Proc. Univ. Bristol Spelaeol. Soc., 1982, 16 (2), 93-104.

MELLS RIVER SINK — A SPELAEOLOGICAL CURIOSITY IN EAST MENDIP, SOMERSET

by

W. I. STANTON

ABSTRACT

The site is a cleft in the side of the Mells River that acts as a resurgence in winter and a swallet in summer. An excavation, 1974-78, began 21m above, and ended 2m below, river level. It showed that a high-level resurgence was active in the Middle Devensian, and was buried under later deposits. Scattered finds of archaeological significance included Woolly Rhinoceros bones and a First Century bronze brooch. Water tracing experiments proved that the Sink is the upper end of an active underground oxbow to the Mells River, 2.5 km long. The cleft was developed along a neptunian dyke of Lower Lias age. Bubbling springs and 'cave coral' are briefly discussed.

INTRODUCTION

The Mells River rises at Gurney Slade and flows east below the north flank of the Mendips to join the River Frome at Frome. It receives water from the Carboniferous Limestone resurgences of Winter Well, Gurney Slade, Ashwick Grove, St. Dunstan's Well, Whitehole, Cobby Wood, Hapsford and other smaller springs (Barrington and Stanton, 1977). Some of these resurgences fail in dry weather, and one of them, Mells River Sink, is so close to the river bed that, at times, the spring flow actually reverses and part of the river disappears down the hole. In the drought summer of 1976 about one quarter of the Mells River was lost into Mells River Sink.

At the village of Mells the Mells River leaves undulating low ground to enter a wooded gorge (Wadbury Valley) incised by superimposed drainage into the north flank of East Mendip (Barrington and Stanton, 1977, p 220). For 3.5 km downstream of Mells the river descends relatively steeply between outcrops of Carboniferous Limestone before it emerges again into low ground at Hapsford. Mells River Sink is close to the upstream end of the gorge (Fig. 23). Water tracing experiments have shown that it is the upper end of an underground oxbow or alternative river course that traverses the Carboniferous Limestone stretch of river bed, emerging at Hapsford Spring.

The Sink itself is a vertical cleft in a limestone outcrop on the south bank of the river. Its natural width at river level is about 0.6m, but within 14m of the river it has been widened at some time in the past, apparently to win stone. This widened portion is approached by a creek or blind inlet of the river, the water in which moves to or from the river, depending on whether the site is functioning as a resurgence or as a sink. Early 1:10560 maps of the area (revised 1902) show this creek at right angles to the river. It is evidently an old-established feature. Water

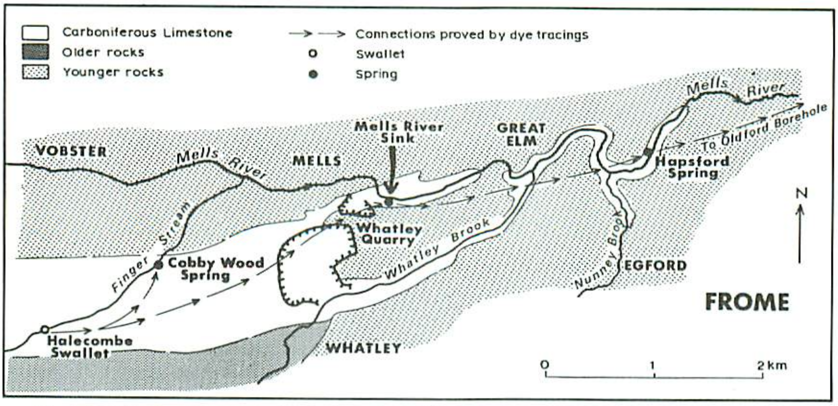


Fig. 23. Site location map including simplified geology and underground flow lines.

sinks or rises through gaps in the mud and vegetable rubbish forming the bed of the creek, showing that the cleft, probably filled with stones, underlies it as far as the river.

In 1974 the creek was still separated from the river, at low water, by a masonry wall crossing its entrance. The remains of this wall, built of massive limestone blocks and lime mortar, extend along the river bank for several metres upstream and downstream of the creek (Fig. 24). The wall is unique to this stretch of the river, and its function appears to have been to prevent the river leaking into the Sink in dry weather. A short way upstream of the masonry wall is a broken line of large sloping rock slabs that may have faced off an earth dam built to block a zone of infiltration into the stony river bank—a loss of water that is still to be seen in dry weather.

The wall was probably built by the Fussells, the 18th to 19th century ironmasters (Atthill, 1971, pp68-94), whose edge-tool works were situated only 300m downstream of the Sink. Its purpose would have been to conserve low flows in the river for the benefit of their water-powered machinery. It was badly damaged about 1977 by flood flows pouring over a fallen tree that jammed across the river.

A small cave excavation was carried out at the Sink about 1960 by the late Mr. D. Mitchell of Frome. Mr. Mitchell recalled, in 1974, that water flowing out of the cleft had sunk underground before reaching the river. Such behaviour has not been recorded subsequently.

