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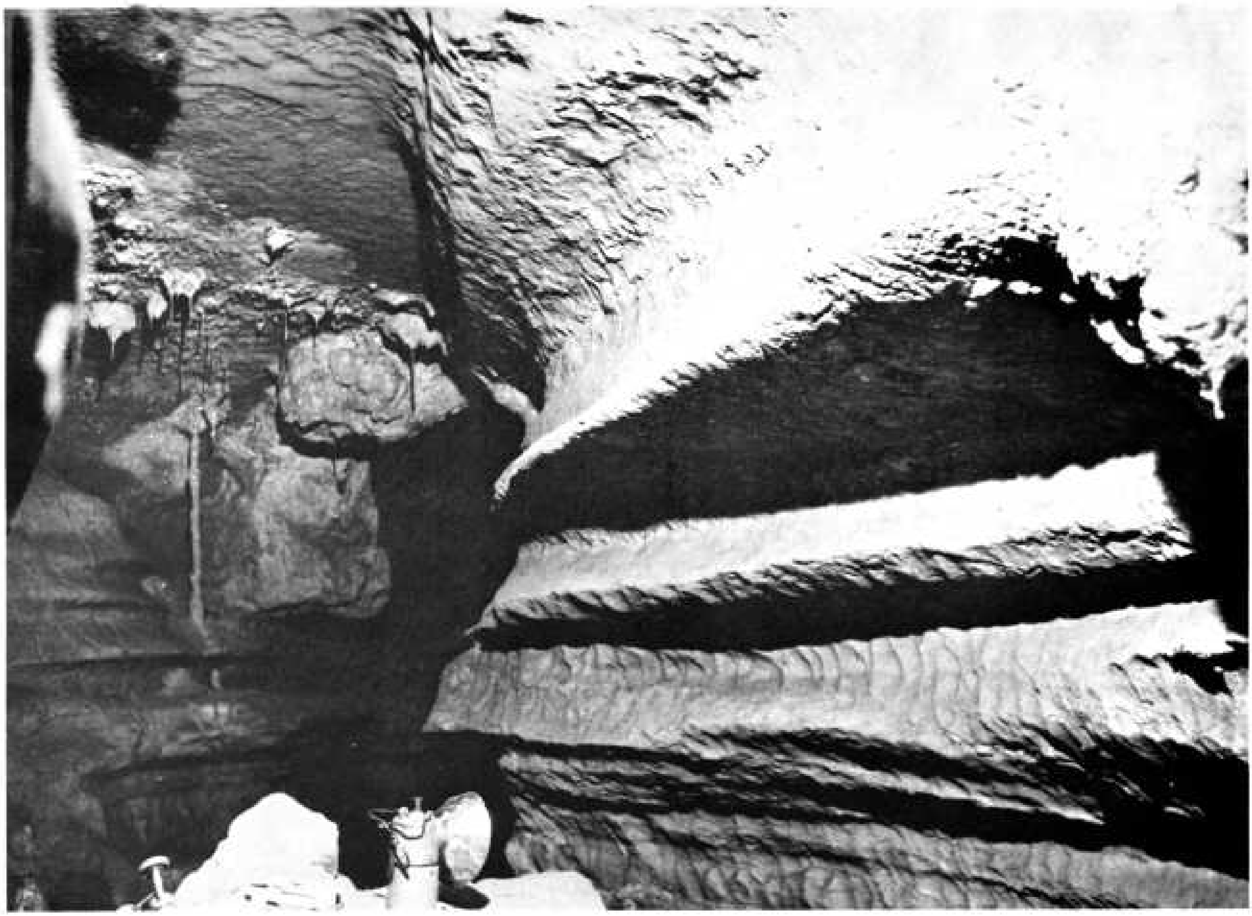

BARBER CAVE, COOLEMAN PLAIN, NEW SOUTH WALES. LOWER DRY PASSAGE WITH FLAT EPIPHREATIC ROOF, SUCCESSIVE VADOSE STREAM INCURVES IN THE WALLS, AND CURRENT MARKINGS. PHOTO FROM J. N. JENNINGS. SEE PAPER COMMENCING PAGE 23.

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A B S T R A C T S

NOTES ON SOME CHIROPTERA FROM QUEENSLAND, AUSTRALIA. By J.L. McKean and W.J. Price. Mammalia, 31, 1967 : 101 - 119.

During August, 1964, a collection of bats (Chiroptera) was made in Queensland. Notes are given on the taxonomy, distribution and habits of 17 species. Areas from which bats were collected include caves at Rockhampton, Mt. Etna and Chillagoe. *Taphozous troughtoni* is regarded as a race of *Taphozous georgianus*, and *Hipposideros ater gilberti* is placed in the synonymy of *Hipposideros ater aruensis*. - A.M.R.

A 3,300 YEAR OLD THYLACINE (MARSUPIALIA : THYLACINIDAE) FROM THE NULLARBOR PLAIN, WESTERN AUSTRALIA. By Jeannette Partridge. J. Roy. Soc. W. Aust., 50, 1967 : 57 - 59.

An almost complete skeleton of the thylacine, *Thylacinus cynocephalus* (Harris) was recovered from Murra-el-elevyn Cave (N 47) on the Nullarbor Plain, Western Australia. Analysis of dried tissue attached to the bones gave a C 14 date of 3,280 + or - 90 years B.P., making this specimen the youngest thylacine yet dated from the mainland of Australia. It is suggested that the thylacine may indicate more humid climatic conditions on the Nullarbor Plain in the past, and its extinction may have been caused by increasing aridity. However, other factors such as disease and competition with the dingo could have contributed to its decline. - A.M.R.

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GEOMORPHOLOGY OF BARBER CAVE, COOLEMAN PLAIN, NEW SOUTH WALES

J. N. JENNINGS

Australian National University, Canberra, A.C.T.

Introduction

Barber Cave is one of the Cooleman Plain caves known for a long time. Inscriptions on the cave walls take white man's knowledge of it at least back to 1875 when it was visited by a party led by John Gale of Queanbeyan. However, the actual date of discovery remains obscure and may belong to the period of the late 1830s to the early 'fifties when there were convict and ex-convict stockmen looking after T.A. Murray's (later Sir Terence Murray) stock on the Plain.

It is of modest dimensions with about 335 m (1,100 ft) of passage, some 25 m (80 ft) of overall height, and no spaces worthy of the name chamber. Within this small compass, nevertheless, it possesses such a good range of cave forms that it was selected to represent "karst cave" in the series of landform prototypes being described and illustrated briefly for teaching purposes in the Australian Geographer (Jennings, 1967b). Here a fuller account of its morphology is presented for speleologists.

Location and External Relationships

Strictly the cave's location (C.R. 715998, R.A.A.S.C. 1/50,000 Sheet 8626-IV Currango) is not within the bounds of Cooleman Plain but lies in the gap in the surrounding igneous ranges which allows the drainage of the plain to escape to the Goodradigbee River and valley. From the broad meridional syncline in Silurian Cooleman Limestone constituting the plain, an anticlinal tongue of this formation projects eastwards between the granite of Black Range on the south and that of Jackson on the north. The cave is thus developed in the same limestone as that of the plain, whereas the limestone of White Fish Cave, the next cave downstream, belongs to a different, Devonian formation according to Stevens (1958). In the neighbourhood of Barber Cave, the Cooleman Limestone is coarsely recrystallised by contact metamorphism and has the appearance of white marble at a number of points in the cave floor where it has been washed clean by the cave stream. There is a dip of about 5 degrees to the southsoutheast, but most of the cave is formed in massive limestone and, in addition, such bedding as is present seems to have lost most tendency to provide planes of weakness for weathering or erosion.

