The Pleistocene Deposits at Gough's Cave, Cheddar, including an Account of Recent Excavations

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INTRODUCTION

Gough's Cave at Cheddar has attracted scientific attention for over half a century, since the discovery of the Upper Palæolithic skeleton known as " Cheddar Man " in 1903. Subsequently an extensive Creswellian industry and later cultures have been unearthed. The present writer has been privileged to study the recent excavations, carried out during the last five years, and to record the information obtained. Since the excavation of the occupied area of the cave is now virtually complete, and since none of the earlier reports includes a full account of the deposits throughout the excavated area, the time seemed opportune to offer a synthesis of all the information available, and to attempt to present a connected account of the stratigraphy. The cultures present are not discussed in detail in this paper, the intention of which is primarily stratigraphical.

I am indebted to the Marquis of Bath for permission to work at the cave, and to his staff at Cheddar, especially Mr. Gerald Robertson, the manager, for constant courtesy and assistance during numerous visits. Mr. E. M. M. Alexander, of the British Museum, has discussed the finds from the recent excavations which were sent to him for study. I also wish to express my thanks to Dr. K. P. Oakley and Professor E. K. Tratman, who have read the typescript of this paper and made suggestions for its improvement. Dr. R. J. G. Savage has kindly advised me on the nomenclature of Pleistocene mammals.

HISTORY OF WORK

Balch has described the entrance to Gough's Cave before any excavation was undertaken, as a " recess where roof and floor met . . . with a low creep penetrating a distance of 43 yards " (1935, pp. 38–9), and Davies says that the entrance was then 2 ft. high (1904, p. 337). In 1892, according to Davies, R. C. Gough, who showed the nearby " Old Cave " to the public,

started clearing out the entrance to the " New Cave ", the present show cave. A pathway was cut along the centre of the cave, to a depth of 4 ft. 6 in. below the top of the deposits. Very soon a considerable part of the cave had been rendered accessible, but the outer part, which sloped down towards the interior, was often flooded, " causing " as Davies says " great loss to the owner ", who started to dig out a fissure on the north side, about 90 ft. from the entrance, to provide drainage. Here the human skeleton which has since become known as the " Cheddar Man " was found in December, 1903. The cave was promptly visited by T. W. Jex-Blake, the Dean of Wells, and by H. St. George Gray, Curator of Taunton Museum, both of whom published brief notes (Jex-Blake, 1904; Gray, 1904), and by H. N. Davies who reported the find to the Geological Society of London on April 13, 1904, his paper being published later the same year. Davies' paper is the only detailed account of the early work, and its interpretation is not without difficulty. His plan (1904, *Fig.* 1) is not accurate and is not to the scale stated ;* his longitudinal section (*Fig.* 2) is discussed on page 88.

The first of the *bâtons de commandement* was found at about the same time as the skeleton, perhaps a little later (*see* p. 92). It was described first by Seligman and Parsons, who published a technical description of the skeleton (1914).

In November, 1927, systematic excavation was begun by the late R. F. Parry, then agent to the Marquis of Bath. The deposits remaining between the entrance and the Cheddar Man Fissure were almost completely excavated, rock bottom being reached in some places. This work resulted in the discovery of more human bones, a second *bâton*, a large number of Creswellian flint implements and flakes and Pleistocene animal bones. Early Iron Age and Romano-British material was found in the upper layers, during the removal of the banks of deposit which had hitherto remained on either side of the path. The results were published by Parry (1928, 1929, 1931) with the assistance of specialists (Cooper, 1931 ; J. A. Davies, 1929 ; Gray, 1929, 1931 ; Keith and Cooper, 1929) and some notes were also published by Balch (1930).

When the Cheddar Man skeleton was found in 1903, some of the bones were left in place in the deposit, and were left untouched by Parry. They were removed about 1935 when various improvements were being made, and the skeleton mounted in the rebuilt museum outside. At the same time the banks of deposit which remained on either side of the path, beyond the Cheddar Man Fissure, were removed.

Excavations were resumed after the last war, under the charge of the late Victor Painter, then head guide. Some remaining deposits were removed

* The scale is, very approximately, 60 ft. to 1 in.

from the Cheddar Man Fissure and several areas excavated beyond the Fissure. The principal find was a piece of amber (Tratman, 1953). The details of these excavations are published in the present paper.

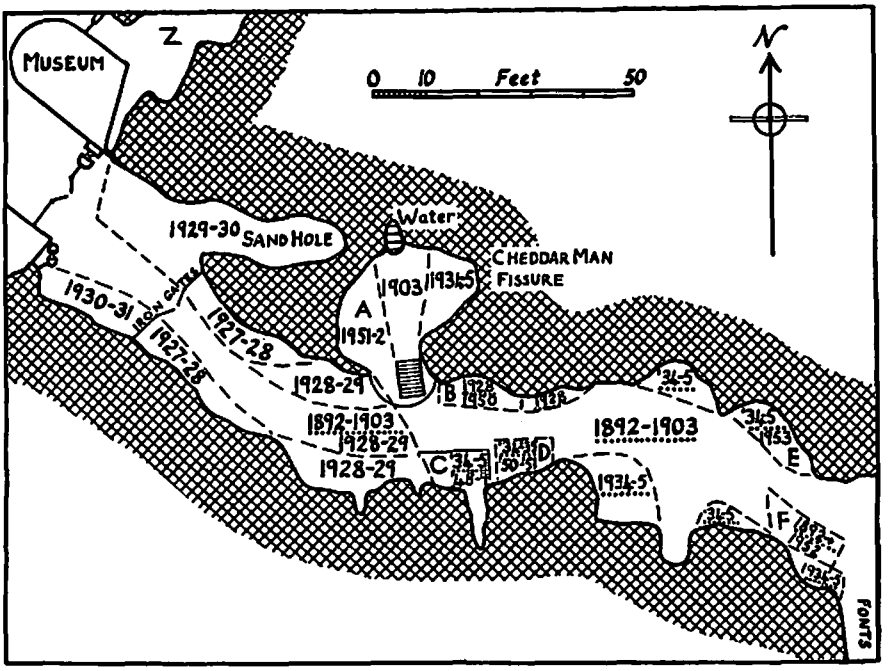

Fig. 12.—Plan of the outer part of Gough's Cave, Cheddar, showing the dates of excavation of different areas. Based on a plan made in 1935, with additions.

Key to Conventions used.—Broken lines mark the limits of the areas in which the cave was excavated. Where two dates are given for an area, separated by a horizontal dotted line, the upper indicates the date of excavation down to the present floor level, the lower that of excavation below this level. Where one date is given above a dotted line, excavation has not been carried below present floor level. A single date without dotted line indicates that the deposits both above and below the present floor level were excavated at this date. Letters A to F mark the position of recent excavations described on pages 78 to 83.

THE EXCAVATIONS IN 1948–53

The excavations made during this period are referred to by letters, their position being shown on the plan, *Fig.* 12. They were carried out by the staff at the caves under the direction of the late Victor Painter. The writer first visited them in December, 1950, and being able to pay only occasional visits his activities were mainly confined to recording the sections exposed in the sides of the excavations.

Excavation A

Carried out 1951–2 to improve the view of Cheddar Man Fissure. The path was shown to be underlain by 3 ft. of Breccia, as in excavation B, and below this was Conglomerate, 3 ft. thick in the south-western corner but thinning eastwards. The deposits correspond to those seen in excavation B. A little Conglomerate may still be seen in the south-western corner, but the rest of the face has been built over.

Excavation B

Made in the autumn of 1950. The section exposed on the south side is shown in *Fig.* 13. The lowest stratum exposed (numbered 2 in the section) consisted of pink laminated sand, becoming coarser towards the base of the section. The bedding was approximately horizontal except in the uppermost layers, which showed minor contortions probably due to differential compaction. That compaction has occurred is shown by the presence, at the northern end of the section, of a gap of several inches between the Conglomerate and the Breccia, due to settling of the sand after cementation of the Breccia.

The Conglomerate (3 in the section) consists of rounded pebbles of limestone, usually about 1 in. in diameter, rarely up to 3 in. or a little more. The matrix of the pebbles is fine sandy material, sometimes imperfectly cemented.