THE EXCAVATION

Mells River Sink is within the estate of the Earl of Oxford and Asquith, of Mells Manor, and in 1974 the Earl kindly gave permission to a group from the Wessex Cave Club, including the author, to carry out a general investigation of the Sink by digging.

Work began in July 1974 when the Sink was accepting a large stream. The flow was dammed off, inconveniencing a number of bull-heads, freshwater crayfish and assorted tiddlers. Tests were initiated which proved that the crayfish were no culinary delicacy, tasting rather

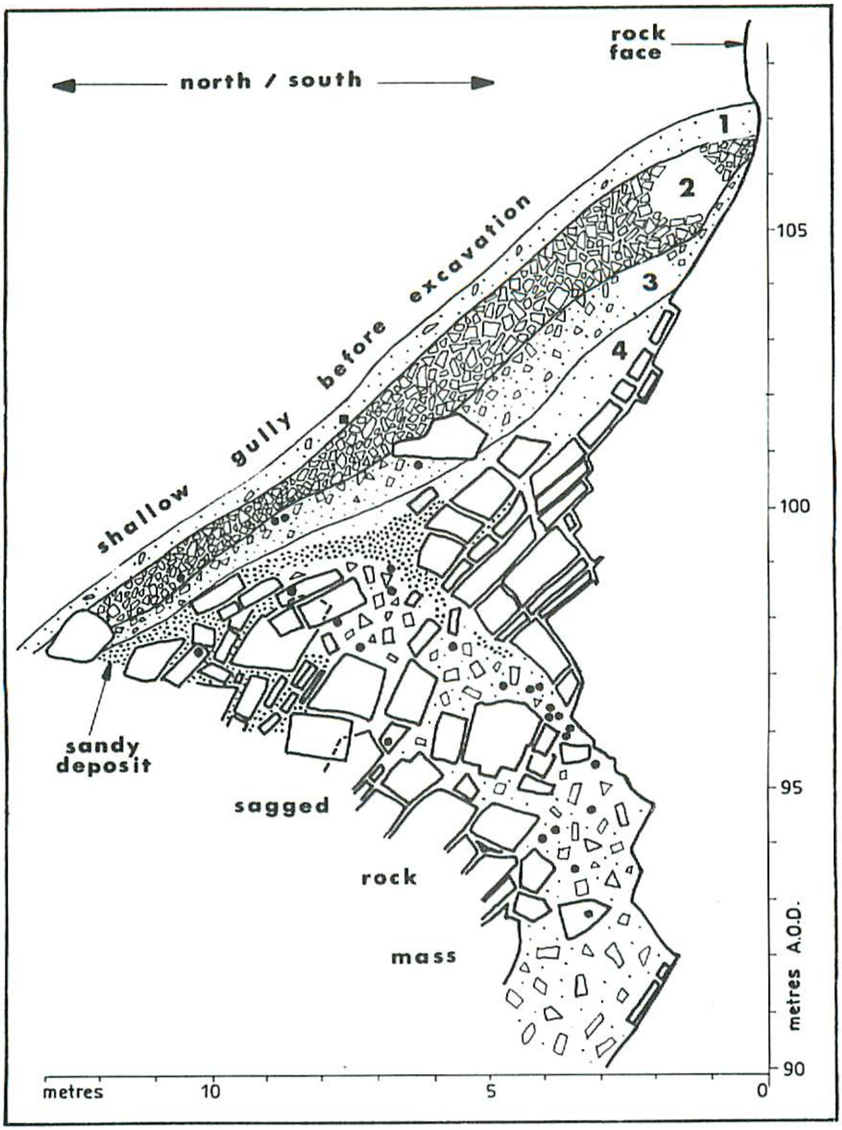


Fig. 24. Plan and sections of Mells River Sink after excavations.

of the Mells sewage treatment works that discharges a few hundred metres upstream.

The natural route of the influent stream was found to be quite steeply downwards through a mass of blackened stones and waterborne organic rubbish. It entered the cleft some 2m below river level. The cleft was followed into the cliff for 4m, but this line of approach became difficult when it expanded to more than 1m in width and showed no signs of developing a solid rock roof. Instead, it was full of loose clean

