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MANOR FARM SWALLET, CHARTERHOUSE-ON-MENDIP, SOMERSET AN ACCOUNT AND GEOMORPHOLOGY

By
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ST 49795563

[Note: P. L. Smart has contributed the Account, Geomorphology and photographs. W. I. Stanton has provided the Survey and notes on the same. Editors].

The entrance to Manor Farm Swallet is located immediately South of the farm of this name at Charterhouse, Mendip and at an elevation of 230m. The swallet is the most easterly of a line of sinks formed at the boundary of the Lower Limestone Shales and Carboniferous Limestone on the southern flank of Black Down. The cave has a surveyed length of 882m and a depth of 151m. Permission to visit the cave should be obtained at Manor Farm from the owner, Mr. Jefferies, who has the key. The normal access route is over the old footbridge to the East of the road and 100m down the valley to the concrete blockhouse which caps the entrance shaft.

HISTORY OF EXPLORATION

The site was first examined during Easter 1947 by P. Stewart and members of the ACES. A series of shafts were excavated at the sink point by various groups up till 1952 when a maximum depth of 8m was reached (Harvey 1950, Stewart 1952). Although at least two of these were shored all either collapsed or were filled in by flooding before reaching any open passage, though the 1952 shaft did reach "a portion of stalgmite bank". Stewart suggested that "The shaft is not yet over the entrance in my belief and a small gallery must needs be constructed. There will probably be a great degree of infilling of clay and compressed mud" (p15-16).

The UBSS started digging at the sink in 1955 with much the same results, the shaft being filled each winter and re-excavated each summer. In 1961 a concrete pipe shaft was installed and this was deepened progressively until 1966 when at −16m a passage was entered 15m long with the stream flowing through it (Norton 1969). Before it had been surveyed or adequately shored the passage collapsed and the following winter the unsupported entrance shaft tilted and sank.

It was decided that a stable artificial entrance shaft was necessary and blasting commenced in bedrock some 10m down valley from the sink. Work continued for the next two years resulting in a 14-m shaft (Pl.30A) with several headings none of which interesected the cave. On July 8th 1968 a collapse 6.5m by 8.5m and 12m deep opened East of the UBSS dig. It was formed by collapse of a debris filled swallet which was undermined by flood waters. A choked bedding passage and narrow draughting rift drained the collapse to the south. The latter was blasted open 11m to an unstable boulder choke. This rift was also joined to a heading from the base of the artificial shaft. Work by UBSS ceased at this point.

NHASA, a miscellany of diggers from many different clubs, commenced work at the site in May 1972, installing a fixed ladder in the artificial shaft and walling off the base of the collapse. Digging was started in the choked bedding passage to the East of the UBSS rift and a railway installed. By September progress had been good and an open rift in the floor was found and blasted open (September Rift) to allow entry to Penthouse Chamber. Here the main mass of the 1968 collapse was encountered blocking the way on. The fill was attacked at the lowest point (P1.31A), the spoil being stacked in polythene sacks in Penthouse Chamber. Enthusiasm and stacking space diminished during the winter of 1972/73 and the dig required frequent blasting to encourage drainage and aid in the removal of large rocks. On Wednesday 5th September, 1973 after the previous weeks bang rubble was cleared, open cave was entered and explored to Albert's Eye, which was finally passed on the 13th opening the remaining portion of the cave. The aven was climbed on the 19th and the inlet explored (BEC and NHASA logs). In all approximately $40m^3$ of material has been excavated to enter the cave, $30m^3$ by NHASA and $10m^3$ by UBSS in the blasted passage and shaft. This does not of course include the numerous surface shafts, the shaft headings, and the UBSS dig.

BRIEF DESCRIPTION OF THE CAVE

The cave is entered by a 14-m blasted entrance shaft which leads via a further blasted section to the abandoned UBSS dig on the right. This ends in a loose boulder ruckle after about 10m, and takes water from the blasted section and the 1968 collapse. The latter has now been blocked, but is located behind a stone retaining wall on the left of the passage. After some 10m running down dip, there is a narrow 6m climb down – September Rift. At the bottom of September Rift a stream enters from a low bedding passage which ends below the 1968 collapse in breakdown and fill. The cave continues down dip with a boulder floored stooping passage through Penthouse Chamber partially filled with dug material from the next section of passage. After 30m a chamber is entered with an impressive curtain on the left.

A major inlet (105m long) enters this chamber from the East – Upstream Passage. After a squeeze this passage opens up under a false floor and leads into a small chamber with an aven in the east wall. The walls of this chamber are plastered with a rich, stinking organic sludge derived from the farmyard. The passage continues with a low section leading into a further chamber some

25m long. The stream enters from a cross rift near the upper end of this chamber. A 3-m climb up leads into this rift and a narrow rough passage, which becomes too tight. Water enters from several cross rifts in this passage, all of which are too narrow to enter. The whole inlet climbs steeply upwards and the end is only 7m below the surface in the farm garden.