The Breccia (number 4) which forms the uppermost part of the section consists of sharp angular pieces of limestone of all sizes, completely unsorted and showing no signs of wear. In places the fragments are tightly packed together, smaller chips filling the spaces between larger ones. Elsewhere the spaces are filled with sand or clay, usually indurated with secondary calcite. A noteworthy feature of the Breccia was a boulder of limestone, 2 ft. 6 in. long and 1 ft. thick, which rested on the Conglomerate. The positions of this, and of a smaller boulder about 1 ft. 3 in. long, are shown in *Fig.* 13. The Breccia is cemented into a solid mass by calcite, precipitated from percolating water after the deposition of the other constituents. Several discontinuous layers, up to about 1 in. thick, at and near the base, consist almost entirely of calcite in a fine-grained state with clayey impurities, and are called " pans " from their resemblance to similar hard layers of mineral matter which are found in some soils. They are shown as solid black in *Fig.* 13 and the other sections.

The boundary between the Conglomerate and the Breccia is sharp where the base of the Breccia is marked by pan or by large pieces of limestone ; elsewhere it is indefinite.

The Breccia yielded animal bones and flint implements of Creswellian type, and near the east wall a piece of amber (Tratman, 1953). The earlier deposits were barren.

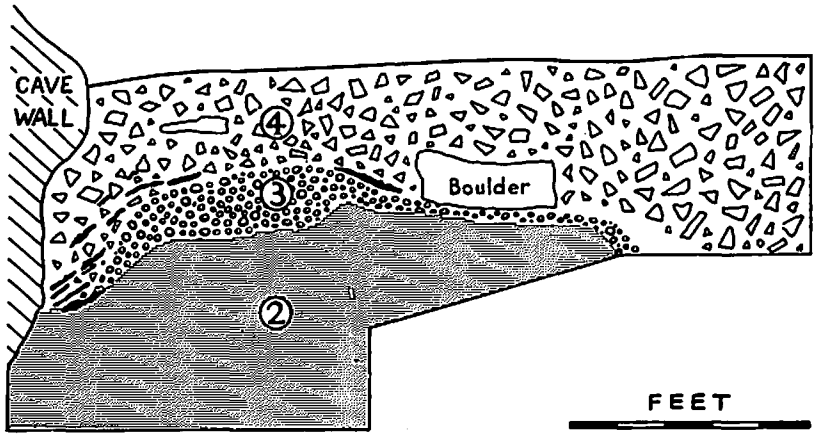

Fig. 13.—Section exposed in the south face of excavation B. The upper limit of the section is the present floor of the cave. For explanation see text.

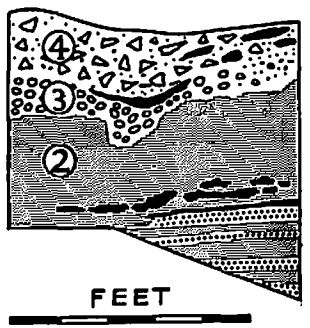

Fig. 14.—Section exposed in the east face of excavation C. For explanation see text.

Excavation C

This excavation was made in the winter of 1948–9 and is still open. The side next to the path is shored up with timber, but a section is still visible on the eastern side and is shown in *Fig.* 14. The sequence shown

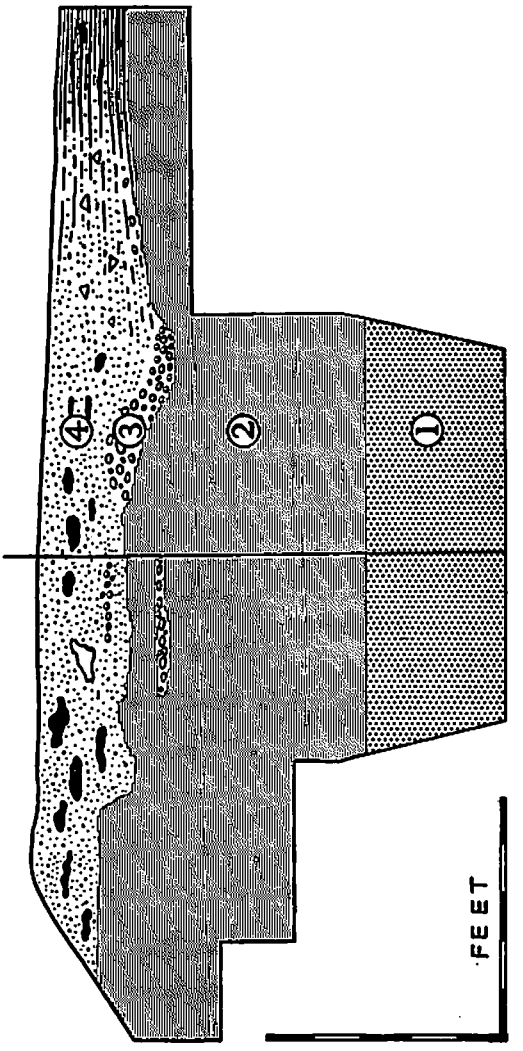

Fig. 15.—Sections exposed in the west (to left of vertical line) and north (to right of vertical line) faces of excavation D. For explanation see text.

here is the same as in excavation B, and is indicated by similar conventions and numbering. The Laminated Sand differs in having layers of pan and in becoming rather coarse, with dark layers, towards the bottom of the

section. The Conglomerate and Breccia are essentially the same as in excavation B. The section is not now visible to the bottom of the excavation, being obscured by débris.

This excavation was completed before the cave was examined by the writer. A few flint implements and animal bones are said to have been found " low down " in the excavation.

Excavation D

Made in 1950–1. This was the deepest of the recent excavations, and an attempt was made to reach rock bottom, but failed on account of flooding of the lower part of the hole. The details of the sections along the western and northern sides are shown in *Fig.* 15. The lowest stratum exposed was a coarse red sand (numbered 1 in *Fig.* 15), of which 3 ft. were seen. The next horizon (number 2) was Laminated Sand similar to that of excavation B, and resting with an abrupt junction on the Coarse Sand. The upper limit of the Laminated Sand was irregular and its thickness varied from 4 to 6 ft. The Conglomerate of excavations A–C was discontinuous and represented by a lenticle of pebbles on the northern side, and by isolated seams of pebbles in the Laminated Sand and in the overlying " Cave Earth " shown in *Fig.* 15. The Breccia which formed the topmost member of sections A–C is not developed here, and its place is taken by the " Cave Earth ", consisting of sandy material, with no clear stratification, sometimes partially cemented, containing specks of charcoal, scattered angular fragments of limestone, and (on the western side) layers of hard pan. The rapidity of the lateral change from Breccia on the eastern side of excavation C to Cave Earth on the western side of excavation D, about 2 ft. away, is striking.

Excavation E

Made in the winter 1952–3, and carried to a maximum depth of 5 ft. below path level. The deposits revealed were not separable into any clear subdivisions, and the whole thickness probably corresponds to the Cave Earth of excavation D. The deposit consisted of fine clayey sand showing a tendency to lamination in places, with coarser bands of dark sand and several beds of pan. In some places the deposits dipped towards the interior of the cave, but the stratification was not at all regular. Next to the cave wall, at the western end of the excavation, about 1 ft. 3 in. of clay underlay angular limestone boulders, up to 1 ft. across, embedded in coarse, impure sand. Traces adhering to the cave wall showed that the Stalagmite, from 1 ft. to 18 in. thick, immediately overlay the deposits before the cave floor was lowered to its present level. No finds resulted from this excavation.

Excavation F

Made in autumn, 1952. This is the furthest excavation from the mouth of the cave of which records have been kept and lies on the south side near

the " Fonts ". It is also the only section seen by the writer which exposed the Upper Stalagmite of Davies, which elsewhere lay above present floor level and can only be traced by the fragments adhering to the walls.

Eighteen inches of the Stalagmite, probably its whole thickness, were exposed at the eastern end of the excavation, immediately underlying the present floor. Westwards it rose above floor level. The Stalagmite consisted of thin sheets of calcite alternating with beds of pure, laminated clay, there being often several alternations to 1 in. The calcareous layers varied from a crystalline to a papery texture. The full section exposed was :

Stalagmite - - - - -		1 ft. 6 in.
" Cave Earth "	Impure, sandy clay with a few angular pieces of limestone - - -	1 ft. 0 in.
	Prominent, dark, sandy band	½ in.
	Clay with sandy patches -	1 ft. 0 in. seen

The prominent dark band owed its colour to finely divided charcoal. The excavation became flooded intermittently and was therefore not carried any deeper. No finds resulted from this excavation.