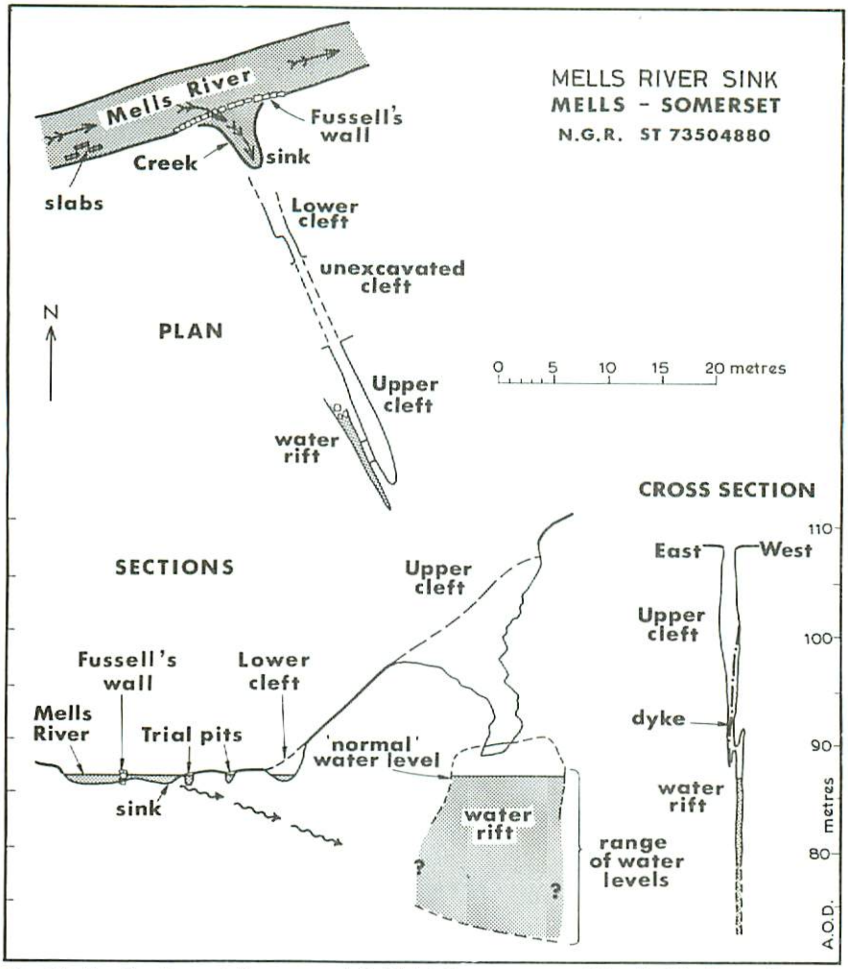


Fig. 25. Section through the upper cleft. Thick lines: measured detail; thin lines: diagrammatic detail. Solid circles: bones. Solid square: brooch. Layers figures 1 to 4.

scree right up to the hillside 4m above. Heavy rain in September caused the Sink to become a spring with an estimated output of 9000 cubic metres daily, and outflow continued at varying rates throughout the winter.

Digging resumed in May 1975 when the spring flow reversed. This time the outcrop of the cleft was traced up the hillside by superficial excavation until it became roofed over, 45m distant from the river and 21m above river level. By starting afresh at this high level the diggers hoped to follow the cleft into the hill under a solid rock roof, but there proved to be no significant overhang, only a rock face sloping at roughly the angle of stratal dip, 50° to 60°N. It was decided to entirely clear out the cleft, from the top down.

A very large quantity of debris was removed and tipped on the hillside. As the tip was clearly visible from the public footpath on the opposite side of the river it was progressively planted with ivy, ferns and other ground cover, which rendered it fairly inconspicuous.

In the course of this work it was discovered that the cleft contained interesting archaeological deposits, in four distinct sedimentary layers sloping parallel to the hillside. These are described later. The excavation followed the cleft down to a depth of 23m, i.e. to 2m below normal river level. The cleft was up to 3m wide, and soon began to resemble a miniature Cheddar Gorge. In its upper part its contents consisted of material fallen from above, but lower down, below 99m A.O.D., it contained very large rock masses almost *in situ*. Originally these were part of the back wall of the cleft, but they sagged away from it in the distant past and became gigantic shattered chockstones where they jammed in the cleft a metre or two further down. They still retain some coherence, as the section, Fig. 25, shows. The nose of the remaining overhang was loose and ready to follow them (Fig. 25) and was removed for safety's sake. Other loose areas were cement grouted.

Below 90m A.O.D. the cleft splits into two narrow parallel vertical rifts, with a thin rock partition between them. The western rift, which became known as the water rift, was reached by following a horizontal joint for one metre westwards from the cleft. The eastern rift was choked, but the water rift was open and 15 to 25cm wide. It could be seen to trend N-S for at least 10m, and contained water at least 13m deep when it was first reached in November 1976. By blasting and cement grouting one side of the water rift it was made passable down to water level, when work ceased, in June 1977.

In the 1978 autumn, which was particularly dry, the water surface in the water rift fell substantially. Water could be heard falling some 10m below its 1977 level, and it was found that the noise of the fall could be reduced by stopping flow from the Mells River into the surface sink. Rocks thrown down still plunged into deep water. The rift did not seem to widen in depth. Loose roof areas were stabilized with cement, but before much enlargement of the rift was achieved the drought ended and the working face was submerged. Further excavation awaits a prolonged fall in water level.

THE DEPOSITS

Fig. 25 is a generalized section through the deposits as excavated. Essentially they consist of 3 sedimentary layers sloping at a steep angle and resting on a massive boulder ruckle, at the top of which are sandy deposits forming a fourth layer.

Layer 1, which was usually 0.5m thick or less, consisted of superficial humus above a brown more or less stony loam.

