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ANALYSIS OF SEDIMENTS IN GOUGH'S CAVE, CHEDDAR, SOMERSET, AND THEIR BEARING ON THE PALAEOLITHIC ARCHAEOLOGY

by

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ABSTRACT

The Cave Earth/Breccia unit is an accretionary wedge of dense sediment, thinning and fining into the cave. Macroscopic examination has shown irregular internal stratification in places, and microscopic examination of a small number of old samples reveals common irregular and extremely localized bedding features. The unit comprises material from three general sources: (1) sands and fine pebbles of regional petrology, probably derived from the Gorge bottom; (2) limestone clasts and fine limestone residues of local provenance; and (3) strictly autochthonous carbonate precipitates, sometimes interstratified as thin, discontinuous speleothems. Apart from the local processes of rockfall and carbonate precipitation, the unit was formed by the gradual introduction of material via the main cave entrance by creep and sheetwash. There is no sign of any geological process of sufficiently high energy to have caused mass mixing or transport of the archaeological assemblage.

PREVIOUS OBSERVATIONS ON THE SEDIMENTS

A detailed description of the deposits of Gough's (New) Cave has been given by Donovan (1955), a paper which includes references to the earlier observations of Davies (1904) and Parry (1929, 1931). Although Donovan was only able to report upon occasional visits to the Cave Management excavations (c. 1949-51) which were themselves restricted to mere remnants of the original fill, his work is of a quality far surpassing the norm for British archaeological caves and it will thus provide a reliable basis for the present brief discussion.

The unit of primary interest here, that containing at least the majority of the Palaeolithic artefacts (and possibly even Mesolithic artefacts and early Holocene fauna, as well), comprises material variously referred to as 'Cave Earth' or 'Breccia'. The basic data are available in the papers by Davies, Parry and Donovan cited above and only the most probable synthesis will be presented here; locations mentioned are shown on Donovan's Fig. 12 (1955, p. 78, incorporated into FIG. 4 on p. 109 of the present volume). In order to avoid compounding any original uncertainty, all linear measurements extracted from the old publications will be cited here in imperial units.

The Cave Earth/Breccia unit was generally wedge-shaped in longitudinal profile, being c. 5 ft. 2 in. thick at the Iron Gates (now removed; see FIG. 1 on p. 103 in the present volume) just inside the entrance (although a maximum thickness of 8 ft. was given by Davies), c. 4 ft. 2 in. thick at the branch to the Cheddar Man Fissure (c. 54 ft. inwards from the Gates) and c. 2 ft. 6 in. thick in Area D (c. 70 ft. inwards). The wedge was not rectilinear but, rather, slightly concave-up; bedding angle was c. 8° near the Iron Gates, dropping to c. 3° in Area D and even less beyond. The boundary with the underlying unit (the Conglomerate) was variously diffuse or abrupt and, in some areas, showed frequent irregularities with an amplitude of as much as c. 1 ft. 9 in., or even more near the cave walls (*infra*).

The Cave Earth/Breccia unit contained a series of lateral lithofacies shifts. Within the outer c. 40 ft. it consisted of clayey 'cave earth' with angular limestone clasts, passing quickly downwards into increasingly sandy material, often with 'laminations' made up of alternations between 'cave earth' and sand; there were some highly rounded pebbles and cobbles of limestone with a little sandstone (presumably reworked from the underlying Conglomerate), and the whole mass was variably cemented with carbonates. By c. 50 ft. into the cave traces of discrete sandy lenses or laminations had been lost, the whole thickness consisting of angular scree with a heterogeneous matrix of limestone grit, sand or clay, often cemented by carbonates; near and at the base there were several discontinuous lenses, up to c. 1 in. thick, of fine-grained (primary) calcite with clay impurities. From this point inwards the sediment changed very swiftly, becoming increasingly more sandy and losing all but a few limestone clasts; the overall cementation and basal calcite lenses were replaced by calcite lenses and discrete cemented patches at all levels. Judging only from Donovan's fig. 15 (1955, p. 81), by c. 70 ft. into the cave the sandy sediments interdigitated with what appear to have been almost horizontal clayey or silty laminations. Deeper still into the cave (Area F) the Cave Earth/Breccia unit could no longer be distinguished from the underlying units, the entire series apparently being represented by clayey fine sand or sandy clay, sometimes laminated and cemented by carbonates. Thus a fining-inwards trend was noted in all clastic units of the deposits. This trend was locally interrupted, at least in the Cave Earth/Breccia unit, by the occasional presence of coarser limestone clasts and even small boulders. Note that Davies refers to thin and discontinuous crystalline stalagmite lenses at various levels in the Cave Earth/Breccia unit but he does not give any indication of where in the cave these had been noticed.