From the Curtain Chamber a 6-m climb down a waterfall leads to the bottom of a vadose canyon some 3 to 5m high. The climb may be avoided completely by following the inlet passage stream under the stalagmited boulder floor of Curtain Chamber in a small steep vadose trench. The canyon continues steeply with several short climbs down a series of large gours, which have been breached by the present stream. It ends in a short squeeze in stalagmited boulders – Albert's Eye. A rift some 8m high is entered with very fine crystalised flowstone formations deposited on a re-eroded fill of limestone, chert and shale debris with a coarse sandy matrix. Re-erosion of this fill has also produced several sections of false floor in the passage down to the junction with the aven tributary.

The aven tributary, 85m long, enters from the west and comprises a short section of walking passage leading to an aven, 7m high. At the top of the aven an inlet passage enters from the north-east carrying a stream, which may be partially derived from the UBSS dig. At the junction with the main passage several dry avens are present.

The main passage continues with a scramble down beside a huge re-eroded flowstone mass. The roof is developed along a bedding plane, though there is evidence of an earlier rift in places. A fine sinuous curtain and large stalagmite boss, The Beehive (Pl.32A) deposited on a trenched fill can be seen on the left. The passage narrows and continues as a high rift with several small inlets. After turning along a cross joint the rift continues narrow and awkward (Pl.30B) to a gravel choke into which the stream sinks.

By traversing back up a prominent ledge just before this choke, access may be gained through jammed boulders to NHASA Gallery. The upper end of this passage is blocked by breakdown and stalagmite fill, but it continues downward with a wide bedding plane roof and a floor of mud covered boulders which are in places cemented by flowstone (Pl.31B). The stream enters from the left near the botton of the gallery. By crawling over the mud fill at the end of NHASA Gallery an obviously phreatic passage is entered with the stream sinking in its floor. This can be followed past a blind 3-m drop on the left into a muddy cross rift (Pl.32B). The cave ends in a tight rift, though a climb up through boulders (in an aven) just before this termination leads into a high level rift with boulders in the roof. This was the original route for water leaving the known cave; the present stream sinks before the 3-m drop. Several digs are being conducted in this area. The deepest point in the cave is at the bottom of the 3-m pit at 81.3m, some 55m above the known resurgence at Cheddar (26m) and a distance of 3.5km away.

STRATIGRAPHY AND STRUCTURE

The Blackdown pericline is the most northerly of the four Armorican anticlines which underlie the Mendip hills. It has an East/West axial trend, and is asymetric – the northern limb having dips of 50° to 70° compared to 20° to 30° to the south. Devonian Quartzites and grits of the Old Red Sandstone outcrop in the core of the anticline and are flanked conformably by younger Carboniferous rocks. The lowest of these are the shales and inter-bedded limestones of the Lower Limestone Shales. This formation becomes progressively more calcareous upwards and passes into a thick succession of limestones, which are in places silicified, dolomitised or oolitic. Mesozoic rocks, mainly Triassic sandstones and conglomerates lie unconformably on the carbonates, but are preserved only in low areas and on the upland margins. Full details of the structure and stratigraphy of this area may be found in the Geological Memoir for the Wells sheet (Green and Welch 1965).

The swallet of Manor Farm Cave is formed at the junction of the Lower Limestone Shales and the lowest of the Carboniferous Limestone formations, the Blackrock Limestone. This is also the case with the other major swallet caves in the area, GB cave (Ford 1964) and Longwood Swallet (Atkinson 1967). Stratigraphically the cave is wholly in the Blackrock Limestone. However in the most northerly sections of Upstream Passage the walls show thin shales inter-bedded with black fossiliferous limestones which are transitional to the Lower Limestone Shales. These are also seen at the cascade just below Stream Junction and below John Ham's Corner. The rest of the cave is excavated in younger beds of coarse black limestone containing abundant silicified fossils of brachiopods and crinoids. A horizon of chert nodules some 21m above the base of the Blackrock Limestone has not been observed in the cave, though it is exposed in Velvet Bottom. It may well be displaced by faulting in the terminal rifts. The average dip of the beds remains constant throughout the cave at 27° in the direction 190°N.

It is evident from the bedrock exposures that the cave is concordant with the dip as far as the end of NHASA Gallery. However only about 17% of the cave is genetically controlled by the bedding, the rest being dominated by strong jointing adjacent to a fault zone which is readily apparent below NHASA Gallery (see Fig.121). The faulting appears to be normal, the terminal rifts forming a Graben type structure. All the fault planes are heavily mineralised with crystaline calcite and subsidiary haematite up to 1m thick. The joints are dominantly vertical, but dips of 70° to 80° to the east are found in the Inclined Rift. The main set is parallel to the major faulting in a direction 005° to 010°N and controls about 43% of the cave passage (including faults of this trend). Associated with these are a set of shear joints trending 030° to 040°N dominant in 19% of the cave. At 90° to these shear joints is a further set at 120°N controlling 21% of the passages. This is also the direction of several faults 'feathering' from the main fault at the end of the cave.