Layer 2 was nearly 2m thick at the top of the cleft, but thinned to around 0.6m further down. It was an unsorted mass of angular limestone fragments of all sizes up to large block, with occasional restricted areas of earthy matrix. Typically the voids between fragments contained coatings of white cotton-wool-like moonmilk (Williams, 1959); usually damp, fresh and fluffy but sometimes dry and dull with a greyish tufaceous appearance. The deposit showed every sign of being a simple limestone scree, derived locally at a time when vegetation was scarce, probably in a cold climate.

Layer 3 was up to 1.5m thick near the top, thinning to 0.3m lower down. Like layer 2 it consisted mainly of angular limestone fragments (sometimes showing solution rounding), but they were smaller and set in a plentiful matrix of dark grey to black soil, often impregnated with moonmilk. The contact with layer 2 was sharp, marked by the entry of the dark matrix. The dark colour appears to be of mineral (manganese oxides) rather than carbonaceous origin.

Layer 4 is a general term for a complex deposit that, unlike layers 1 to 3, partly accumulated under water. At the base of layer 3 the soil colour changes rapidly from blackish to brown, and the soil becomes a clayey loam in the highest part, with fewer stones. Lower down, below 101m A.O.D., the loam gives way to sand and stones lying on, and tightly packed into the gaps of, a massive boulder ruckle. A sample of sandy material was found to contain 40% clay and silt. In the remaining 60% sand, insoluble grains (limonite and manganese ores, chert, silicified fossils and quartz; mostly rounded shapes) exceeded soluble grains (limestone and calcite; mostly subangular shapes). The sand is not, therefore, derived from the Old Red Sandstone, but appears to be local material from the Carboniferous Limestone and Jurassic rocks that has been sorted and packed by flowing water.

Lower down in layer 4 the sand was absent and the gaps between boulders were open, often coated with moonmilk. Many boulders had phreatically sculpted, solutionally etched, surfaces. Between the main ruckle (the sagged rock masses mentioned above) and the back face of the cleft was a gap 1 to 2m wide full of loosely jammed smaller rocks. At least one quarter of this deposit consisted of open voids. Below 97m A.O.D. stalactitic 'coral' was locally present on the edges and upper faces of stones. It is discussed in a later section. Stiff brown structureless mud also became common, filling voids in certain areas of the ruckle.

The layer 4 ruckle began to pass, below about 93m A.O.D., into rock that was cracked and broken but still in place. This rock formed the vertical partition between the water rift and the main fissure. Large deposits of the stiff brown mud occurred in this area, and the coral was universally present down to normal water level at 87m A.O.D.

A feature of the contact between layers 3 and 4 was its usually convex-upward section. There was often little or no earthy or sandy matrix at the top of layer 4 where it abutted against the rock faces, and it was surmised that rainwater trickling down the east and west faces of the cleft might have washed out the fine fraction of layer 4, allowing the remaining stones to compact and changing an originally flat surface to one that was highest in the middle and lowest at the edges.

All the layers, except possibly layer 2, contained widely dispersed smooth rounded pebbles of quartz and, less commonly, quartzite. The largest was 7cm in diameter. In layer 4 they occurred down to 99m A.O.D. At first they were thought to have archaeological significance, as possible slingstones or gaming stones, but their wide distribution through the layers makes it far more likely that they were weathered out of the pebbly basal beds of the Jurassic strata that rest unconformably on the Carboniferous Limestone a short way upslope of the cleft.

ARCHAEOLOGY

Some 50 bones and bone fragments were found in the excavation and have been identified by Mr. A. P. Currant of the British Museum (Natural History). His account forms Appendix 1. Other archaeological material was examined by Mr. N. Cook of Wells Museum. There is no indication that the site was ever used as a habitation by man or beast.

In layer 1 were found several fragments of a late 15th century crock of red paste with a brown lead glaze over a simple pattern in white slip, perhaps Donyatt ware. Among a few small pieces of rusted iron was part of a wide mediaeval horseshoe. The phalanx of pig came from this layer. A notable find from the base of the layer was the 1st century brooch or toga pin of silvered bronze (Plate 4). Much of the silver coating has vanished but the brooch is otherwise uncorroded and in perfect working order. Its position so deep in the layer may be due to mass movement or the work of burrowing animals.

Layer 2 was effectively barren, only one unidentifiable bone fragment being found. Layer 3 produced 3 unidentifiable pieces of degelatinised bone with deeply corroded surfaces.

The bulk of the bone material came from layer 4, where it was present in the voids of the boulder ruckle down to 94m A.O.D. The fox bones were found close together at 97m A.O.D., close to the back face of the cleft, and probably represent one animal that fell or crawled into the ruckle. The Woolly Rhinoceros bones appear to be portions of the fore-legs of a single young individual. The other identifiable bones from this layer are of horse, reindeer and bovid. Mr. Currant comments that layer 4 can be confidently placed in the Pleistocene and "the presence of *Coelodonta* suggests a cold stage, either Middle Devensian or earlier, as there is no evidence of this animal surviving into the Late Devensian in Britain".