Donovan gives no overall genetic interpretation of the Cave Earth/Breccia unit. He suggests (1955, p. 95) that, although much of the coarser limestone debris was obviously strictly local, some of the clasts may have worked their way inwards down the slope. He rules out any possibility of stream action and one gets the impression that he has 'creep' processes in mind rather than rapid mass movement. Since the unit contained allochthonous elements (silicified fossils not present in the bedrock, sandstone, etc.), he refers much of the finer sediment to 'flooding', that is, effluent action. The present author believes such action to be most unlikely as a major source of the fines in the Cave Earth/Breccia unit. The allochthonous material was simply too coarse to have been emplaced by an intermittent resurgence without major, and very obvious, erosional effects. Indeed, Ford and Stanton (1968), using the same arguments as well as the absence of gravels further into the system, have contested Donovan's concept of a resurgence even for the obviously water-laid deposits below the Cave Earth/Breccia unit; they prefer a process of overland flow down the Gorge during periods of permafrost as a mechanism for the import of exotic elements (specifically the sandstone). Sandstone debris also occurs, in an apparently disturbed context, in Gough's Old Cave (just down-gorge from Gough's (New) Cave). Tratman (1960) has suggested a phreatic origin for this material as well but, since the rock-floor of the Old Cave is approximately at the same level as the roof at the entrance to the New Cave, input from the Gorge bottom would again seem to be a more reasonable interpretation, although strict contemporaneity between these sediments in the two caves is not necessary. The large volume of 'exotic' sediment in the New Cave precludes secondary derivation from the Old Cave. The Cave Earth/Breccia unit, as described by Davies, Parry, and Donovan, bore all the hallmarks of being a simple accretionary wedge emplaced by creep and sheetwash, with much of the sediment derived from outside the main entrance. This implies a 'catchment' which must have been wider than the gorge-side immediately above the cave. The most likely route for the range of allochthonous elements observed would have been down the Gorge bottom and it therefore seems necessary to assume that the sedimentary fill of the Gorge was thick enough at this time to create a surface at the same altitude as the cave mouth. That very large quantities of sediment have moved down the Gorge during the Quaternary is shown by the scale of the fan at the Gorge mouth (underlying the town of Cheddar itself).

NEW OBSERVATIONS ON THE SEDIMENTS

The above arguments are based entirely upon the published accounts of the deposits. The present author has also had the opportunity of studying two sets of carbonate-cemented samples collected during past excavations. It should be noted that these samples are extremely small, each falling within the range 30-300g, and that any general conclusions must therefore remain somewhat speculative. A major part of all samples has been left physically and chemically intact; these portions have been returned to their respective museums.

The first set, referred to here as Set A, was collected during the Cave Management excavations (described by Donovan, 1955) and is housed in the British Museum (Natural History); it comprises five samples, labelled 'GC/1950-51/12', 'GC/1951/14', GC/1949-50/15', GC/1950-51/16' and 'GC/1949-50, 1950-51/17'. The samples come from c.57 ft.-71 ft. into the cave (Areas B, C and perhaps D, in Donovan's terminology); the dates refer to 'winter seasons' (the date of the last sample being uncertain) and the final element of each label refers to the number (increasing downwards) of the 6-inch spits in which the deposit was dug. It would therefore appear that Set A represents the lower part of the Cave Earth/Breccia unit. All five samples are essentially similar and they will be described collectively here.

The sediment may be generally characterized as a badly sorted silty sand, with some matrix-supported larger elements, and massive and quite homogeneous marginally post-depositional cementation by carbonates.