GENERAL ACCOUNT OF THE STRATIGRAPHY

1. The Main Passage (Figure 16)

The present writer has seen no sections nearer to the entrance than excavation A, and the stratigraphy of the important outer part of the cave, where the majority of the finds occurred, must be reconstructed from the accounts of Parry and of Davies. Parry, while he carefully recorded the depths of all finds, has left rather inadequate records. Davies published a longitudinal section of the cave (1904, *Fig.* 2) which is definitely misleading, as far as it can be checked. It is discussed below on page 88.

Parry reached rock bottom in the area just inside the iron gates. He recorded " clayey red loam and sand " (1929, Table) and " sand and clay, with very few pebbles " (1928, p. 33) resting on it. Near the sides of the cave the thickness of this was 6 in. ; in the centre the rock floor lay about 2 ft. deeper (Parry, 1928, p. 35),* and as the succeeding " gravel " was said to be only " slightly thicker " the deposits below presumably also thickened towards the centre. As Parry's next horizon corresponds to the Conglomerate of the recent excavations, the small thickness of sand and clay resting on the rock floor must be the sole representative of the much thicker deposits exposed below the Conglomerate in excavations B, C and D. This is due

* Parry did not go down to rock bottom throughout the area which he excavated ; according to his 1928 report it was reached in three places in the central part of the cave. The rock floor is presumably irregular or pocketed, as in other caves of solutional origin.

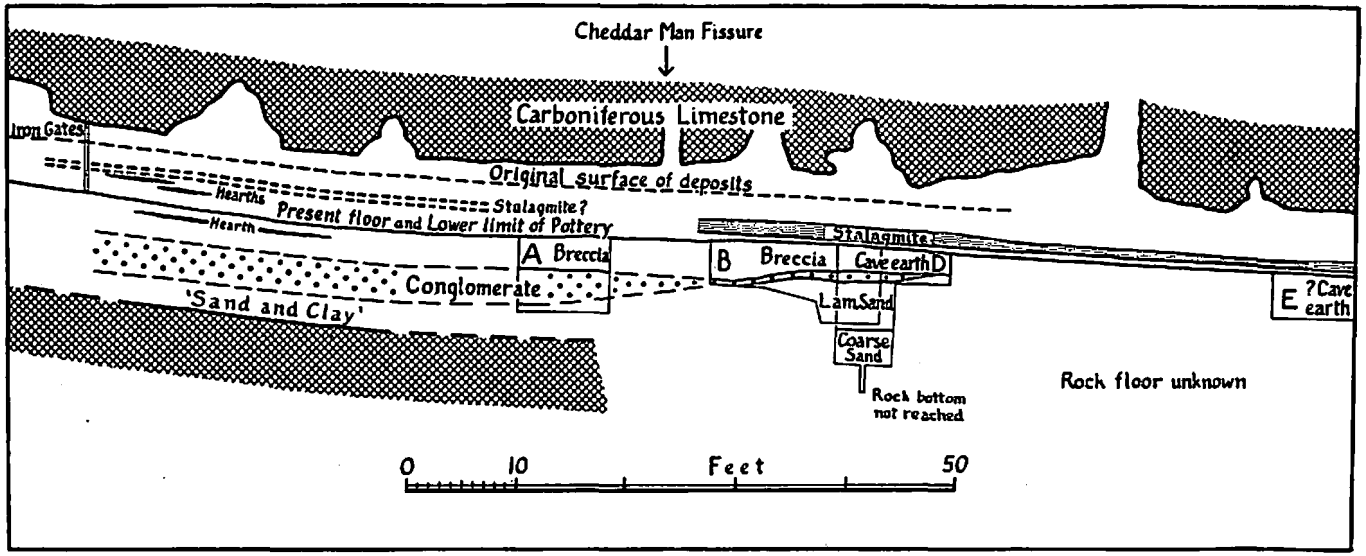

Fig. 16.—Diagrammatic longitudinal section along the centre line of Gough's Cave, Cheddar, constructed from all available data and based on accurate levelling. Details of excavations A, B, D and E, which were at the sides of the cave, have been projected on to the line of section. The rock floor is shown as too regular, consequent upon lack of accurate information.

partly to a rise in the level of the base of the Conglomerate, mainly to the fall of the rock floor (*Fig.* 16). These deposits were best exposed in excavation D where a total thickness of about 10 ft. was proved below the Conglomerate. The bottom 2 ft. were proved by driving a bar down and their composition is not known. The features of the remainder have already been described (p. 82).

The Conglomerate is the first horizon which can be traced throughout the excavated portion of the cave, with the exception of excavations E and F. It is the " gravel " of Parry's accounts, described in 1928 (p. 33) as " composed of waterworn limestone pebbles with a few of sandstone, with a filling of red cave earth and sand ". Just inside the iron gates the Conglomerate was 3 ft. thick near the sides, " slightly thicker " in the centre ; it is entered as 3 ft. 6 in. in Parry's Table of 1929. The thickness seems to have been fairly constant throughout the area excavated by Parry, who in his last report (1931, p. 46) says that the layers varied " only by a few inches from those described in the previous report ". About 3 ft. of Conglomerate are still exposed in the south-western corner of excavation A.

In the area of the recent excavations the Conglomerate is thin or absent ; the thinning occurs rapidly beyond the Cheddar Man Fissure. In excavation B, on the north side of the cave, it varies from just over a foot in thickness to a mere seam of pebbles, and is similar in excavation C on the south side. In excavation D, a few feet further east on the same side, it is reduced to discontinuous lenticles of pebbles. These occur at, above and below the junction of the Laminated Sand with the Cave Earth and suggest that the Conglomerate passes laterally into sandy deposits.

The deposits above the Conglomerate were referred to as the Cave Earth by Parry, who gave the following successions. In 1928 (p. 33) :

2 ft. 6 in.	Red cave earth.
5 ft. 6 in.	" Mixture of cave earth and sand, the proportion of sand increasing with depth. The beds were of laminated appearance, bands of clayey cave earth alternating with bands of almost pure sand."

In 1929 (Table between pp. 104–5) :

2 ft. 6 in.	" Reddish clayey cave earth with small angular limestones."
6 in.	" Ditto, with sand."
5 ft. 0 in.	" Ditto, with sand increasing with depth, with waterworn pebbles of limestone and some of sandstone. In section it has a laminated appearance.... It forms a concrete like breccia against the rocks and round any bones, etc."

In the recent excavations the deposits above the Conglomerate were only seen up to the present floor level, as no deposits above this level remained

after 1935. In excavations A and B they consisted of the Breccia which has already been described in detail (p. 79), with a maximum thickness remaining of about 3 ft. The top 4 ft. 6 in. of deposits on the site of excavation B were removed by Parry (1931, pp. 46–7), who gives no details. Parry says that his excavation here was " down to the gravel ", but it seems that this meant down to the Breccia which here immediately underlay the floor, not to the Conglomerate which is referred to by Parry as " the gravel " in the outer part of the cave, for the deposits below floor level were only excavated in 1950. Parry's remark therefore implies that the Breccia here was overlain, at the level of the present floor, by uncemented deposits. Along the wall at this place can be seen the trace of a stalagmite bed, up to 1 ft. 6 in. thick, the base 6 in. above the floor. This must have been removed by Parry but is not mentioned by him. The section above the Conglomerate at the site of excavation B was, therefore, presumably as follows :

2 ft. 6 in.	" Cave earth."
1 ft. 6 in.	Stalagmite.
6 in.	" Cave earth."
	Present floor level.
2 ft. 6 in.	Breccia.
	Conglomerate.

On the opposite side of the cave, the area of excavations C and D, the " banks of cave earth " against the wall appear to have remained until 1934–5, although this is not very certain. At any rate, there is no record of their removal. Below present floor level, as seen in the recent excavations, the deposits consist of Breccia, on the eastern face of excavation C, passing, in a distance of 2 ft., into Cave Earth with hard, cemented patches in the west face of excavation D. The Cave Earth seen in this excavation showed no distinct bedding or lamination. It contained occasional angular fragments of limestone and traces of occupation.

There is not enough information available now to reconstruct the distribution of Breccia. The Cave Earth contains angular pieces of limestone and presumably there were all stages of transition from the one to the other, the formation of hard Breccia or soft Cave Earth at any one place depending on the proportion of limestone débris and the amount of percolating water available to deposit calcareous cement.