INTERPRETATION — THE FOSSIL RESURGENCE

Layers 1 to 3 are subaerial deposits that accumulated on the floor of the cleft at the angle of rest of the hillslope. Layer 2 is apparently a frost-broken scree and its barren nature suggests that it represents the last periglacial phase (Late Devensian, maximum cold about 19,000 B.P.) (ApSimon, 1979). If so, layer 1, containing the Roman brooch, is Post-Glacial. Layer 3 either represents an interstadial, or it is the base of the same scree deposit as layer 2, into which all the fines have been washed by percolating water.

Layer 4 (Middle Devensian or earlier) shows no sign, other than the presence in it of Woolly Rhinoceros and Reindeer, of being a periglacial deposit. The topmost portion, above the sand deposits, is a stony clayey loam, not a frost-broken scree. The significant change in layer 4 begins with the sand deposits, which were sorted and packed into the gaps in the boulder ruckle by flowing water. Above the sand, layer 4 is a sub-aerial deposit like the layers above it.

The complex nature of layer 4 is explained as follows. The section (Fig. 25) is in fact a section through a fossil resurgence. When the great rock mass sagged away from the back face of the cleft, as mentioned above, it must have obstructed the existing resurgence lower down and, at the same time, opened a gap full of loose rubble up which the dammed-back waters could rise and overflow. The rising water re-adjusted the fallen debris, washing stones, gravel and sand into the gaps in the mass, tending to plug any leaks*. At times of flood the main route up through the gap was kept clear, but brown mud accumulated in stagnant backwater areas. At times of low flow the water level dropped, and small animals, and the bones of large ones, were able to penetrate down into the ruckle.

When the fossil resurgence was active, perhaps 30,000 years ago, the Mells River would have been flowing at a level several metres higher than its present bed.

In summary, the deposits are interpreted as follows:

Layer	*Description*	*Age*
1	Brown stony soil and humus	Post-glacial to recent
2	Limestone scree without matrix	Late Devensian (frost-broken)
3	Scree with dark soil matrix	
4 (upper)	Brown stony loam	Interstadial
4 (lower)	Sands of fossil resurgence	Middle Devensian

GEOLOGY

The Carboniferous Limestone at Mells River Sink dips north at 55 to 70 degrees. This is normal for the vicinity. The cleft follows a dip joint occupied by a vertical neptunian (i.e. sedimentary, not igneous) dyke of Lower Lias (Downside Stone) that varies in thickness from 0.1m to 0.5m.

Most of the Lias dyke consists of a medium-grained calcarenite composed largely of angular calcite grains (mostly crinoid fragments). Locally the rock carries rounded and polished grains and ooliths of ochre and limonite. Similar grains form a significant proportion of the sand in layer 4, where they are replaced to varying degrees by black manganese oxides.

* The sealing of quite large fissures in solid limestone, or the gaps in a boulder ruckle, by fast-flowing streams moving a bed load of coarse sediments, is observable in caves and surface river beds. Cobbles jam across the widest fissures, the smaller gaps between cobbles are plugged by pebbles, and gravel, sand and silt in turn block the remaining openings. The packing tends to be very tight in underground situations because of the pressure of ponded-back water.