The matrix has a strong clastic carbonate component, comprising vein calcite crystals and tiny limestone fragments. However, there is also a strong non-carbonate and/or exotic component, including a slightly better sorted quartzitic coarse silt and fine sand (only c. 30% of the HCl-insoluble residue is finer than coarse silt); a very badly sorted medium and coarse sand, comprising cherts, silicified or partially silicified fossil fragments (especialy crinoid columnals), fine-grained quartzites, very fine-grained iron-rich particles (fragments of ancient nodular iron concretions), siltstones and very small amounts of Old Red Sandstone; rare pebbles (*infra*) of chert, quartzite, quartz, iron-rich material and limestone in the size range 0.5-10.0 mm. The matrix material has a mixture of forms and surface textures. The 'authochthonous' element comprises quite fresh and angular limestone fragments, vein calcite and quartz grains, as well as some of the chert fragments. The 'allochthonous' element, which is estimated to have represented c. 40% of the matrix at the time of deposition, comprises very well rounded and shiny quartzitic and opaline grains, rounded and/or corroded fossils, and the larger, highly rounded and shiny particles referred to above as 'pebbles'. There are also many 'dirty' quartz grains that may have been derived from a relatively coarse sandstone (certainly not the Old Red). The matrix shows zones of weak and extremely localized fabric (on a scale of no more than a few millimetres laterally), expressed as preferential orientation of the main plane of particles or as stringers of coarser sand grains. Microbedding angles, and even orientations, are quite variable within a single sample. There are no true laminations in any of the samples and, apart from the minor fabric features noted, the matrix is relatively homogeneous.

There are only a few larger limestone clasts (autochthonous massive calcite mudstone) in these small samples. They lack signs of significant postdepositional alteration. A few clasts show one altered surface (randomly oriented in the matrix), representing the rock wall/roof before breakdown.

There is no significant alkali-soluble organic matter (i.e. <0.1% of material under 1 mm). Well indurated (carbonate) megafaunal bone fragments of all sizes are quite common and they lack signs of rolling; no microfaunal debris was recognized. Phosphate content is variable and patchy within single samples. There are a few sand-sized charcoal fragments; these are in good condition (coherent and with angular breaks) but, although structure is visible, they are too small for source-wood identification (in passing, it should be noted that this is not the case for the charcoal inclosed within the remnants of this unit still surviving in the cave; fragments up to c. 4 cm are not uncommon). Small chips (0.5-2.0 mm) of dehydrated flint or very fine-grained chert, showing fresh mechanical fractures (archaeological?), are present but very rare (1-3 recognized per sample).

Overall carbonate content (clastics and precipitates) in the fraction below 2 mm is c. 70%. A significant amount of this carbonate has been introduced after deposition of the original sediment, although not necessarily after the formation of the whole sedimentary unit. Indeed, even allowing for the relatively sandy texture of the sediment, the homogeneity and density of the carbonate cement would suggest that clastic sedimentation and carbonate precipitation operated concurrently throughout this period. It is not impossible that the carbonate clasts in the silt grades could have contributed to the cement by solution and reprecipitation, but the total lack of signs of strong diagenesis (e.g. segregation features, vugs, etched crystals, different generations of cement, etc.) would suggest that any such authigenic component is minor. In some samples (especially those from spits 14 and 15) carbonate input was fast enough, or clastic input was slow enough, to allow the very localized build-up of very minor speleothems (thin drapes and knobbly protuberances) at the irregular contemporary surfaces. These speleothems are pure and crystalline but they are composed of neomorphic mosaics (they have recrystallized in a more or less closed system). No reworked speleothem clasts were recognized. There are no signs of significant iron, manganese or phosphate mobility.

The second set of seven samples, Set B, comes from two sources. The first three samples have separate labels marked '(1) 1949-50, 50-51, level 17', '(2) 1950-51, level 16' and '(3) 1950-51, level 16'. These three samples were collected during the Cave Management excavations; they were formerly housed, with Set A, in the British Museum (Natural History) but, because they each contain flint artefacts cemented into the matrix, they have recently been transferred to the Cheddar Caves Museum. The other four samples in Set B are marked, both on labels and on the samples themselves, '(5)-12', '(7)-13'; '(8)-13' and '(9)-12x'. These samples may have been collected as early as the Parry excavations but they are essentially undocumented; they are housed in the Cheddar Caves Museum. They also contain flint artefacts, no doubt the reason for which they were originally collected. Set B therefore contains samples from spits ('levels') 17, 16, 13 and 12.

The samples from spits 17-16 are similar in composition to Set A, although there are slightly thicker and more common primary calcite lenses, less limestone and more sand. The samples from spits 13-12 have much more limestone, less exotic sand and the matrix is dominated by silt. The main difference between Set A and Set B is that all samples of the latter show very clear signs of diagenesis, including massive carbonate remobilization. They are positively riddled with open vugs, there are multiple generations of carbonate cement, the original fabric and speleothem lenses show common microfaulting, and some limestone clasts (especially in spit 16) have suffered the sort of 'fissuring' described from Sun Hole (Collcutt, Currant & Hawkes, 1981, p. 28) and which is probably attributable to long-term dampness in the deposits. The possible significance of this difference in preservation will be discussed below.