The Stalagmite can be traced, by its remains on the north wall, from excavation B as far as " The Fonts ", and its position has been projected on to the line of section in *Fig.* 16. It cannot now be traced in the main passage between the Cheddar Man Fissure and the entrance, but its former position can be seen, 2 ft. above the present floor, in Sand Hole (*see Fig.* 12). Stalagmite still remains, capping Pleistocene deposits, in the cave behind the museum, marked " Z " in *Fig.* 12. Davies, describing the deposits in

the outer part of the cave, emphasized that " The upper stalagmite-bed covers the cave-earth as a continuous sheet " (1904, p. 338) and shows it (op. cit., *Fig.* 2) a little more than half way up the deposits which had then been excavated (i.e., the top 4 ft. 6 in.). He said that it was from 5 to 12 in. thick. Parry, who excavated the deposits remaining on either side of the path, makes no mention of stalagmite ; as we have seen (p. 86) he certainly appears to have cut through stalagmite on the site of excavation B without recording the fact. It is possible that the Stalagmite became impersistent towards the cave walls, permitting the mixture of cultures which occurred there (*see* p. 90), and was not thought worthy of mention by Parry. The position of the Stalagmite in relation to the human cultures is discussed on page 93.

For the deposits above the Stalagmite we have only Davies' description " recent superficial accumulation " and Parry's " reddish clayey cave earth with small angular limestones ", already noted above, which presumably corresponds to it. None of these deposits now remain.

The deposits exposed in excavations E and F cannot be identified with those in the main excavations nearer the entrance. Already at the inner end of excavation D the distinction between the Laminated Sand and the Cave Earth has almost disappeared. The fine and coarse sands at E and F may most plausibly be regarded as the equivalent of the Cave Earth, for they have in common with it coarse constituents which are absent from the upper part of the Laminated Sand, and at F the deposits were seen to be immediately overlain by the Stalagmite. No finds were made here.

2. The Cheddar Man Fissure

Sections of the deposits were given by Davies (1904, *Figs.* 4, 5). Some deposits remained on the east side of the fissure, where the skeleton was found, until 1934–5. A photograph of the section represented in Davies' *Fig.* 4, showing some bones still *in situ*, was published by Seligman and Parsons (1914, *Plate* 23, *Fig.* 1). The sequence in the fissure was :

6 in.	" Recent accumulation of earth and stones."
5 in.	" Upper bed of stalagmite."
3 ft. 6 in.	Cave earth with blocks of limestone.
6 in.	" Lower bed of stalagmite."
8 in. to 12 in.	Sand and pebbles of limestone and sandstone.
	Rock floor.

The rock floor of the fissure can be seen at the present day and is evidently higher than that of the main passage ; it lies about 7 ft. below the present floor of the latter. The bed of sand and pebbles resting on it, traces of which can still be seen in a recess of the wall on the east side, is correlated with the Conglomerate of the sections observed by the writer. Davies said (1904, p. 339) that there was a " sudden drop of a few feet " in the deposits at the

mouth of the fissure, and this can still be seen in the traces of the " Upper stalagmite " adhering to the wall. Allowing for this the bed would connect with the Conglomerate seen in excavation B. Further, the Conglomerate may be seen resting on the rock floor of the fissure in the south-western corner of excavation A. It is clear that the deposits, found in the main passage below the Conglomerate, are absent in the fissure. Davies' Lower Stalagmite therefore belongs to a horizon above the Conglomerate and was presumably one of the hard, calcareous layers in the Cave Earth and Breccia, perhaps more continuous than usual. Such bands were noticed at the base of the Breccia in excavation B (*see Fig.* 13) and at various levels in the Cave Earth in excavation D. Davies' Cave Earth corresponds to the Cave Earth and Breccia of the recent excavations, and his Upper Stalagmite, as already noted, can be traced on the rock wall round the corner into the main passage, where its occurrence has already been discussed (p. 86).

3. Notes on the Account by H. N. Davies

It remains to account for certain discrepancies between H. N. Davies' account and later observations, which have been ignored in the preceding pages in order to avoid unduly complicating the story. Davies' section through the deposits in the main passage (1904, *Fig.* 2) goes down to rock bottom although the lower part is shown as unexcavated. There is, unfortunately, no vertical or horizontal scale, and it does not seem to be drawn accurately to scale. The thickness of the unexcavated deposits below the cave path is less than that already excavated above; the latter thickness is known to be about 4 ft. 6 in., that is, the height of the banks remaining on either side of the path until Parry removed them. The succession below the path is shown as " Lower Stalagmite-floor ", underlain by impersistent sand and pebbles and overlain by the Cave Earth which continues to the base of the Upper Stalagmite, above path level (*see* p. 87). Both thickness and details of deposits are completely at variance with those noted by Parry, and the explanation must be that Davies, who seems on the whole to have been a careful observer, extrapolated the lower part of the section from what he had observed in the Cheddar Man Fissure. According to Parry's map (1931, *Fig.* 1) no part of the main passage, inside the iron gates at least, was dug below path level until 1928, and this confirms that Davies had no direct knowledge of these deposits. Once more, however, there is an apparently inexplicable contradiction in the recorded facts, for Davies said of his Lower Stalagmite that " It covers the rocky floor of the vestibule and passages in some parts, but in others, and especially in fissure *g* . . . it has some inches of sand and pebbles beneath it " (op. cit., p. 339). It seems unlikely that R. C. Gough reached true rock bottom anywhere in the entrance passage, except perhaps at the very entrance itself, for Davies also says (p. 337)

that " The rock-floor was found to dip steeply inward for some yards ", and shows it as stripped of deposits, at the entrance, in his section. This area (around the present turnstiles) is now concreted over and there is no visible evidence. The central area here was not touched by Parry, although he excavated at the sides, and this supports the possibility that it had already been disturbed by Gough.* If this assumption is correct, and the right-hand or western end of Davies' section be accepted as good evidence down to rock bottom, then the Conglomerate and deposits below it were absent in this area, and the Cave Earth rested on rock bottom. It is also possible, however, that Gough and Davies mistook a bed of hard breccia for rock bottom.

The following Table shows the correspondence between Parry's terms and layer numbers, the nomenclature of H. N. Davies, and the stratification recognized in the present paper :—

Nomenclature proposed in the present paper	*Parry*, 1928, 1929, 1931	*Parry's layers*	*Davies*, 1904
Romano-British and Early Iron Age deposits	Reddish clayey cave-earth with small angular limestones	1–4	Recent superficial accumulations
Stalagmite	—	5	Upper Stalagmite
Creswellian Cave Earth and Breccia	Cave Earth	6–16	Cave Earth Lower Stalagmite
Conglomerate	Gravel	17–23	Bed of sand and pebbles
Laminated Sand Coarse Sand	Clayey red loam and sand	24	—

THE STRATIGRAPHIC POSITION OF THE HUMAN CULTURES AND PRINCIPAL FINDS

1. Palæolithic (Creswellian)

One flint implement was found by Parry in the deposits below the Conglomerate, and twenty in the Conglomerate; these flints, which are a minute proportion of the total number found, were all at the sides of the cave, near the entrance. Parry was " strongly under the impression that these had been carried down below their original level by the retreating water after flooding, as they were all found at the sides of the cave, often

* Seligman and Parsons (1914, p. 243) say that there had been some digging below floor level before 1914, and flints had been found. There appears to be no record of the depth or extent of this excavation.

against the cave walls and usually in sandy patches" (Parry, 1931, p. 47). None was found in or below the Conglomerate in the centre of the passage. Cave deposits are often loosely packed near the cave walls and Parry's view may well be correct. No implements were found in or below the Conglomerate during the recent excavations. The great majority of Palæolithic flint implements were found in Parry's layers 10 to 16,* that is, in the lowest 3 ft. 6 in. of the Cave Earth and Breccia. The greatest concentration of Pleistocene animal bones occurred at about the middle of this zone. There was an overlap of Palæolithic and Early Iron Age artefacts throughout a vertical thickness of about 18 in., and a similar overlap of the faunal remains accompanying the two cultures. This seems to have been an actual mixing of objects of the two cultures in the same place, and is remarked on as such by Parry (1929, p. 103), and not merely the recording of the objects at the same level in different places, such as might have occurred from the digging of a variable series of deposits in arbitrary layers. In fact, although the cave was dug in 6-in. layers, these were measured parallel to the inward dip of the strata, and Parry remarks that there was little variation in the stratification. It is also clear from Parry's other remarks that he would not have been deceived by such an obvious source of error, and we must accept that the objects were actually more or less intimately mixed.† The significance of this is discussed on page 93.