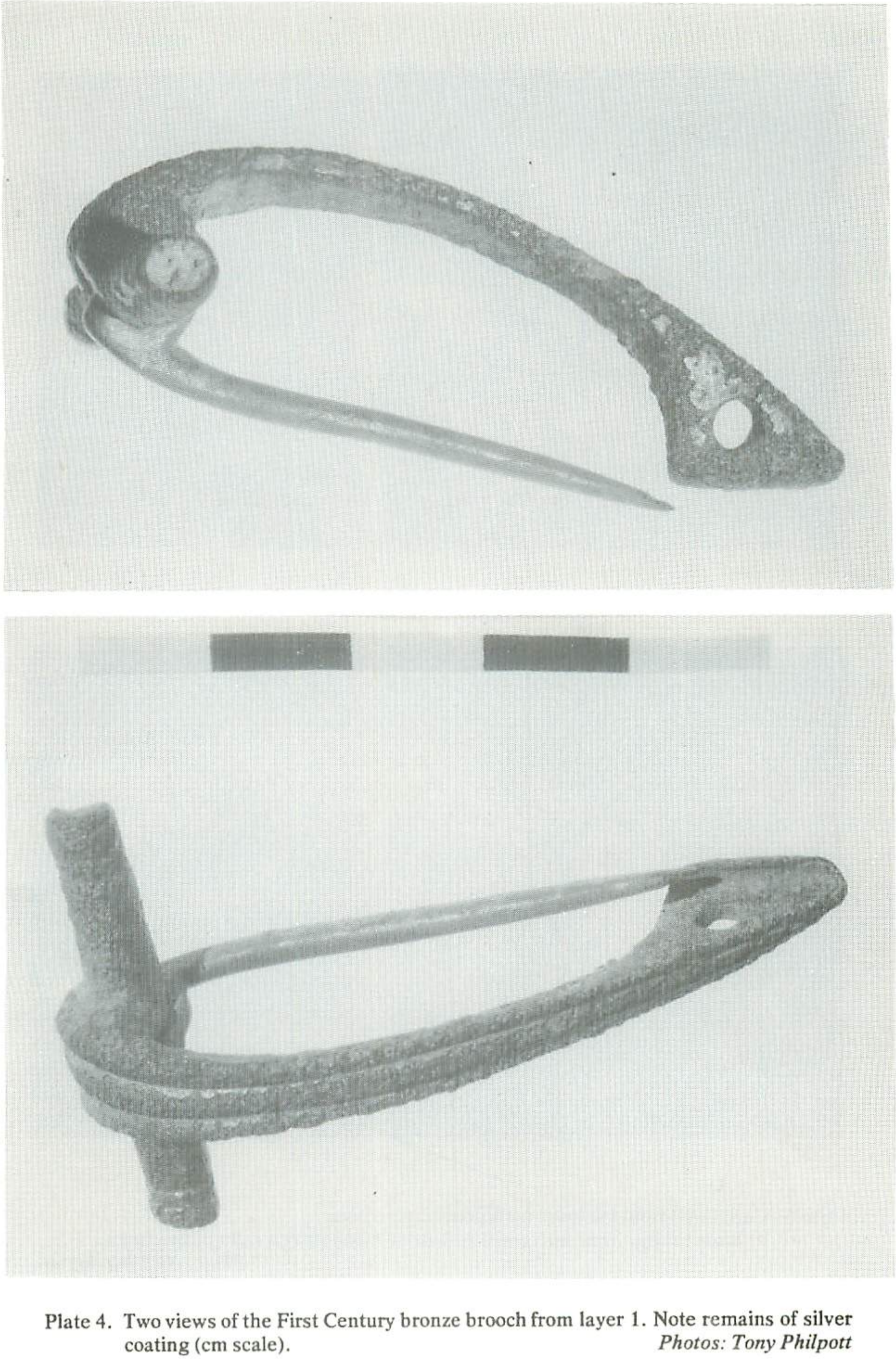
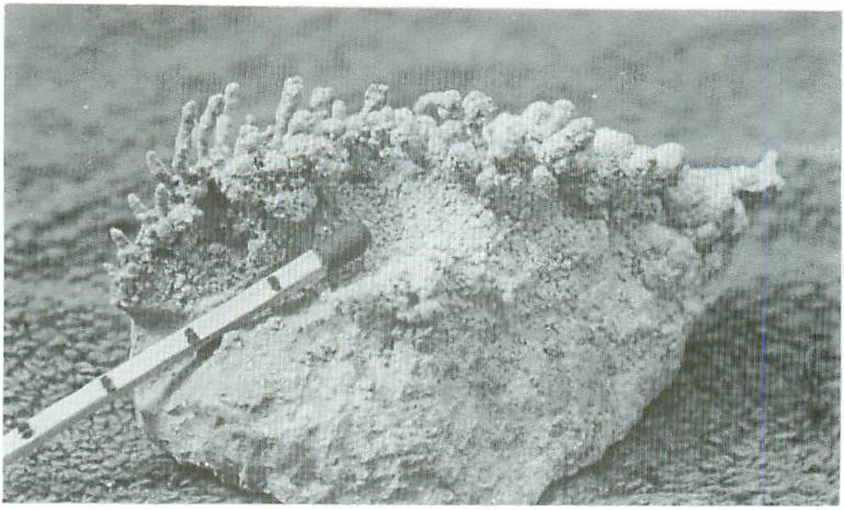


Plate 4. Two views of the First Century bronze brooch from layer 1. Note remains of silver coating (cm scale). *Photos: Tony Philpott*



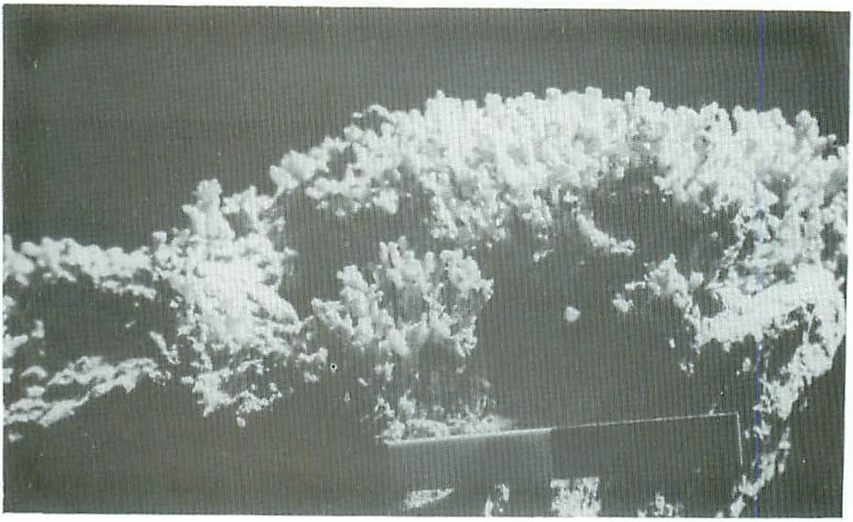


Plate 5. Cave Coral from the fossil resurgence. (cm scales).

a) Stout twiggy coral, encrusted with dried moonmilk on right of specimen.

