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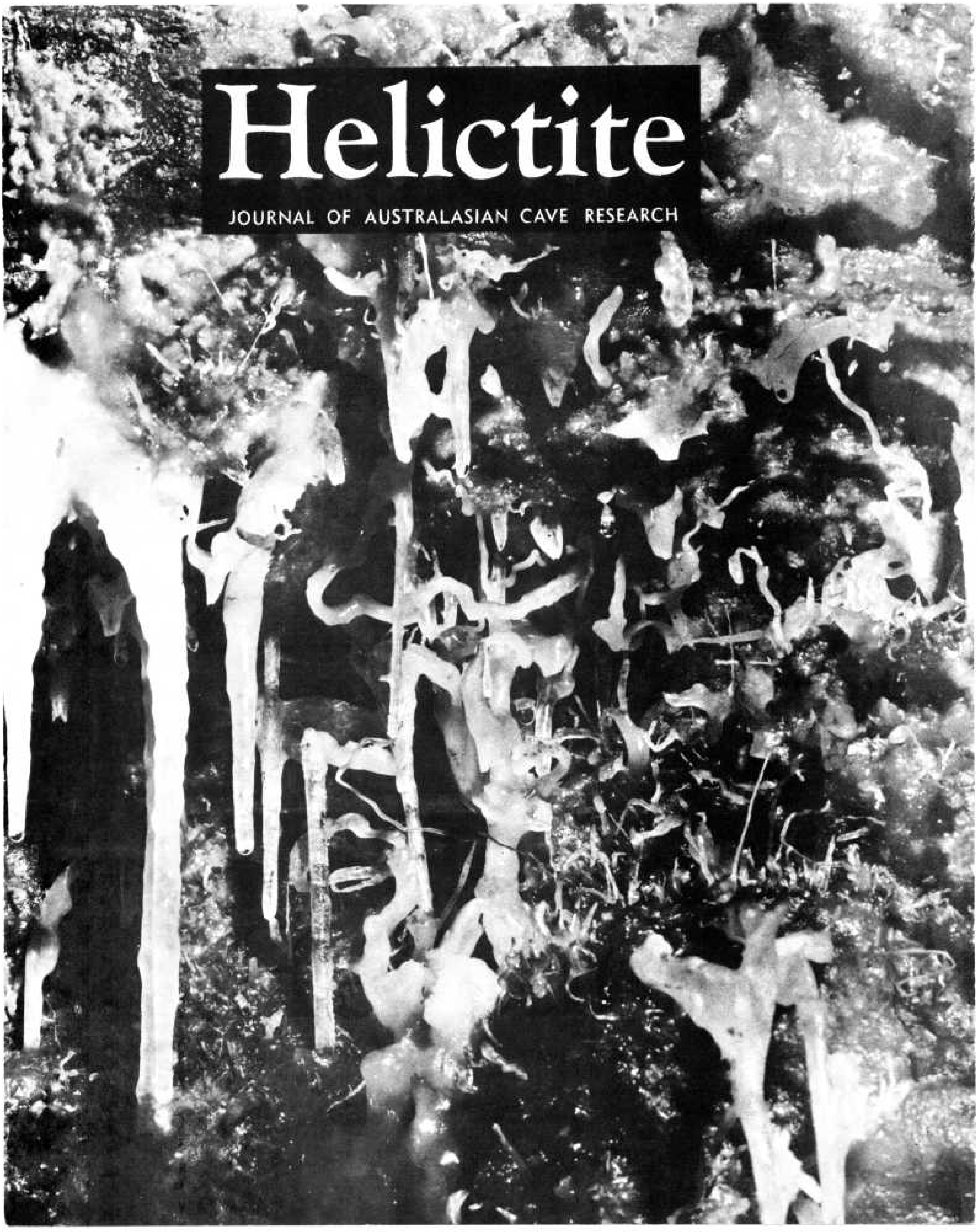

" H E L I C T I T E "

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OBITUARIES

HERBERT WOMERSLEY (1889 - 1962)

The sudden death of Herbert Womersley late last year will be felt with deep regret in entomological circles throughout the world. Born in England, he was brought out to Australia by R. J. Tillyard to work on the lucerne flea in Western Australia. From there he became Curator of Entomology at the South Australian Museum in Adelaide, a post which he held from 1932 until his retirement in 1954. Up till the time of his death, Womersley continued to work at the Museum as honorary Acarologist. His particular interests lay in the fields of Apterygote insects, mites and spiders, and he became the foremost acarologist in Australia with an international reputation. He described several new species of mites from Australian caves, thus making a contribution to the study of the cave fauna of Australia.

PROFESSOR PAUL A. REMY (1894 - 1962)

With the tragic death of Paul A. Remy at Makokou in the Republic of Gabon, in West Africa, on March 19, 1962, Speleology has lost one of its most active and enthusiastic workers. For many years Remy studied animal life in European caves and made many important contributions to the study of Biospeleology, particularly in the field of Entomology. From 1937 to 1960 he was Professor of Zoology at the University of Nancy in France, and in 1960 became Professor of General Ecology at the National Museum of Natural History. He was a member of the Speleological Commission of the National Centre of Scientific Research, a member of the Board of Directors of the Subterranean Laboratory at Moulis, and a member of the editorial committee of the Annales de Speleologie.

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GEOMORPHOLOGY OF THE DIP CAVE, WEE JASPER, NEW SOUTH WALES

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Australian National University, Canberra

Introduction

The Dip Cave lies about three miles south of Wee Jasper on the western side of the Goodradigbee valley about 500 yards from the river. The cave underlies the nose of a spur running fairly steeply down from the Wee Jasper range west of the valley. Only the terminal part of the spur is of limestone, the rest is of impervious rocks. In fact, shales outcrop along the road immediately above the cave. Below this spur there is a much more gently inclined bench in the limestone, trenched by steep-sided gullies coming down from the two flanks of the spur.

Exploration and Exploitation

Part of the Dip Cave has been known for many decades; this comprises what is now called the No. 2 Series (apart from some small side passages at the eastern end) and the Lower and Middle Passages of the No. 1 Series. The way into this part of the cave was easy; no doubt it was entered soon after settlement of the valley. However, it seems to have escaped mention in early publications referring to the Wee Jasper caves such as Bennett (1834) and there is not much hope now of getting any precise information on its actual discovery.

In 1955, the Canberra Speleological Society turned attention to it and found most of the remainder of the system by descending into the Main Chamber by a 65 feet pitch through a small entry four feet by two. From Main Chamber, the largest in the whole system, most of No. 3 and No. 5 Series were quickly explored, together with the Upper and Lower Links to the Dismal Chamber. All this was quite virgin and calcite barriers had to be breached at certain tight points. Though it is readily accessible from the previously known part of the Dip, with a little care required at the Bridge, the Upper Passage of No. 1 Series was also regarded as a new discovery because of the absence of any footmarks in its thick guano.

A draught led to the discovery of the rathole leading from No. 3 into the roof of the Stalagmite Chamber. At first only the roof could be seen and there was excited argument as to whether a new series had been discovered or whether it was only No. 2 Series after all. When some small columns had been removed, a downwards view soon settled the matter in favour of the sobersides. The traverse round from this point to the elegant balcony-passage between Stalagmite Chamber and Daylight Chamber was also made for the first time on this occasion when the long-known cave and the newly discovered one were linked into one system.