In the Cheddar Man Fissure and beyond, the deposits with Creswellian remains were immediately overlain by the Stalagmite (" upper stalagmite " of Davies, 1904), for one of the bones of " Cheddar Man " touched the bottom of the Stalagmite, and at excavation B its base was only 6 in. above Breccia with Creswellian flints. The same relationship probably held for the central part of the cave nearer the entrance, for the upper limit of Creswellian finds, and the lower surface of the Stalagmite according to Davies, approximately coincide. The mixing, referred to above, may have occurred only at the sides, where the deposits were looser and the Stalagmite impersistent or absent (*see also* p. 87).

The only information now available about most of the finds is the layer in which they were found. Parry remarked that " the majority of the pygmy forms... come from the upper layers " (1931, p. 47). Professor E. K. Tratman, who has been cataloguing the collection at the caves, informs me that traces of " Proto-Solutrean " technique occur, mainly on implements from the

* Parry's layers were each 6 in. thick, and were numbered from the top downwards. For their equivalence to the subdivisions here recognized, see the table on page 89.

† A striking instance of the disturbance of the Creswellian levels is afforded by the two perforated fox canines, apparently a pair (Gray, 1929, *Plate* 20, *Figs.* 1, 2), which were found not less than 2 ft. apart vertically, one in layer 9 and one in layer 14.

deepest levels. H. N. Davies described a block of limestone resting on an old surface in the Cave Earth, at about the level of the present floor, which was surrounded by flint chips and had others lying upon it. It had evidently "served as a tool-bench" to a flint worker (Davies, 1904, p. 339). This was left in position at the time, but has been subsequently removed.

"*Cheddar Man.*"—The site of the human skeleton was adequately described by H. N. Davies (1904). The skeleton was about 12 ft. inside the fissure now named after it, in the upper part of the Cave Earth and below the Stalagmite.* It was associated with Creswellian flints, some of which were figured by Davies (op. cit., *Fig.* 7) and by Seligman and Parsons (1914, *Fig.* 4). Davies thought the skeleton belonged to a former inhabitant who had been drowned. Seligman and Parsons thought that it was "quite uncertain" whether it represented a burial or an accidental death (1914, p. 244). Gray, who saw the site shortly after the discovery, said "there is little doubt that the bones were in sequence, and that the skeleton was a contracted one" (1904, p. 3). The present writer believes that it was a burial. The face had been injured, injuries which may have caused death but which would be unlikely to have occurred during drowning. Two phalanges were cemented to the inside of the skull, a fact in harmony with the hypothesis of a burial of bones, such as seems to have occurred at other late Palæolithic sites, although not impossible to account for by disturbance of the bones by flood waters after decomposition. If a drowned body had floated into the fissure one would expect it to lie at one level, and probably to be extended, but the "Cheddar Man" skeleton, whether contracted or merely without special order, was certainly not extended, and was distributed throughout about 2 ft. thickness of deposit. Moreover, it is unlikely that the inhabitants of the cave would have allowed a decomposing corpse to remain lying in the fissure. If a burial, it must have been made into the upper part of the Cave Earth, towards the end of the Creswellian occupation. The Stalagmite above the Cave Earth was undisturbed.

Other Human Remains.—Very incomplete remains of at least five individuals were found by Parry in 1927–8. Two crania, one of a child about three years old, and one of a young adult, were complete enough for detailed comment by Keith (1929, p. 118). The major parts of the two crania were found in layers 10 to 13, the other bones in layers 6 and 7, at the same level as Romano-British pottery. The bones from layers 6 and 7, however, included two skull fragments which Keith was inclined to regard as missing parts of the two crania, one especially, a right parietal, having a similar convolutionary pattern to the adult cranium. If this be admitted, the remains may all belong to the same culture, though it would be difficult to

* The level assigned to the skeleton in Parry's table (1929) is incorrect.

prove whether this is Creswellian or Romano-British. They have generally been regarded as the former, and Keith thought the adult cranium very similar to that of the " Cheddar Man ". The crania were found in fragments, those of the adult one being separated by a distance of 7 ft. The limb bones were very fragmentary and had been split in the same way as the Pleistocene animal bones which had been used for food. Professor Tratman informs me that all the skull fragments and the mandible referred to in the next paragraph bear cut-marks. Two cut-marks are also visible on the skull of " Cheddar Man ".

In the season 1928–9 a human mandible was found in layer 14, that is, between 1 ft. and 18 in. above the top of the Conglomerate. It was associated with Creswellian flints and is undoubtedly of Palæolithic age. The location of the find is not mentioned by Cooper in his report (1931), but was presumably in the central part of the passage between the iron gates and the Cheddar Man Fissure. Professor Tratman finds that the form of the mandible is identical with that of one from Aveline's Hole, Burrington.

The human remains from Gough's Cave have recently been catalogued, with references, by Oakley (1953, pp. 198–9).

The " Bâtons de Commandement."—Two of these were found, the only ones known from Britain. They have been described and figured by Gray (1929). The circumstances of discovery of the first, which is incomplete, are unknown. Gray (1929, p. 113) and Parry (1931, p. 49) say that it was found in 1903, Gray adding that it was found with Cheddar Man. If this was so, however, it is curious that none of the three people who visited the cave shortly after the discovery of " Cheddar Man " in December, 1903, one of whom was Gray himself, mentions a *bâton* in their reports, although all refer to the associated flints. The *bâton* was first published by Seligman and Parsons (1914, *Fig.* 3) who say nothing about its discovery. One concludes that this *bâton* was found during further excavation in the fissure, after the finding of the skeleton. A splinter which fitted on to the part previously found was recovered by Parry in 1928 from layer 13, that is, about the middle of Creswellian Cave Earth. Parry does not record where it was found, but remarks that it was at least 8 ft. from the main portion. It was, therefore, presumably in the main passage near the fissure. This *bâton* is made from the proximal end of a human left femur, the age of the individual represented being estimated by Dr. R. J. G. Savage at between 13 and 16 years. See also Seligman and Parsons (op. cit., p. 245).

The second *bâton* was found in the autumn of 1927, about 1 ft. below the top of the Conglomerate, against the cave wall on the south side and about 17 ft. inside the iron gates. Presumably it had slipped down to this position from the Creswellian Cave Earth (*see* p. 89). It is of antler, possibly reindeer.

Other Bone Implements.—A number of bone awls were found by Parry distributed throughout the Creswellian levels. One from layer 10, made from the tibia of a varying hare, showed " tally " markings (Parry, 1931, p. 48, *Fig.* 2 (2)).

Amber.—A piece of amber was found in the autumn of 1950, in the Breccia of excavation B, about 1 ft. below present floor level, near the north wall. It has been fully described by Tratman (1953).

Hearths.—Three hearths were described by Parry (1929, pp. 103–4), in layers 6, 7 and 13, but no finds are recorded from them and no comment was made as to their age. They were all Creswellian if the assumed upper limit of that culture (p. 90) is correct.

Fauna.—The Pleistocene fauna was listed by Parry (1929, p. 104; 1931, p. 49) and the mammals are repeated below (p. 102). In view of the disturbance of the deposits, and the fact that the levels of the later finds were not fully tabulated, the levels recorded for the species by Parry may have little significance.

2. Early Iron Age

Early Iron Age pottery, and a few other relics, were found throughout a vertical range of 2 ft. 6 in., from 2 ft. to 4 ft. 6 in. below the original surface of the deposits (Gray, 1929, 1931). This was at the sides of the cave; if the Creswellian deposits were capped by Stalagmite about 2 ft. above present floor level, at least in the middle of the cave, the Iron Age people presumably lived on the surface of the Stalagmite, and objects subsequently found their way to lower levels near the cave walls. The Early Iron Age finds were not numerous, and reinforce the impression that the Iron Age people, whose belongings have been found in such abundance in the Somerset Lake villages, did not live in caves for preference.