Photo: Nick Barrington

b) Many-branched coral. *Photo: Tony Philpott*

At 98m A.O.D. the dyke splits into two parallel vertical branches, one of which wedges out. At 92m A.O.D. it becomes a yellow porcellanous limestone enclosing a breccia of Carboniferous Limestone fragments.

Similar dykes of Lower Lias are not uncommon in the neighbourhood. Many have been encountered in Whatley Quarry (Stanton, 1982), and one was cored in a borehole drilled by Wessex Water Authority in 1973, 180m east of the Sink. The dyke under consideration formed a line of weakness that guided the development of the cleft. Flakes of stone from it were present at all levels in the loose debris at the back of layer 4.

HYDROLOGY

The Mells River flows from west to east past Mells River Sink, and water tracing experiments, 1973-75, showed that underground water in the Carboniferous Limestone moves in the same direction at a level several tens of metres lower (Fig. 23). In winter the water table is higher than the river, and the Sink emits water at up to 9000 cubic metres daily. In a dry year such as 1978 the autumn water table stands 15m or more below river level (not only in the vicinity of the Sink but in the whole limestone outcrop between Mells, Whatley and Hapsford, as shown in a borehole network drilled by Wessex Water Authority, 1978-80) and up to 2000 cubic metres daily flows into the Sink from the river. The input is limited by the remains of the Fussells' wall, by chokes of waterborne rubbish, and by the low level of the river in dry weather.

In the water tracing experiments mentioned above, dye poured into the Sink reached Hapsford Spring (Fig. 23) four days later. At the time (June 1975) much more water was entering the Sink than was emerging from the Spring, which dried up, as it does in most summers before the dye pulse ceased. The Water Authority study has shown, by contouring the water table as measured in the borehole network, that the remainder of the dyed water (plus all the other groundwater of the limestone aquifer between Mells and Hapsford Spring) must have travelled a further 3000m northeast to the Oldford Boreholes (ST 786.506), which yield about 16,000 cubic metres daily for public supply and industry. En route, the water transfers from Carboniferous Limestone up into Inferior Oolite, the aquifer tapped by the boreholes. (For a description of transfer caves, see Barrington and Stanton, 1977, p53.) In a dry summer the water table stands below river level all the way from Mells to Oldford, and there are no other outlets for the groundwater.

The underground streamway from Mells to Hapsford and beyond is presumably totally phreatic in winter and partly vadose in summer, i.e. a paraphreatic cave (Tratman, 1957). It may well be a significant cave system, passable to cave divers over part of its length. Such underground oxbows to surface streams are not uncommon; other British examples are Porth yr Ogof in South Wales and the River Manifold sinks in Derbyshire, and the subterranean sections of the Chapel Beck near Chapel-le-Dale in Yorkshire. Similar underground oxbows must have existed in the distant past when Mendip's dry valleys carried streams, and some of the shallow phreatic cave systems (e.g. Flower Pot, Ubley Warren Swallet, St. George's Cave) and many of the sinkholes that are known beside and beneath dry valleys may be the truncated relics of such oxbows (Barrington and Stanton, 1977, p219).

The great quarry at Whatley (Fig. 23) began sub-water-table working in 1978 and now pumps out as much as 9000 cubic metres daily to keep the low levels dry. This has caused a significant drop in the Carboniferous Limestone water table between Mells and Hapsford. As a result, Mells River Sink has not 'sprung' since the 1980 winter. It seems likely that there will be no more natural reversals of flow until the quarry is abandoned. One consequence has been that the surface sink is now very heavily choked with waterborne rubbish, which used to be flushed out every winter when the sink became a spring.

A small black fish was seen underground in the water rift during the excavation in June 1977. It was not captured or identified.

CURIOSITIES

The Bubbling Springs It was typical of Mells River Sink, and still is typical of Hapsford Spring, that when they were active springs they emitted swarms of gas bubbles. Emission was most intense when spring flow resumed after a period of failure, but it continued throughout the period when the springs were flowing. The bubbles appeared to rise through holes in the bed of the spring, whether this consisted of stones, sand or waterborne rubbish. Emission of a train of bubbles from any one point was only repeated after a long interval. It seemed that the gas was released in a rush from storage in porous material when a significant volume had collected there.

Samples of the gas were taken for analysis, which was kindly carried out by Dr. J. Andrews of Bath University and by Dr. B. Colenutt of Brunel University. The gas was found to be air, with a proportion of carbon dioxide slightly higher than normal (exact proportion not determined).

Other springs beside Mells River Sink and Hapsford Spring are known to emit gas bubbles in amounts large enough to suggest that they too consist of air rather than organic decomposition products. Local examples include the spring at Great Chalfield Manor, Holt, Wiltshire (ST 859.631) and the Roaring Springs near North Wraxall, Wiltshire (ST 821.743). The Hot Springs at Bath also evolve large volumes of gas, which appears to consist (Dr. J. Andrews, pers. comm.) of air from which the oxygen fraction has been lost by oxidation underground.