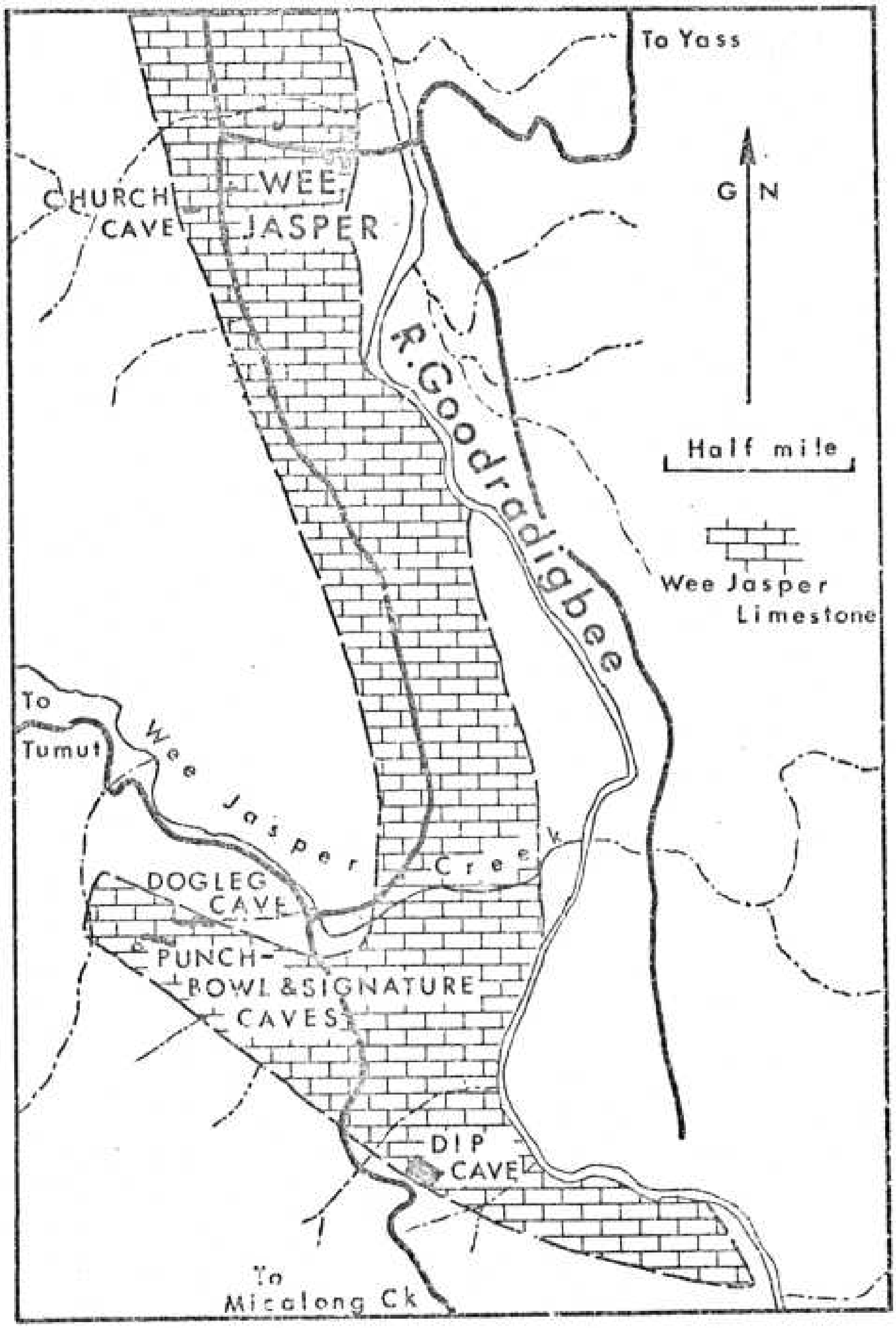
Later the squeeze near the eastern end of No. 5 disappointingly led into the short and narrow, though tall, finish to that series. Much more rewarding was the climb down through the block pile at the western end of No. 3 proper; this led into No. 3 Extension, one of the most attractive parts of the cave. The alternative way into No. 3 Extension directly from Main Chamber was in fact first penetrated from the No. 3 Extension end.

The members of the Canberra club who took part in this first phase of activity at the Dip were H. Black, F. Doutch, D. Fitzsimon, J.N. Jennings, J. Leslie, W. Lucas, H. Mahon, D. Moore, V. Pickering, G. Young and J. Webb. There followed a lull in discovery when surveying was the order of the day and in this J.N. Jennings, D. Moore and E. Smith were the ringleaders, helped by numerous "slaves." The original plot of the survey was on a scale of 20 feet to the inch. This has been generalised for reproduction on the reduced scale of the accompanying figures.

As the plan of the system emerged, it was apparent that there was a strong liklihood of more cave east of Main Chamber and between the eastern ends of Nos. 3 and 5 Series. As at that time we were convinced that we had tried all possible surface entries, search was directed vigorously underground at the surrounding parts of the cave already discovered. In this way a lot of effort went in vain. However, in 1957, J. Kirkpatrick, then a member of C.S.S., and his brother Tim, from Sydney, went out one day without the preconceptions of the habitués, descended an open 20 ft. pitch and discovered No. 4 Extension. When this was being surveyed later on, contact was established by sound between E. Smith in Main Chamber and J.N. Jennings in the extension; in a few seconds they faced one another through a narrow impenetrable slit in a flowstone choke. The survey was carried through this slit, but quite deliberately it has not been opened up to allow through movement.

J. Webb and D. Fitzsimon were so impressed by the quality and quantity of the bat guano in some parts of the Dip that they formed a company to exploit it. Between 1957 and 1960, Federal Fertiliser Co. extracted a substantial amount of excellent manure from the eastern end of No. 1 Upper Passage, where at the time of the survey a great pile of dung had been lowered eight feet for a sight line of the traverse. The two club members concerned have left Canberra, but J. Andrews has continued to extract guano from No. 1. In the course of this activity, there has been much fall of rock from the top of the Daylight Hole, which is now substantially larger than it was originally. The survey represents it as it was in its natural state, however.

Unfortunately this is not the only "exploitation" of the Dip. The Main Entrance has for some time been used and still continues to be used


To Yass
G N
WEE JASPER
CHURCH CAVE
R. Goodradigbee
Half mile
Wee Jasper Limestone
To Tumut
Wee Jasper Creek
DOGLEG CAVE
PUNCH-BOWL & SIGNATURE CAVES
DIP CAVE
To Micalong Ck

by local residents as a tip heap. The old, direct way down is usually blocked nowadays and the tighter entry at the southern side of the doline is the regular route now. More and more rubbish of all descriptions is moving into the cave, some reaching to the start of the Slab Chamber.

The usual way of tackling the cave today is to put one or two men down the 65 ft. pitch into Main Chamber. They take a ladder and safety line through to the rathole connecting No. 3 with Stalagmite Chamber. Meanwhile the rest of the party enters by Main Entrance and climbs up the ladder dropped into Stalagmite Chamber by the others. In this way nobody needs to stay on top. The procedure is reversed for coming out. No. 4 Extension has to be dealt with separately and a ladder is recommended for safety, though it can be done with a rope only.

Relationship of Cave Morphology to Geological Structure

Some may think that the naming adopted by C.S.S. for the parts of the cave is exceedingly unimaginative. However, its numerical basis grew up quite spontaneously because of the outstanding characteristic of the cave and it has proved most effective in use. The Dip Cave consists almost exclusively of five parallel series of chambers, rooms and passages, with exiguous crosslinks, except in the case of Nos. 1 and 2 which merge in a larger way at their western ends. This geometrical plan is a faithful reflection of geological structure.