Barber Cave is a through-cave, penetrating the extremity of a right bank spur which ends bluntly in the wall of Clarke Gorge (see inset location map on Figure 1). Cave Creek flows perennially through this gorge from the Blue Waterholes one kilometre upstream. The spur has a flat top, which, along with a number of similar relict features in the gap and in the Goodradigbee valley, belongs to a former valley floor leading outwards and gently downwards from the flat interfluves of Cooleman Plain. Rejuvenation not only led to the cutting of gorges along Cave Creek but also to the erosion of a small valley on the western side of this spur by a tributary stream flowing down the northern slopes of Black Range. This nearly perennial tributary flowed on the surface to join Cave Creek, but the lowermost part of the valley is now dry and the stream passes into the wet, active entrance of Barber Cave.

The valley is blind at this entrance to the amount of 12 m (40 ft), but immediately down valley is a doline about 4.5 m (15 ft) deep with a dry, inactive entrance at its bottom where the stream formerly went underground. Very large granite boulders perch on the limestone col between the blind valley and the doline in testimony to this earlier stage in the river's history.

At a straight line distance of 150 m (500 ft), the Barber Cave stream resurges in a doorlike exit at the foot of the wall of Clarke Gorge and 21. m (7 ft) above creek level to which it runs over loose rocks at an average angle of 20 degrees. About 30 m (100 ft) upvalley there is a dry exit - a roughly elliptical, horizontal opening, 12.8 m (42 ft) above river level at the top of a soil and talus slope of 30 degrees (see generalised long section in Figure 2).

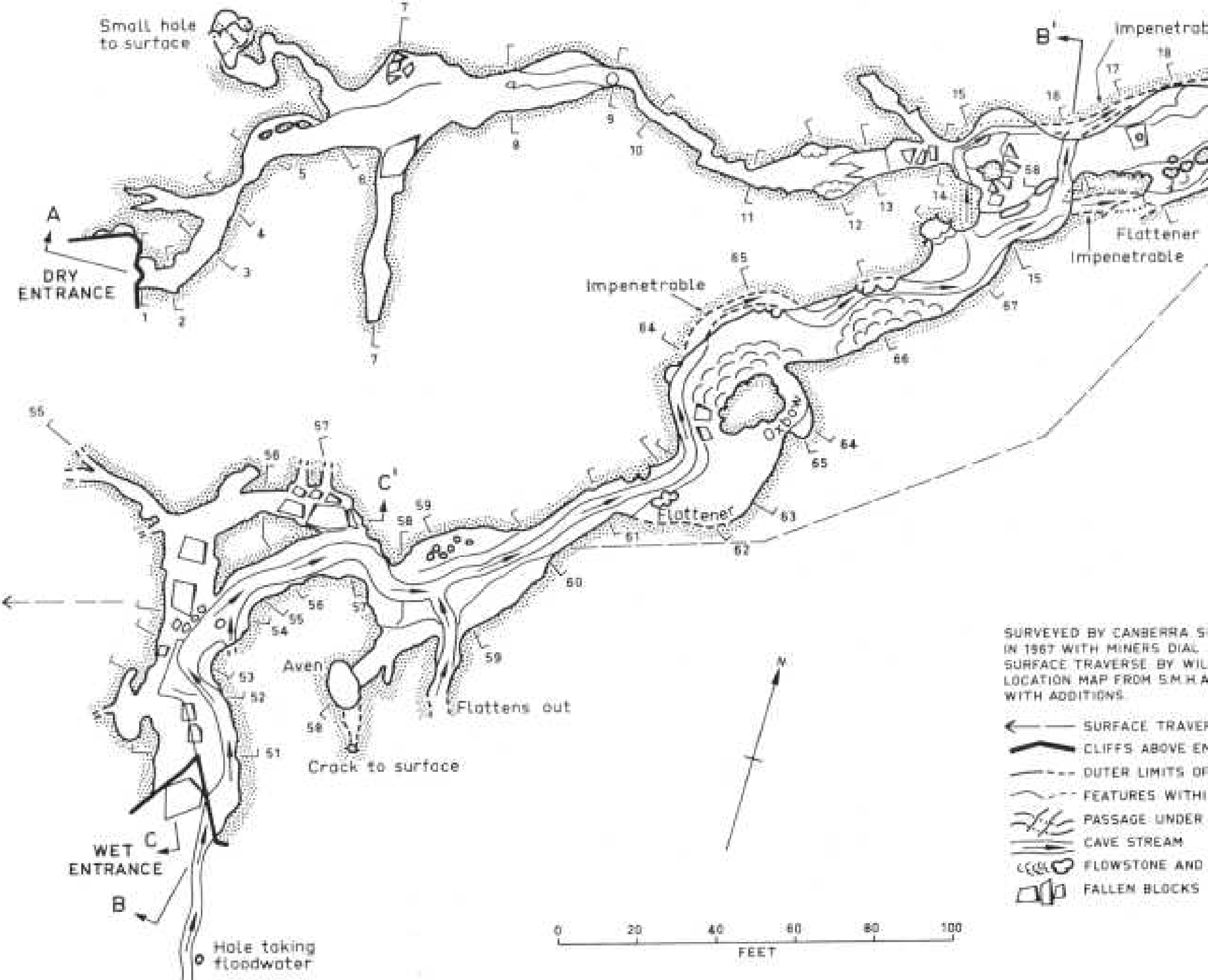
Underground Morphology

Although the cave is in broad terms elongated along the strike, the dip is too small for there to be any close relationship between the cave plan and the disposition of the beds. Instead numerous short reaches of the cave have linearities suggestive of joint guidance in several sets - N, WNW and SW - whilst stream meandering has modified much of the cave walls to obscure any former structural control there.

(a) The Wet Passage (Figure 2, long-sections B-B1, B1-A11)

The active stream passage falls 17.7 m (58 ft) in a distance of 200 m (650 ft). It is generally low, 0.6-1.8 m (2-6 ft) and wider than it is high, often many times. In the first few metres it drops steeply over bedrock for the most part but then more gently over igneous boulders and sand. A tiny feeder comes in on the right bank, which is probably supplied from a hole in the earth bank of the surface valley only 9 m (30 ft) from the cave entrance.

FIGURE 1.


Small hole
to surface
Impenetrable
Flattener
Impenetrable
Impenetrable
Oxbow
Flattener
DRY
ENTRANCE
A
B'
C'
Aven
Flattens out
Crack to surface
WET
ENTRANCE
C
B
Hole taking
floodwater
N
0
20
40
60
80
100
FEET
SURVEYED BY CANBERRA
IN 1967 WITH MINERS DIAL
SURFACE TRAVERSE BY
LOCATION MAP FROM
WITH ADDITIONS.
SURFACE
CLIFFS ABOVE
OUTER LIMITS
FEATURES
PASSAGE UNDER
CAVE STREAM
FLOWSTONE AND
FALLEN BLOCKS

