loss is more important than evaporation for $CaCO_3$ deposition (White, 2004) and the fact that both Aveline's Hole and Gough's Cave became more or less closed to the outside air would not necessarily have inhibited stalagmite growth. Old wives' (or old guides') tales of 'an inch in a thousand years' type are misleading. Stalagmite/speleothems can grow quite rapidly. Deposition may have continued, at a reduced rate, after the Atlantic phase. German stalagmites, in quite a different situation from these Mendip caves, recorded continuous growth from 17600 BP to the present (Niggemann et al., 2002), but the growth rate during the Atlantic was higher than before and after.

STRATIGRAPHICAL DISTRIBUTION OF FINDS IN THE CAVE EARTH AT AVELINE'S HOLE

The excavators commented on the random distribution of finds in layer 3. Davies (1921, p. 68) wrote that the human bones [in the cave earth] "were extremely numerous and occurred without any relation to the position of bones in the human body". Most finds of both human and animal bones in the cave earth, apart from the 'ceremonial burials', were of isolated, disarticulated bones. Renewed study of the finds in this volume, and new radiocarbon ages, raise further problems concerning the interpretation of the original records.

Davies (1923, p. 116) was of the opinion that the flint industry was 'homogeneous'. This industry, including bitruncated trapezoidal backed blades (Cheddar points) and curve-backed points, is now attributed by Jacobi (this volume) to the first half of the Late Glacial Interstadial (i.e. about 12 500 – 12 000 ^{14}C years BP). It was found in all three layers of the cave earth along with bones radiocarbon dated at around 9000 BP (this volume). Shell beads, i.e. perforated gastropod shells presumably derived from ceremonial burials, were also distributed throughout the cave earth, and the Jurassic fossil gastropod *Pseudomelania*, probably from a burial, was in the third foot (Davies, 1924, pp. 10, 12). It is impossible to avoid the conclusion that the cave earth has been completely reworked.

How might this have happened? Davies thought that only the topmost foot of the cave earth had been 'disturbed' (by 19th century excavators) except at the foot of the incline (Davies, 1921, p. 64). Tratman (1975b, p. 369) recorded that there were various degrees of disturbance, but that "It was possible to separate the disturbed and undisturbed to a major extent." Disturbance prior to the modern period seems likely. The possibilities are either burrowing animals, or inorganic, physical processes. Fox bones were ubiquitous, though the fox is not usually regarded as a burrowing animal (and is not adapted as such, cf. e.g. the badger). Resident foxes could have caused some disturbance, though not perhaps to a depth of one metre. Badger is recorded as frequent in the first and second feet (Davies, 1921, p. 65). Dr Stanton (*pers. comm.*) tells me that at both Fissure Cave and Badger Hole (Wookey Hole) badgers had been active at least 30 m inside these caves. A more difficult question is the time of the appearance of badger in the British postglacial fauna. Andrew Currant (*pers. comm.*) notes that badger was absent from the Late Glacial Interstadial fauna at Gough's Cave, but that, nevertheless, a very early arrival after the last glaciation is possible.

As regards physical processes, some of the numerous angular limestone blocks in the cave earth, attributed to frost weathering of the roof, are large and could have disturbed the sediment where they fell. One would expect the effect to be local. More probable are processes of soil creep and/or freeze and thaw such as cryoturbation. These would have been facilitated by the slope of around 20º-25º, and indeed the fact that thicker cave earth occurred at or near the bottom of the slope of the first chamber – at 18.3 m to 19.8 m from datum, the cave earth was 1.5 m [5 feet] thick (Davies, 1925, p. 106) – would be consistent with such activity. Davies (1924, p. 14) also wrote of an area 5.5 to 18.3 m from datum, up to 1.5 m from the north wall, that "It is possible that this part of the cave was levelled by the former human occupants, who brought earth from outside the cave to fill in the spaces between the large limestone blocks …". Unfortunately he did not give further details.

In the light of the above, it is a question whether any of the cave earth finds were indigenous to it. Radiocarbon ages for 18 human individuals from Aveline's Hole (Marshall and van der Plicht, this volume) range from 9210±70 to 8890±40 yr BP and thus almost exactly span the age of Cheddar Man, which has radiocarbon dates of 9100 ± 100 and 9080 ± 150 yr BP (Burleigh, 1986), intrusive into the cave earth at Gough's (Tratman, 1975a). One possibility is that the older flint industry, attributed by Jacobi (this volume) to itinerant hunting parties and unsurprisingly, therefore, unaccompanied by human remains, belonged to the cave earth, while the human bones were incorporated after its formation. Alternatively, all the finds from the Aveline's cave earth may date from after its deposition, and have been introduced subsequently.

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