The Wee Jasper Limestone* is described by H.S. Edgell in his Sydney University B.Sc. thesis, "The Geology of the Burrinjuck-Wee Jasper District," as a black, massive limestone, fine-grained, dense and homogeneous, with a fairly high percentage of impurities of an insoluble nature. Only certain beds are strongly fossiliferous (biostromal in type). In the Dip, these beds show up well in certain walls, e.g. the Coral Wall at the east end of No. 1 Upper Passage and the south wall at the east end of No. 5.

The whole Lower Middle Devonian rock sequence of which this limestone forms part has been folded into a syncline by earth movements of late Middle Devonian age (Taberabberan). At the Dip the limestone beds have been turned up on their sides and are inclined nearly vertically.

Certain beds have responded to solution more readily than others and so the passages and chambers are arranged in an almost perfect manner along the strike of the limestone sequence. In contrast with the fre-

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* This name is taken from an unpublished Bureau of Mineral Resources geological map of Wee Jasper-Cooleman Caves Area (N53-3). In Edgell's thesis it is named the Lower Goodradigbee Limestone.

quent occurrence of strong bedding control of various cave levels in the vertical plane, caves are rarely so strictly governed in plan by the bedding of the rocks as is revealed in the case of the Dip. A similar instance has been drawn to my attention by E. Hamilton Smith in the case of Mair's Cave, Buckalowie Creek, South Australia. Edgell has previously stressed the pronounced variability of the different beds in the Wee Jasper Limestone in their susceptibility to solution on the evidence of surface landforms.

The direction of strike and so of the trend of the parallel cave series averages 115° true bearing but it varies about 5° on either side of this. A tendency to waviness along the line of some passages seems to be due to this slight variation in strike. The remarkable control by bedding is seen both in large features, e.g. in the shape of the Main Chamber which is about 230 ft. long and up to 60 ft. wide, and in small, e.g. in the three closely adjacent narrow passages at the east end of No. 4 Extension.

The control of bedding is also seen to be dominant in the cross-sections. Since the parallel series are so close together, it is not practical to insert the numerous surveyed cross-sections into the plan in the usual way. Instead, three cross-sections through the whole system are given in a separate figure. This furnishes far fewer individual cross-sections than is usual but has the advantage of showing them in their correct relative levels and positions. The cross-sections were positioned to include the full width of the system and therefore they are a random selection as far as the individual passages and chambers are concerned. Nevertheless the dominance of vertical walls following bedding planes is readily apparent.

The plan shows how along a given series there are abrupt changes in width often with double rectangular corners, whereby a passage becomes a room or a chamber, or a chamber sharply increases in width. This is due to the removal of additional beds as is clearly seen in the successive sudden increases in width of No. 5 Series eastwards from the Rift. Joint control is coming into play in this characteristic. Moreover joint control is involved in some of the crosslinks between the parallel series, e.g. between No. 5 and Main Chamber, and also in the network of small passages south of the eastern end of Daylight Chamber. Some of the apparently joint-controlled fractures are vertical; many others are inclined at large angles to the vertical and control roof form at many points as can be seen from the longitudinal sections. Thus the three passages at the east end of No. 4 Extension are all inclined at about 30° down to the WNW in accordance with joints of this inclination and a double upper level at the southwest corner of the same extension is markedly controlled by joints inclined at the same angle in the opposite direction. The western part of the roof of the Dismal Chamber shows the effect of both these systems of joints.

Factors Concealing the Formation of the Cave

The clarity with which the morphology of the cave reflects the geological structure, is almost counterbalanced by the obscurity which hinders any effort to interpret the origin and evolution of the cave. The two aspects are interconnected.

(a) Cave Breakdown. The cave is a dead cave in the sense that there are no flowing watercourses or even large stagnant pools in it. The sole water is in occasional drips and one or two small rimstone pools, readily emptied by visiting cavers in a few trips. For a long time there has been no active excavation and generally speaking the architecture of the cave is dominated by the effects of cave breakdown. In competent limestones such as occur here, the structural planes of weakness of the rocks control that breakdown. Most of the cave floors are therefore covered by angular limestone blocks, both large and small. On the plan only the parts of the cave particularly characterised by large collapse blocks are so represented schematically: in fact, it is very general. Breakdown has been largely in the form of wall slab in W.E. Davies' terminology, i.e. tabular pieces of individual beds break away from the walls and fall inwards into the chamber or passage. (Davies 1949). This is particularly impressive, for example, in Slab Chamber, where great wall slabs lean against the north wall and enclose a lateral extension beneath it. Again halfway along No. 3 Series eastward from the entry to No. 2, wall slabs have dropped a little way only from roof level so that the obvious way forward is quite low; underneath, however, the tilting together has produced a lower room with some attractively coloured decorations.

The piles of breakdown debris vary much in thickness; towards the west end of No. 3 proper, the ruckle has been penetrated downwards for a depth of 30 ft. at two points. Because of the amount of breakdown, most of the walls consist of fractured surfaces, not of water-eroded ones which might tell a story.

Collapse has occurred more drastically between the Main and Dismal Chambers to eliminate the former connection between the two. A great mass of blocks and red earth separates the two parts of what were previously one larger cavity and gives rise to slipping talus slopes on each side. Dismal Chamber now has to be reached by a lateral passage on the south side, known as the Upper and Lower Link because there are two levels. Some collapse earth and clay is penetrating through to the Lower Link which will eventually be blocked by the same process. Clay is also moving northwards from the main collapse into a small room off No. 5 Series. At the surface this collapse shows itself as a shallow enclosed despression only 2-3 ft. deep and no breakthrough to the surface has occurred.

The Main Entrance is the result of a more advanced stage of the same process; here the roof has fallen in completely and has provided ready access to the cave. It is a collapse doline. There are small debris piles beneath Daylight Hole and beneath the 65 ft. pitch into Main Chamber, showing that collapse is going on here also, though the small surface apertures in solid rock at the top indicate its limited effect as yet. It will enlarge these into larger roof windows and in due course they also will become sizeable collapse dolines.

(b) Secondary Deposition. A second factor making the formation of the cave difficult to reconstruct is the prevalence of secondary calcite deposition or "decoration," using that term in a technical rather than an aesthetic sense. Much of the walls is covered with at least a thin skin of flowstone and many parts of the floors are so covered, including collapse blocks. Most of this decoration is no longer very active nor very attractive, the best parts in these respects being found in No. 3 Extension and No. 4 Extension. In both there are some good curtains, one set in the Gong Room resonating sonorously. There are gours and micro-gours in these parts, and formerly there were cave pearls. The western extremity of No. 5 and the eastern extremity of No. 3 are well endowed with small stalactites and stalagmites, but in both localities much re-solution is going on at the present time. A little way east of the entry to No. 2, the north wall of No. 3 carries much lublinite. There are a number of points where helictites occur though they are not of any great complexity or in any great abundance at any one place. Calcified roots are frequent for such occurrences, including some very good examples in the Gong Room. Quite a good variation of colour in the decorations can be found in the cave, including leaden blues as well as various orange-red shades. However, the general quality of calcite decoration is not such as to warrant the commercial development of the cave.