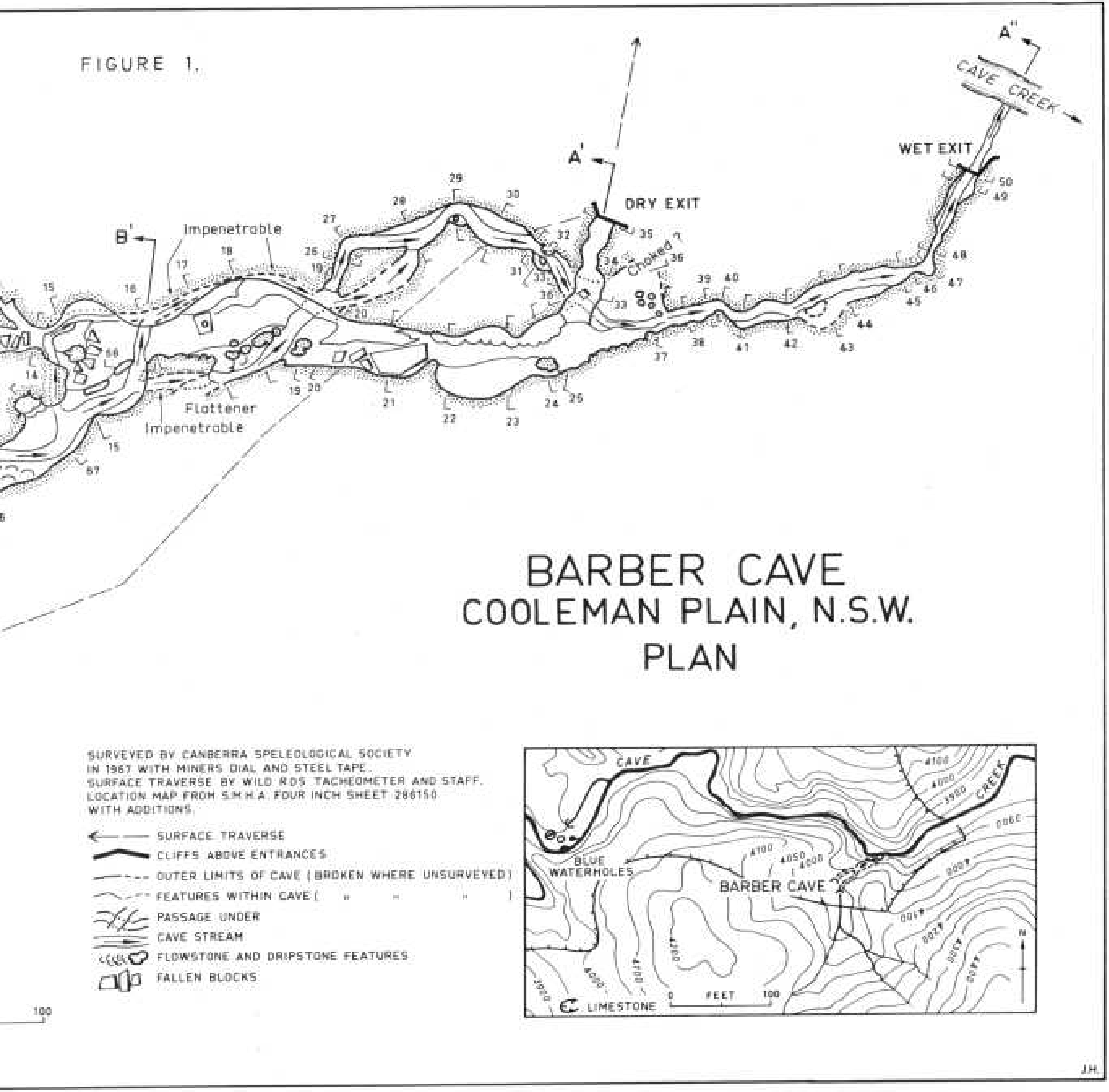

BARBER CAVE
COOLEMAN PLAIN, N.S.W.
PLAN
CAVE CREEK
A''
A'
B'
WET EXIT
DRY EXIT
Choked
Impenetrable
Flattener
Impenetrable
SURVEYED BY CANBERRA SPELEOLOGICAL SOCIETY
IN 1967 WITH MINERS DIAL AND STEEL TAPE.
SURFACE TRAVERSE BY WILD RDS TACHEOMETER AND STAFF.
LOCATION MAP FROM S.M.H.A. FOUR INCH SHEET 286150
WITH ADDITIONS.
SURFACE TRAVERSE
CLIFFS ABOVE ENTRANCES
OUTER LIMITS OF CAVE (BROKEN WHERE UNSURVEYED)
FEATURES WITHIN CAVE (" " ")
PASSAGE UNDER
CAVE STREAM
FLOWSTONE AND DRIPSTONE FEATURES
FALLEN BLOCKS
CAVE
CREEK
BLUE WATERHOLES
BARBER CAVE
LIMESTONE
0 FEET 100
N
J.H.

FIGURE 1.

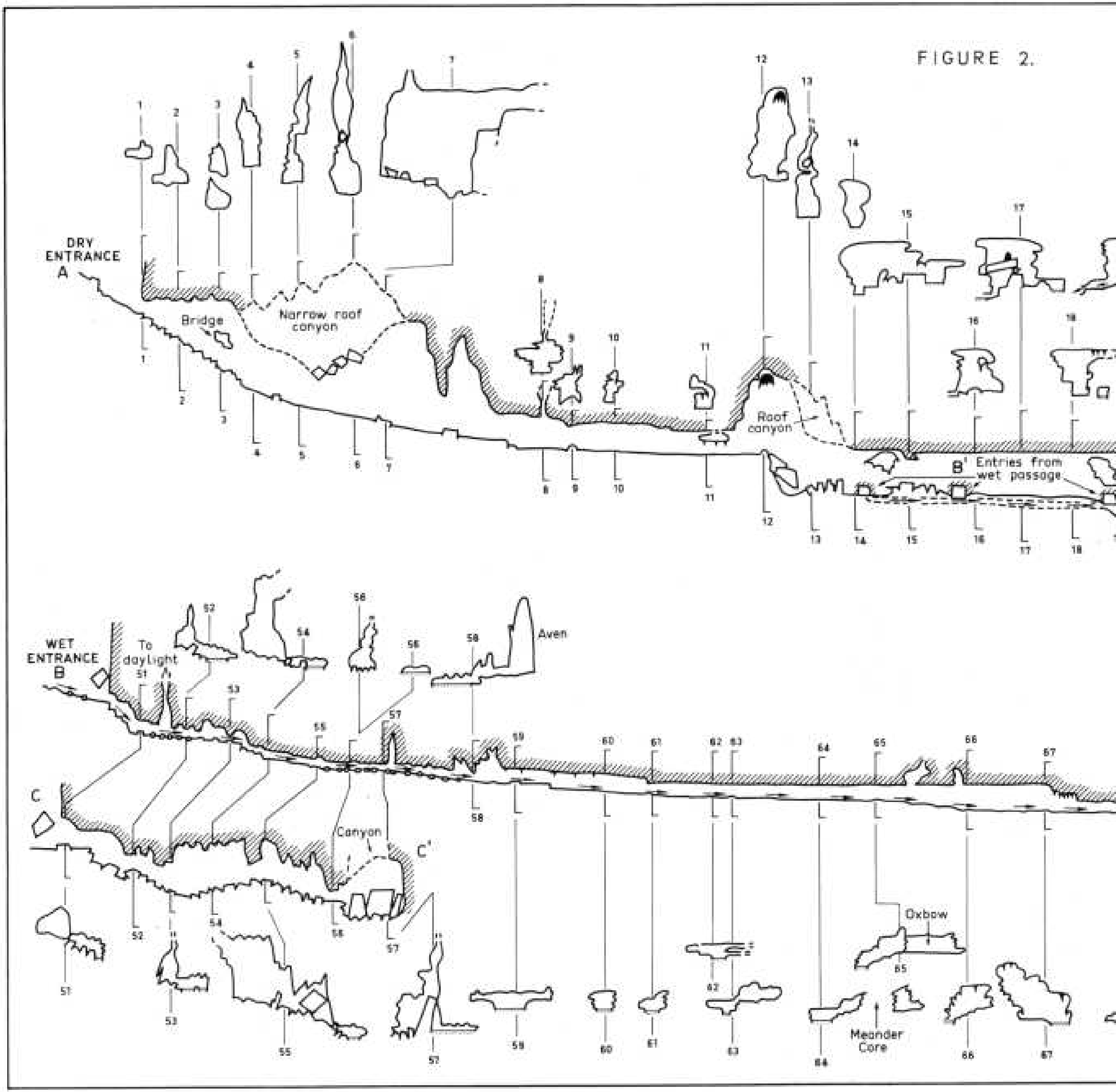
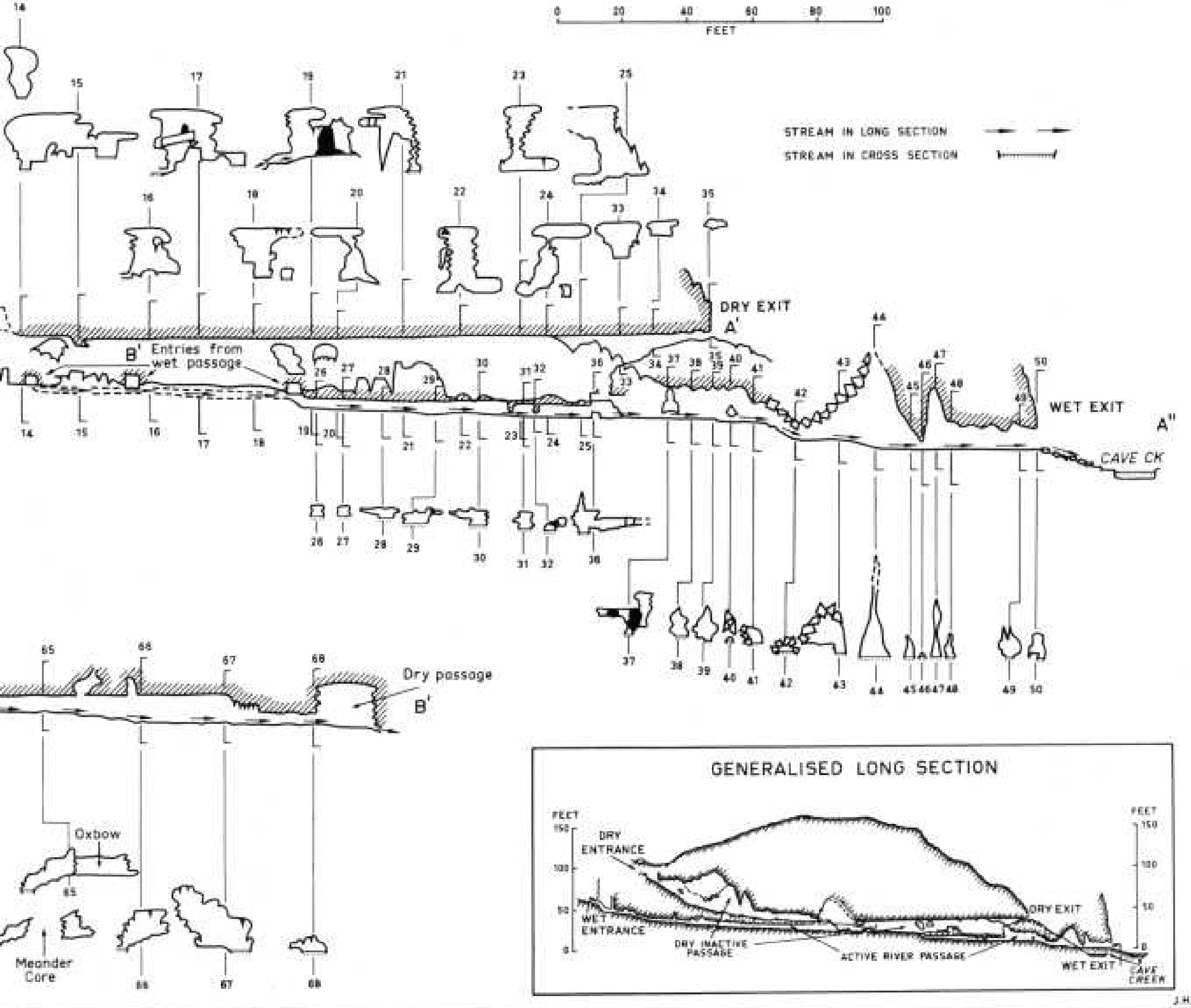