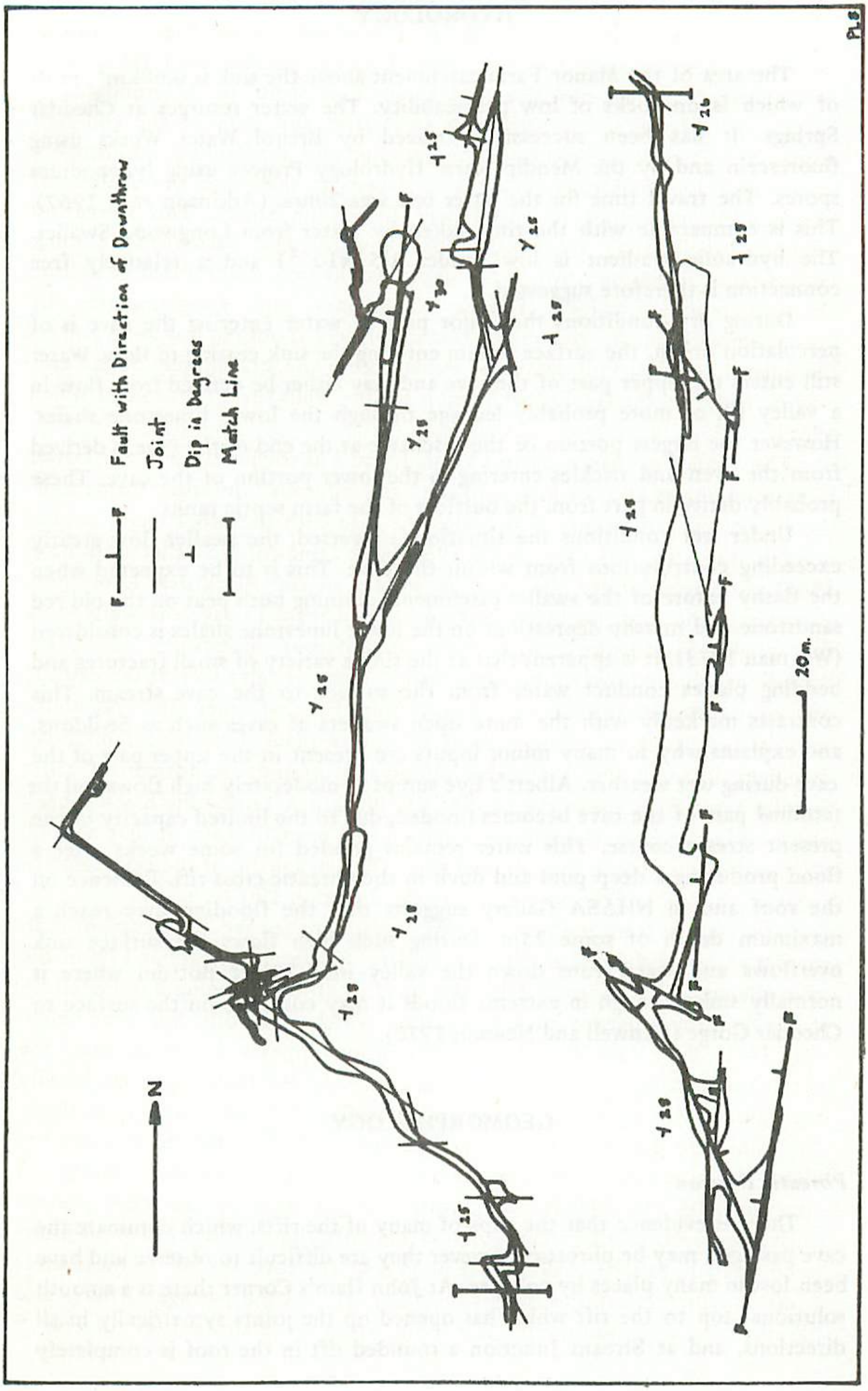

Fig. 121 Structural Geology of Manor Farm Swallet.

HYDROLOGY

The area of the Manor Farm catchment above the sink is 0.68km^2, most of which is on rocks of low permeability. The water resurges at Cheddar Springs. It has been successfully traced by Bristol Water Works using fluorescein and by the Mendip Karst Hydrology Project using lycopodium spores. The travel time for the latter test was 20hrs. (Atkinson *et al* 1967). This is comparable with the time taken by water from Longwood Swallet. The hydraulic gradient is low (under 1.5 x10^{-2}) and a relatively free connection is therefore suggested.

During dry conditions the major part of water entering the cave is of percolation origin, the surface stream entering the sink ceasing to flow. Water still enters the upper part of the cave and may either be derived from flow in a valley fill or more probably leakage through the lower limestone shales. However the largest portion of the discharge at the end of the cave is derived from the aven and trickles entering in the lower portion of the cave. These probably derive in part from the outflow of the farm septic tanks.

Under wet conditions the situation is reversed, the swallet flow greatly exceeding contributions from within the cave. This is to be expected when the flashy nature of the swallet catchments draining both peat on the old red sandstone and marshy depressions on the lower limestone shales is considered (Wayman 1973). It is apparent that at the sink a variety of small fractures and bedding planes conduct water from the surface to the cave stream. This contrasts markedly with the more open swallets of caves such as Swildons, and explains why so many minor inputs are present in the upper part of the cave during wet weather. Albert's Eye sumps at moderately high flows and the terminal part of the cave becomes flooded, due to the limited capacity of the present stream course. This water remains ponded for some weeks after a flood producing a deep pool and duck in the phreatic cross rift. Evidence on the roof and in NHASA Gallery suggests that the flooding may reach a maximum depth of some 25m. During such high flows the surface sink overflows and water runs down the valley into Velvet Bottom where it normally sinks, though in extreme floods it may continue on the surface to Cheddar Gorge (Hanwell and Newson 1970).