The only water sample collected from this dry cave came from a small rimstone pool on the northern side of the large stalagmitic mass reaching to the Main Chamber roof in the corner near to the entry into No. 5. The data are as follows:

Date: 15 Nov. 1959. Temp.: 56°F. pH: 8.4. $CaCO_3$: 126 mg/l. $MgCO_3$: 32 mg/l.

This sample was above saturation equilibrium level for calcium carbonate; there are fresh pool deposits lining the gour in association with this.

(c) Bat Guano. Much of the lack of quality is due not solely to comparative inactivity but also to fouling by bats. Substantial parts of the cave floor are more or less covered by bat guano. The greatest accumulation was formerly found in the eastern end of No. 1 Upper Passage; there is also plenty in Dismal Chamber in No. 4, close to the eastern end of No. 3 and in a small room south of No. 5 just west of the Rift. The guano is generally dry, though this is not true of part of the guano-covered section of No. 3 mentioned above. In this latter part, the guano is leached by drips; the flowstone and rock beneath are rotten as a result of the attack by ammoniacal and other chemical products.

Even more interesting is the state of the draperies and bedrock walls around the big accumulation of dry guano in No 1 Upper Passage in particular. Both show a pronounced irregular corrosion producing a sort of cindery surface not encountered in the cave away from thick guano. The obvious explanation is that it is due to bat urine trickling down the walls from perches higher up. However, it is so general over some surfaces that one is tempted to speculate whether chemically active gases rising from the guano pile below may not be involved in the process.

Thus the effects of a former large bat population also contribute to obscuring evidence bearing on the formation of the cave. Former, because only a few bats have been seen in the cave and none captured, though in No. 1 Passage, at least, the species concerned is almost certainly the Bent-wing Bat, Miniopterus schreibersii blepotis.

Evidence as to Origin and Evolution

Because of the three factors discussed above, the amount of bedrock showing evidence of water action - "speleogens" in the American terminology - is not great. It is most common on cave roofs, rather less on the walls and virtually absent from the floors of both chambers and passages. Some of the small side passages have most eroded rock exposed along them.

(a) The Floors. As has been indicated, the floors mainly consist of combinations of collapse blocks, flowstone and guano in varying proportions. Additionally in a few places there are level floors of loamy earth or clay, red or brown in colour; these are generally at low points in the system.

i. The east end of No. 1 Lower Passage (-125').
ii. Immediately west of the beginning of Slab Chamber (-100').
iii. In the low lateral extension along the north side of Stalagmite Chamber (-118').
iv. In the short passage linking Stalagmite and Daylight Chambers (-108').

In this last place, a small pit three feet deep showed no change in nature and little indication of stratification. These level clay and earth floors represent nevertheless waterborne accumulation at a late stage in the draining of the cave to produce its present state of erosional inactivity. It is possible that bedrock floors underly them at no great depth.

Certain other low parts of the system have level floors, though carrying rubble and flowstone as well as loam and clay.

i. The flat floor at the eastern end of No. 3 Extension is the lowest part of the whole cave (-129'). In a narrow cleft here there is a shattered mass of red-brown, silty, laminated clay.
ii. The lowest parts of No. 4 Extension have a common level at about -125'. At the bottom of the shaft in the southwest corner of this extension broken laminated clay is found at much the same level.

Another occurrence of laminated clay in fragments is also at a low point in the system, namely in the small side passage winding down from the west end of the southern wall of Daylight Chamber.

Despite the absence of bedrock floors, all these instances combine to suggest that the lower limit of development of the cave system is about 110-130' below the top of the Daylight Hole. This is significantly 40-50' lower than the inner margin of the valley-side bench below the spur containing the cave. It does not appear therefore that the cave developed in relation to this bench. On the bench itself the deepest fissure penetrated so far reaches down about 40 ft., which agrees with the suggested lower limit in the cave.

(b) The Roofs. In contrast, the roofs include substantial amounts of smoothly eroded rock in flat or gently arched surfaces, which truncate the bedding in a very clearcut manner. This is seen for example in -

i. No. 3 Series for some way on either side of the entry to No. 2.
ii. Dismal Chamber and Main Chamber close to the intervening collapse.
iii. Stalagmite Chamber.
iv. West end of No. 1 Upper Passage.
v. Eastern extremity of No. 3.

Unfortunately these roofs cannot be examined closely for the most part. Where they can, it is clear that they are due to solution when water filled the passages and chambers to the roofs and was moving with a definite current, probably under hydrostatic pressure.

(c) Channel Grooves in Walls. At two points, channel grooves can be seen in the side walls, namely the south wall of No. 1 Upper Passage close to the entry from the Bridge and the middle of the south wall of Daylight Chamber. Here are several nearly horizontal, smoothly incurved grooves in the bedrock, 2-3 ft. high and one above the other. These are regarded as the sides of channels carved by free-surface streams as they cut down to successively lower floor levels. There seem to be similar features high up at the west end of No. 3 Extension. In all cases it is not easy to determine direction of flow.

(d) Current Markings. Current markings, i.e. asymmetrical hollows due to solution by turbulent water flow, are not well developed as a rule in the cave and additionally are often partially obscured by calcite skins. At many points the solutional hollowings seem to represent a half-way stage between true current markings and phreatic spongework; they are not systematically asymmetrical and have sharper crests between than is usual for current scallops. As a result the number of points where a confident direction of flow is determinable is few.

Perhaps the clearest case is in the Rift. This tall, narrow passage has current markings reaching high up the walls on both sides, which indicate flow from west to east. The Rift is one of the few parts of the major passages where cave breakdown has done little to destroy the former cave form. A number of other occurrences of current markings along No. 5 Series make it clear that the flow was in the same sense along its whole length. Similarly, there are sufficient clear cases in No 4 Extension to infer that the same motion prevailed there, though some markings indicate more downward movement than forward. No. 3 Extension is contradictory; at the western end there is evidence of downward and eastward movement whereas at the other end the movement was from east to west.

From No. 2 Series there is not a very certain indication of westward flow on the south wall of Daylight Chamber, whilst the small side passages off this wall chiefly indicate downward flow. The westernmost of these passages is a typical downward winding vadose passage with a characteristic oxbow. In No. 1 Series, the movement was westward at three points - towards the east end of Upper Passage, close to the Bridge, and at the west end of Lower Passage.

(e) Inclinations of Passages. The general trends of passages in level may also give some indication of flow direction, though the possibility of uphill flow is by no means excluded when the solutional roofs point to pressure conduits.

At this point some reference must be made to the question of different storeys, levels one above the other, in the cave. As regards No. 1 Series, the naming of Upper, Middle and Lower Passages was essentially descriptive in purpose and it is not certain that there are three erosional storeys because of the collapse in depth in this vacinity. Undoubtedly a long upper level and a short lower level occur in undisturbed bedrock. However for an intermediate erosional level, the only evidence is a solution smoothed roof at the western end of the Middle Passage near the Bridge and also the consolidated stream gravels at the same altitude in the roof of the far western end of the Lower Passage.

In No. 2 Series there is an upper passage linking Daylight and Stalagmite Chambers some 30 ft. above the ordinary low-level connection. The rathole into No. 3 belongs to this upper level also and there seems to be another remnant in the partition between Stalagmite and Slab Chambers now blocked by flowstone.

At various points along No. 3 Series there appear to be relict sections of a high level passage in the roof, largely filled with flowstone now. In No. 4 Series, the Upper and Lower Links derive from two erosional levels not far apart in altitude, with the upper one almost choked with secondary deposition.