FIGURE 2.
DRY ENTRANCE
A
Bridge
Narrow roof canyon
Roof canyon
B'
Entries from wet passage
WET ENTRANCE
B
To daylight
Aven
C
Canyon
C'
Oxbow
Meander Core

FIGURE 2.

BARBER CAVE

EXTENDED LONG AND CROSS SECTIONS



Over the first 30 m (100 ft), the stream passage is roughly paralleled on the northern side by a much taller passage (long-section C-C1) which represents a much modified oxbow and with which it interconnects at many points. This is floored by collapse blocks of varying size, collapse giving it an irregular roof profile as well. In replacing this outer passage, the stream passage has developed at a lower level (cross-sections (= Xscts) 51-55) but close to their junction it has aggraded to become slightly higher than along the abandoned course (Xscts 56-57). In Xsct 55, where a fissure passage enters from the north, there is an overall cross-section height of 10.7 m (35 ft).

Just below the junction of the two passages, there is a well-developed aven about 7.5 m (25 ft) high, close to the stream on the southern side (Xsct 58) and a fissure just outside the aven's southern wall reaches up to the surface, though the last four feet (about 1 m) of it is not penetrable. Immediately down stream, a tributary of some size enters from the south, and hereabouts there are remnants of a cave floor about 0.6 m (2 ft) higher than the present stream level.

The next feature of interest down stream is an oxbow in the right bank with the cutoff passage about 1.2 m (4 ft) lower (Xscts 64 and 65). A meander niche in the oxbow carries rock pendants in its roof. Flowstone aprons occupy the convex banks of the active stream bed here, whilst the stream has migrated laterally beneath the base of the concave wall for a distance of more than 6 m (20 ft). The cave reaches its greatest depth of more than 36 m (120 ft) beneath the surface about here (see generalised long-section, Figure 2). The roof is remarkably smooth and flat along this section so that with a descending floor the height of the passage increases. The flat roof leads laterally into the dry passage though calcite decoration obscures this relationship somewhat and a small channel beneath blocks and flowstone leads high flood flows across to the northern side of the dry passage. Along the main stream bed the roof lowers once more though retaining its smooth flatness. Here the stream divides again, the main flow continuing straight on, initially through a flat aperture only ten to twenty centimetres high, whereas another high stage overflow course bears left. Small and crude rimstone dams, subject to much damage from pebbles, have raised the floors slightly in the two main passages in this section.

All stream branches cross the dry passage almost at right angles and unite once more north of it, the two flood branches being too low and small to follow to this reunion. A second flood channel forks off at this point to the right for a very short distance; the main channel has cut it off at a lower level where it remains small and low with smooth roof and floor in bedrock (Xscts 26-32).

The stream passage makes a final crossing beneath the dry passage near the dry exit and along here there is open lateral connection between the two again (Xsct 25). Floor remnants about 1 m (3 ft) above the stream on both sides of it occur above a point where secondary precipitation almost chokes the wet passage (Xsct 37) and may also conceal a former outlet completely (Xsct 36). There follows a confined section where the stream is almost entirely in collapse blocks, only the right wall being in situ (Xscts 41-43); the stream must lie very close to the external talus slope. A high, narrow fissure passage with a gravelly floor succeeds, almost closed at one point by decoration (Xscts 44-47). The final 9 m (30 ft) to the wet exit is of small size and flat floored with bedrock barely covered by gravel (Xscts 48-50).

Igneous pebbles and boulders are found right through the wet passage in the present bed and also inactively stranded on shelves and in channel incurves.

(b) The Dry Passage (long-section A-A1)

The dry passage falls 14.6 m (48 ft) in 140 m (450 ft) and is generally larger than the wet passage. It begins with an irregularly level roof and a steeply falling floor in loose rocks and earth. A bedrock bridge is remnant from a former higher passage floor (Xsct 3). Beyond is the highest part of the cave, though this is not at all obvious because it is a very narrow canyon much choked by fallen blocks and secondary calcite (Xscts 5-6). The most spacious room in the entire cave is found in this canyon section where two small side passages unite with it (Xsct 7). The one on the north side leads to the surface in a small twisting passage. In this room shelves and meander niches as much as 1.2-1.5 m (4-5 ft) above the lowest part of the floor belong to a former cave floor level (Xsct 8). The dry passage then becomes very low and narrow with a flatter gradient (Xscts 10-11). There are false floors here and much flowstone so that it is likely the canyon continued through this section, prior to choking, to the next part beyond, where the roof is high once more (Xsct 12) and substantial wall decoration reaches to it. The floor then drops sharply over fallen blocks and here a much lower but extremely flat roof begins (Xsct 14). Carrying a number of small stalactites, this roof runs almost to the dry exit, only the last 2 or 3 m (7-10 ft) becoming less regular and rising slightly. Fallen blocks and decorations are very characteristic of this section (Xscts 17, 21) but there remain many channel incurves over parts of the walls, in some places in considerable number over their full height of about 5.5 m (18 ft) (Xscts 21-23). Well developed meander niches are found at both floor and roof levels. One of the floor niches is particularly well endowed with anastomosing half-tubes and rock pendants in its ceiling. At the final crossing of the wet passage there is an abrupt rise in floor level of the dry passage (Xsct 25).