GEOMORPHOLOGY

Phreatic Erosion

There is evidence that the tops of many of the rifts, which dominate the cave passages, may be phreatic, however they are difficult to observe and have been lost in many places by collapse. At John Ham's Corner there is a smooth solutional top to the rift which has opened up the joints symetrically in all directions, and at Stream Junction a rounded rift in the roof is completely choked by a coarse impure tufaceous deposit and truncated by breakdown. It can be followed to beyond the large stalagmite boss where it forms a short high-level oxbow to the east. The rift above the Fluted Pots exhibits a similar smooth eliptical form, and as high as Penthouse Chamber (210m OD) phreatic forms are visible in the roof. The concordance of the cave with the bedding has been previously noted; it appears that the joints have served to localise dip tube development at joint bedding plane intersections. Thus the proto-cave developed largely down dip with contemporaneous passages at different elevations controlled by the "significantly penetrable bedding planes" (Ford 1971). For example at the southern end of Penthouse Chamber, separate development is evident at 200m, 195m and 192m OD. All the major passages were probably defined in this proto-cave phase including Upstream Passage, the Railway Tunnels, the Aven Tributary(s) and a route through NHASA Gallery.

Most of the phreatic remnants discussed above are probably paraphreatic in origin, relatively short lived and due only to the limited capacity of the extant drainage system. Thus the 'level' of the phreas gradually dropped as passage development reduced the head required to move water through the cave. However, above the cascade upstream of Stream Junction there are the clear remains of a strike tube with phreatic pocketing blocked by stalagmite fill downstream. It probably connected with a phreatic rift seen in the dry aven above Stream Junction, the two forming a classical 'lifting chimney' (Ford 1963). From this chimney a small tube leads southward meandering down dip on a bedding plane; this is now entrenched some 3m. Water from the top of the present aven may have joined this chimney, but evidence suggests that a contemporary phreatic passage led from the base of the aven to the tufa choke rift mentioned previously at a level below that of the top of the lifting chimney. For a time the two systems operated separately, the main passage being tributary somewhere in the lower part of the cave, but eventually the lifting rift intersected the aven conduit and the two joined at this point. This group of features might be interpreted as representing a still stand of the water table at some 155m, however there is no conclusive evidence that it was other than local. It is probably best interpreted as a perched sump caused by structural controls during the initial paraphreatic development.

The only definite evidence for an enduring phreatic rest level is found in the classical phreatic rifts below NHASA Gallery. To what level the phreas extended up NHASA Gallery is difficult to determine due to collapse, but the rifts have ceiling levels at about 92m, which is also the highest phreatic feature recorded in the boulder ruckle. However the possibily phreatic Fault Aven has its roof at 110m. The Inclined Rift appears to be levelled to just below this elevation. The top of the terminal boulder ruckle is probably slightly higher at about 120m. Whether these represent separate rest levels is debatable and it would appear that the upper level must be accepted in order to generate sufficient head to force water out through the terminal boulder ruckle. This is supported by the muddy nature of NHASA Gallery up to this level.

Vadose Erosion

The major part of the cave volume is due to vadose erosion below the paraphreatic rifts. Vadose entrenchment in the lifting chimney route progressively breached the series of avens downstream of Stream Junction, conducting water into the lower aven route, until finally the chimney itself breached the latter. The present aven developed joining an upper aven route into the lower aven route in much the same manner. The phreas probably remained at about 110 to 120m during this period.

NHASA Gallery undoubtedly originated as a phreatic passage of moderate size, but its present form is probably due to extensive vadose erosion. Two streams entered the Gallery, one down the inclined rift and the other at its upper end, a situation analagous to Curtain Chamber at present. The latter stream gradually leaked into the Inclined Rift to give the present inlets to the east of the passage. The abandoned high level route became filled by stalagmite and the broad bedding plane roof of NHASA Gallery developed due to collapse.

Fill

There is extensive evidence of fill throughout the cave. The sections with a low floor gradient e.g. above Stream Junction and at the Stalagmite Boss, show the thickest deposits. No clastic material is evident in the Aven, and in view of the siliceous nature of the matrix and the presence of Old Red Sandstone pebbles, it is probably derived from the swallet.

Much more extensive than the clastic fill is the huge volume of coarsely crystaline stalagmite in the form of large gours and flowstone slopes, which have completely filled the bottom of the vadose canyons; in places it is several meters thick. This deposit is laid down above the fill. The latter has been re-eroded and sections of false floor have resulted.

Such a fill phase has been widely recognised on Mendip and has generally been attributed to the glacial period(s). Recent evidence based on the isotopic analysis of speleothems for O_{18}/O_{16} ratios (temperature) and Th_{230}/U_{234} ratios (date B.P.) indicates that during cold periods stalagmite deposition slows or stops completely, whilst it is at a maximum during warm phases (Thompson 1971). This is supported by geochemical observations which show that a thick soil cover or plentiful supply of organic debris is required to dissolve appreciable amounts of calcium carbonate to saturation. Furthermore there must be free movement of water into the underground system. Neither of these conditions would be met with a glacial or even periglacial climate. Certainly stalagmite deposition in Alpine caves in Canada is extremely slow at present. Thus it would seem that warm and relatively humid conditions are required for the deposition of the enormous quantities of stalagmite seen in Manor Farm, and other Mendip caves.