Because collapse not only irregularises floor profiles with block piles but also breaks up roof continuity, what was the original attitude longitudinally of the different series of chambers and passages is not always apparent. However, in No. 1 Upper Passage collapse is restricted to two parts only. It is continued in a balcony traverse on the south side of the high collapse area west of the Bridge and this leads to a low extension with two holes in the floor down to Lower Passage. Considering the whole extent of Upper Passage there is quite a substantial fall from east to west corresponding with the sense of the current markings hereabouts.

Whilst No. 2 is so irregular from collapse as to preclude any indication of former trend, No. 3 proper has a definite fall from west to east. No. 3 Extension seems to be quite a separate development from this. Both No. 4 and No. 5 are much affected by collapse but in both the western end is substantially higher than the eastern end. Also, the bedrock roof of the Lower Link falls from west to east. For what they are worth, these indications from Nos. 4 and 5 agree with the sense of the current markings in them.

(f) Minor Phreatic Features. In contrast with the features so far discussed which imply current flow of some velocity even though the currents involved may not have been free-surface streams for the most part, there are other features scattered through the cave, which are of the types regarded by Harlen Bretz and others as evidence of solution under true phreatic conditions, i.e. slow flow below a watertable.

i. Bell-holes in roofs, e.g. in a guano-floored room close to the east end of No. 3 in the neighbourhood of the cross-link to No. 2 in the same series and in an inclined upper passage at the south-west corner of No. 4 Extension.
ii. Roof blades, here sharp ribs along beds, e.g. in the small rooms south of No. 5 just west of the Rift.
iii. Rock pendants, e.g. about halfway along No. 1 Upper Passage from the Bridge and also just west of the Bridge.
iv. Spongework, best seen in the neighbourhood of No. 1 Lower Passage. Also along the south wall of No. 3 east of the cross-link to No. 2.

These phenomena are too exiguous in their occurrence in the cave to imply by themselves an important true phreatic phase in its history. The writer considers that features of these types can develop on a small scale here and there even in a vadose cave system. However, it is not thought that this is the case here because of other arguments in support of phreatic action of considerable importance in the life of the cave.

(g) General Arguments for Phreatic Work. Even allowing for subsequent cave breakdown, it is evident that the cave system developed previously by water action was even then very much dominated by structure; it exhibited no sign of a branching river system and partook much more of a network in so far as it was integrated at all.

The nature of the cross-links between the major series needs mention here. Those between No. 1 Upper Passage and Daylight Chamber, between Stalagmite Chamber and No. 3 Series are water-eroded passages, though joint-guided. The link between No. 2 and the west end of No. 1, the two ways from Main Chamber to No. 3 proper are due to collapse of parts of the intervening walls, though there remains the possibility of solutional passages below having promoted collapse at these points. The direct link from Main Chamber to No. 3 Extension is a solutional passage partly along a joint but it is affected by collapse now. The oblique slit leading from Main Chamber to No. 5 is a collapse feature.

The general pattern of the cave is regarded as being more of a true phreatic pattern than of any other nature.

Then there are the striking facts that a considerable extent of passage and chamber, over 1,000 yards in length, is concentrated in a small area of maximum dimensions 270 yards by 100 yards within a limited height range of 130 feet, and that the whole development is in the nose of a spur with no apparent causal relationship to neighbouring drainage lines. When the cave began to form, the local topography must have been very different as the cave is in the highest surviving part of the limestone hereabouts.

The simplest assumption is that the valley floor lay above the top of the cave, which at that time developed phreatically with slow water movement. The cave pattern acquired then has not been fundamentally changed since, though small phreatic features, e.g. spongework, remain evident in few parts only.

(h) Cave Breccia. In the Dip there are several occurrences of cave breccia.

i. In the roof of Slab Chamber.
ii. On the partition wall of Slab Chamber against Stalagmite Chamber.

iii. Low down on the north wall of Slab Chamber close to the eastern entry to the low lateral extension on this side.

iv. On the north wall of Main Chamber below the westernmost high aven.

v. On the wall at the east end of Main Chamber beneath another aven.

vi. On the south wall of Main Chamber close to the wide, shallow entry into No. 2.

These breccias contain angular limestone fragments of very varied size in a matrix of red earth or clay, often calcite-cemented. In parts they become bone breccias and collections have been made by J. Mahoney and E. Smith. Mahoney (personal communication) has not completed examination of them but provisionally lists the following. There are four species of rodents of the genera, Rattus, Pseudomys, Gyomys, Mastacomys; all probably are living species. Of marsupials, there are two possums (Cercatertus sp., Petaurus sp.), a marsupial mouse (Antechinus sp.) and a koala bear (Phascolarctos sp.); all living species. The only extinct fossil was a large kangaroo (Sthenurus sp.) and came from locality v., whereas the others came from ii. and iii. However, collecting has not been thorough enough to be sure that faunal differences really exist between the breccias. At the moment it is best to treat them as a whole and all that can be said as to age is that they are either Pleistocene or Recent.

There is no evidence of stratification by water and in fact these breccias are older, consolidated versions of the fresh collapse materials seen in such places as the extreme east end of Daylight Chamber Soil products and broken bedrock, together with the remains of animals which have died in surface clefts or fallen down surface holes, have slid down under gravity. Most of these deposits lie close to high avens in the roofs of chambers in accordance with such an origin. The breccia in the roof of Slab Chamber is however somewhat perplexing. From below this roof looks exceedingly precarious but outside the ground is largely occupied by close-set ribs of bedrock, with only narrow, shallow soil hollows between. Here the breccia matrix must have moved down only slightly opened bedding planes and incorporated larger blocks lower down.

The breccias are chiefly thin plasters against the walls now, presumably remnants of larger masses. Such materials could hardly have escaped stratification if they had been emplaced during the earlier phases of excavation of the cave when water was busily at work. They belong to the subsequent phase of cave breakdown and comparative inactivity of solution by percolating soil water solely.

The Probable Evolution

The Dip is a cave which owes much of its overall layout, both in plan and section, to an early phase of true phreatic development when the valley floor lay above it. At this time a series of parallel passages in the bedding planes, together with a few linking passages along joints, were etched out without systematic arrangement in level. Not much is known of the denudation chronology of the region as a whole to enable this phase to be dated. Tertiary basalts overlay a fairly mature relief at 2,000 - 2,400 ft. west of the Goodradigbee valley and Edgell attributed both to the Pliocene. Later work, e.g. that of Gill and Sharp (1956) in the Snowy Mts. suggests that a much older age, possibly Eocene, is conceivable for the surface at 2,000 - 2,400 ft. Whatever its age, there followed the cutting down of the Goodradigbee valley about a thousand feet before the story of the cave began. These beginnings may well belong to the Tertiary, however.