The main point to be made concerning these two sets of samples is that they confirm, on a micro-scale, what has already been inferred from the excavators' descriptions of the deposits as a whole. 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.

To complete the picture, we may note that Davies (1904) refers to both a lower and an upper 'stalagmite', sandwiching the Cave Earth/Breccia unit. The lower 'stalagmite' presumably corresponded to the macroscopic calcite lenses recorded by Donovan near the base of the unit, although Davies stresses that this material was hard and crystalline. The upper 'stalagmite', described by Davies as laminated and friable, was also noted by Donovan; he was able to trace remnants of it adhering to the cave walls at levels above the then surviving portions of the Cave Earth/Breccia unit. However, in Area F (c. 125 ft. inside the cave) where the stratigraphy was more complete, Donovan describes this 18 in.-thick 'stalagmite' as consisting of thin sheets of calcite alternating with beds of pure, laminated clay, and as lying directly above the lateral equivalent of the Cave Earth/Breccia unit. The present author has recently studied the remains of this 'stalagmite' within the cave. It does not appear to be a discrete unit but, rather, a gradational series with calcite laminations becoming thinner and rarer downwards. From the Cheddar Man Fissure inwards, on both sides of the passage, there are very conspicuous signs of mud-cracking (drying rather than synaeresis) in the clastic beds, the walls of cracks having been draped with calcite during each subsequent precipitational phase. In Area F near the south wall, calcite laminations continue to occur below the 18 in. indicated by Donovan and they are separated by water-laid laminated beds, often showing a crude fining-upwards trend from medium sands to clays. W. I. Stanton has demonstrated to the author that, just a few metres further still into the cave on the north wall, there are thick deposits of almost clastic-free, laminated calcite, each lamination consisting of porous accumulations of calcite 'flakes' (known colloquially as 'cave ice') indicating the former presence of a pool at this low point in the ancient phreatic conduit which constitutes the main passage at Gough's. Judging by the merely occasional mention of this 'stalagmite' made by observers other than Davies, and by the nature of the surviving traces, it would appear that it was nothing like a continuous 'floor' right across the passage, save perhaps in the deeper part of the cave.

This, then, completes the observations which, if the synthesis is correct, show a logical, even classic, facies progression from the entrance to the deeper part of the cave.

GENERAL IMPLICATIONS OF THE SEDIMENTOLOGICAL STUDY

Environment

Little can be said concerning the contemporary environment. The evidence for wash and speleothem formation shows that the cave itself, even up-slope of the pool, was at least seasonally damp or even wet, but this is hardly surprising considering its geomorphic position; such evidence would only exclude the most extreme cold and/or dry conditions in the regional environment. One might suggest very tentatively that, had the area been subject to seasonally high rainfall or snowmelt, one would have expected evidence of debris flow or some other high energy process. The lack of appreciable alkali-soluble organic matter would seem to rule out heavily vegetated (temperate) conditions. The present author places no climatic significance upon the occurrence of angular limestone scree in such a setting (Collcutt, 1979, 1984a).

Chronology

It is difficult to estimate the time span represented by the Cave Earth/Breccia unit. It seems unlikely that the wedge could have formed in under a couple of centuries since time must be allowed for the concurrent carbonate precipitation. At the other extreme, as long as the wedge contained no hidden unconformities, it could probably have formed within five centuries, especially if the vegetation cover in the immediate 'catchment' was not so dense as to inhibit sediment mobility. The whole suite of clastic units at Gough's clearly need not represent a continuous time sequence; the clastic input resulting in the Cave Earth/Breccia unit would probably have been 'turned on', and then 'off' again a few centuries later, by relatively minor variation in the altitude of deposits in the Gorge bottom, and/or in the importance of any obstructing talus, near the cave mouth. Certainly, before their removal over the last two centuries, huge scree aprons existed at the base of the cliffs in this part of the Gorge (cf. PLATE 1, opp. p. 96). Such screes are not always due to periglacial phenomena (see the discussion of Holocene finds by Jacobi in this volume).