Relatively little modern dating and analysis has been applied to the clastic fill of caves, despite the wealth of methods made available by Quaternary research, therefore the period of its deposition is more problematic. Present cave streams in flood may entrain pebbles of large size, as demonstrated by the filling of the end of the Gorge in GB during the flood of 1968. However when very large quantities of sediment are brought into a cave the stream is not immediately capable of removing it, though over a period of several hundred years it may succeed in doing so – such is the case with the collapse material at both GB and Manor Farm. However, if during a period of declining discharge such massive injections of debris occurred, the swallet would eventually become blocked, precluding further input. Ponding might occur in the swallet valley with the deposition of lacustrine/fluvial sediments. The collapse at the head of the Gorge in GB has revealed just such horizontally laminated sediments, though no detailed analysis has been conducted to date. The onset of periglacial conditions with declining rainfall and increased mass movement is thus likely to cause the injection of sediment into a cave, followed sooner or later by its complete closure. Thus the sediment phase probably marks the onset of a cold period.

The closure of the cave swallet is also of importance for the deposition of extensive stalagmite deposits. In post glacial times the swallet will require a considerable time for re-excavation, thus most water entering the cave will be highly saturated percolation water. Furthermore there will be little or no sediment scour to interfere with stalagmite deposition. Once the swallet reopens then re-excavation of both the preglacial fill and the post glacial stalagmite can occur. It would appear that this reopening is in its final phase at Manor Farm, though swallet water has entered the cave for some considerable period of time via diffuse routes through the choked sink. The cave is at present in an Interglacial erosive phase.

Discussion

The sequence of development postulated for the cave, and a possible chronology based on the correlations of Ford (1963) with resurgence levels at Cheddar, is given in Table 1. The main cave did not evolve until the last interglacial, though the dip tube network was probably initiated before this time. The phreas stood at 110 to 120m in NHASA Gallery. The exact relationship of clastic and stlagmite fill with the Chelford Interstadial is not clear, but there was probably a drop of the phreas to 92m during the Early Last Glaciation. The cave then became blocked during the Main Last Glaciation with the deposition of the extensive stalagmite fill in early post glacial times. The phreas rest level is now below the known end of the cave (81m OD).

TABLE 1

Sequence of Development of Manor Farm Swallet

Phase	*Events*	*Pleistocene Time*
1	Proto-cave dip tubes	Uncertain
2	Initial phreatic and vadose erosion Phreas at 110–120m OD	Last Interglacial
3	? Clastic Fill and Blockage? Phreas lowered to 92m OD	Early Last Glaciation
4	?	Chelford Interstadial
5	Phreas lowered below 81m OD	Main Last Glaciation
6	? Stalagmite Deposition?	Post Glacial
7	Present Re-excavation	

TABLE 2

Chronology of Longwood Swallet, GB Cave and Manor Farm Swallet

Phase coding based on Ford (1964), Atkinson (1967) and this paper. Figures in brackets represent phreas rest levels in meters OD.

Pleistocene Time	*Longwood Swallet*	*GB Cave*	*Manor Farm*
Unknown	1a	1	1
Penultimate Interglacial	1b 2a (138–141)	2a (135)	
		2b	
Penultimate Glaciation	3a 3b	3a 3b	
Last Interglacial	4a (120–123)	4 (120)	2 (110–120)
	4b	5a	
	4c	5b	
Early Last Glaciation	5a 5b	5c	3
Chelford Interstadial	6a (90–93)	5d (90?)	4 (92)
	6b		
	6c		
Main Last Glaciation	7a 7b	5e	5 6
Post Glacial	8 (under 70)	6 (under 70?)	7 (under 80)

Comparing the above chronology with that of Longwood and GB caves, it can be seen that both are probably older than Manor Farm, as is implied by the smaller size and relative simplicity of the latter. It is suggested that a 90m phreas level is present in GB, but remains unobserved beyond the present end of the Gorge and that the two second fill sub-phases can be correlated with the start of the Early Last Glaciation and the Main Last Claciation. The inclusion of a further phase in this manner brings GB into line with Atkinson's findings for the deeper Longwood Swallet, the phreas rest levels showing a remarkably good correlation as would be expected in a limestone mass with a moderately high permeability and only one outlet (see Table 2). Comparing the Manor Farm levels the 92m phreas fits well, while the upper figure for the 110 to 120m level is more concordant. No correlations above this level are evident. It is apparent that until absolute dating of both clastic and stalagmite fills are attempted there can be no satisfactory conclusion to the problems of intercorrelating the cyclic phases of different caves.

NOTES ON THE SURVEY OF MANOR FARM SWALLET

W. I. STANTON

Survey work in the main cave involved seven vists between October 1973 and June 1974. The instruments used were a liquid-filled prismatic compass graduated in degrees and calibrated before each visit, an Abney Level, and a Fibron tape graduated in centimetres. They were hand-held for all readings, and the "leapfrogging" procedure was employed. The survey is therefore rated at Grade 5. No closed traverses were obtained, but previous experience with these instruments suggests that the position error of a survey point relative to any other is likely to be less than 1% horizontally and 0.5% vertically of the traverse distance between them.