3. Romano-British

Romano-British pottery occurred throughout the uppermost 4 ft., but only a few shards were found in the upper 2 ft. of the range. The shards were more numerous than those of the Early Iron Age, and there is, indeed, abundant Romano-British material from Cheddar sites. Concerning the vertical distribution of the remains, the remarks made on the Early Iron Age also apply here. The Romano-British occupation presumably followed shortly after that of the Early Iron Age, and the total thickness of deposits which accumulated during both was probably small. The rare shards of Romano-British pottery found in the topmost part of the deposits may have got there as a result of later disturbance.

4. General Observations

The mixing of Palæolithic with Early Iron Age, and Iron Age with Romano-British remains indicates considerable disturbance of the deposits.

The writer believes that this was largely caused or aided by water during times of flood. Clay or sand may have sometimes been washed out of existing deposits, leaving cavities which became filled with material from higher levels. Burrowing animals may have contributed, although burrows are not mentioned by Parry.

MODE OF FORMATION OF THE DEPOSITS

Gough's Cave has been subject to periodic floods ever since it was opened up. The great spring of Cheddar at present emerges from the foot of a vertical face of limestone a short distance to the south of the cave. After heavy rain water enters the cave on the south side, at first in the neighbourhood of " The Fonts " which is the lowest part of the cave. This water drains away into the water-filled pit at the end of the Cheddar Man Fissure, but if the inflow increases a point is reached where the pit cannot take all the drainage and the water will then rise and flood the cave. On one occasion, at least, within living memory, in 1930, the water rose high enough to overflow at the mouth of the cave, 20 ft. above the level of the spring. In normal times the water of the spring is clear, but in times of flood it carries sediment, and in times of heavy flooding the water in the cave may also become muddy. Balch has recorded that the flood of 1930, mentioned above, left a deposit varying in thickness from $\frac{1}{8}$ to $\frac{7}{8}$ in., the thickest deposit being where the water was deepest (Balch, 1930, p. 26). These facts are important for an understanding of the deposits of the cave.

The deposits below the Conglomerate, varying in thickness from nothing up to more than 10 ft., no doubt originated by the settling of sediment in times of flood, and where they are fine-grained, in the Laminated Sand of excavations B to D, the individual layers, resulting each from a period of flood, can be seen. The writer suggests that the cave was at this time permanently flooded, the deposits resulting from rainy periods when the water was carrying a heavy load of sediment. This hypothesis is suggested by the fact that finds are very rare in these deposits near the entrance (1 flint in layer 24—Parry, 1929, Table; *see also* p. 89 of this paper) and absent further back, where, moreover, the sediments exposed in the recent excavations were clearly undisturbed by human or animal occupation. As the cave was later to become one of the most desirable residences in the Gorge the rarity of remains at this level needs explanation, and is most easily accounted for by flooding.

The Conglomerate is evidence of a swift-flowing stream, the only agent which could have produced the water-worn pebbles. It is most probable that the limestone fragments originated by weathering of the roof, and collected on the stream-bed where they became rounded. The alternative hypothesis, that they had been rounded elsewhere and were then transported

to the site, would demand a still more powerful stream, and its adoption would not materially affect the conclusions reached. Although it slopes downwards towards the interior the cave, whose entrance at present lies about 5½ ft. above the roadway (not the rock floor) of the Gorge, is unlikely to have acted as a swallet, and was probably an outlet for the underground stream. Parry, referring to the Conglomerate, remarks that " this was no doubt the old river bed " (1928, p. 33). Limestone débris was absent, so far as is known, from the earliest deposits. The change represented by the base of the Conglomerate was therefore twofold : on the one hand the cave became an active stream passage, on the other a supply of limestone débris commenced.

The limestone débris in the layers above the Conglomerate is predominantly in the form of sharp, angular fragments, quite unaffected by stream action. The limestone seen in the Breccia and Cave Earth of the recent excavations was all like this. Davies, however, says (1904, p. 338) that in the Cave Earth some of the limestone was angular, some rounded, and Parry records water-worn pebbles of limestone and sandstone between 3 ft. and 8 ft. below the original surface of the deposits (1929, Table). The angular limestone blocks, some of which are very large, can have suffered no transport and must have fallen from the walls or roof, as Davies supposed. The existing records unfortunately do not show whether such falls were more frequent at some levels than others, except for the presumed capping of Breccia by Cave Earth at excavation B (*see* p. 86) and the " fall of heavy stones " recorded by Parry as occurring between layers 8 and 11 (1929, Table). Conclusions cannot be founded on these isolated data as there is bound to have been an element of chance in the fall of material at any one place, depending, among other things, on the state of the roof in different places.

It is customary to regard Breccias in cave deposits as the result of frost weathering of the limestone during periods of cold or arctic climate. In Gough's Cave Breccia is well-developed at excavation B, 90 ft. from the entrance, which is a long way inside for frost weathering to have effect. In the absence of other causes known to produce Breccias, however, the operation of frost-weathering must be assumed. It is possible that, to some extent, the limestone débris tended to work its way inwards, aided by the slope of the floor.

The remaining constituents of the Breccia and Cave Earth were clearly introduced by floods. The Cave Earth exposed in the recent excavations was not well stratified, but that seen by Parry nearer the entrance had " a laminated appearance, bands of clayey cave earth alternating with bands of almost pure sand " (1928, p. 33). The flooding must now have been intermittent, as the deposits carry abundant traces of occupation.

The Stalagmite which, in places at least (*see* pp. 87, 90), capped the Creswellian Cave Earth and Breccia, consisted of thin calcareous laminæ

alternating with layers of fine sand or clay. The sand and clay are flood deposits, as before. In the intervals between flooding the floor was covered by a trickling film of water which deposited calcium carbonate. During the period represented by the Stalagmite the cave was uninhabited, and was presumably too damp and perhaps too often flooded for the purpose.

The deposits above the Stalagmite must again have resulted from floods. Davies, who calls them " recent superficial accumulations ", gives no details. According to Parry (1929, Table) the topmost 2 ft. 6 in. had " small angular limestones " but there is no evidence that a breccia was present, and some limestone may have been produced by ordinary weathering of the cave roof, without particularly severe climatic conditions.

INTERPRETATION OF THE DEPOSITS

Deductions as to the climate prevailing during the times when the different deposits in Gough's Cave were formed depend on the causes assumed to account for the flooding of the cave and for its functioning as an outlet for the underground stream which normally emerges at the spring lower down. The flow of the spring at the present day is very sensitive to variations in rainfall, and a heavy fall of rain results in an increase of flow from six to twelve hours later. The water becomes muddy at the spring, though not in the cave, from twelve to eighteen hours after the rain. In November, 1954, the flood water in the cave did not become muddy although the spring was muddy for at least ten days. Under present conditions, therefore, only the heaviest floods, such as that of 1930, result in deposition of sediment in the cave.

Two other factors must be considered : first, the possibility of blocking of the spring. This does not seem probable, except as a short-lived phenomenon, for when the cave is functioning as an outlet there is a head of water of about 20 ft. at the spring, probably enough to remove any obstruction. The second factor is that the channels which supply the spring have no doubt undergone continuous enlargement by solution of the limestone, permitting progressively greater flow before the cave came into operation as an overflow. It is impossible to evaluate this factor but it may have been significant.

To account for the earliest deposits, presumed to denote continuous flooding on account of the absence of occupation, the second factor mentioned in the last paragraph may perhaps be invoked. Precipitation is likely to have been more evenly distributed throughout the year than at present, for there is little " reservoir capacity " in the limestone and to-day the flow of the spring dwindles rapidly in dry weather, the ratio of maximum and minimum rates of flow being about 40 : 1. Whether the total annual rainfall was greater than nowadays depends on the unknown factor of the size of the spring outlet.

The formation of the Conglomerate may most easily be accounted for by assuming a cold climate with heavy winter snowfall on Mendip top, whose spring melting would flood the underground drainage channels in the limestone and cause Gough's Cave to function as a stream outlet, and very low winter temperatures to cause frost weathering of the limestone near the cave mouth. The principal objection to this hypothesis is that during the frozen period of the winter the cave would have been dry, and an obvious shelter for man and beasts, whose traces are very scanty in the Conglomerate and were believed by Parry to have been derived from higher levels (*see* p. 89). It is more than probable, however, that a stream of sufficient force to wear the limestone débris into rounded pebbles would have destroyed any traces of occupation.