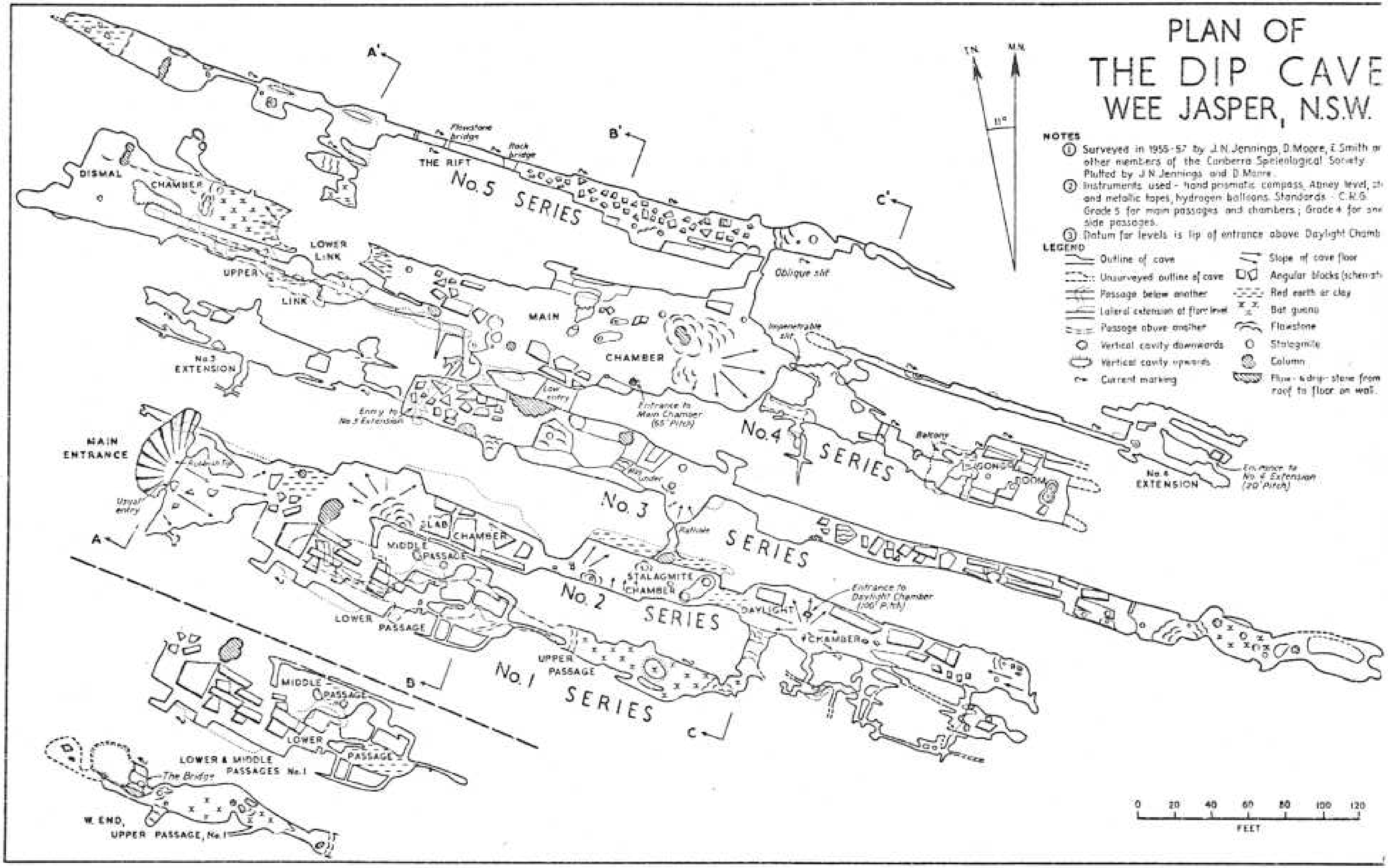
Next the valley was cut down to the stage of the limestone bench below the spur containing the Dip. Edgell has noted this halt in the downcutting of the Goodradigbee about 200 - 250 ft. above its present bed and reports that high level gravels occur in association with it. During the regrading to this stage, the cave came under the influence of stronger water currents, though to begin with it remained full of water most of the time. In the terminology proposed by Glennie (1958), the flow at this stage would belong to either or both of his categories - epiphreatic and bathy-phreatic. The smooth solution roofs, the inclinations of some of the passages and the current markings developed now, though a fully integrated stream system did not. No. 1 and possibly No. 2 drained west to a developing gully on that flank, whereas most of No. 3, No. 4 and No. 5 drained eastward to the ancestor of the present gully on that side. The points of outflow from the cave have all been blocked by collapse and calcite deposition. By the time the bench was fashioned, the upper parts of the cave must have been drained. Cave breakdown would be inaugurated, leading to considerable enlargement of parts of the system.

Then the Goodradigbee cut down still further to its present level of about 1,200 ft., leaving the limestone bench up above its present flood plain. The two gullies on either side of the Dip spur now cut down through this bench, their streams becoming more and more intermittent in flow as the chances of sinking into the limestone increased. This process drained the Dip finally and the absence of much indication of vadose stream action suggests this happened fairly quickly. Cave breakdown became dominant and secondary deposition more important than before.

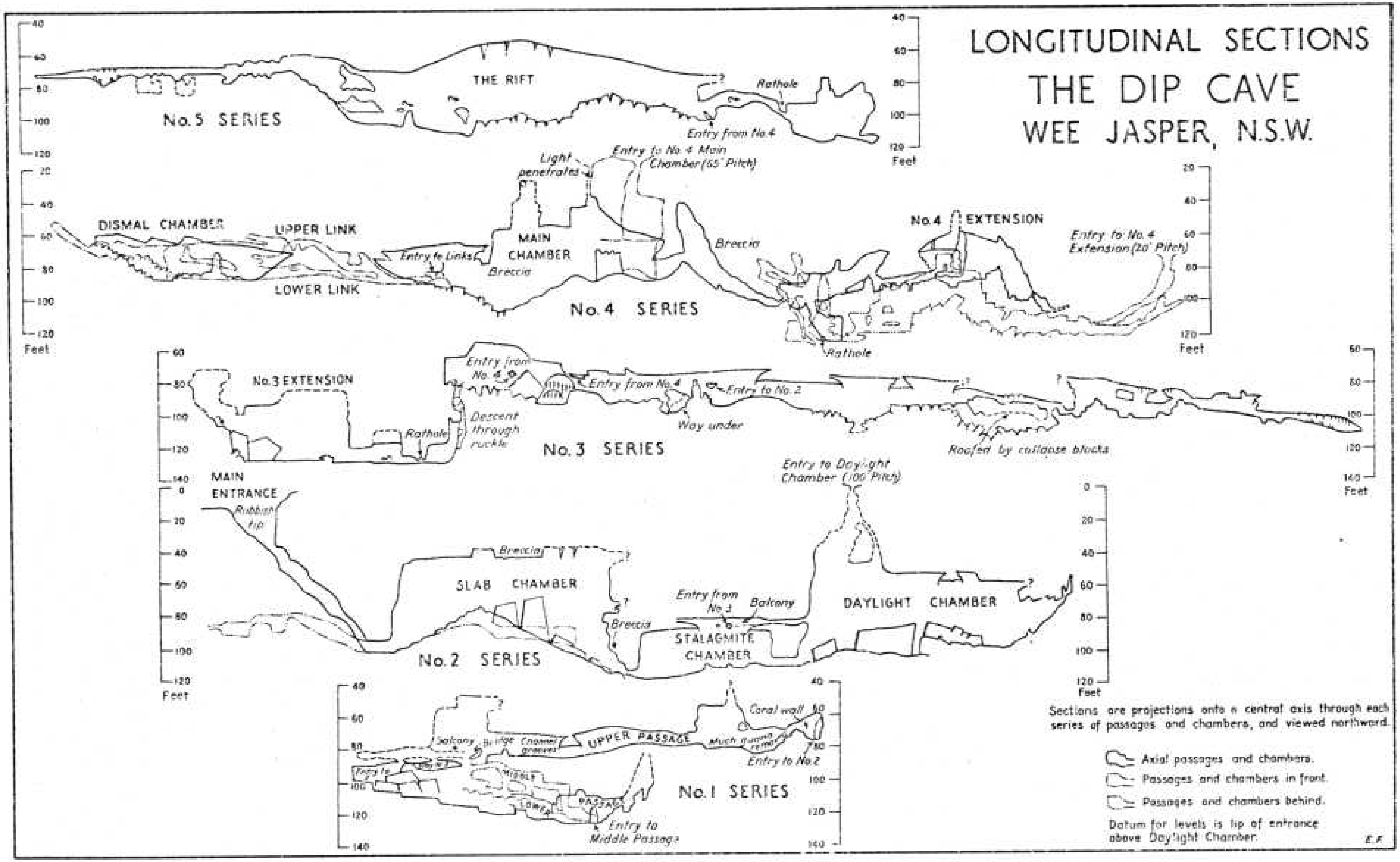
During this time of dominant cave breakdown, the cave breccias were introduced into the cave and the included fauna shows this phase does not go back before the Pleistocene.