Co-ordinates based on Grid North were calculated by computer and the survey was first plotted on graph paper and then transferred to an accurate grid on transparent paper.

The length of the cave as surveyed is 882 metres (2900 feet), and the vertical range is 151.5 metres (497 feet).

The surveying party in the main cave included Tom Davies, Will Edwards, Bob Elliott, Brian Mulloy, Terry Tooth and Alan Trickey. The rifts and ruckle extension at the lower end of the cave was surveyed to Grade 4 by Bristol Exploration Club members Roy Bennett, Phil Kingston and Colin Clarke, using Suunto equipment, and was drawn initially by Dave Irwin.

Permanent survey stations were established at three points in the cave and are shown by a solid triangle on the plan. Their co-ordinates and descriptions follow:

Eastings	*Northings*	*Altitude*	*Description*
793.75	617.39	213.12	Hammered cross in roof, 1m above floor.
777.89	499.53	147.46	Nail in crack in east wall 0.5m above upstream end of false floor.
814.73	292.80	86.69	Drill hole on west wall 0.5m above floor.

The altitude of the cave entrance was established by a Grade 5 traverse from a point where the 800 foot contour on the six-inch O.S. map crosses a wall northeast of the entrance blockhouse. An error less than 2 metres is probable. The cave was related to the ground overhead by a Grade 5 traverse from the entrance to the wall corner at ST 49805 55644.

The surveyors' thanks are due to Mr. Jeffries of Manor Farm for his helpfulness and co-operation at all times.

TACKLE REQUIRED

Entrance Pitch	14m (50ft) ladder, short belay and lifeline. (Free climbable with care).
September Rift	6m (20ft) ladder, short belay or tape. Free climable with a little effort.
Curtain Chamber Pitch	6m (20ft) ladder, long belay and lifeline *or* 10m (35ft) handline. Easily free climable but care needed on top moves.
Blind Pitch at End	3m (10ft) ladder, long belay and lifeline. An awkward free climb.
Main Aven	7m (25ft) ladder, short belay and lifeline. Has to be climbed with aid to instal ladder.

Flooding

In wet weather the cave takes a moderately large flow. The Entrance pitch and Curtain Chamber pitch may both become wet making the latter awkward without aid. At high flow Albert's Eye sumps and should not be dived.

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Plate 30A
The Entrance Shaft Photo: P. L. Smart

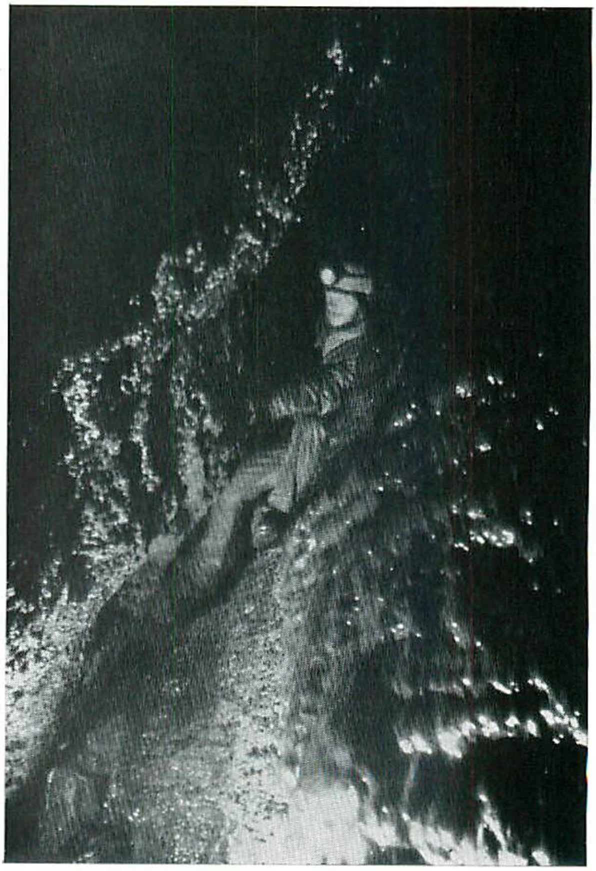

Plate 30B
The Inclined Rift Photo: P. L. Smart.