A feature common to all the springs mentioned, except the Hot Springs, is that they periodically dry up as the water table falls below spring level. It is suggested here that, in the case of Mells River Sink and Hapsford Spring, air which enters the cave system at times of low water table is trapped under pressure in blind cavities when the water rises again. The compressed air dissolves to excess in the groundwater and is released when pressure returns to normal at the spring.

The Cave Coral 'Cave coral' was present in some abundance in the voids between rocks in layer 4, from 99m A.O.D. down to 90m A.O.D. It occurred in several forms, notably as stout twigs up to 15mm long, thinnest at the base and sometimes branching (Plate 5a) or as multiple-branched fuzzy clumps (Plate 5b). The colour is pale grey, often seeming dirty, seldom pure white. Coral is found in voids as little as 20mm across. It is clearly not a splash deposit, as has been proposed for cave coral elsewhere in Mendip (e.g. Balch, 1948, p114), no doubt correctly in some cases.

The coral at Mells River Sink is confined to the fossil resurgence in layer 4, from the sand layer at the top down to normal water level in the water rift. This is the zone that has been subject to periodic flooding, and, without going into detail, the coral seems to have grown as a result of that flooding, possibly at times when the ruckle was drying out after a fall in water level. It is almost always found on the upward-directed faces, and particularly the sharp edges, of rocks. Little or none was seen on downward-facing surfaces. Hill (1976, p13) notes that all theories of subaerial cave coral formation link it with thin films of water and, except in splash deposits, with surface tension effects.

The voids in the ruckle also contain moonmilk, which must have grown when the ruckle was relatively dry. It is often intergrown with the coral, and seems at times to have been inundated, when it has shrunk or coagulated into blebs on the heads of coral twigs, or into thin felted layers which have dried to cracked tufaceous material. The regular association of cave coral and moonmilk is interesting for the way it points to a repeated cycle of conditions favouring first one and then the other type of calcite deposition in the ruckle environment.

ACKNOWLEDGEMENTS AND CONCLUSION

The diggers are grateful to the Earl of Oxford and Asquith for his permission to carry out the excavation.

Archaeological finds from the site are lodged in Frome Museum. Samples of the cave coral are on display in Wookey Hole Caves Museum, and the author has others which could be made available for study. A large part of the deposit remains unexcavated (Fig. 24).

109 working visits were paid to the excavation. The regular diggers were Alan Clarke, Tom Davies, Will Edwards, Bob Elliott, Terry Tooth, Roy and Lyn Vranch and the author. The digging team intends to return to the site when water level conditions are favourable.

REFERENCES

APSIMON, A. M. 1979 Ice Age man on Mendip: old finds in new contexts. *Proc. Univ. Bristol Spelaeol. Soc.*, **15**, 91-106.

ATTHILL, R. 1971 *Old Mendip.* David and Charles (2nd. ed.)

BALCH, H. E. 1948 *Mendip, its swallet caves and rock shelters.* Bristol (2nd. ed.)

BARRINGTON, N. and STANTON, W. I. 1977 *Mendip, the Complete Caves and a View of the Hills.* Cheddar Valley Press.

HILL, C. A. 1976 *Cave Minerals.* Nat. Spelaeol. Soc.

STANTON, W. I. 1982 Further field evidence of the age and origin of the lead-zinc-silica mineralization of the Mendip region. *Proc. Bristol Nat. Soc.* (in press)

TRATMAN, E. K. 1957 A nameless stream: suggested new term. *Cave Res. Gp. Newsletter* (68-9), 6.

WILLIAMS, A. M. 1959 The formation and deposition of moonmilk. *Trans. Cave Res. Gp. G.B.*, 5, 133-138.

APPENDIX

MAMMAL REMAINS FROM MELLS RIVER SINK

by A. P. CURRANT

The following animals are represented amongst the material recovered from the 1975-76 excavations.

Rodentia, indeterminate postcranials, recent, ?intrusive.

cf. *Vulpes vulpes* (red fox), small fragment of a mandibular ramus; 5th or 6th thoracic vertebra; 2nd or 3rd lumbar vertebra; distal end of left scapula; distal end of right humerus; proximal end of right ulna lacking the olecranon process; proximal end of right radius; shaft and distal end of left femur; left tibia; right tibia; right tibia of a juvenile; proximal ends and shafts of right metatarsals 2, 3 and 4; proximal end of left metatarsal 4. With the exception of the juvenile tibia all of this material could belong to a single individual.

Coelodonta antiquitatis (woolly rhinoceros), shafts and distal ends of associated left and right humeri; shaft and distal end of left metatarsal 2; phalanx.

Equus ferus (horse), distal end of left scapula.

(*Sus scrofa* (pig), phalanx, recent, preservation very distinctive.)

Rangifer tarandus (reindeer), shaft of right femur, two fragments of metapodial.

A large bovine, cf. *Bos* or *Bison*, phalanx.

The distal end of a large bird ulna—undetermined.