Allogenic gravel and boulders are to be found at various points in the dry passage, on ledges and shelves as well as on the floor.

Evolution of the Cave

When the stream of Barber Cave flowed subaerially, it must have dropped very steeply over the last part of its course to Cave Creek. Gradually joints and some bedding planes within the spur to the east were opened up by phreatic solution producing the anastomosing half-tubes seen at a number of points in the cave. Water began to flow freely through some of these along preferred courses till eventually one of them captured the stream which began to sink at the dry entrance doline. It is likely that Cave Creek flowed at the level of the dry exit at this time.

In its upper course through the limestone, the stream began to cut vigorously downwards as a free-surface vadose stream equipped with igneous rock tools for abrasion as well as acidulated water for solution. In contrast, the lower course developed initially as an almost horizontal elliptical passage at the level of the flat roof of the dry passage. Unless we assume a precipitation greater than at present or more effective through lower temperatures, this flat shallow-phreatic passage must have dried out episodically as the present active stream passage does. At this stage the longitudinal profile of the cave assumed a form closely comparable with the equilibrium profile (see generalised long profile, Figure 2) of an adjusted surface stream. In this way an underground course of greater length and lesser gradient was substituted for the former subaerial course down the dry valley. At this time Cave Creek cannot have been degrading its bed, otherwise this profile could not have developed.

Eventually Cave Creek resumed the incision which had already fashioned the major part of Clarke Gorge and this led to the development of a lower exit. There followed the cutting down of the cave farther back and the flat-roofed section of the dry passage was deepened in a halting manner suggested by the many wall incurves and meander niches. Whether this lower exit was the present wet exit or there was for a time an exit at an intermediate level now choked by flowstone and buried by talus due to entrance collapse seems indeterminable on present evidence, though the more complex history makes subsequent evolution more understandable, and the flat-roofed low area depicted in Xsct 36 may be part of such an intermediate exit.

In the middle of this process of degradation of the lower part of the dry passage, phreatic preparation induced the cave stream to capture the surface stream a little higher up its course and the upper part of the dry passage became disused. The high collapse passage leading from the wet entrance was produced by vadose canyon development prior to collapse and to cutoff by the present active stream course. The flat roof of the wet passage above its first crossing of the dry passage indicates that the stream here frequently filled to the roof; a shallow-phreatic phase for this section is thus involved. Then vadose incision of about a metre followed whilst this upper part of the wet passage continued to feed the lower part of the dry passage (upstream of Xsct 25).

A further major change followed the functional replacement of the lower part of the dry passage by the low active stream passage to the north of it (Xscts 26-32). Though not so flat as the shallow-phreatic roofs already described, the roof of this section is a product of solution also so it must have filled up and been subjected to pressure flow at some stage, indeed, as it still does in small sections today.

The wet passage of today has a greater length and lesser gradient than the dry passage. It is more composite in nature than the latter and consequently does not exhibit as regular a longitudinal profile as the dry passage did at a certain stage. Since the present active exit of the cave came into operation, Cave Creek has incised slightly and left it hanging by a modest amount. The cave stream is now a free-surface vadose stream over its full length, only filling to the roof at a few points in times of flood.

Dripstone and flowstone decoration has no doubt been forming in places ever since parts of the cave ceased to be permanently or frequently water-filled. As a result, more decoration is to be expected in the dry passage and in those parts of the wet passage left high and dry by incision and lateral migration than in the active parts of the cave. This is in fact the case though the pattern is more complicated in detail than this would suggest. Inactive secondary encrustations are more common in the dry passage, implying less percolation water there. One of the least decorated parts of the cave is the low, active, wet passage north of the dry passage.

Age of the Cave

The cave has yielded no direct evidence of its age, which can only be approached indirectly through the geomorphology of the area. Along with other high plains in this part of New South Wales, Cooleman Plain has been claimed to be Pliocene in age (David and Browne, 1950). Though this carries greater conviction than Stevens' claim (1958) of Devonian age for it (Jennings, 1967a), no great certainty can be attached to it. It is certainly younger than the Kiandra basalts about 12 miles southwest which Gill and Sharp (1956) maintain are Oligocene in age on palynological grounds. Rejuvenation of the drainage of the Plain is attributable to Tertiary epeirogenic uplift (the Kosciusko uplift), formerly regarded as Pliocene-early Pleistocene in age, but now thought by many (cf. Gill and Sharp, 1956; Gill, 1964) to be a much longer and interrupted event stretching through most of the Tertiary into the Pleistocene. Gorge development had proceeded well on its way prior to the formation of the cave, so an upper Tertiary-Pleistocene rather than a lower Tertiary <u>terminus post quem</u> may be inferred for the cave. Clarke Gorge seems to have been more or less completed prior to the major Pleistocene cold period affecting Cooleman Plain and producing periglacial blockstreams there, one of which is found within the gorge at its upstream end and reaches to within 50 feet of river level. There is evidence (Caine and Jennings, in press) from further south in New South Wales that this cold period lies between 33,000 and 15,000 B.P. The dry passage at least is likely to have developed prior to this cold period. Much more investigation of the area will be necessary before anything more precise than these vague indications of age for the cave can be proffered.

Acknowledgments

The help of many members of the Canberra Speleological Society in surveying and other work in Barber Cave is most sincerely acknowledged.

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ABSTRACTS AND REVIEWS

THE RHAPHIDOPHORIDAE (ORTHOPTERA) OF AUSTRALIA. PART 5. THE RHAPHIDOPHORIDAE OF FLINDERS ISLAND. By Aola M. Richards. Proc. Linn. Soc. N.S.W., 92, 1967 : 151 - 156.

The species Speleotettix flindersensis Chopard is re-described and placed in the genus Cavernotettix Richards as Cavernotettix flindersensis (Chopard). Specimens for the re-description were obtained from a limestone cave near Ranga in the southwestern part of Flinders Island. This cave is the only known habitat for the species. C. flindersensis is the only species of Rhaphidophoridae known to occur on the island. The range of Cavernotettix is now extended from the Southern Highlands of New South Wales to Flinders Island, about 30 miles off the northeastern coast of Tasmania. So far no representatives of the genus have been recorded from Tasmania. Thus C. flindersensis is more closely related to Mainland Rhaphidophoridae than to any known Tasmanian forms. Migration must have been from the north, presumably via the land bridge which extended from Wilson's Promontory to Flinders Island during the Pleistocene. C. flindersensis is considerably larger than the other three species in the genus, possibly due to the isolation of its island habitat. A key is given for the species in the genus Cavernotettix. - A.M.R.

GROUNDWATER IN THE BARKLY TABLELAND, N.T. By M.A. Randal. Bur. of Min. Res., Geol. and Geophys., Bull. 91, 1967 : 110 pp. plus 1 folded map.

This bulletin deals with the groundwater resources of the central and eastern parts of the Barkly Tableland, near the Queensland border. Several areas of limestone and dolomite are referred to in the geology of the Tableland, but only the Camooweal Dolomite, which is medium to thick-bedded, is classified as cavernous. The dolomite is generally concealed by black soil and Mitchell grass. It may have been deposited as a carbonite mud in a warm shallow sea under quiet conditions - presumably an environment of evaporation and precipitation. Drillers' logs of waterbores in the Tableland area frequently refer to caves, cavities and fissures in underlying limestones. - E.A.L.

COLLECTION OF SPECIMENS FOR RADIOCARBON DATING AND INTERPRETATION OF RESULTS. By H.A. Polach and J. Golson. Aust. Institute of Aboriginal Studies, Manual No. 2, 1966 : 42 pp.