Qualification to the Above Suggestions

It is reiterated that the 'wedge' has been defined in the present paper using a mixture of information from both published sources and new observations; for want of a better limit, the upper boundary is taken to have been the top of the gradational 'stalagmite'. The age-span estimates and environmental suggestions offered above afford the best approximation available for the bulk of the unit (assumed to date from the Pleistocene). Nevertheless, the probable occurrence of early Holocene microfauna in the uppermost part of the wedge would suggest that the later history of this unit was perhaps a little more complex. Tratman (1975) proposed not unreasonably that the more continuous, uppermost part of the 'stalagmite' is in fact Boreal in age. A further theoretical point is that, in fine detail, the wedge was likely to have been irregularly time-transgressive.

IMPLICATIONS FOR THE TAPHONOMY OF THE ARTEFACTS AND FAUNA

Because of the unusual size, and thus importance, of the Gough's Cave collections, the Palaeolithic artefacts and associated biological finds have long been subject to speculation: do they represent the remains of a single 'culture' or of several, and were they in primary or secondary context?

The Possibility of Mass Transport

The energy levels indicated would not be enough to move at least the larger artefacts and bones very far from their original positions, save perhaps in the lower levels of the unit at its proximal end (near the cave entrance) where coarser exotics were recorded. Had objects been swept into the cave by more violent wash, or had a fast mass movement event gone unnoticed in the recording of the stratigraphy, artefacts and bones should have suffered considerable damage; this is not the case (Jacobi and Currant pers. comm.). Only such light material as charcoal would have been really mobile under these conditions; charcoal is common in the surviving deposits, even as far in as the 'Fonts', an area which would have been very difficult, if not impossible, of access for the Palaeolithic visitors to the cave.

The Reported Artefact Distribution

An interesting feature of the artefact distribution is the vertical spread, with flints apparently present (according to the spit numbers marked individually upon them, i.e. 4-25) in a zone some 11 ft. thick. The top part of this zone has clearly been affected by some type of disturbance (pottery was found down to spit 9, domestic animal bones occurred at least as far down as spit 11, and traces of a Mesolithic presence were recovered as far down as spit 12). Similarly, the lowest 4 ft. 6 in. (spits 17-25) can be accounted for by Parry's observation (1931, p. 47) that the sediments and contained artefacts had been drawn downwards near the cave walls due to preferential drainage (cf. a similar situation at Pontnewydd Cave; Collcutt, 1984b, p. 52). This still leaves an apparent zone about 2 ft. 6 in. thick (spits 12-16 which contained the majority of the Palaeolithic artefacts) to be explained.

The Possible Effects of Trampling

Burleigh, Jacobi and Jacobi (1985) have published data on flint break refits from the cave; the majority of vertical separations between mutually fitting elements appear to be one foot or less. These authors suggest 'treadage and scuffage' as a possible mechanism for such dislocation. However, the present author feels that this process is unlikely to have been significant in such 'coherent' (carbonates, silts and clays) and 'armoured' (limestone clasts) sediment. Many, often rather badly controlled, experiments on trampling have recently been reported in the general literature but marked vertical disturbance has only been claimed in loose sands or very wet muds. Moreover, Hughes and Lampert indicate that the inclusion of coarse debris (for example, shell) will inhibit mixing, and they go on (1977, p. 139) to comment:

The deposit at Seton, a limestone cave excavated by Lampert, displayed good stratigraphic integrity with thin, sharply defined occupation layers continuous over a large area. Precipitated calcium carbonate and tightly packed limestone rubble appeared to be the binders in this deposit.

The Possible Effects of Microtopography

Of relevance here are data from Pixie's Hole (Devon), where the present author (Collcutt, 1984a) uncovered part of an Upper Palaeolithic 'occupation floor' in similar sediments and geomorphic setting to those at Gough's Cave. On a very small scale, flint artefacts at Pixie's could be seen to be distributed in a band c. 10-15 cm thick, with a marked size decrease from top to bottom. Such a distribution is to be expected given the probable 'roughness' of any former stony surface. When the positions of artefacts from a whole metre square were projected on to a single longitudinal (slope-parallel) vertical plane, the apparent thickness of the sloping band increased to 25-35 cm, merely reflecting the increasing amplitude of irregularities as wider horizontal areas are grouped. There is simply no need to invoke trampling to explain such a distribution.

Remaining Uncertainties

Even taking into account a normal degree of irregularity for any former surface, the 'discrete' vertical spread of artefacts (c. 2 ft. 6 in.) at Gough's, together with those few refits which show a vertical displacement of over one foot, might still be considered by some readers, although not by the present author, to constitute something of a problem.