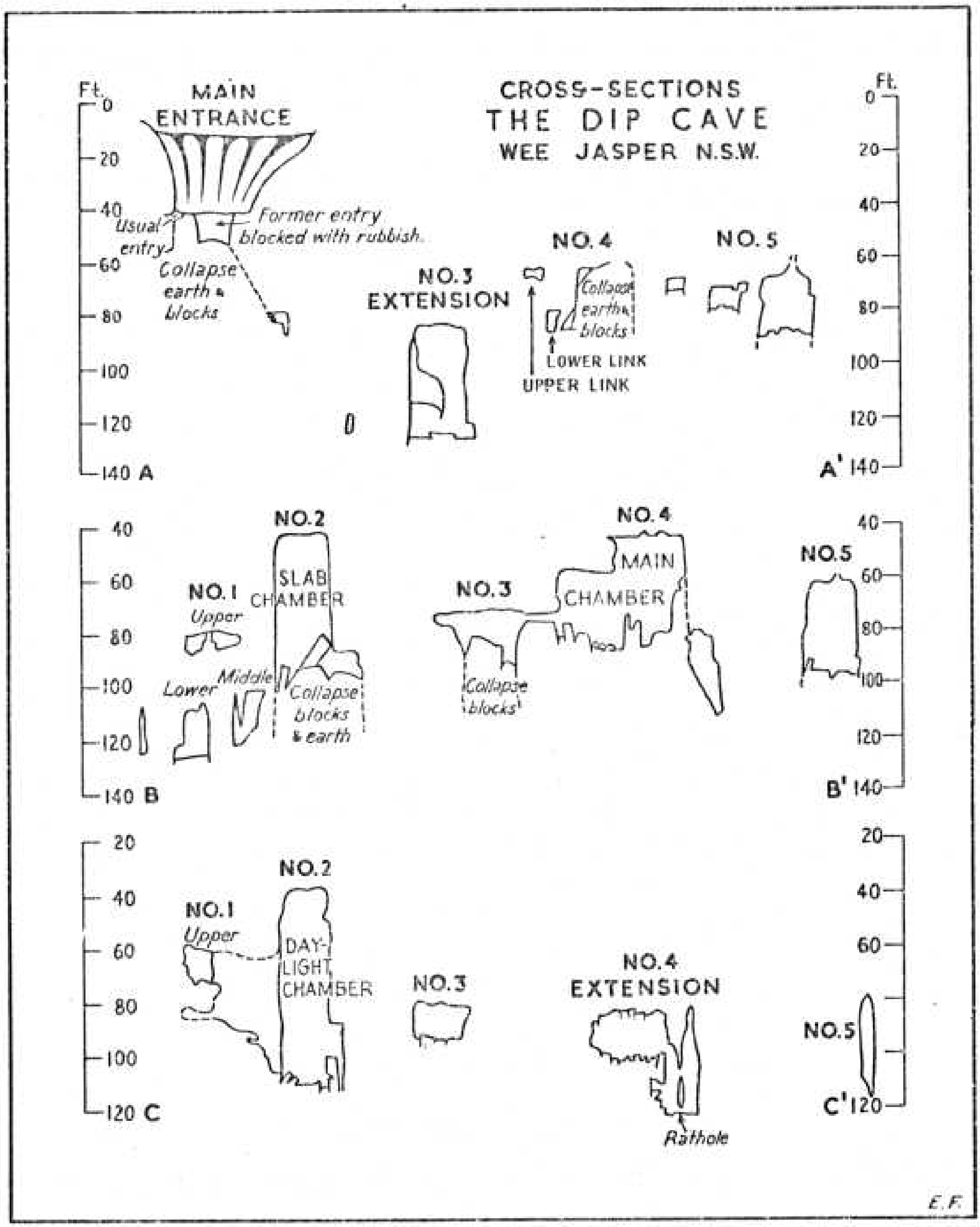
Though much of the breakdown may have come during and closely after the draining of the system, it has continued right up to the present time. Some of the block ruckles show signs of cracking and movement. This can be seen for example in the descent to No. 3 Extension from No. 3.

(Turn to Page 58)



PLAN OF
THE DIP CAVE
WEE JASPER, N.S.W.
NOTES
① Surveyed in 1955-57 by J.N. Jennings, D. Moore, E. Smith and other members of the Canberra Speleological Society. Plotted by J.N. Jennings and D. Moore.
② Instruments used - hand prismatic compass, Abney level, and metallic tapes, hydrogen balloons. Standards - C.R.G. Grade 5 for main passages and chambers; Grade 4 for side passages.
③ Datum for levels is lip of entrance above Daylight Chamb
LEGEND
Outline of cave
Unsurveyed outline of cave
Passage below another
Lateral extension at floor level
Passage above another
Vertical cavity downwards
Vertical cavity upwards
Current marking
Slope of cave floor
Angular blocks (schematic)
Red earth or clay
Bat guano
Flowstone
Stalagmite
Column
Flow- & drip- stone from roof to floor on wall.
T.N.
M.N.
11°
A'
B'
C'
A
B
C
Flowstone bridge
Rock bridge
THE RIFT
No.5 SERIES
DISMAL
CHAMBER
LOWER LINK
UPPER LINK
No.3 EXTENSION
MAIN
CHAMBER
Oblique slit
Impenetrable slit
Low entry
Entry to No.3 Extension
Entrance to Main Chamber (65' Pitch)
MAIN ENTRANCE
Usual entry
No.4 SERIES
Balcony
GONG ROOM
No.4 EXTENSION
Entrance to No.4 Extension (20' Pitch)
No.3 SERIES
Rathole
LAB CHAMBER
MIDDLE PASSAGE
STALAGMITE CHAMBER
No.2 SERIES
Entrance to Daylight Chamber (100' Pitch)
DAYLIGHT CHAMBER
LOWER PASSAGE
UPPER PASSAGE
No.1 SERIES
MIDDLE PASSAGE
LOWER PASSAGE
LOWER & MIDDLE PASSAGES No.1
The Bridge
W. END, UPPER PASSAGE, No.1
0 20 40 60 80 100 120
FEET


LONGITUDINAL SECTIONS
THE DIP CAVE
WEE JASPER, N.S.W.
No.5 SERIES
THE RIFT
Rathole
Entry from No.4
Light penetrates
Entry to No.4 Main Chamber (65' Pitch)
DISMAL CHAMBER
UPPER LINK
LOWER LINK
Entry to Links
MAIN CHAMBER
Breccia
No.4 SERIES
No.4 EXTENSION
Entry to No.4 Extension (20' Pitch)
Rathole
No.3 EXTENSION
Entry from No.4
Entry from No.4
Entry to No.2
Descent through ruckle
Way under
No.3 SERIES
Roofed by collapse blocks
MAIN ENTRANCE
Rubbish tip
Entry to Daylight Chamber (100' Pitch)
SLAB CHAMBER
Entry from No.1
Balcony
DAYLIGHT CHAMBER
STALAGMITE CHAMBER
No.2 SERIES
Coral wall
Balcony
Bridge
Channel grooves
UPPER PASSAGE
Entry to No.2
MIDDLE
PASSAGE
LOWER
No.1 SERIES
Entry to Middle Passage
Feet
Sections are projections onto a central axis through each series of passages and chambers, and viewed northward.
Axial passages and chambers.
Passages and chambers in front.
Passages and chambers behind.
Datum for levels is lip of entrance above Daylight Chamber.
E.F.