This multilithed handbook is intended for use by archaeologists throughout Australia, and as many samples suitable for carbon dating have been and will be found in caves, the content is also of considerable interest to speleologists. Mr. Polach of the Department of Geophysics and Geochemistry, Australian National University, Canberra, conducts the University's radiocarbon dating laboratory. Mr. J. Golson is an archaeologist in the Department of Anthropology of the same university. The radiocarbon laboratory is intended as a research unit into radiocarbon dating methods and interpretation as well as providing a radiocarbon dating service. The paper sets out a number of principles to enable the laboratory and its archaeological clients to be of best service to each other in the production and interpretation of radiocarbon dates.

Validity of the method and sources of error are discussed, e.g., misassociation of sample and event, contamination of sample, uncertainty of C 14 at the time of death, and factors likely to affect count rate. A chapter follows on interpretation of a C 14 age and considers the age and its error, the relationship between radiocarbon ages and actual ages, and how radiocarbon results should be applied. The paper stresses that the archaeologist begins the interpretation with the radiocarbon age produced by a laboratory. This age, its attendant error, and the code and sample number of the laboratory responsible for it must always be quoted. A procedure is recommended for interpreting radiocarbon ages in terms of calendar years.

Requests to a laboratory for radiocarbon dating should always be accompanied by full details relating to the sample, its nature, the stratigraphy, environment and state of preservation. A sample record sheet is given together with detail on amount of sample for dating to be submitted; the handling of samples is discussed and the suitability of several materials for dating (e.g., woody materials, shell, soil, etc.). Notes are given on filling in the record sheet for each sample. An excellent brief guide. - E.A.L.

THE SEVENTH ARCHBOLD EXPEDITION. By H.M. Van Deusen. Bioscience, 16 (7), 1966 : 456 - 463.

A short, general account of the seventh of an important series of biological explorations of New Guinea which began in the 1930s. This 1964 expedition was led by Dr. Van Deusen, a mammalogist on the staff of the American Museum of Natural History, New York, and explored the Huon Peninsula. Limestone caves of the Finschhafen coast were investigated briefly. A cave in ancient coral limestone contained large numbers of black flying foxes (Dobsonia) and large whip scorpions. Small freshwater crabs and fossil giant clams were found in a stream passage in the cave. Another cave contained small bats, but access to tunnels and other roosting rooms was prevented by extensive flowstone. - E.A.L.

MARSUPIAL CARNIVORE DENS IN AUSTRALIAN CAVES. By Ernest L. Lundelius, Jr. Studies in Speleology, 1 (4), 1966 : 174 - 180.

A brief account of the mode of accumulation of bones in caves is followed by a description of fossil coprolites attributable to the Tasmanian Devil (Sarcophilus harrisi) from three caves in Western Australia. The caves are Wedge Cave, 100 miles north of Perth; Nannup Cave, 180 miles south of Perth; and Webb's Cave, on Mundrabilla Station, 55 miles west of Eucla on the Nullarbor Plain. A list of prey species of the Devil is given from the three caves. Comparison is made with recent faeces of the same animal, and also of the Tiger Cat (Dasyurus maculatus) and of the Native Cat (Dasyurus geoffroyi). It is observed that no information is available concerning the faeces of the Tasmanian Wolf (Thylacinus cynocephalus), or of the extinct "Marsupial Lion" (Thylacoleo carnifex), but that a close examination of remains associated with bones of these two animals might yield information. - A.M.R.

A SURVEY OF PHOSPHATE DEPOSITS IN THE SOUTH-WEST PACIFIC AND AUSTRALIAN WATERS. By W.C. White and O.N. Warin. Bur. of Min. Res., Geol. and Geophys., Bull. 69, 1964 : 173 pp., 7 tables, 7 folding maps and 63 text figures.

This report describes investigations to find phosphate deposits in many islands north and northeast of Australia to replace the waning reserves of Nauru, Ocean and Christmas Islands. Only one worthwhile occurrence was found on Bellona Island in the Solomons. In themselves these investigations are of little direct interest to the speleologist. However, the general descriptions of the islands are useful to him in indicating which of them have some caving potential. The latter fall into two categories - the emerged atolls which may carry caves in their higher rims and the islands cored with other rocks but which carry a surround of emerged fringing reef, now forming terraces of some thickness round the outer parts of the islands.

There are some other points in the book for those interested in karst. On some Fijian islands, "qilos" are described; these are circular closed depressions, several hundred yards across with vertical walls 50-100 ft high. The walls are in limestone and the clay floors directly overlie volcanic rock. They are thus a special kind of doline.

For several islands the forms of the limestone beneath the phosphate deposits are described. Beneath many parts of the phosphates on Bellona Island, the limestone floor is irregular with deep chimneys, 10 to 20 ft deep, filled with the mineral; there may also be stumpy pinnacles rising above the tops of the chimneys. Rounded forms are characteristic of this subsoil weathering as opposed to sharp and jagged subaerial weathering. On Ocean Island the pinnacles are taller and more vertically sided and the pits deeper; there may be a difference of height of 80 ft. Nauru Island seems somewhat intermediate in the dimensions of its similar features. On these two islands the limestone surface is dolomitised. W.C. White suggests that the solution to produce these forms takes place in a zone of sea spray after slight emergence of the reefs and dolomitisation takes place at this time also. On further emergence soil and phosphatic material bury the solution forms and it is at this time that smoothing of their surfaces will take place through subsoil solution. It is not clear how this hypothesis could apply to the Bellona Island occurrences since these lie within the former lagoon, which would have been protected from sea spray from first emergence. Nor of course does it apply to basically similar forms ("geologische Orgeln") which are characteristic of many karst areas of completely different geomorphological histories to those of oceanic islands. However, it may well be true of the emerged reefs such as are found at Ocean and Naura where there would be no protection from spray during emergence.

\- J.N.J.

GEOLOGY OF BOUGAINVILLE AND BUKA ISLANDS, NEW GUINEA. By D.H. Blake and Y. Miezitis. Bur. of Min. Res., Geol. and Geophys., Bull. 93 / Bull. PNG 1, 1967 : 56 pp. plus map in pocket.

Bougainville and Buka Islands, although politically part of the Territory of New Guinea, are the northernmost islands of the Solomon group. The Solomon Islands are mostly formed of Cainozoic volcanic rocks, sedimentary rocks derived from volcanics, and subordinate organic limestones. A Pleistocene reef complex, the Sohano Limestone, forms most of Buka and also outcrops on the north coast of Bougainville. The limestone is an elevated reef complex forming a platform which terminates in cliffs along the north and east coasts. The cliffs range in height from less than ten feet on Bougainville to almost 300 ft at Iltopan, on the northeastern tip of Buka. The drainage on the Sohano Limestone outcrop is mostly underground and surface streams are found only in low-lying areas on the west side of Buka. Underground rivers reach the sea in caves at Lonahan (Taema Caves) and Melasang on the east coast of Buka.

The Keriaka Limestone of Lower Miocene age outcrops mainly in a roughly rectangular area of about 100 sq miles on the western side of Bougainville, southeast of Cape Moltke, where the limestone forms cliffs up to 100 ft high. It occurs as an uplifted reef complex in the Keriaka district, the plateau having a maximum height near its eastern margin of 4,400 ft where it is bounded by high cliffs. The limestone here is at least 4,000 ft thick. Its base is not exposed. The plateau landscape is typically a karst of very closely spaced dolines, grading into valleys of integrated drainage and separated by a reticulate system of saw-tooth ridges about 400 ft high. The slopes tend to be concave and very steep. In some areas on the periphery of the former atoll pyramidal hills are more conspicuous than conical dolines, resulting in a fine-textured type of kegel karst. The landscape is mantled with many feet of volcanic ash from surrounding volcanoes and this must have influenced the development to some extent. Small isolated outcrops of the Keriaka Limestone have been found also on the eastern side of Bougainville, the largest (just west of Mentai Mission) having a well-developed karst topography similar to that of the Keriaka Plateau. The reviewer spent three months at Torokina, on the coast near the plateau, over 20 years ago, and was subjected to frequent earthquakes of varying intensity. This paper does not refer to actual caves in the Keriaka Limestone, unfortunately, but it would be interesting to know the effects of frequent seismicity on cavern development in the area. - E.A.L.