The fall of limestone from the walls and roof continued throughout the Creswellian occupation, but judging from the abundance of finds the cave was now a permanent habitation, and floods only occasional affairs. The severe winters must have continued during this period, but with little snowfall. The abruptness of the transition from the Conglomerate to the Creswellian deposits above may be significant. In the recent excavations the beds above the Conglomerate showed no trace of stream action ; nearer the cave mouth, Parry mentions rounded pebbles in the Creswellian deposits, but as he differentiates these deposits from the " gravel" the pebbles were presumably a minor constituent, and as they were associated with angular fragments they were probably introduced from elsewhere rather than rounded on the spot. The abandonment of the cave by the stream appears to have been relatively sudden and complete.

The cave was uninhabited from after the Creswellian period until the Early Iron Age. Immediately after the Creswellian occupation Stalagmite began to form, and by analogy with other caves this is believed to have occurred during the period marked by the Mesolithic industries. Stalagmite formation was interrupted from time to time by floods ; the combination presumably marks a wetter and probably warmer climate than that of Creswellian times, but the climatic causes of stalagmite formation remain to be investigated. So far as is known, there was no angular limestone in the Stalagmite, so the climate was now milder.

There are neither finds nor deposits attributable to the Neolithic and Bronze Age, unless stalagmite formation continued into this period. Presumably the cave was not dry or it would have been inhabited, as were the much less accessible Sun Hole and Soldier's Hole. Possibly the cave mouth was used by a stream, which even if it only flowed intermittently may have served to keep the floor free of sediment, down to the level of the Stalagmite. The climate may therefore have had heavier rainfall than at present, perhaps heavier than during the Mesolithic. Stream action or

floods at this time, as well as later, may have contributed to the disturbance of the deposits which is indicated by the distribution of the finds.

From the Early Iron Age onwards the cave has been normally dry, and habitation possible except during occasional floods which continued to add to the deposits.

COMPARISON WITH OTHER MENDIP CAVES

There are no recorded cave sites in Mendip where the Pleistocene stratigraphy is as well differentiated as at Gough's Cave. The first site to claim comparison is Soldier's Hole, high up the side of Cheddar Gorge near Gough's Cave, excavated by Parry in 1928–9 and reported by him (1931), Balch (1928, 1930), Jackson (1931), and in an anonymous report (1928) presumably by either Balch or Parry. On account of its position Soldier's Hole was not subject to flooding, and here we find the "Proto-Solutrean" and Neolithic cultures, absent from Gough's Cave. The deposits are not described in sufficient detail for any deductions to be made as to the conditions under which they were formed, but stalagmite bosses were found buried in the deposits above the Creswellian stratum, and may have formed at the same time as the Stalagmite at Gough's. The deposits at Soldier's Hole were less disturbed than the later layers of Gough's Cave, and there was a definite barren layer, between 1 and 2 ft. thick, resting on the Creswellian deposit and containing the lower parts of the stalagmite bosses. The Neolithic and later remains were found above this, the Neolithic flints being embedded in tufa (Anon., 1928, p. 38).

At Aveline's Hole, Burrington (various reports; *see* bibliography in Donovan, 1954, p. 33), the sequence was :—

	(Recent débris.)
To 8 in.	Stalagmite, discontinuous.
3 ft. 0 in.	Red cave earth, with many large angular boulders of limestone, some pebbles of sandstone. Creswellian flints, Magdalenian stage 6b harpoon, abundant fauna, palæolithic human bones.
4 ft. 0 in. (where seen)	Light brown loam with angular pieces of limestone, some very large. Almost barren : no implements, rare bones of birds and rodents, the same species as in the red cave earth above.
	Rock floor.

The cave is probably a solution cavity exposed by the downcutting of the Combe, and the writer believes, with J. A. Davies (1925, p. 110), that it may once have acted as a swallet. The gradient of the floor is such that deposition would be unlikely so long as the cave was used by a stream, which might erode any pre-existing deposits. Both of the deposits below the Stalagmite, with their ubiquitous angular boulders, may correspond to the Creswellian Cave Earth of Gough's Cave, and this view is strengthened by

the fact that the implements found in the Cave Earth do not compare with those from Cheddar in perfection and variety; they may correspond to only the end of the occupation at Gough's, or to an even later period. It is not clear what factor was responsible for the change from light brown loam to red Cave Earth; the colour change may mark the advent of a warmer or drier climate. Professor Tratman believes that the loam was formed of fine, horizontal laminations, and it may have been deposited when the cave was flooded; subsequent drainage or lowering of the water table would have permitted human occupation.

Sun Hole, on the opposite side of Cheddar Gorge from Gough's Cave and Soldier's Hole, has been excavated by the Society and a report on the Pleistocene levels is published in this number of *Proceedings* (p. 61). They are very thick and very barren. There is abundant angular limestone throughout, but this fact is of limited significance in view of the exposed position of the site and the fact that the excavated deposits are very near the entrance. Tufaceous stalagmite capped the Pleistocene deposits and in this respect the site falls into line with those already discussed and with Gough's Cave.

In addition to Soldier's Hole, "Proto-Solutrean" flints have been found at Uphill, and Wookey Hole (Badger Hole and Hyæna Den). No stratigraphy is recorded for the Uphill specimens. At the Hyæna Den the Creswellian culture has not been found, and the cave may have become filled up before it appeared, for the hyæna was locally extinct by the time the Creswellian was established. The stratigraphy of Badger Hole, which has yielded Creswellian, has not been published. These sites are, therefore, of little use for comparison.

The following correlation may be tentatively proposed:—

Culture	*Gough's Cave*	*Soldier's Hole*	*Sun Hole*	*Aveline's Hole*
Mesolithic ?	Stalagmite	Stalagmite bosses and barren level (layers 2 and 3)	Stalagmite	Stalagmite
Creswellian	Creswellian Cave Earth and Breccia	Creswellian Cave Earth ("layer 3" = working layers 4–9)	Red earth with angular limestone fragments	Red Cave Earth Light Brown Loam
"Proto-Solutrean"	Conglomerate	"Proto-Solutrean" Cave Earth ("layer 4" = working layers 10–17)	? not reached	No deposit; ? occupation by stream
	Sands below Conglomerate	? working layers 18–22, in fissure	—	—

SUMMARY OF THE LATE PLEISTOCENE IN MENDIP

Both the "Proto-Solutrean" and the Creswellian cultures were accompanied by a climate with severe winter frosts. The coming of the Creswellian seems, however, to have coincided approximately with a climatic change, apparently involving decrease of precipitation (? snowfall), and it was certainly accompanied by a faunal change, for the large pachyderms and carnivores, mammoth and rhinoceros, cave lion and hyæna, disappeared from the area about this time.* Bison may also have become locally extinct.† The remaining fauna, which persisted unchanged, included reindeer, Irish giant deer, red deer, roe deer, horse, brown bear, arctic fox and ordinary fox, varying hare, lemmings (*Dicrostonyx* and *Lemmus*), and other rodents and small mammals. Cave pika appears in the Creswellian levels only. Birds included grouse and ptarmigan. The assemblage includes species supposed to indicate several different types of environment. Against the presence of tundra species, reindeer and lemmings, must be set the fact that horse was the commonest food-animal throughout the Creswellian occupation at Gough's Cave, and while this may indicate the preference of the hunters the animal must have been common. It is conceivable that the tundra species lived on the Mendip uplands, while if sea-level was only slightly lower than at the present-day extensive grazing lands for horse would have existed where the Somerset levels now lie. Red deer presumably indicate the presence of some forest; their bones were rare in Gough's Cave compared with horse, but this again may be a result of the preferences or the hunting skill of the inhabitants.

There is little information about the transition from Pleistocene to post-Pleistocene in north Somerset, and no published section exhibits this part of the succession in adequate detail. We cannot be certain of the order in which the remaining Pleistocene animals disappeared, or whether they or the Creswellian people left first. None of the caves has yielded an undoubted Mesolithic occupation, and it has been suggested above that the Mesolithic is represented by stalagmite formation in many caves. At Chelm's Combe, near Cheddar, however, a shallow rock shelter in an exposed situation, there is no stalagmite, and a Neolithic occupation and burial are underlain by about 16 ft. of rapidly accumulated deposits with a fauna which

* None of these species occurs at Gough's Cave; the fauna cited by Davies (1904, p. 337) is incorrect. *See* Parry, 1929, p. 104 and 1931, p. 49. They do not occur in any other Creswellian deposit in Mendip. All four species were found at the Hyaena Den, Wookey Hole (Dawkins, 1863, p. 267), associated with "Proto-Solutrean" implements. The "Proto-Solutrean" level at Soldier's Hole yielded cave lion, hyæna and a fragment of mammoth tusk.