CROSS-SECTIONS
THE DIP CAVE
WEE JASPER N.S.W.
MAIN ENTRANCE
Usual entry
Former entry blocked with rubbish.
Collapse earth & blocks
NO.3 EXTENSION
NO.4
Collapse earth & blocks
LOWER LINK
UPPER LINK
NO.5
A
A'
NO.1
Upper
Lower
Middle
NO.2
SLAB CHAMBER
Collapse blocks & earth
NO.3
Collapse blocks
NO.4
MAIN CHAMBER
NO.5
B
B'
NO.1
Upper
NO.2
DAY-LIGHT CHAMBER
NO.3
NO.4 EXTENSION
Rathole
NO.5
C
C'
Ft.
E.F.

Moreover, the calcite decorations show frequent signs of sinking of the floor and movement of wall slab; cracks are common in many stalagmites, curtains and columns. One example is the barrier of fused columns in Dismal Chamber, which has broken away from the roof and dropped several feet as a whole. Halfway along No. 3 from the entry to No. 2, in the lower room enclosed by wall slab, a group of curtains and shawls shows three directions of growth due to two successive movements of the slabs, only the final direction retaining its proper relation to gravitational forces. Though no running water nor even moderate sized pools of water have yet been seen in the Dip after the wettest weather, some solution by seepage water beneath the rock piles must still be going on. This is the explanation of the cracked blocks, tilted and cracked decorations, rather than earthquake tremors.

Conclusion

Though the Dip would be expensive to open up commercially and the appeal to the public in terms of attractive decoration is limited, it is nevertheless a cave of considerable scientific and some sporting interest. It deserves the usual care, which visiting cavers ought to bestow on every cave and warrants protection from the tipping of rubbish which is despoiling more and more of the forepart of the cave.

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A SPIDER INHABITANT OF THE WAITOMO CAVES, NEW ZEALAND

The following is an extract from a letter received recently from W.S. Bristowe, M.A., Sc.D., of London, addressed to "Helictite."

"The Waitomo Glow-worm Cave came top of my list of sights to see when I knew that I was paying what might be my only visit to New Zealand in April, 1957.

"Walking through the cave in a party led by a guide, and with no opportunity to linger, I did not see any spiders or spiders' webs. The guide's emphatic statement that there were no spiders to find awakened an obstinate determination to prove him wrong. After all, I have collected spiders in the Arctic, I have had them sent to me from 23,000 ft. up Mount Everest, and I believe them to live on every land surface where insects exist, except possibly the Antarctic Continent.

"I challenged the guide's statement and was kindly provided with a powerful torch and allowed to make my own search. In complete silence, except for the occasional scampering of a rat which never came within the beam of my torch, I found a number of harvestmen (Hendea myersi cavernicola Forster) on the walls near the water. They had been described three years earlier. And then, at last, I found a very small spider, and later several more with inconspicuous webs in wall crevices. The spiders all belonged to one species in the sub-family Linyphiinae. Eyes were of normal size, and the well-pigmented body suggested that it was not a true troglodyte restricted to cave life, but my ignorance of New Zealand species has so far discouraged me from attempting its identification. My challenge had succeeded, but I had to leave others to collect further specimens and perhaps discover further species."

AMERICAN SCIENTIST TO VISIT AUSTRALIAN CAVES

The assistant professor and acting head of the Geology Department at La Salle College, Philadelphia, Pennsylvania, U.S.A., Brother Gerardus Nicholas, F.S.C., will visit Australia in July this year to study insect life in limestone caves for comparison with that of North American caves.

Brother Nicholas has visited more than 500 caves in the U.S.A., Canada, Mexico and the Bahaman Islands, and has conducted biological surveys in the caves of Maryland, West Virginia, Kentucky, New Mexico, South Dakota and Montana. He is the author of 60 papers in the fields of ecology, speleology and palaeontology. He is a past-president of the National Speleological Society, U.S.A.

While in Australia, Brother Nicholas will give slide lectures to various speleological groups on caving and cave fauna in America.

ABSTRACTS

NOTES ON TWO EUROPEAN MILLIPEDES (DIPLOPODA) IN NEW ZEALAND. By Otto Schubart. Trans. Roy. Soc N.Z., Zoology, 2, (2?) : 191-197, 1962.

Two European millipedes, Brachydesmus Superus Latzel and Ophyiulus verruculiger Verhoeff, are recorded for the first time in New Zealand. One specimen of B. superus was found in a Christchurch garden. In Europe it has been recorded from mole holes and caves in Spain, France, Belgium, Ireland, England, Germany, Italy and Switzerland. Eight specimens of O. verruculiger were found on a mud bank 110 ft. down Virginia Cave, Te Kuiti. This species is of Mediterranean origin, and is not normally a cave dweller. It was probably washed into the cave by storm water.

Orthomorpha gracilis (Koch), a circumtropical species, has been recorded from Rotorua "out of doors." In South Africa it has been recorded from wooded pit-props in the Kimberley and Johannesburg mines in Transvaal. It is also common in the Brownstone Cave in Pennsylvania, and in a strand cave on Funchal, Madeira.

Lists are given of exotic millipedes established in countries of the southern hemisphere. No information is available for Australia. European species found in New Zealand, South Africa and South America were all found to be similar. - A.M.R.

REPORT ON AUSTRALIA AND MELANESIA. By Frederick D. McCarthy. Asian Perspectives, the Bulletin of the Far-Eastern Prehistory Association. Vol. 5, No. 2, Winter 1961, 141-155. Published December 1962. Papers presented at the 10th. Pacific Science Congress, Hawaii. Section 1, Current Research in Pacific Islands Archaeology.

This paper is a general report on excavations and p ehistoric cultures in the various States of Australia, together with preliminary historical reconstructions. Of interest to speleologists are references to cave paintings and rock shelters. Mention is made, but no details given, of work by Dr. Gallus from 1957 on in limestone caves in the Nullarbor Plain, South and Western Australia. McCarthy also refers to superimposition in Australian rock art and cave paintings.

In his report on New Guinea and Melanesia, he emphasises the small amount of archaeological work done to date. The need f r additional data was recognised. Difficulties of working in these areas including financial problems, are pointed out. Rock shelters, cave paintings and rock art are discussed. Discoveries indicated that New Guinea might play an important part in the study of the migration of man into Australia and Oceania. - E.A.L.

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