LIMESTONE AND LIME IN THE TERRITORY OF PAPUA AND NEW GUINEA. By J.S. Hosking. <u>CSIRO Div. of Building Res. Tech. Paper No. 21</u>, 1967 : 36 pp.

The Territory of Papua and New Guinea is shown to be rich in limestones which are well distributed throughout the mainland and associated islands. The limestones range in age from Permian to the present - they are still being built up extensively in the coral reefs fringing the mainland coasts and neighbouring islands. Soft, friable coralline limestones abound on the islands and coastal areas of the mainland. Limestones are widely distributed in the highlands and are older and consequently harder, denser, more massive and bedded. Limestones of intermediate age and compaction outcrop frequently on the coastal ranges and hills between the low coastal plains and the highlands of the mainland; such limestones often form the core or backbone of islands.

The paper is mainly concerned with the economic use of limestone in the Territories but provides interesting discussion on limestone areas under age and district. No indication of caves is given. Limestones range from a few inches thick to limestones of Miocene Age in Western Papua extending from the headwaters of the Fly and Strickland Rivers, through the Southern Highlands and Darai Hills, to the Gulf of Papua to within some miles of Port Moresby. These limestones attain their greatest thickness of more than 11,000 ft in the large rectangular plateau of the Darai Uplift, about 20 miles wide by 90 miles long. The plateau is pitted with steep-sided sink holes, hundreds of feet deep and separated from each other by narrow ridges and conical pinnacles. Vertical cliffs up to 1,000 ft high form the western boundary of the plateau. Miocene limestones are also a feature of New Britain, New Ireland and Bougainville. Palaeogene limestones are also a conspicuous feature of the highlands where they are represented by the Chimbu, Nebilyer and Mendi Limestones of the Eastern, Western and Southern Highlands respectively. Each formation is several thousand feet thick. The Chimbu Limestones, well-known to Territory speleologists, outcrop mainly between Goroka and the Wahgi Valley. Tremendous cliffs rise above the valley floors in the vicinity of Chuave, Kundiawa and Mingende. The Nebilyer Limestones stretch as cliffs up to 1,000 ft high along the sides of the Nebilyer River Valley, southwest of Mt. Hagen.

In contrast, coralline limestones ranging in age from Pleistocene to the present are common on the islands and coastal areas of the mainland. The deposits range from beaches only a few feet above sea level to isolated cliffs and headlands. They may extend inland for considerable distances, either as low plains or as tiers of terraces and hills up to about 100 ft high. Twenty-odd years ago, this reviewer visited many islands north of New Guinea, such as the Trobriands, and islands off the coast of New Britain and New Ireland, and found numerous small caves in low sea cliffs and near-coastal areas. - E.A.L.

SOME PSEUDOSCORPIONIDEA FROM AUSTRALIA, CHIEFLY FROM CAVES. By M. Beier. Aust. Zool., 14 (2), 1967 : 199 - 205.

Four species of Pseudoscorpions, three of them new, are recorded from New South Wales caves. A fifth species, *Sundochernes dewae* Beier, is recorded from birds' nests in hollow trees. *Sathrochthonius tuena* Chamberlin is recorded from guano in the Southern Limestone, Jenolan Caves, and the Basin Cave, Wombeyan. This true cave-dwelling species was originally described from an unnamed cave, possibly in the Blue Mountains of New South Wales. *Morikawia cavicola* Beier was taken in guano from the Grill Cave, Bungonia. It is another troglobite with eyes and eye-pigment greatly reduced. *Sundochernes guanophilus* Beier was taken in guano in Fig Tree Cave, Wombeyan, but is not cave adapted. *Protochelifer cavernarum* Beier was also collected from guano in Murder Cave, Cliefden, and Belfry Cave, Timor. It is the first known cavernicolous species of the genus *Protochelifer*, which is distributed in Australia and New Zealand. Nearly all the material was collected by Miss Barbara Dew of Sydney. - A.M.R.

THE ORIGIN OF EASTER CAVE DOLINE. By D.C. Lowry. Aust. Geog., 10 (4), 1967 : 300 - 302.

J.N. Jennings cited Easter Cave entrance, near Augusta, Western Australia, as an Australian example of a solution doline in "Australian Landform Examples No. 7 - Solution Doline and Subjacent Karst Doline," Aust. Geog., 10, 1966 : 132 - 133. The cave is developed in Pleistocene aeolianite formed by the lithification of a calcareous coastal dune. Lowry believes that Easter Cave was initiated by solution at or just below the watertable, about 120 ft below the surface. The cave migrated upwards by roof collapse in the vicinity of the present entrance until it intersected a cluster of solution pipes. Soil which had been filling and overlying the pipes fell through into the cave. The thick layer of soil at the surface then eroded rapidly to form a funnel-shaped doline. Lowry's hypothesis is supported by evidence obtained by auger drilling. He also discusses, briefly, suggestions on the possible origin of solution pipes in aeolianite. - E.A.L.

NEW RECORDS OF THE FALSE VAMPIRE BAT IN QUEENSLAND

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Abstract

Four new distribution records of the false vampire bat in Queensland are recorded, and notes on the Mt. Etna population are given.

Introduction

In Queensland the false vampire bat, Macroderma gigas Dobson, has previously been recorded from two localities (McKean and Price, 1967). These are Mt. Margaret, in southwestern Queensland, and the limestone caves on and near Mt. Etna, 18 miles north of Rockhampton. The present note records four additional localities for the species in Queensland (Figure 1) and provides some information on the Mt. Etna population.

Helensvale

A single mummified carcass of a false vampire bat was identified in May, 1967, on the bar wall of the Lion's Den Hotel, Helensvale, 20 miles south of Cooktown. The species appeared to be well-known to local residents, one person reporting that a specimen had recently been caught by a cat. Numerous "caves" occur between the huge granite boulders of Black Mountain, three miles west of Helensvale. Some of these "caves" are moderately large and dark, and could provide appropriate roosting sites for bats.

Mt. Carbine

Ten mine tunnels, varying from about 40 ft to 1,000 ft of passage, were examined at Mt. Carbine on May 21, 1967. Several patches of false vampire droppings and a single false vampire bat were located in one of these tunnels (c. 100 ft long). On December 24, 1967, the Mt. Carbine tunnels were visited again, but no false vampires were found.

Lappa Junction

Mines, known as Tommy Burn's and The Cabbage Patch, occur about four miles south of Lappa Junction on the Sunnymount road. On May 18, 1967, two false vampires were present in the lower portion of the Tommy Burn's. They were roosting in a small (c. 10 ft high), completely dark chamber at the deepest extremity of one lead of the mine. A small guano patch was present.

One of these bats was caught by mist netting. It was a male with very enlarged testes (c. 8 mm diam.) and epididymides. The pelage was brownish-grey above, and dirty whitish beneath with orange-brown tips to the belly and lower chest hairs. The hairs above the nose-leaf and on the membrane between the ears were, similarly, orange-brown at their tips. Three patches of false vampire droppings were noted in The Cabbage Patch. No false vampire bats were present, although locals reported that this mine was a regular roost for "very large grey bats."

On December 27, 1967, no false vampires were found at these mines, but relatively fresh guano patches occurred at both. The extensive upper level of the Tommy Burn's mine showed no evidence of use by false vampires on either date.

Chillagoe

Between December 28, 1967, and January 8, 1968, some 25 large caves and many small caves were examined in the Chillagoe district. Skeletal remains of false vampire bats were recorded from four of these - a single mandible from Pinka Cave (CH 20); a skull, mandible and limb bones from Tea Tree Cave (CH 43); a skull from Cathedral Cave (CH 15); and a complete skeleton from an unnamed cave about six miles northwest of Mungana. These caves were in well-separated bluffs of the Chillagoe-Mungana limestone. They varied from being comparatively small, enclosed and humid (Tea Tree Cave) to comprising very large chambers with many daylight holes (Cathedral Cave).