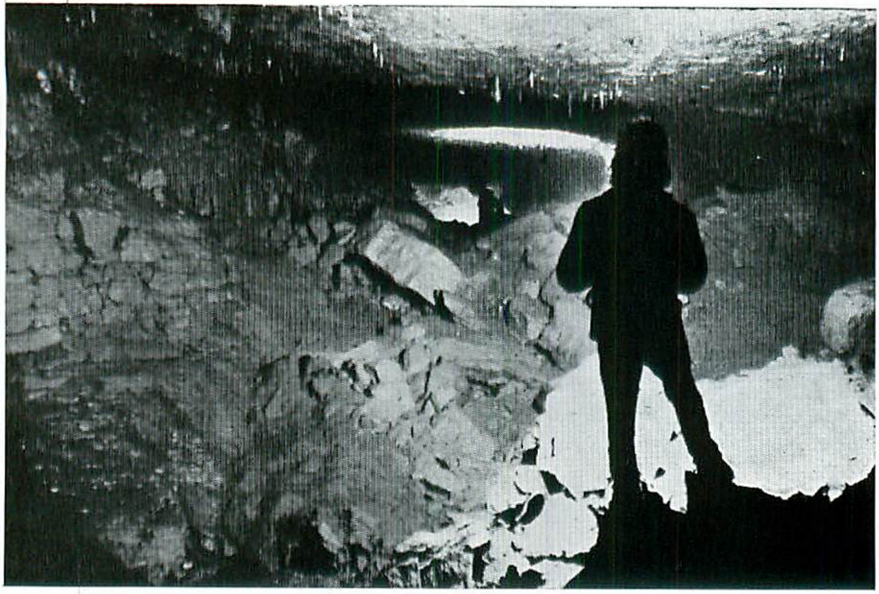

Plate 31A. Penthouse Chamber Dig—October 1972. Photo: P. L. Smart.

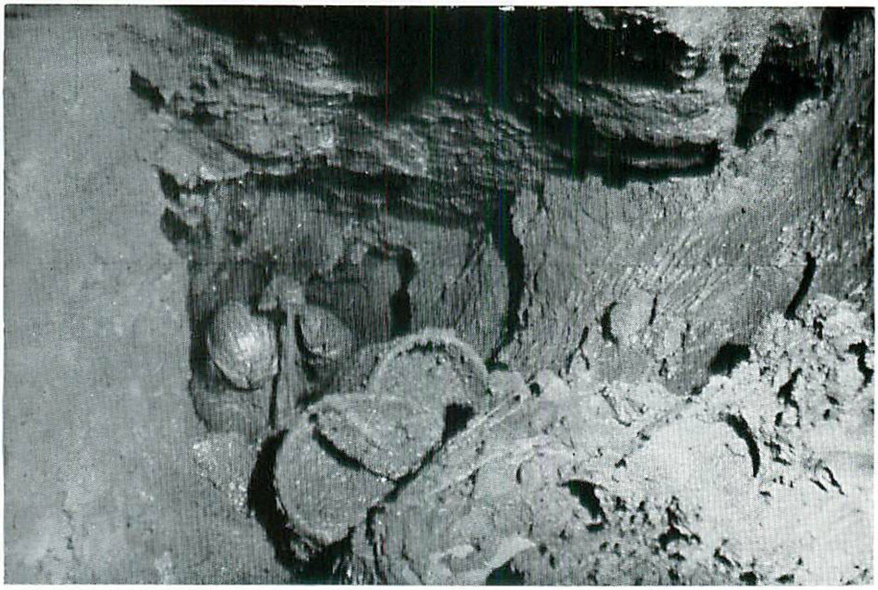

Plate 31B. NHASA Gallery. Photo: P. L. Smart.

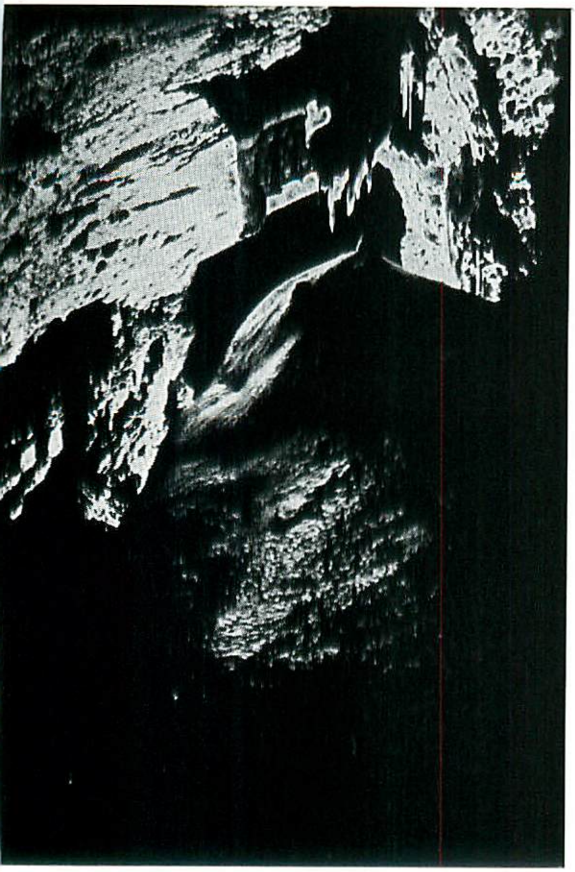

Plate 32A
Curtain and Boss below Stream Junction.
Photo: P. L. Smart.