† Bison occurs in the "Proto-Solutrean" and lowermost Creswellian levels at Soldier's Hole. It is not listed by Parry from Gough's Cave, although Balch records it (1948, Table facing p. 142).

includes reindeer, red deer, horse, lemmings and cave pika. The reindeer persists up to a level little more than a foot below that containing Neolithic pottery.* Hardly any traces of human occupation were found in the pre-Neolithic levels, although the bones of the larger animals had apparently been brought to the site for food. Two doubtful bone implements, not diagnostic of any particular culture, are described by Clay (1927, p. 114) and Jackson mentions reindeer antler which had probably been utilized (1927, p. 119). The flint flakes marked on the section from layers 6 and 9 (Balch, 1927, *Plate* facing p. 108, "*u*" and "*v*") are not described in the text. The small thickness of deposit separating the reindeer from the Neolithic levels, and the absence of the Creswellian culture, lend some support to the view that the latter may have ended in the area before the disappearance of the last survivors of the Pleistocene fauna.

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* The shelter was dug in 1-ft. layers. Layer 4 (from the top) yielded Neolithic pottery, layer 6 reindeer bones. Eight flint scrapers (of post-palæolithic type) are shown as from layer 5 in the diagram (Balch, 1927, *Plate* facing p. 108), but are said to be from layer 4 in the text (Clay, 1927, p. 114).

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Further references to Gough's Cave will be found in Donovan, 1954, p. 33.

APPENDIX I

MAMMALIAN AND MOLLUSCAN FAUNA

The complete list of mammals from the Creswellian Cave Earth is as follows :—

CARNIVORA

Alopex lagopus (*Arctic Fox*)
Canis lupus (*Wolf*)
Felis sylvestris (*Wild Cat*)
Meles meles (*Badger*)
Mustela putorius (*Polecat*)
Ursus sp. (*Bear*)
Vulpes vulpes (*Fox*)

UNGULATA

Bos sp. (*Ox*)
Capra hircus (*Goat*)
Capreolus caprea (*Roe Deer*)
Cervus elaphus (*Red Deer*)
Equus caballus (*Horse*)
Megaceros giganteus (*Irish Giant Deer*)
Ovis aries (*Sheep*)
Rangifer tarandus (*Reindeer*)
Sus sp. (*Pig*)

RODENTIA

Arvicola abboti (*Abbot's Vole*)
Arvicola amphibia (*Water Vole*)
Castor fiber (*Beaver*)
Lemmus lemmus (*Lemming*)
Lepus timidus anglicus (*English Pleistocene Variable Hare*)
Ochotona spelæa (*Cave Pika*)

No mollusca have been recorded by previous workers, but material from the recent excavations sent to the British Museum for identification included, as well as the land snail (*Zonites cellarius*), the marine species *Mytilus edulis* (Mussel) and *Ocenebra erinacea* (Sting Winkle), presumably brought to the cave for food.

APPENDIX II

Mechanical Analyses of the Deposits

I am greatly indebted to Mr. Donald Mackney, of the Soil Survey of England and Wales, for studying the sedimentary petrology of samples collected during the recent excavations. Some of his results are given below; it is hoped to publish further details of the heavy mineral assemblages later.

MECHANICAL ANALYSES OF DEPOSITS

Sample No.	*Coarse Sand* 2·0–0·2 mm. per cent	*Fine Sand* 0·2–0·02 mm. per cent	*Silt* 0·02–0·002 mm. per cent	*Clay* < 0·002 mm. per cent	*Total* per cent
1	89·5	4·6	2·0	0·9	97·0
2	8·9	63·4	10·6	13·2	96·1
3	0·4	56·4	19·1	17·7	93·6
4	7·2	45·5	15·3	20·1	88·1
5	75·0	12·0	5·6	0·2	92·8
6	67·7	16·9	5·3	1·7	91·6
7	57·0	24·0	8·8	4·0	93·8
8	0·3	66·7	18·5	4·9	90·4

The difference between the total and 100 per cent includes carbonate and sesquioxide removed before analysis, as well as experimental errors.

List of Samples

1. Coarse Sand of excavation D, 2 ft. above the bottom of the excavation.
2. Laminated Sand of excavation D, 4 ft. above the bottom of the excavation.
3. Laminated Sand of excavation B, 4 ft. above the bottom of the excavation.
4. Cave Earth of excavation D, about 1 ft. 6 in. below level of present floor.
5. Coarse band in deposits at excavation F, 1 ft. below base of the Stalagmite.
6. Coarse band in deposits at excavation E, 3 ft. below present floor.
7. Coarse band in deposits at excavation E, 4 ft. 6 in. below present floor.
8. Deposit at excavation E, 2 ft. 6 in. below present floor.

Notes on the Samples

Coarse Sand (Sample 1).—Visual inspection under a binocular microscope revealed that the commonest grain size is about 0·5 mm. A small proportion of the quartz grains are highly polished. Minor constituents are worn, silicified crinoid ossicles, and fragments of other fossils, derived ultimately from the Carboniferous Limestone; in some the silica can be recognized as Beekite.

This sample was remarkable for the almost complete absence of heavy minerals, the separation yielding an insufficient number to warrant counting. Iron oxides were present, principally magnetite and limonite. Barite in extremely delicate form was detected, and a few large, well-worn grains of zircon and rutile.

Laminated Sand (Samples 2 and 3).—In both samples material between the limits 0·2 to 0·02 mm. forms more than half the total volume, and the first sample has only 0·4 per cent of grains larger than 0·2 mm., although the second, near the base of the deposit, has 8·9 per cent.

The heavy mineral counts for both samples are very similar, except for a large quantity of barite in the second. The barite differed in the two samples: that from the first had a sharp, dentate outline, like that in the Coarse Sand; that in the second occurred as irregular lumps with rounded outlines, some over 0·25 mm. in diameter. The barite in the first sample cannot have suffered any appreciable amount of transport and may be authigenic, having crystallized out in its present position after the deposition of the sediment. The rounded grains from the second sample show, however, that detrital barite is also present, and may have formed the source of the recrystallized mineral in the other sample and in the Coarse Sand.

Magnetite, Limonite and Leucoxene are all present in significant quantity in both samples. The principal difference from the Coarse Sand is the much higher percentage of Leucoxene.

Cave Earth (Sample 4).—The composition is basically the same as that of the Laminated Sand, although the fraction between 0·2 and 0·02 mm. is less than half the total, and the clay fraction is slightly higher than in either of the samples of Laminated Sand. The heavy mineral composition, also, is very similar with the exception of the presence of "carbonate", unimportant in the other samples, in the Cave Earth. This is almost certainly calcite or aragonite which has crystallized out from percolating waters after the deposition of the Cave Earth.

Deposits in excavations E and F.—Four samples (5 to 8) were analysed from the beds exposed in excavations E and F, and believed to be the equivalent of the Cave Earth. Three of these (5 to 7) were taken from the dark, coarse bands which were a prominent feature in these sections. The mechanical analyses of all are very similar, showing a predominance of material in the grade 2·0 mm. to 0·2 mm. Examination of the coarse fraction with the binocular microscope showed that occasional quartz grains were highly polished. Prominent constituents of the coarse fractions are worn pieces of silicified fossils from the Carboniferous Limestone, and in sample 7 this material predominates. Sample 8, representing the normal deposits of excavation E, shows some resemblance to the Laminated Sand in its analysis, especially in the high value for fine sand.

Note on the Source of the Deposits

The source of the constituents of the deposits, other than the Carboniferous Limestone pebbles and fragments, has not been definitely established. From analyses and comparisons which have been made the following have been provisionally ruled out as major contributors:—

1. The non-calcareous part of the Carboniferous Limestone. The deposits are not, therefore, essentially "residual clays" resulting from solution of the limestone.

2. The local Triassic rocks. Comparison of the heavy mineral assemblage with that of the Somerset Trias suggests that the latter is not an important source, although it may have made some contribution.

The presence in the coarse sand fraction of abundant fragments of silicified fossils suggests that the material composing the deposits has been carried through the underground drainage system from the swallets which feed it, for silicified fossils are common in the Carboniferous Limestone in the lower part of the Z zone, in which many of the swallets occur, but are unknown in Cheddar Gorge or in Gough's Cave.