No live false vampire bats, and no guano that could be attributed to this species, were located in the course of the survey. Mr. V. Kinnear described one sighting of two large bats that may have been false vampires, but the occurrence of the diadem bat, Hipposideros diadema (Geoffroy), at Chillagoe (McKean and Price, 1967, personal observation) renders the identity of these two individuals doubtful. The skeletal material located was certainly of relatively recent origin, being entirely free of calcification, even in areas where deposition might be expected to be high and, in some cases, with only moderate or no erosion of the bone. The complete skeleton was in good condition although no flesh or membranes remained. It was found in a position where water run-off would sometimes be considerable. While the existence of an extant population of false vampire bats at Chillagoe must therefore await confirmation, it is clear that they have occurred in the area in comparatively recent times. The presence of the species in mine tunnels near Lappa Junction, only 30 miles to the south-east, adds weight to the probability that it still survives at Chillagoe.

Mt. Etna

The major cavernicolous areas of this district comprise Mt. Etna itself, Limestone Ridge (with Johansen's Cave) about ¼ mile from Mt. Etna, and Olsen's Caves about three miles from Mt. Etna. A number of large caves (more than 1,000 ft of passage) are known. The majority, especially those of Mt. Etna, take the form of deep vertical shafts interconnected by a complex of passages and chambers. Daylight holes, often of large size, are characteristic, and it is clear that for these caves the cave climate (temperature, humidity, etc.) must be influenced considerably by surface conditions.

The author has visited the Mt. Etna district on seven occasions between April, 1966, and January, 1968. False vampire bats have been noted in varying numbers on all visits. In particular, the use of Johansen's Cave as a nursery site has been confirmed. Between 100-150 individuals (adults and young) were present in the cave during early April and mid-December, 1966, and again in mid-January, 1968. Five or six individuals were present on May 9-10, 1967, but none were observed on visits during early October, 1966, June 1, 1967, or August 18-19, 1967. When present, the colony has been located in one of the several large chambers of Johansen's Cave. Guano deposits suggest that a single chamber is probably used throughout any one season but that different chambers may be used in different years. The occupied chambers may or may not have large daylight holes but, once disturbed, the bats typically retreat noisily into the darker more enclosed portions of the cave. The use of chamber "A" in the 1966-67 season implies that no especial environmental features are necessary for nursery purposes. This chamber opens to the surface by several daylight holes and is subject to considerable temperature changes and draughts.

On all visits false vampire bats have been observed in or near caves at Mt. Etna. Generally one, or a few, individuals have been disturbed in the twilight zone of large caverns. No more than six individuals have been noted in one cave and there is no suggestion that nursery sites, other than Johansen's, occur in the area. In January, 1968, one false vampire was found roosting under a small, slightly domed, limestone overhang at Mt. Etna. The overhang was about 2 ft deep and 3½ ft high. It was situated behind a patch of semi-evergreen vine-thicket and was, thereby, dimly lit. Fewer false vampires have been observed on Mt. Etna at times when the Johansen's nursery colony was in residence.

A number of false vampires have been captured by mist netting the entrances of caves. Adult males with very enlarged testes have been recorded in May and lactating females, with enlarged thoracic and pubic teats, in December. The time of birth is not known. On December 15-16, 1966, all, except perhaps two, juveniles in the nursery could fly but while many spent some of the night flying within the cave none appeared to leave it to feed. Throughout the night most of the juveniles remained clustered in a ceiling dome about 2 ft in diameter. This dome was occupied during the day by both adult and juvenile individuals. Two juveniles, captured on this date, weighed 83 g (female) and 104 g (male) respectively (c.f. adult

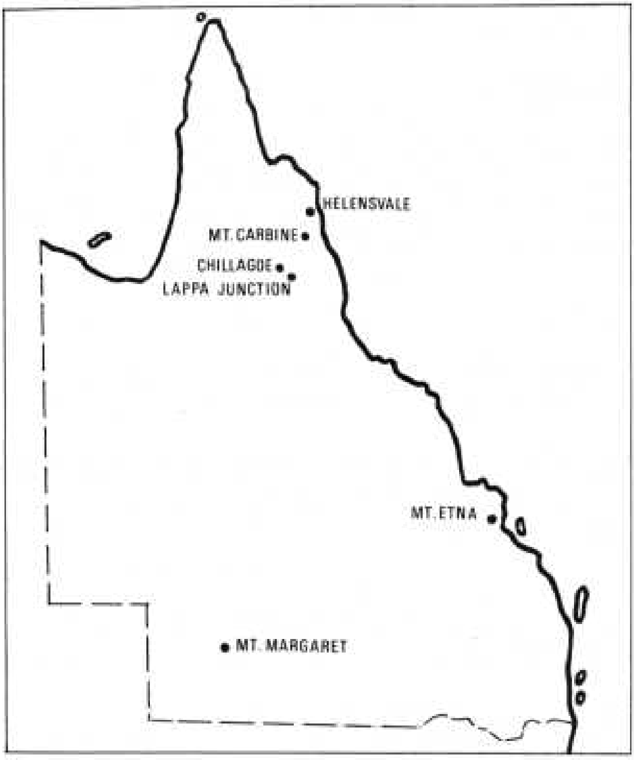

Figure 1. Known distribution of false vampire bats in Queensland.

weight of approximately 150 g). No adult female has been observed carrying more than a single young, and these have always been in the reversed position characteristic of rhinolophid bats (Dwyer, 1966). The pelage of juveniles in December and January appears as grey with a slight slatish tinge beneath, and as a fawny-brown or dark grey above. Adult individuals typically appear whitish or greyish-white beneath and as grey or brownish-grey above. Seasonal variation in pelage colour is evident, but the details of this are not clear.

The Mt. Etna population of false vampire bats remains the largest population of this species recorded from Queensland. Whether the difference between the present estimates for the size of the Johansen's nursery colony (i.e., 100-150) and the estimate of 450 in August, 1964 (McKean and Price, 1967), is indicative of a genuine decline in numbers during the intervening years cannot be assessed. Certainly, recent observations at Johansen's confirm the suggestion by McKean and Price (ob. cit.) that mortality by humans shooting or stoning bats might be quite high. None of the 22 individuals banded by McKean and Price at Johansen's have been retrapped by the author, and the remains of dead false vampires are not infrequently found. Current limestone mining in the area also threatens the survival of this population. It is comforting, therefore, to know that this rare and interesting mammal survives, at least in small numbers, at several other localities in Queensland.

Acknowledgments

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A B S T R A C T

AUSTRALIAN GLOW-WORMS OF THE GENUS *ARACHNOCAMPA* EDWARDS (DIPTERA: MYCETOPHILIDAE). By R.A. Harrison. Pacific Insects, 8 (4), 1966 : 877 - 883.

The genus *Arachnocampa* Edwards is re-examined and divided into two subgenera - *Arachnocampa* Edwards and *Campara* Harrison. In the subgenus *Arachnocampa*, Harrison places the New Zealand species *Arachnocampa (Arachnocampa) luminosa* (Skuse) and the Tasmanian species *A. (A.) tasmaniensis* Ferguson. A redescription is given of the latter species from material collected from Entrance Cave and Exit Cave, Ida Bay, and from Cashion Creek Cave, Florentine Valley. Two new species are placed in the subgenus *Campara*. *Arachnocampa (Campara) richardsae* Harrison occurs in New South Wales and may also occur in Victoria. In New South Wales specimens have been collected from a railway tunnel at Newnes (type locality), from Hazelbrook in the Blue Mountains, and from a limestone cave at Gloucester. In most cases pupae were collected and adult flies obtained in the laboratory.* *A. (C.) flava* Harrison is a Queensland species. The type locality is Numinbah. It has also been collected from Benowa and Springbrook. It is easily separated from *A. (C.) richardsae* by the shining pale yellow colour. - A.M.R.

(* This species is named after Dr. Aola M. Richards, of Sydney, who collected most of the specimens.)

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