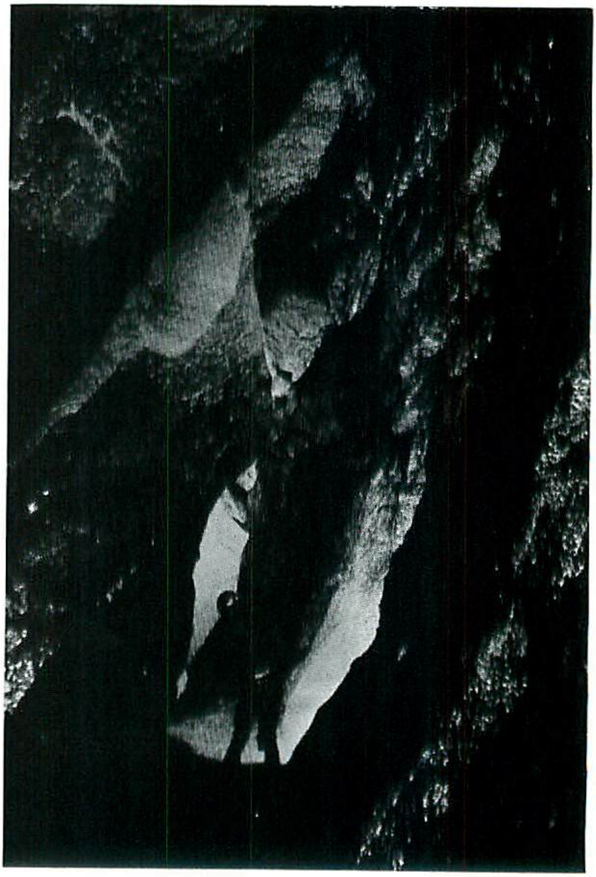

Plate 32B
'erminal Rift with mineralised fault in roof.
Photo: P. L. Smart.

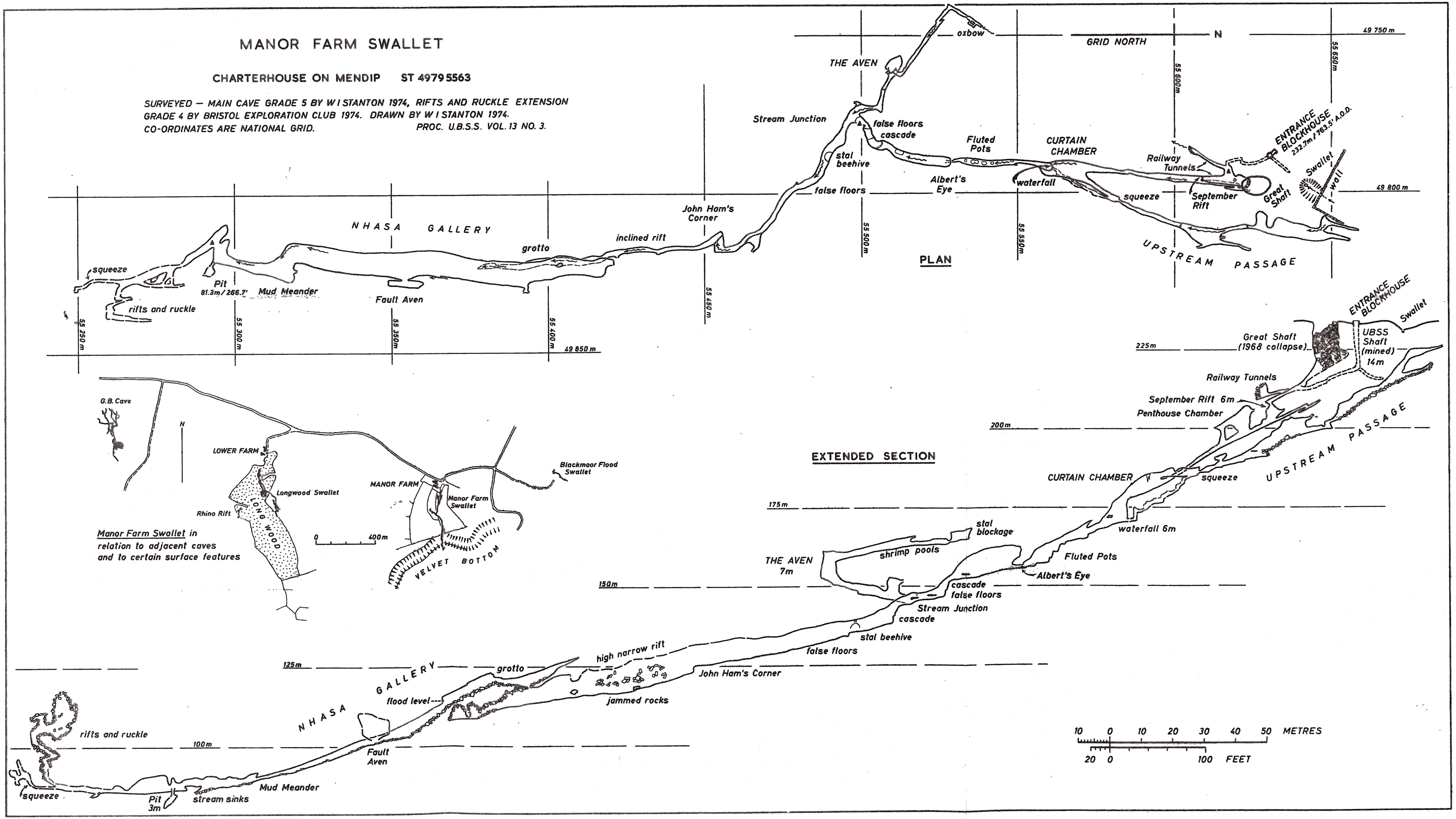

Plate 33 Survey based on National Grid and inset area map on Ordnance Survey.