If trampling can be ruled out, so can long-term vertical drift under the influence of artefact mass, form and attitude, a process which is dependent upon either a loose sedimentary matrix or upon a fine sediment which has been repeatedly dilated by biological or moisture effects (cf. Moeyersons, 1978; Barton & Bergman, 1982). The mud-cracking noted above, in addition to being restricted to the upper part of the Cave Earth/Breccia unit, has not been observed to extend in any given episode to more than 10 cm depth and it commonly affects nearer 2 cm.

Parry's statement that '[the] flint and bone implements were distributed through the various layers [spits] down to the floor of the cave [bedrock]' (1929, p. 103) has usually been interpreted to mean that artefacts were indeed dispersed over a significant depth range within restricted horizontal zones, even away from the walls and even discounting the obvious disturbance which some Palaeolithic artefacts suffered during later occupation. However, without the exact figures for the horizontal provenance of each find, there is simply no way that we can evaluate the taphonomic situation, in an area roughly 60 ft x 18 ft., in any detail. One might speculate over a number of possibilities which, singly or in combination, might have helped to create the apparent spread: multiple occupations by the same 'cultural group', within a span of a few centuries; active disturbance (digging) by the inhabitants themselves or, possibly, even by animals; an extremely irregular living 'surface' in places, with later small-scale erosion creating vertical spread in the 'fill' of original depressions; more extensive and widespread zones of subsidence, perhaps associated with permanently wet depressions (cf. Glover, 1979); misunderstanding of Parry's general statements, with the true spread in given areas being less extreme than now feared; etc., etc. However, since the artefacts, radiocarbon dates and biological remains all seem to be internally consistent, the present author can see no advantage in pursuing the matter further unless 'new' primary data are recovered. In the meantime, it is worth stressing that there is absolutely no evidence to suggest that the assemblage is 'mixed' in any gross sense.

IMPLICATIONS FOR THE TAPHONOMY OF THE POLLEN

Finally, the condition of the two sets of old samples described above has a bearing upon pollen analysis at Gough's. It should be noted that no lithostratigraphic importance should be attached to the difference in condition; the operation of diagenetic processes would depend entirely upon very localized sub-surface drainage patterns. Set A showed signs of having been massively cemented more or less concomitantly with clastic sedimentation; given such complete loss of interconnecting porosity, there would have been no possible access for water or fine particles at any later date. The final deposition of any included pollen would therefore be broadly contemporary with that of the mineral material, although the sedimentological data throw no light upon the complex taphonomic stages which would necessarily have preceded inclusion in the deposit. Set B, on the other hand, showed signs of major carbonate remobilization and the development of ubiquitous secondary porosity. The final deposition of any pollen contained in this set could have been at any time(s) between the clastic sedimentation and the date of sampling; indeed, given the resurgence activity leading to flooding recorded in the historical past (but absent from the later Pleistocene sedimentation pattern itself), the actual pollen would almost certainly be markedly diachronic.

Now, in all cases where enough material was available, the samples studied by Leroi-Gourhan (in this volume) were each split into two portions, only one portion being used for pollen extraction; the remaining portions of each sample constitute the study material described here as Set A (note that the present author did not see Leroi-Gourhan's samples 11, 13 and, more importantly, the second, apparently polluted sample from spit 14; *ibid.*). The samples used by Campbell (1977) were totally destroyed in the process, before they could be examined by a sedimentologist. Campbell assumed that these cemented samples had been collected during the Parry excavations; they were housed, along with those samples of Set B from spits 13-12 described above, at Cheddar. Campbell (pers. comm.) did not note the precise condition of the geological matrix of his study material, so that there is room to suggest that his samples might also have been vuggy. On the other hand, there is no absolute reason why any analysed palynological sample should have been in an identical condition to the others now remaining in its group (cf. the different conditions noted within the samples from the Cave Management Collection). It is worth pointing out that no amount of cleaning or surface stripping of vuggy samples would suffice to remove pollution which had occurred prior to sampling.

Both Campbell and Leroi-Gourhan were informed of the arguments presented in the present paper before this volume went to press.

FUTURE SEDIMENTOLOGICAL RESULTS FROM GOUGH'S CAVE

The present study seeks to provide a synthesis of the geoarchaeological information available from existing documentation and samples. However, the surviving sediments in Gough's Cave, although mainly restricted to patchy remnants adhering to the cave walls, are still of the greatest interest. The need to understand Britain's most productive Later Upper Palaeolithic cave site in all possible detail makes it imperative that these remnants be preserved for future research.

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